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"THE ATOPIC SHIELD OF THE AMUR REGION": A HYBRID SYSTEM FOR SEVERE ALLERGY CONTROL AND INTERRUPTION OF THE ATOPIC MARCH

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Abstract
This paper presents the concept of creating a multidisciplinary medical and social hub on the basis of the Amur State Medical Academy, integrating outpatient therapy, intensive care, and digital technologies. The project is aimed at controlling severe allergies and interrupting the "atopic march" in patients of the Far East. The implementation of the developed hybrid system includes digital monitoring (MAKS-bot), face-to-face outreach schools for patients, and distance learning for primary care medical workers. It is expected that the implementation of such an initiative will allow transferring patients into the category of conscious disease management, improve the quality of local emergency care, and reduce the frequency of hospitalizations.

Keywords: atopic dermatitis, atopic march, digital health, patient school, telemedicine

According to statistics, atopic dermatitis is diagnosed in 20% of children and 2-8% of adults. In the Far East, the situation is exacerbated by specific climatic features (low insolation, long winter, dry indoor air). Without proper control, 30-80% of patients risk developing respiratory allergies, and 30-40% - severe bronchial asthma, which is classified in clinical practice as the "atopic march" [1].

A standard mandatory health insurance (MHI) outpatient appointment, limited to 12 minutes, does not allow the doctor to fully educate the patient in self-monitoring skills and skin care [2]. Existing educational online resources are often maintained by single-specialty physicians; they do not take into account the risks of life-threatening conditions, as well as the logistical and territorial specifics of the Far Eastern Federal District.

Thus, there is an urgent need for a comprehensive approach in which the outpatient sector will be integrated with the intensive care unit, and patients and doctors in remote rural areas will have access to continuous education and telemedicine support to prevent the development of severe complications.

Objective

To transform the paradigm of care for severe allergic diseases: to transfer patients from the category of reactive treatment of exacerbations into the category of conscious disease management through the integration of digital services and the training of local specialists.

Materials and methods

The work is based on the development of the concept of a pilot medical and social project in the Amur region with a planned coverage of at least 1,000 patients per year. The implementation

mechanism includes four modules: preventive (outreach schools, distribution of basic emollient kits), emergency response (simulation training for parents on recognizing anaphylaxis and providing first aid), IT-block (integration of a bot into the MAX system, symptom diary, teleconsultation platform), and B2B-block (online courses for rural health post (FAP) paramedics).

Results and discussion

The developed hub model allows for creating a continuous chain of interaction: "patient – family – rural paramedic – regional center". The competitive advantage of the system is the unique integration of outpatient practice with the competencies of anesthesiologists and intensivists. This provides families not only with knowledge on hypoallergenic living conditions but also with a clear algorithm of actions in critical conditions before the arrival of the emergency medical service (EMS) team.

The digital environment provides continuous monitoring of the course of atopic dermatitis and mitigates the risks of patient dropout due to the remoteness from regional centers, thereby increasing adherence to therapy [3, 4]. Advanced training of paramedics and district pediatricians in remote areas will reduce their fear of managing severe patients. According to calculations, the implementation of this system will lead to a 20-30% reduction in the frequency of emergency EMS calls and hospitalizations to intensive care units due to severe exacerbations of allergic diseases (status asthmaticus, anaphylaxis), and will also reduce the percentage of transformation of atopic dermatitis into bronchial asthma.

Conclusion

The "Atopic Shield of the Amur Region" system generates a pronounced medical and economic effect and can serve as an effective multidisciplinary tool for interrupting the atopic march and strengthening the medical potential of remote territories.

References:

1.Ksenzova L.D. Atopic march. Risk of development of allergic rhinitis and bronchial asthma in children with atopic dermatitis. Allergol. i immunol. v pediatrii. 2018; 55 (4): 25—30. doi: 10.24411/2500-1175-2018-00019. (In Russ.)

2.Migacheva N.B., Zhestkov A.V., Kaganova T.I., Katkova L.I. Educational programs in the care system for patients with atopic dermatitis: who needs it? Pediatria. Journal named after G.N. Speransky. 2018; 97(5): 151-158. DOI: 10.24110/0031-403X-2018-97-5-151-158. (In Russ.)

3.Cherrez-Ojeda I, Robles-Velasco K, Osorio MF, et al. A Systematic Review and Meta-analysis of Mobile Health Applications and Telemonitoring in Atopic Dermatitis Self-Management. Dermatol Ther (Heidelb). 2024;14(7):1787-1798. doi:10.1007/s13555-024-01213-0

4.Yang H, Shu H, Wang LH, et al. Smartphone-Based Digital Eczema Education Program for Atopic Dermatitis in Children Aged 0 to 6 Years: Multicenter, Randomized, Parallel Controlled Clinical Study. J Med Internet Res. 2026;28:e79559. doi:10.2196/79559

DIGITAL TRANSFORMATION OF CRITICAL CARE MEDICINE: FROM INTUITIVE PRACTICE TO PREDICTIVE ANALYTICS

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Abstract

This paper presents an analytical review of global trends in the implementation of artificial intelligence (AI) in intensive care based on publications from 2021-2026 (PubMed, eLibrary, CNKI). A paradigm shift is noted: from narrow predictive models (sepsis, hemodynamic instability) to generalist systems based on foundation models and large language models (LLMs). The regulatory challenges of 2026 and the potential for scientific and technological cooperation between the Russian Federation and the People's Republic of China are analyzed.

Keywords: artificial intelligence; machine learning; foundation models; predictive analytics; intensive care unit (ICU); clinical decision support systems (CDSS)

A modern ICU generates thousands of parameters per patient daily: waveform telemetry, laboratory data, as well as respiratory and hemodynamic support parameters. The reactive paradigm—intervention following the manifestation of decompensation—has exhausted itself: a clinician's cognitive capacity is limited to the simultaneous processing of 5-7 variables, while conventional scoring systems (SOFA, qSOFA, NEWS) lack sufficient sensitivity. The transition to a proactive model based on the predictive analytics of streaming data is a logical stage in the evolution of critical care medicine.

Objective

To analyze global trends in the application of AI in critical care (2021-2026) and evaluate the potential for technological integration between the Russian Federation and China.

Materials and methods

A narrative analysis of publications from 2021-2026 in PubMed, MEDLINE, eLibrary.ru, CNKI, and Wanfang was conducted using the following search queries: "machine learning," "foundation models," "ICU," "sepsis prediction," and "clinical decision support." Priority was given to consensus documents, multicenter validation studies, and implementation trials.

Results and discussion

The implementation of the TREWS algorithm in a prospective multicenter study was associated with a reduction in sepsis mortality; the Sepsis Watch system underwent the largest multisite external validation (2025), confirming the generalizability of deep neural networks. The FDA approved AI tools for predicting hemodynamic instability (CLEWICU). The spectrum of validated tasks has expanded to include the prediction of acute kidney injury (AKI), respiratory failure, and cardiac arrest, as well as AI-driven personalization of hemodynamic targets. A key trend of

2025–2026 is the transition from narrow models to generalist systems (foundation models, LLMs, agentic AI), which necessitated a revision of device-centric regulatory frameworks and the concept of "agentic oversight." An international consensus of 22 experts (Critical Care, 2025) identified the following priorities: data harmonization, mitigating algorithmic bias, and staff training. The barriers remain the same: interpretability, alert fatigue, and data drift.

China possesses large-scale datasets and a robust medical AI industry; Russia has strong mathematical schools and extensive experience with CDSS. Promising areas include: federated learning without cross-border transfer of personal data, cross-population model validation (reducing ethnic bias), harmonization of ICU data annotation standards, and joint regulatory approaches to generalist AI systems.

Conclusions

1.Between 2021 and 2026, AI in the ICU has evolved from research prototypes to regulatory-approved tools with a proven impact on mortality.

2.The paradigm is shifting from narrow predictive models to foundation models and agentic AI, which requires new regulatory mechanisms.

3.Russian-Chinese cooperation in the form of federated learning and mutual validation can accelerate the clinical translation of AI in both countries.

References:

1.Adams R, Henry KE, Sridharan A, et al. Prospective, multi-site study of patient outcomes after implementation of the TREWS machine learning-based early warning system for sepsis. Nat Med. 2022;28(7):1455-1460. doi:10.1038/s41591-022-01894-0

2.van de Sande D, van Genderen ME, Huiskens J, Gommers D, van Bommel J. Moving from bytes to bedside: a systematic review on the use of artificial intelligence in the intensive care unit. Intensive Care Med. 2021;47(7):750-760. doi:10.1007/s00134-021-06446-7

3.Valan B, Prakash A, Ratliff W, et al. Evaluating sepsis watch generalizability through multisite external validation of a sepsis machine learning model. NPJ Digit Med. 2025;8(1):350. Published 2025 Jun 11. doi:10.1038/s41746-025-01664-5

4.Cecconi M, Greco M, Shickel B, et al. Implementing Artificial Intelligence in Critical Care Medicine: a consensus of 22. Crit Care. 2025;29(1):290. Published 2025 Jul 8. doi:10.1186/s13054-025-05532-2

5.Freyer O, Mathias R, Muti HS, et al. The regulation of artificial intelligence in intensive care units: from narrow tools to generalist systems. NPJ Digit Med. 2026;9(1):246. Published 2026 Mar 21. doi:10.1038/s41746-026-02535-3

HUMAN RESOURCE MANAGEMENT IN DIGITAL HEALTHCARE: ANALYSIS OF NON-MATERIAL MOTIVATION AND PSYCHOLOGICAL RESILIENCE AMONG PEDIATRIC ANESTHESIOLOGISTS-RESUSCITATORS

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Abstract

This paper explores the human factor within digital healthcare transformation, focusing on non-material motivation and psychological needs of pediatric anesthesiologists-resuscitatologists. A cross-sectional study was conducted to examine drivers of professional retention and burnout prevention. The analysis reveals a critical mismatch between low basic salaries and extreme workloads, highlighting that sustainable technological integration in smart hospitals requires addressing foundational clinician well-being.

Keywords: non-material motivation, pediatric anesthesiology, professional burnout, workplace ergonomics

The rapid evolution of modern healthcare towards smart medicine, digital innovations, and industrial integration heavily relies on the resilience of its human resources. In pediatric anesthesiology and resuscitation, the cognitive and emotional burden is amplified by the high stakes of clinical decisions, intense shift patterns, and complex communication with patients' families. While administrative focus frequently prioritizes financial compensation for overtime, the transition to digitalized clinical environments necessitates a holistic approach to staff motivation, labor protection, and mental health support to ensure operational safety and prevent severe professional burnout.

Objective

To investigate the specific structure of non-financial motivational factors and determine the demand for institutional psychological support among anesthesiologists-resuscitatologists in a multi-profile pediatric hospital compared to other medical specialists.

Materials and methods

In May 2025, a pilot cross-sectional anonymous survey was carried out among medical professionals at the Amur Regional Children's Clinical Hospital. The final sample included 50 valid questionnaires. The primary group consisted of pediatric anesthesiologists-resuscitatologists (n=6), and the control group comprised physicians from other clinical departments (n=44). Job satisfaction parameters were measured using a 5-point Likert scale. Statistical processing was executed via IBM SPSS Statistics 26.0, employing the non-parametric Mann-Whitney U-test for independent group comparisons.

Results and discussion

The empirical analysis demonstrated a pronounced divergence in financial satisfaction among pediatric anesthesiologists-resuscitatologists. Satisfaction with overall aggregate income was rated at 3.00 points (vs. 2.29 points in the control group; $p>0.05$), whereas satisfaction with the guaranteed base salary was critically low, scoring 2.00 points (vs. 2.35 points). Regarding motivational drivers, the anesthesiology cohort identified a substantial increase in the base wage and the optimization of work schedules to reduce excessive overtime as absolute priorities. Unlike physicians in elective departments, anesthesiologists emphasized workplace ergonomics as vital factors, specifically high-quality catering during 24-hour shifts and dedicated, isolated relaxation rooms. Furthermore, this group demonstrated the highest institutional demand for confidential psychological support and structured burnout prevention programs.

The findings indicate that a relatively acceptable total income is achieved exclusively through extreme workloads, additional shifts, and dual-employment, which masks the deficiency of the base salary. This operational model inevitably leads to severe physical and emotional exhaustion. Consequently, the motivational hierarchy of critical care physicians shifts toward basic financial, physiological, and psychological security. Providing an adequate base salary for a standard shift, alongside ergonomic rest environments and accessible psychological relief, represents a fundamental prerequisite for maintaining workforce stability during digital health integration.

Relying solely on financial compensation for excessive overtime within a low base salary framework cannot resolve the systemic issue of physician attrition in pediatric critical care. To retain highly qualified specialists capable of working in advanced, technologically integrated healthcare systems, hospital administrations must implement a balanced strategy: significantly increase the share of the guaranteed base salary within the total remuneration structure while concurrently enhancing non-material working conditions and mental health support.

References:

1.Nikitina T.P., Efremov S.M., Ionova T.I. Professional burnout, quality of life issues and psychological burden in anesthesiologists and intensive care specialists in contemporary conditions after COVID-19 pandemic: results of an internet-based survey // Annals of Critical Care. – 2023. – № 2. – P. 102-116. DOI: 10.21320/1818-474X-2023-2-102-116.

2.Thomas Craig K.J., Willis V.C., Gruen D. et al. The burden of the digital environment: a systematic review on organization-directed workplace interventions to mitigate physician burnout // Journal of the American Medical Informatics Association. – 2021. – Vol. 28. – № 5. – P. 985-997. DOI: 10.1093/jamia/ocaa301.

3.Khodus S.V., Oleksik V.S., Stukalov A.A. et al. Effective communication: key communication skills in anesthesiologist-resuscentrician practice // Innovative methods of diagnostic and treatments in traditional Russian and Chinese medicine. Materials of the 19th Russian-Chinese Biomedical Forum. – Harbin, 2024. – P. 31-33.

COMPARATIVE ASSESSMENT OF IMMUNOGLOBULIN LEVELS IN CERVICOVAGINAL SECRETIONS AND BLOOD SERUM IN MONO- AND MIXED HPV INFECTION

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ABSTRACT. The study demonstrates that human papillomavirus (HPV), particularly in the form of mixed infection, is accompanied by pronounced suppression of local and systemic humoral immunity against the background of vaginal dysbiosis. It was established that in mixed infection, pronounced dysbiosis occurred in 48.5% of cases, whereas in monoinfection, absolute normocenosis predominated (84.4%, $p<0.001$). IgA levels in cervicovaginal secretions were reduced by 1.4-fold in monoinfection and by 1.7-fold in mixed infection ($p<0.001$) relative to controls; a similar trend was observed in blood serum (reduction by 1.6- and 1.7-fold, respectively, $p<0.001$). IgG concentrations also significantly decreased by 1.6–2.0-fold ($p<0.001$). At the same time, serum IgM levels were significantly higher in monoinfection compared to controls (2.94 [2.29; 3.35] vs. 1.71 [1.37; 1.96] mg/mL, $p<0.05$). The identified changes indicate the formation of a secondary immunodeficient state, creating conditions for prolonged viral persistence.

Keywords: human papillomavirus, mixed infection, cervicovaginal secretions, humoral immunity, immunoglobulins, vaginal dysbiosis.

Human papillomavirus (HPV) remains one of the most common causative agents of sexually transmitted infections. Viral persistence is closely associated with the state of local mucosal immunity and the vaginal microbiome [1, 2]. Dysbiotic disturbances and concomitant infections not only damage the protective barrier but also provoke inflammatory reactions, reducing the level of secretory immunoglobulin A (sIgA) and facilitating viral immune evasion [3, 4]. However, the specifics of the humoral immune response during simultaneous infection with multiple HPV types (mixed infections) remain insufficiently studied.

Objective: To evaluate immunoglobulin (Ig) levels of classes A, G, and M in cervicovaginal secretions and blood serum in women with mono- and mixed HPV infection.

Materials and methods. A prospective comparative study of 134 women of reproductive age was conducted. The main group comprised 100 patients with confirmed HPV infection, divided into subgroups of patients with monoinfection (n=38) and mixed infection (n=62). The control group consisted of 34 women with negative HPV test results. Genotyping and viral load assessment were performed by real-time polymerase chain reaction (PCR). Concentrations of total IgA, IgG, and IgM in cervicovaginal secretions and blood serum were determined by enzyme-linked immunosorbent assay (ELISA). The study was approved by the Biomedical Ethics Committee of the Far Eastern Scientific Center of Physiology and Pathology of Respiration. Statistical analysis was performed using IBM SPSS Statistics v.23.0 with the Mann–Whitney U-test and Pearson's χ^2 test. Data are presented as median (Q1; Q3). Differences were considered significant at $p<0.05$.

Results and discussion. Association of two or more HPV genotypes was detected in 31% of patients. Microbiome analysis showed that pronounced dysbiosis was significantly more common in mixed infection (48.5%) compared to monoinfection (3.1%, $p<0.001$), where absolute normocenosis predominated (84.4%).

Assessment of the humoral immune component revealed a significant decrease in IgA levels in cervicovaginal secretions: in monoinfection – down to 2.56 [1.83; 2.56] mg/mL, in mixed infection – down to 2.02 [1.52; 2.46] mg/mL vs. 3.52 [3.26; 4.37] mg/mL in controls ($p<0.001$). A similar trend was observed in blood serum: IgA reduction by 1.6- and 1.7-fold, respectively ($p<0.001$). IgG concentrations were also significantly lower in both groups of HPV-positive patients compared to controls (by 1.6–2.0-fold, $p<0.001$), indicating impaired antibody synthesis processes and the formation of secondary immunodeficiency.

Unlike other classes, serum IgM concentration was significantly higher in monoinfection (2.94 [2.29; 3.35] mg/mL) compared to the control group (1.71 [1.37; 1.96] mg/mL, $p<0.05$), whereas in mixed infection, no significant differences from controls were detected (2.35 [1.69; 2.73] mg/mL). Elevated IgM in monoinfection may reflect compensatory activation of the early humoral response, which in mixed infection with concomitant dysbiosis becomes exhausted, failing to ensure adequate switching to IgG synthesis.

Conclusion. HPV infection, particularly in the form of mixed infection, is accompanied by pronounced suppression of local and systemic humoral immunity (reduced IgA and IgG) against the background of anaerobic dysbiosis. The identified immunoglobulin imbalance creates favorable conditions for viral persistence and justifies the need to include correction of vaginal microbiome and immune status in comprehensive management protocols for such patients.

REFERENCE

1.Plotzker R.E., Vaidya A., Pokharel U., Stier E.A. Sexually transmitted human papillomavirus: update in epidemiology, prevention, and management // Infect. Dis. Clin. North. Am. 2023. Vol. 37, Iss. 2. P. 289 – 310. doi: 10.1016/j.idc.2023.02.008

2.Tikhomirov A.L, Sarsaniya S.I., Filatova G.A. Human papilloma virus: from understanding of immunopathogenesis to rational tactics of management. Gynecology. 2018; 20 (3): 5–11. DOI: 10.26442/2079-5696_2018.3.5-11

3.Liu Y., Li T., Guo R. et al. The vaginal microbiota among the different status of human papillomavirus infection and bacterial vaginosis // J. Med. Virol. 2023. Vol. 95, Iss. 3. e28595. doi: 10.1002/jmv.28595

4.Semenov D.M. Immunopathology, allergology, infectology 2016; 2:67-73. DOI: 10.14427/jipai.2016.2.67

PREDICTION OF PREGNANCY LOSS RISK IN WOMEN IN THE FIRST TRIMESTER WITH CHRONIC CYTOMEGALOVIRUS INFECTION

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ABSTRACT. The study demonstrates that the combination of the heterozygous GC genotype of the VEGFA gene (rs2010963) and the homozygous TT genotype of the ESR1 gene (rs2234693) is a significant marker of a high risk of pregnancy loss in women in the first trimester with chronic cytomegalovirus (CMV) infection. A total of 70 pregnant women were examined, including 45 with clinical signs of threatened miscarriage and 25 without pregnancy complications. The identified associations allow considering the combination of these polymorphisms as a critical combination reflecting the synergistic effect of vascular, hormonal, and infectious factors, which improves the accuracy of predicting threatened pregnancy loss in early gestation in the presence of CMV infection.

Keywords: cytomegalovirus infection, pregnancy loss, VEGFA, ESR1, polymorphism.

Pregnancy loss, with a prevalence reaching up to 20% in the population, remains a pressing issue in modern obstetrics [1]. The medical and social significance of this pathology is determined by the high risk of perinatal losses and the development of congenital fetal abnormalities [1]. The etiology of pregnancy loss is multifactorial and includes endocrine and immunological disorders, infectious factors, and genetic predisposition [2]. In recent years, increasing attention has been paid to the role of genetically determined disorders that form the individual background for the realization of pathological processes [3]. Chronic cytomegalovirus (CMV) infection, exhibiting tropism for endothelial and trophoblast cells, contributes to the development of endothelial dysfunction and impaired placentation processes [4]. In the context of CMV infection, genetic polymorphism may predispose individuals to critical disruptions in angiogenesis and hormonal reception, underscoring the need to identify specific combinations of genetic markers [3]. Vascular endothelial growth factor A (VEGFA) plays a key role in chorionic villi vascularization, and its -634G>C polymorphism (rs2010963) is associated with altered vascular response and an increased risk of reproductive loss [5]. Additionally, the estrogen receptor alpha (ESR1) mediates the secretory transformation of the endometrium, and the –397T>C polymorphism (rs2234693) is associated with changes in receptor density and activity, which, in the presence of an unfavorable genotype, leads to endometrial functional insufficiency [6]. However, isolated analysis of individual VEGFA and ESR1 gene polymorphisms does not provide sufficient prognostic accuracy, and existing approaches are predominantly retrospective. To date, no method has been proposed that accounts for the combined effect of these polymorphisms in chronic CMV infection.

Objective: To develop a method for predicting the risk of pregnancy loss in women in the first trimester with chronic CMV infection based on the assessment of the combined polymorphic variants of the VEGFA and ESR1 genes.

Materials and Methods. The study was based on a comprehensive examination of 70 women in the first trimester of pregnancy with chronic CMV infection, including 45 with clinical signs of threatened miscarriage (main group) and 25 without pregnancy complications (comparison group). Chronic CMV infection was verified by enzyme-linked immunosorbent assay (detection of IgG antibodies to CMV with a high avidity index). Peripheral venous blood was collected into EDTA-containing vacutainers. Genomic DNA was extracted from whole blood using a rapid method with the "DNA-express-blood" reagent kit (NPFB "Lytekh", Russia). Molecular genetic analysis of the polymorphic loci VEGFA 634G/C (rs2010963) and ESR1 397T/C (rs2234693) was performed using real-time polymerase chain reaction. Statistical analysis was conducted to evaluate the associations of genotypes with the threat of pregnancy loss.

Results and Discussion. Molecular genetic analysis revealed associations of the heterozygous GC genotype of the VEGFA gene (rs2010963) and the homozygous TT genotype of the ESR1 gene (rs2234693) with threatened pregnancy loss in women with chronic CMV infection in the first trimester. It was established that isolated analysis of individual VEGFA and ESR1 gene polymorphisms does not provide sufficient prognostic accuracy. However, the simultaneous presence of the heterozygous GC genotype of the VEGFA gene (rs2010963) and the homozygous TT genotype of the ESR1 gene (rs2234693) showed a statistically significant association with the development of threatened miscarriage.

The obtained data allow interpreting this genotype combination as "critical," wherein the combined effect of genetic and infectious factors triggers chorionic vascular insufficiency (mediated by the VEGFA polymorphism) and disruption of hormonal adaptation (mediated by the ESR1 polymorphism) against the background of chronic CMV infection. The absence of this genotype combination (e.g., with other ESR1 variants such as CC) was associated with a low risk of pregnancy loss and a physiological course of gestation.

Conclusion. The study established that the combination of the heterozygous GC genotype of the VEGFA gene (rs2010963) and the homozygous TT genotype of the ESR1 gene (rs2234693) is a reliable and significant marker of a high risk of pregnancy loss in women in the first trimester with chronic CMV infection. The developed method enables risk prediction in women at the planning stage or during the first trimester of pregnancy. A comprehensive assessment of vascular (VEGFA), hormonal (ESR1), and infectious (CMV infection) factors provides a qualitatively new level of accuracy for personalized prognosis and establishes a foundation for the timely prescription of preventive therapy.

REFERENCE

1.Baroeva M.D., Popova L.S., Tsallagova L.V., Datieva F.S., Mamieva S.Ch., Basayeva E.K. Features of Genetic Polymorphism in Miscarriage in Residents of the Republic of North Ossetia-Alania // New Technologies in Health Recreation: Proceedings of the IX All-Russian Scientific and Practical Conference. Vladikavkaz, 2025. Pp. 48-55.

2.Sidelnikova V.M., Sukhikh G.T Miscarriage: A guide for practicing physicians. Moscow: МИА, 2011.

3.Zaytseva N.I., Revina D.B., Shcherbakova L.N., Panina O.B. Genetic origins of recurrent

miscarriage: A review of the literature // V.F. Snegirev Archives of Obstetrics and Gynecology. 2023. T.10, №2. C.85-94. DOI 10.17816/2313-8726-2023-10-2-85-94.

4.Kisteneva V.B. The role of CMV infection in formation of perinatal pathology // Children Infections. 2013; 12(3):44–47.

5.Nagayeva O.A., Shcherbakova L.N., Revina D.B., Alekseyenkova M.V., Zaytseva N.I., Kirillova K.I., Samokhodskaya L.M., Panina O.B. Polymorphism of genes predisposing to atherosclerosis, angiogenesis factors, and endothelial function, and recurrent miscarriage of unknown origin // Technologies of Living Systems. 2023. №4. C.53–63. https://doi.org/10.18127/j20700997-202304-05

6.Bahia W, Soltani I, Haddad A, Soua A, Radhouani A, Mahdhi A, Ferchichi S. Association of genetic variants in estrogen receptor (ESR)1 and ESR2 with susceptibility to recurrent pregnancy loss in Tunisian women: A case control study // Gene. 2020; 736:144406. doi: 10.1016/j.gene.2020.144406

COMPARATIVE ASSESSMENT OF THE IMPACT OF TRADITIONAL AND ELECTRONIC CIGARETTES ON SOME CARDIOVASCULAR HEALTH INDICES IN MEDICAL STUDENTS

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Abstract. A comprehensive examination of 65 first- to fourth-year medical students who smoked traditional and electronic cigarettes was conducted, compared with healthy volunteers. The results indicate a negative impact of smoking on key cardiovascular parameters, with a comparative assessment of indicators in traditional and e-cigarette users demonstrating a more pronounced negative impact of electronic nicotine delivery systems on the cardiac conduction system.

Key words: smoking, traditional and e-cigarettes, cardiovascular system, student volunteers.

One of the pressing issues facing today's youth is the use of nicotine-containing products, which negatively impact the functional activity of organs and body systems and lead to long-term consequences such as addiction, pathological conditions, and diseases [1-3, 5]. Assessing the impact of nicotine-containing products in various forms on the cardiovascular system in future physicians is a priority for the medical community in terms of fostering a proactive approach and promoting a healthy lifestyle among young people [4].

Objective

To comparatively assess the impact of traditional and electronic cigarettes on certain cardiovascular indicators in medical students.

Materials and methods

In the 2025-2026 academic year, a study was conducted with the participation of 65 first- to fourth-year students (57% women, 43% men, average age 21.2 [18.0; 25.7] years) studying in the specialties of General Medicine and Pediatrics, who signed voluntary informed consent. Students with pathology of the cardiovascular and nervous systems, chronic somatic diseases in the acute stage and infectious processes established according to medical records were not included in the study. The study participants were randomized into 2 groups: the first group included non-smoking students (n = 30), the second - smokers (n = 35); the second group was divided into 2 subgroups - smokers of traditional cigarettes and users of electronic nicotine delivery systems. Electrocardiograms were recorded using a MEDINOVA ECG-9803 electrocardiograph. Blood pressure was recorded using a LITTLE DOCTOR LD-71 mechanical tonometer, and heart rate was measured using a COCpr-2b-2-000 mechanical stopwatch. All results were statistically processed using Statistica 16.0, with intergroup differences considered significant at $p < 0.05$.

Results and discussion

The study results showed that after smoking, both the group of students consuming traditional cigarettes and the group of e-cigarette users experienced an average increase in systolic blood pressure of 13 mmHg, which was statistically significantly higher than in the former group ($p < 0.05$). However, no deviations in systolic blood pressure from the reference range were observed in only 20% of traditional cigarette smokers and 27% of e-cigarette smokers. No deviations in diastolic blood pressure were recorded in 20% of traditional cigarette users and 46% of e-cigarette users. Heart rate analysis revealed a more pronounced negative impact of e-cigarettes ($p < 0.05$).

Electrocardiographic parameters in the group of smoking volunteers revealed conduction disturbances in 72% of cases, including incomplete right bundle branch block in 60% of cases. It is important to note that 82% of e-cigarette users reported abnormal cardiac conduction in their study participants, compared to 57% of traditional cigarette users.

Thus, a comparative assessment of cardiovascular parameters in traditional and e-cigarette users in the current study indicates a more pronounced negative impact of electronic nicotine delivery systems, primarily on the cardiac conduction system. These results suggest further study of cardiovascular parameters during smoking to confirm the statistical significance of the observed changes.

References:

1. Androsova O.G., Allazov D.R., Zinin M.S. The effect of electronic cigarettes on the liver (literature review) // Bulletin of Respiratory Physiology and Pathology. - 2025. - Issue. 96. - P. 154-163.

2. Pereverzev D.I., Simonova N.V., Dorovskikh V.A., Anokhina R.A. The effect of cytoflavin on the parameters of left ventricular systolic function in patients with acute myocardial infarction // Experimental and clinical pharmacology. - 2017. - Vol. 80, No. 1. - P. 14-15.

3. Simonova N.V., Aleshina T.E. The influence of circadian biorhythms on the cognitive status of second-year students studying in the specialty General Medicine // Scientific Notes of the Crimean Federal University named after V.I. Vernadsky. Sociology. Pedagogy. Psychology. – 2024. – Vol. 76, No. 10. – P. 163-169.

4. Simonova N.V., Smirnova G.O., Aleshina T.E., Alieva V.P., Kerimova Yu.D., Maksimenko E.E., Mirkarimov V. Features of the cognitive status in smoking and non-smoking medical students // Scientific notes of the V.I. Vernadsky Crimean Federal University. Biology. Chemistry. – 2025. – Vol. 11, No. 2. – P. 199-203.

5. Wang Q., Ji X., Rahman I. Dysregulated metabolites serve as novel biomarkers for metabolic diseases caused by e-cigarette vaping and cigarette smoking // Metabolites. – 2021. – Vol. 11, No. 6. – P. 345.

FEATURES OF THE ALPHA RHYTHM OF THE BACKGROUND ELECTROENCEPHALOGRAM DURING SMOKING

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Abstract

An electroencephalographic study of the functional activity of the brain was conducted in smoking (n=26) and non-smoking (n=20) medical students using a Neuron-Spectrum-4 electroencephalograph: the amplitude, dominant frequency, index, and representation of the alpha rhythm were assessed. Analysis of the alpha rhythm of the background electroencephalogram revealed certain characteristics in smoking subjects: the use of nicotine-containing products contributes to a reduction in the index and power of the alpha rhythm.

Key words: medical students, smoking, electroencephalogram, alpha rhythm, amplitude, frequency.

The problem of smoking in modern society requires a targeted study of the impact of nicotine-containing products on the development of consequences of nicotine addiction [1, 2, 4-7]. Results from studies of functional brain activity associated with smoking remain fragmented [3]. Therefore, studying the impact of nicotine-containing products on the main characteristics of the background electroencephalogram in student volunteers is of interest for identifying predictors of negative changes in the central nervous system.

Objective

To study the characteristics of the alpha rhythm of the background electroencephalogram in medical students who smoke.

Materials and methods

The study involved 46 student volunteers majoring in General Medicine and Pediatrics. After signing informed consent, the participants were randomized into two groups: the first group (n=20) consisted of nonsmokers, and the second group (n=26) consisted of smoking volunteers. Using a Neuron-Spectrum-4 electroencephalograph (Neurosoft LLC, Russia), the subjects' brain biopotentials were recorded from 19 active electrodes placed on the scalp in accordance with the International 10-20% Electrode Placement Scheme. The amplitude, dominant frequency, index, and alpha rhythm representation were assessed within the study range. All results were statistically processed using Statistica 16.0 and are presented with the median and interquartile range. Statistically significant results were considered at $p < 0.05$.

Results and discussion

The results of the study showed the presence of some statistically significant features of the alpha rhythm against the background of smoking: the maximum amplitude of the alpha rhythm over

the left hemisphere was 820.0 [817.0; 832.0] μV, which reliably exceeded the similar indicator in non-smokers, which was 113.0 [93.0; 119.0] μV (p=0.0000); the average amplitude of the alpha rhythm over the left hemisphere in smokers was 23.0 [20.0; 26.0] μV, which is less than in non-smokers (24.0 [15.0; 28.0] μV, p=0.0382); the maximum amplitude of the alpha rhythm over the right hemisphere was 810.0 [804.0; 823.0] μV, which significantly exceeded the similar indicator in non-smokers, which was 107.5 [95.0; 131.0] μV (p=0.0000); the average amplitude of the alpha rhythm over the right hemisphere in smokers was 23.0 [20.0; 27.0] μV, which in terms of parameter values was practically no different from the group of non-smokers (23.0 [16.0; 28.0] μV). Thus, in the absence of statistically significant differences in the average amplitude of the alpha rhythm over the right hemisphere, a reliable decrease in power over the left hemisphere was recorded against the background of a statistically significant excess of the maximum amplitude of the alpha rhythm during smoking.

In smoking medical students, the alpha rhythm index in the spectrum was two times lower than in non-smoking students (16.7 [8.4; 18.7]% compared to 33.2 [17.2; 39.1]%, p=0.0016), while no statistically significant differences were recorded for the "alpha rhythm representation" indicator, which was 81.6 [64.3; 87.8]% in non-smokers and 85.6 [65.1; 87.6]% in smokers (p=0.5409).

Thus, while the reference range for the main parameters of the background electroencephalogram was maintained in all examined medical students, a reduction in the alpha rhythm index and power was recorded in the group of smoking volunteers, which suggests further research with an expanded sample of volunteer subjects.

References:

1. Androsova O.G., Allazov D.R., Zinin M.S. The effect of electronic cigarettes on the liver (literature review) // Bulletin of Respiratory Physiology and Pathology. - 2025. - Issue. 96. - P. 154-163.
2. Gulyaeva A.S., Simonova N.V., Romanova A.N., Aleshina T.E., Tereshchenko T.A. Evaluation of mnestic functions in medical students during the school day // Cardiovascular Therapy and Prevention. - 2024. - Vol. 23, No. S6. - P. 177.
3. Doletsky A.N., Dokuchaev D.A., Lata A.A. Transformation of views on the mechanism of generation and physiological interpretation of the EEG alpha rhythm // Volgograd Medical Scientific Journal. – 2019. - №1. – P. 14-19.
4. Simonova N.V., Aleshina T.E. The influence of circadian biorhythms on the cognitive status of second-year students studying in the specialty "General Medicine" // Scientific notes of the Crimean Federal University named after V.I. Vernadsky. Sociology. Pedagogy. Psychology. – 2024. – Vol. 76, №10. – P. 163-169.
5. Simonova N.V., Smirnova G.O., Aleshina T.E., Alieva V.P., Kerimova Yu.D., Maksimenko E.E., Mirkarimov V. Features of the cognitive status in smoking and non-smoking medical students // Scientific notes of the Crimean Federal University named after V.I. Vernadsky. Biology. Chemistry. – 2025. – Vol. 11, No. 2. – P. 199-203.
6. Tereshchenko T.A., Simonova N.V., Aleshina T.E., Gulyaeva A.S. Features of concentration of attention in second-year students during the school day // Cardiovascular Therapy and Prevention. – 2024. – Vol. 23, No. S6. – P. 176.
7. Wang Q., Ji X., Rahman I. Dysregulated metabolites serve as novel biomarkers for metabolic diseases caused by e-cigarette vaping and cigarette smoking // Metabolites. – 2021. – Vol. 11, No. 6. – P. 345.

RISK FACTORS OF CHRONIC NON-COMMUNICABLE DISEASES IN STUDENTS OF THE AMUR STATE MEDICAL ACADEMY

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Abstract

Chronic non-communicable socially significant diseases (CND) are one of the leading causes of death in Russia and worldwide. Despite numerous programs to develop a healthy lifestyle paradigm, a significant proportion of the population still has risk factors (RF) for developing such diseases. We assessed the prevalence of certain RF among students at Amur State Medical Academy and found that a third of the participants are obese or overweight, one in eight students smoke tobacco, and almost half of those surveyed have an unhealthy diet. The obtained data may indicate that high awareness of medical students about various aspects of the occurrence of CND, contrary to expectations, does not always form a dominant tendency towards a healthy lifestyle. These facts indicate the need to introduce additional preventive measures and information campaigns aimed at students, including medical schools.

Keywords: smoking, obesity, hypercholesterolemia, unhealthy diet, chronic non-communicable diseases

The formation of health and active longevity of the population is a complex multifactorial process. Cardiovascular and respiratory diseases, diabetes mellitus, and oncological pathology are among the most widespread CND, which are the main cause of death both in Russia and worldwide. These diseases have a significant impact on social potential and the economy [3]. It is believed that despite the active measures taken by states to prevent CND, significant RF for their development (low physical activity, unhealthy diet, smoking, overweight and obesity) are still widespread, including among young people [1, 2 ,4].

Objective

To identify the prevalence of some leading RF of CND among medical students using the example of students from the Amur State Medical Academy.

Materials and methods

The study was conducted at the Amur State Medical Academy among 3rd-5th year students of the medical and pediatric faculties. The study involved 193 students, of whom 67% (n=129) were women and 33% (n=64) were men. The age of the study participants was 22[22;24] years.

Such risk factors as unhealthy diet, low physical activity, and a family history of cardiovascular and oncological diseases were assessed based on the results of the questionnaire. The physical examination included calculation of the body mass index (BMI) according to Quetelet and measurement of waist circumference. The level of total serum cholesterol was also assessed.

During the statistical analysis of qualitative characteristics, the absolute (n) and relative (%) frequency of their occurrence were assessed. Quantitative data were presented as median (Me), lower (Q1) and upper (Q3) quartiles in the format Me[Q1;Q3]. Comparative analysis was carried out using the Mann-Whitney test and the Pearson test (χ^2). Differences were considered statistically significant at $p<0,05$.

Results and discussion

In the total cohort of patients, 24 people smoked tobacco. Smoking was more common among men (17%, n=11) than among women (10%, n=13), but without statistically significant differences. The number of cigarettes smoked per day in the general cohort of patients was 5[3;6] cigarettes per day. The men we examined smoked 6[5;9] cigarettes per day, which was comparable to the figure for women (4[2;5] cigarettes per day, p=0,4). One of the frequently identified RF for CND among students is unhealthy eating habits. 40% (n=52) of women and 48% (n=31) of men surveyed stated that they do not adhere to healthy eating rules with comparable frequency (p=0,358). In addition, we found low physical activity in 19% (n=25) of women and 13% (n=8) of men, p=0,321. A family history of cardiovascular diseases was reported by 11% (n=8) of women and 3% (n=2) of men, and a family history of oncopathology by 7% (n=9) and 6% (n=4) respectively.

The BMI in the overall group was 22[21;27]kg/m^2, in men – 25[22;28]kg/m^2. The BMI of men was significantly higher than that of women (BMI 22[20;26]kg/m^2, p=0,005). Among men, excess body weight was detected in 28 people (44%), which was significantly more common than in women (26 patients (20%), χ^2=11,238, $p<0,001$). Among both men and women, obesity was recorded in 11% of cases (7 and 14 examined patients respectively There were no significant differences in the incidence of obesity between men and women (p=0,566). In the group of men, grade 1 obesity was found in 4 of the examined individuals, grade 2 obesity in 2 of the examined individuals, and grade 3 obesity in 1 of the examined individuals. Among women, stage 1 obesity was detected in 6 patients, stage 2 obesity was detected in 5 patients, and stage 3 obesity was detected in 3 patients. The total cholesterol level in the overall patient cohort was 4,3[4,0;4,6] mmol/l. In men, the total cholesterol level was 4,5[4,3;4,8] mmol/l, and in women it was 4,2[3,9;4,6] mmol/l, p=0,75). Hypercholesterolemia was detected more often in men (17% (n=11) and in women (9% (n=11), but without a significant difference (p=0,123).

The data we obtained may indicate that even high awareness of medical students about various aspects of the occurrence of CND, contrary to expectations, does not always form a dominant tendency towards a healthy lifestyle. These facts indicate the need to introduce additional preventive measures and information campaigns aimed at students, including medical schools.

References:

1.Apoyan SA, Guryanov MS, Pozdeeva AN. Prevalence of risk factors of chronic non-communicable diseases among medical students with different levels of physical activity. Saratov Journal of Medical Scientific Research 2020; 16 (4): 940–943.

2.Assessment of Cardiovascular Risk Factors in Young Adults through the Nursing Diagnosis: A Cross-Sectional Study among International University Students / G. Duarte-Climents, T.F. Mauricio, J. Gómez-Salgado, R.P. Moreira, M. Romero Martín, M.B. Sánchez-Gómez // Healthcare (Basel). –

2021. – Vol. 9, № 1. – P. 91. DOI: 10.3390/healthcare901009.

3.Kontsevaia AV, Myrzamatova AO, Mukaneeva DK, Sapunova ID, Balanova YuA, Khudiakov MB, Drapkina OM. The economic burden of main non-communicable diseases in the Russian Federation in 2016. Russian Journal of Preventive Medicine. 2019; 22(6):18-23. (In Russ.). https://doi.org/10.17116//profmed20192206118.

4.Zhukova A.V., Pishchikova M.P., Tolmachev D.A. Health status of medical university students and its components // Modern Science. 2021; 11–2:97–101.

DIGITAL TECHNOLOGIES IN TEACHING COMMUNICATION WITH 'DIFFICULT PATIENTS' IN THE INTENSIVE CARE UNIT (ICU): AN INNOVATIVE APPROACH AND INDUSTRIAL INTEGRATION OF THE EDUCATIONAL PROCESS

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Abstract

The digital transformation of medical education opens up new opportunities for preparing physicians for work in the extreme conditions of the intensive care unit (ICU). High levels of stress in patients, fear of pain and death, often provoke destructive behavior ("difficult patients"), requiring anesthesiologists to possess not only clinical knowledge but also developed communication skills. In this regard, a program called "Resource Management in Crisis Medical Situations" was developed within the Anesthesiology-Resuscitation program at the Accreditation and Simulation Center. It integrates modern digital tools - video recording, structured debriefing, electronic questionnaires, and interactive scenario analysis. The experience of systematically training residents in algorithms for interacting with various psychological types of patients is presented. The potential for the industrial integration of simulation technologies into routine clinical practice and postgraduate education is discussed, thereby bridging the gap between theoretical training and real-life ICU conditions.

Keywords: difficult patients, medical education, communication, simulation training

The intensive care unit (ICU) is a highly stressful environment where patients often exhibit complex emotional and behavioral reactions due to critical illness. Effective communication under these extreme conditions is a crucial component of safe and successful medical care, highlighting the acute need to integrate modern digital and simulation technologies into the professional training of anesthesiologists and resuscitation specialists.

Objective

The objective of the training was to develop skills in working with "difficult patients" using digital educational technologies [1], develop and implement scientifically based communication algorithms to improve the professional competencies of intensive care physicians [2], and integrate simulation methods into continuing medical education.

Materials and methods

The training was conducted at the Accreditation and Simulation Center of the Amur State Medical Academy as part of the proprietary program "Resource Management in a Medical Crisis." Since 2023, 34 clinical residents have completed the module. Classes were held in small groups (6-8 people) using simulation scenarios, video recordings, and debriefing. An anonymous electronic survey was used to evaluate effectiveness. Additionally, literature was reviewed and conflict

situations from ICU practice were retrospectively analyzed [3, 4].

Results and discussion

Based on literature review and clinical experience, five consistent types of "difficult patients" were identified, most commonly encountered in the ICU: aggressive, anxious (overly worried), manipulative, doubtful (low trust in treatment), and apathetic (indifferent). During the simulation training, residents practiced several key scenarios: postoperative delirium with aggression toward a nurse, a manipulative relative threatening to complain [5], an anxious patient demanding a doctor's constant presence at the bedside, and a patient refusing respiratory support.

Analysis of video recordings of the training sessions revealed that, in stressful situations, residents tend to either aggressively defend their position or withdraw from contact. After analysis and correction, most participants changed their nonverbal responses and communication style [6]. An anonymous retrospective survey of 34 residents yielded a high percentage of positive feedback. Trainees confirmed that the knowledge they gained helps them better understand patient behavioral motivations, and the burnout prevention techniques were deemed useful and are planned for future use.

The obtained results confirm that in the intensive care unit (ICU), the "purity" of a patient's psychological type is often distorted by their somatic status (cerebral hypoxia, delirium). This requires physicians to perform a primary differential diagnosis between psychological reactions and organic CNS damage, a task not always considered in standard communication courses [2].

The typology identified is provisional: in real-life practice, a patient may exhibit characteristics of several types simultaneously. Nevertheless, the proposed strategies for interacting with each type allow physicians to more quickly navigate conflict situations and choose effective tactics [3].

Particularly noteworthy is the effect noted by the residents of reducing fear of aggressive relatives and changing the patient's perception from a "nuisance" to a "partner" [5]. This indicates that simulation training with video debriefing influences not only behavioral skills but also the emotional and value-based attitude toward patients.

A separate section on burnout prevention included in the module received high marks. Working with difficult patients is a powerful source of professional stress, and developing skills with Self-regulation training should become a mandatory part of postgraduate training for resuscitation specialists.

Thus, systematic training in communication algorithms for difficult patients not only improves medical safety but also contributes to the preservation of staff psychological health.

Conclusions

Knowledge of the typology of "difficult patients" is a mandatory part of a resuscitation specialist's competencies. Digital technologies (video recording, electronic questionnaires, debriefing) significantly increase the effectiveness of training and should become a standard in postgraduate training. This module can be scaled up to other residency programs. Mandatory use of simulation, video debriefing, and emotional self-regulation training is recommended.

References:

1.Khodus S.V., Barabash I.V. Difficult patient: a study guide for clinical residents. – Blagoveshchensk: Amur State Medical Academy, 2025. – 88 p.

2.Khodus S.V., Stukalov A.A., Pustovit K.V., Oleksik V.S., Barabash I.V. Communication skills in the work of an anesthesiologist-resuscitator // Amur Medical Journal. – 2023. – No. 2. – P. 37–42.

3.Klopova I.A. Doctor vs. Patient: A Practical Guide to Conflict-Free Communication. – Yekaterinburg: Ridero, 2022. – 120 p.

4.Stolyarenko D.D. Psychology of Communication: A Textbook for Medical Universities. – 9th ed., revised and enlarged. – Rostov-on-Don: Phoenix, 2024. – 412 p.

5.Mikhailov I.V., Kuznetsova O.A. Psychological Aspects of Interaction with Relatives of Intensive Care Patients // Bulletin of Anesthesiology and Resuscitation. – 2023. – Vol. 20, No. 3. – P. 82-87.

6.Silverman D., Kertz S., Draper D. Communication Skills with Patients / translated from English by A.I. Dorman. – M.: Granat, 2018. – 304 p.

IMMUNOHISTOCHEMICAL ASSESSMENT OF SKIN WOUND DEFECT HEALING USING BIODEGRADABLE TISSUE-ENGINEERED PRODUCTS IN THE CONTEXT OF DEEP FROSTBITE

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Abstract

The study conducted on 50 male laboratory rats with simulated deep frostbite, compared the effects of standard therapy versus a biodegradable tissue-engineered product based on a gelatin-ribose polymer with dermal fibroblasts on matrix metalloproteinase 9 (MMP9) expression in the wound defect area. Immunohistochemical assessment of MMP9 in dermal cells revealed a 1.71-fold increase in protein levels on day 7 relative to the comparison group, and a 1.57-fold increase on day 14.

Keywords: frostbite, biopolymeric tissue-engineered product.

The development of novel modifications of biodegradable tissue-engineered products for the treatment of deep frostbite remains highly relevant in the field of critical temperature state medicine [1]. Matrix metalloproteinase 9 (MMP9) is a key regulator of the inflammatory response, cell migration, angiogenesis, and extracellular matrix remodeling in skin tissue. This study focuses on investigating the dynamics of its expression.

Objective

To perform histological and immunohistochemical evaluation of wound defect healing after deep skin frostbite in an experimental setting, comparing standard therapy alone and in combination with implantation of a biodegradable tissue-engineered product.

Materials and Methods

The study was carried out on 50 male Wistar rats (weight 134 (122–164) g, age 2.16 (2.0–2.42) months). The animals were divided into groups: control (n=10, intact), comparison (n=20), and experimental (n=20). In the comparison and experimental groups, local contact deep frostbite of the back was induced according to the method of Boyko V.V. [2]. All frostbite animals received primary surgical debridement and topical application of Levomekol ointment; the experimental group additionally received implantation of the biodegradable tissue-engineered product (BTP). Wounds were covered with a sterile dressing, changed daily. Scaffolds were fabricated according to a patented method [3]. Isolation, cultivation, and seeding of dermal fibroblasts into the scaffolds were performed as described in [4]. Animals were euthanized on days 7 and 14 post-injury. Immunohistochemical analysis was performed on paraffin-embedded skin sections. Antigen detection was carried out using a monoclonal antibody against matrix metalloproteinase 9 (MAA553Ra21, Lab Vision, USA). The immunohistochemical reaction was performed according to the manufacturer's instructions. MMP9 expression was evaluated by calculating the percentage

of immunopositive cells relative to the total number of dermal cells per field of view using a ZEISS ERc digital microscope (Germany). Statistical analysis was performed using IBM SPSS v. 23.0. Differences between two independent groups with non-normally distributed quantitative data were assessed using the Mann–Whitney U test.

Results and Discussion

On day 7, MMP9 expression in the experimental group was significantly higher by 1.71 times compared to the comparison group ($p=0.023$). On day 14, MMP9 expression in the experimental group remained higher by 1.57 times compared to the comparison group ($p=0.016$). Analysis of MMP9 dynamics between days 7 and 14 revealed no statistically significant differences within either group: expression decreased 1.11-fold in the comparison group ($p=0.917$) and 1.21-fold in the experimental group ($p=0.144$). Compared to the intact group, MMP9 levels increased 1.32-fold in the comparison group on day 7 ($p=0.251$), 1.19-fold in the comparison group on day 14 ($p=0.347$), 2.26-fold in the experimental group on day 7 ($p=0.009$), and 1.71-fold in the experimental group on day 14 ($p=0.011$).

The immunohistochemical findings indicate that although MMP9 levels decreased by day 14 in both groups, the reduction was not statistically significant, suggesting sustained proteolytic activity throughout the observation period. However, the higher absolute values in the experimental group may reflect more intensive matrix turnover, which is essential for complete regeneration.

Our results demonstrate that the application of the BTP in deep frostbite is associated with a significant activation of MMP9, exceeding that observed in the comparison group. This may facilitate more effective removal of damaged matrix and create favorable conditions for reparative cell migration.

References:

1.Rakhmanov R.S., Bogomolova E.S., Narutdinov D.A., Razgulin S.A., Potekhina N.N., Nepryakhin D.V. Assessment of bioclimatic indices in the territories of subarctic and continental climatic zones of the Krasnoyarsk Territory. Gigiena i Sanitaria. 2022; 101(3): 288–293. DOI: https://doi.org/10.47470/0016-9900-2022-101-3-288-293

2.Kovalev G.A. et al. Morphological characteristics of wounds caused by cryodestruction. Actual Problems of Medicine. 2015; 22(219): 33-38.

3.Method for improving physical properties and increasing porosity of gelatin by modification with ribose and sodium chloride. Patent RU 2767252; filed 20.02.21; published 17.03.22, Bull. No. 8.

4.Barannikov S.V. Evaluation of changes in cytokine profile during standard therapy of cold injury and using biodegradable tissue-engineered constructs. In: Innovative Methods of Diagnosis and Treatment in Traditional Russian and Chinese Medicine: Proceedings of the XX Russian-Chinese Biomedical Forum, Blagoveshchensk, September 15–17, 2025. Blagoveshchensk: Amur State Medical Academy, 2025. pp. 21–22. EDN WLDDIV.

EXPERIENCE OF USING ORGAN-SPARING SURGERY FOR PLACENTA ACCRETA USING DISTAL TOURNIQUET HEMOSTASIS

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Abstract

Over the past few decades, the incidence of placenta accreta has increased 100-fold. This complication is the most common indication for hysterectomy during pregnancy. In recent years, uterus-sparing surgical techniques for placenta accreta have been increasingly adopted. This approach reduces intraoperative blood loss and preserves the patients' quality of life.

Keywords: placenta accreta, pregnancy, surgery, hemostasis.

Placenta accreta (placenta accreta spectrum - PAS) is a term describing the abnormal invasion of the trophoblast - a part or the whole of the placenta into the myometrium of the uterine wall.

Objective

To evaluate the efficacy of distal tourniquet hemostasis in pregnant women with placenta accreta.

Materials and methods

An analysis was conducted of two cases involving uterus-sparing surgery for placenta accreta spectrum. Patient age, obstetric history, and complications of the current pregnancy are described. The patients underwent laparotomy, classical (corporeal) cesarean section, distal tourniquet hemostasis, and metroplasty. The diagnoses of placenta adherenta or creta (according to FIGO classification) were morphologically confirmed.

Results and discussion

In 2025, two patients with placenta accreta spectrum (PAS) underwent delivery via an organ-sparing procedure at the Regional Perinatal Center of the Amur Regional Clinical Hospital.

Patient B, aged 26, had a medical history comprising two failed miscarriages followed by uterine curettage, as well as one preterm delivery via Cesarean section at 33 weeks of gestation due to severe preeclampsia and severe pneumonia.

Patient D, aged 31, had a history of one vaginal delivery, one early-term instrumental abortion, and three deliveries by Cesarean section; the indication for the first Cesarean section was a breech fetal position combined with a relatively high estimated fetal weight.

Both patients' pregnancies were complicated by anemia, which was managed with anti-anemic therapy using oral iron preparations.

The patients were admitted to the perinatal center at gestational ages of 36.6 and 37.4 weeks. Delivery was performed electively at 37.1 and 37.6 weeks. Characteristic features of the placental invasion included a pronounced network of varicose veins in the lower uterine segment, thinning of the area of the previous uterine scar and the lower uterine segment throughout its extent, and a uterine hernia. A transverse incision was made in the uterine body, above the upper edge of the placenta. The weights of the full-term fetuses were 3,660 g and 3,052 g, with Apgar scores of 9/9 and 8/8, respectively. Following the clamping and ligation of the umbilical cords, a Foley catheter tourniquet was applied at the level of the internal os. The uterine aneurysm—along with the area of placental ingrowth—was excised, followed by metroplasty and removal of the tourniquet. Carbetocin was administered for hemorrhage prophylaxis. The placentas were located on the posterior wall, extending to the anterior wall via the lateral uterine wall and the internal os, which they covered. Blood loss in both cases amounted to 2,000 ml; blood and plasma transfusions were administered.

Microscopic examination revealed myometrial fragments showing physiological myocyte hypertrophy and moderate edema, with closely adherent necrotic decidual tissue and an absence of Nitabuch's layer (fibrinoid necrosis). The histological appearance in this area is consistent with placenta adherenta or placenta accreta (firm attachment or ingrowth of the placenta into the muscular layer) according to the FIGO classification.

In the postoperative period, the patients received anti-anemic therapy to correct mild anemia. They were discharged home with their infants on the sixth day.

The choice of treatment method for PAS remains a subject of debate. Hysterectomy is associated with significant intraoperative blood loss, the loss of future reproductive function, and a reduced quality of life. Organ-sparing surgery, in turn, requires the coordinated efforts of a multidisciplinary team comprising obstetrician-gynecologists and anesthesiologists-intensivists skilled and trained in this technique, a transfusion specialist, and—when necessary—a urologist and a vascular surgeon.

References:

1.Matsuzaki S., Mandelbaum R.S., Sangara R.N. [et al.]. Trends, characteristics, and outcomes of placenta accreta spectrum: A national study in the United States // Am J. Obstet. Gynecol. – 2021. – Vol. 225. – P. 534.
2.Gumenyuk, E.G. Placenta accreta: a literature review with a discussion of a "near-miss" clinical case / E.G. Gumenyuk, I.S. Rudakova // Medical and Pharmaceutical Journal "Pulse". – 2020. – Vol. 22. – No. 1. – P. 21–33.
3.Talanova I.E., Smolin S.A., Umarova A.I., Belova K.A., Balagurova E.V. Experience with metroplasty using distal compression hemostasis for organ-sparing surgery in cases of placenta accreta // Russian Journal of Human Reproduction. – 2021. – 27(5). – P. 142–146.
4.Kulikov I.A., Dobrokhotova J.E., Belousova T.N., Nizyaeva N.V., Borovkova E.I., Burdenko M.V., Davydova D.S., Manafova N.R. Placental ingrowth in a monochorionic diamniotic twin pregnancy // Gynecology, Obstetrics and Perinatology. – 2023. – 22(3). – P. 122–128.
5.Fonseca, A. Maternal morbidity and mortality due to placenta accreta spectrum disorders / A. Fonseca, D. Ayres de Campos // Best Pract Res Clin Obstet Gynaecol. – 2021. – Vol. 72. – P. 84–91.
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Molecular mechanisms of cold-induced bronchospasm and the search for new drugs

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Abstract

The results of a study of the role of oxidative stress and expression of the cold receptor TRPM 8 in the development of bronchospasm in response to cold, typical for patients with COPD, are presented, and an alternative mechanism is proposed to explain the anti-inflammatory effect of corticosteroid drugs.

Key words: low temperatures, bronchospasm, COPD, TRPM8, exhaled air condensate, corticosteroids .

Oxidative stress and TRPM8 receptor expression are considered as molecular mechanisms of bronchospasm developing under the influence of low temperatures on the body and characteristic of patients with COPD [1]. Over the past few years, we have conducted studies aimed at clarifying the role of oxidative stress and TRPM8 expression in the pathogenesis of COPD [2], and also proposed a new mechanism explaining the anti-inflammatory effect of corticosteroid drugs [3,4].

Aim

Generalization of the results obtained in elucidating the role of oxidative stress and TRPM8 expression in the pathogenesis of COPD and consideration of a new mechanism of the anti-inflammatory effect of corticosteroid drugs.

Materials and methods

The study material was blood and exhaled breath condensate (EBC) from COPD patients, and blood and lung tissue from male Wistar rats. The content of lipid oxidation products was determined by EBC using UV absorption spectra of lipid extracts [5]. An experimental model of COPD in male Wistar rats was created by inhalation exposure to cigarette smoke and tobacco aerosol. To study the expression of genes associated with TRPM8, RNA was isolated from whole blood. RT-qPCR was performed using specific primers. Relative expression was calculated using the DESeq2 method. Raw RNA sequencing data from human whole blood samples were obtained from the Sequence Read Archive. Co-expression modules were identified using WGCNA. The formation of TRPM8 complexes with corticosteroid drugs was studied using rigid and flexible molecular docking methods [3,4]. The ligand structures were taken from the PubChem database in sdf format. The 3-D model of TRPM8 was downloaded from the UniProtKB database (PDB ID: AF-Q7Z2QW).

Results and discussion

Elevated levels of oxidized lipids were found in the EBC and blood of COPD patients compared to healthy individuals, particularly in patients with hypoosmolar bronchial reactivity. Inhalation

exposure of rats to cigarette smoke produced an experimental COPD-like phenotype (pulmonary tissue hardening, infiltrates, emphysema, and goblet cell hyperplasia). This phenotype is characterized by increased expression of TRPM 8 genes and its cold receptors (COL4A2, IL2RA, and CCL13), confirming the role of TRPM 8 in the pathogenesis of COPD. Analysis of RNA sequencing results from human whole blood samples revealed a co-expression network of genes involved in immune response, inflammation, and signaling in leukocytes, functionally linked to immunity, cell migration, and apoptosis , associated with TRPM8 and including the genes IL2RG, LCP1, CYBB, PECAM1, CASP8, and MPZL1. Validation of the bioinformatics analysis results by RT- qPCR using specific primers confirmed increased expression of TRPM8, IL2RG, LCP1, and CYBB in rats with an experimental COPD model. Results of rigid and flexible molecular docking TRPM 8 with corticosteroid drugs indicate a high affinity of the protein to substances of a corticosteroid nature, capable of acting as antagonists of the natural activator of TRPM 8 menthol, indicating an alternative mechanism of anti-inflammatory action of corticosteroid drugs.

Conclusion

The obtained results confirm the role of oxidative stress and TRPM 8 expression as molecular mechanisms in the pathogenesis of COPD and suggest an alternative mechanism of the anti-inflammatory action of corticosteroids associated with the ability to act as antagonists of natural activators of TRPM 8.

Referencees:

1.Naumov D.E., Gassan D.A., Kilimichenko K.F., Afanasyeva E.Yu., Sheludko E.G., Kolosov V.P. Features of TRPM 8 receptor expression in the respiratory tract of patients with bronchial asthma . Bulletin of respiratory physiology and pathology. 2018; (69):19-24.

2.Borodin E.A., Prikhodko A.G., Shtarberg M.A., Nahamchen L.G., Afanasyeva E., Kolosov V.P. Perelman J.M. Dynamics of lipid peroxidation in the exhaled breath condensate in healthy people during hypo- and hyperosmo -lar bronchial provocation tests. Der Pharma Chemica . 2016. Vol. 8, No. 14. P.169-173.

3.Borodin EA, Leusova N.Yu , Chupalov AP, Timkin PA, Timofeev EA, Kolosov VP, Perelman Yu.M. Two-step strategy for the search for ligands for target proteins. International Journal of Pharmaceutical and Phyto -pharmacological Research. 2021, Vol.11. Issue 2. P. 69-73.

4.Timkin P.D., Timofeev E.A., Borodin E.A. Ligand modification TRPM 8. Bulletin Physiology and pathology of respiration. 2022. No. 84. P. 32-36.

5.Borodin EA, Shtarberg MA, Prikhodko AG, Kolosov VP, Perelman JM Modified noninvasive method of studying the oxidation of lipids of airways. Der Pharma Chemica. 2015. Vol. 7, No. 11. P. 186-192.

EVALUATION OF THE ANTIOXIDANT STATUS OF PATIENTS WITH CHRONIC CEREBRAL ISCHEMIA AGAINST THE BACKGROUND OF STANDARD THERAPY OPTIMIZED WITH MEGLUMINE SODIUM SUCCINATE

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Abstract

Antioxidant status parameters were assessed in patients with chronic cerebral ischemia, randomized to the control (n=19) and study (n=16) groups. In the control group, patients received standard therapy according to Clinical Guidelines. In the study group, in addition to standard therapy, meglumine sodium succinate 1.5% solution for infusion was administered intravenously, 400 ml daily at a rate of 4.5 ml/min, for 10 days. Inclusion of a succinate-containing drug in pharmacotherapy promoted statistically significant positive changes in antioxidant status.

Key words: meglumine sodium succinate, antioxidant status, chronic cerebral ischemia, patients.

The annual increase in the number of patients with cerebrovascular pathology requires early diagnosis and timely pharmacological correction of antioxidant status, as our previous clinical studies have demonstrated correlations between oxidative stress markers and cognitive impairment [1-3, 7]. The pharmacological activity of meglumine sodium succinate is known to include antihypoxic and antioxidant effects [4]. Testing a succinate-containing drug to optimize pharmacotherapy for chronic cerebral ischemia reveals potential for its use in patients with neurological and psychiatric disorders.

Objective

To study the antioxidant status parameters of patients with chronic cerebral ischemia during standard therapy optimized with meglumine sodium succinate.

Materials and methods

A total of 35 patients with chronic cerebral ischemia secondary to cerebral artery atherosclerosis and/or hypertension were observed at the Amur Regional Psychiatric Hospital. Patients were randomized into two equal groups with no statistically significant differences in their medical history at baseline. The control group (n=19) received standard therapy according to Clinical Practice Guidelines. Patients in the study group (n=16) received, in addition to standard therapy, 400 ml of meglumine sodium succinate 1.5% solution for infusion, administered intravenously at a rate of 4.5 ml/min, for 10 days. Antioxidant status was assessed using generally accepted methods described in our previously published studies [1, 2, 5, 6]. Statistical analysis of the results was performed using Statistica software. The statistical significance of intergroup differences was assessed using the Mann-Whitney test, and intragroup differences were assessed using the Wilcoxon test, with a critical significance level of $p < 0.05$.

Results and Discussion

The observation results showed that, compared with patients in the control group, the study group demonstrated a statistically significant decrease in plasma lipid peroxidation products by 13-17% ($p < 0.05$) along with a 24% increase in ceruloplasmin concentrations ($p < 0.05$). Furthermore, the statistically significant positive dynamics of the parameters (diene conjugates, malondialdehyde, ceruloplasmin) in the study group suggests the antioxidant activity of the succinate-containing drug, which was recorded by the end of a ten-day course of meglumine sodium succinate administration to patients with chronic cerebral ischemia. The positive impact of optimized meglumine sodium succinate pharmacotherapy on the antioxidant status of patients with chronic cerebral ischemia contributes to an increase in the cohort of patients with very mild and mild cognitive impairment, with a redistribution of categories, and a decrease in the number of patients with moderate impairment by the end of the succinate-containing pharmacotherapy course. Moreover, the differences in the number of patients in the latter category over the course of succinate-containing therapy are statistically significant ($p<0.05$). Thus, the efficacy of meglumine sodium succinate, included in standard therapy for chronic cerebral ischemia, suggests further clinical trials to expand the range of results and clarify the pharmacodynamic characteristics of the succinate-containing drug in patients with this disease.

References:

1. Brash N.G., Simonova N.V. Comparative assessment of cognitive dysfunction parameters and their correlation relationships with antioxidant status when using Reamberin // Experimental and Clinical Pharmacology. - 2022. Vol. 85, No. 9. - Pp. 7-14.

2. Brash N.G., Simonova N.V., Starberg M.A. Experience with the use of Reamberin for the correction of cognitive impairment and antioxidant status in the late period of traumatic brain injury // Korsakov Journal of Neurology and Psychiatry. - 2022. - Vol. 122, No. 4. - Pp. 61-66.

3. Vasenina E.E., Levin O.S., Sonin A.G. Current trends in the epidemiology of dementia and the management of patients with cognitive impairment // S.S. Korsakov Journal of Neurology and Psychiatry. Special issues. - 2017. - Vol. 117 (6 2). - P. 87-95.

4. Zatvornitsky V.A., Simonova N.V., Starberg M.A., Tereshchenko T.A., Gulyaeva A.S. Protective effects of reamberin during noise exposure in an experiment // Experimental and clinical pharmacology. - 2024. - Vol. 87, No. 1. - P. 25-30.

5. Nosal L.A., Simonova N.V., Dorovskikh V.A. Experience of using reamberin to correct cognitive functions in epilepsy in children // S.S. Korsakov Journal of Neurology and Psychiatry. – 2020. – Vol. 120, No. 11. – P. 53-58.

6. Simonova N.V., Dorovskikh V.A., Li O.N., Anokhina R.A., Starberg M.A., Simonova N.P. Correction of oxidative stress with natural antioxidants // Bulletin of Physiology and Pathology of Respiration. – 2014. - No. 53. – P. 84-88.

7. Marques de la Plata C.D., Hart T. Impact of age on long-term recovery from traumatic brain injury // Arch Phys Med Rehabil. – 2018. – Vol. 89(5). – P. 896–903.

A COMPARATIVE ANALYSIS OF THE EFFICACY AND SAFETY OF FERROUS SULFATE AND SUCROSOMAL IRON IN THE TREATMENT OF IRON DEFICIENCY ANEMIA

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Abstract

Federal sulfate and sucrosomal iron were compared in 60 patients with iron deficiency anemia. In mild anemia, both medications increased hemoglobin equally, but in moderate anemia, sucrosomal iron significantly outperformed the standard iron in terms of hemoglobin and ferritin increases. Unlike ferrous sulfate, the sucrosomal form does not cause intestinal inflammation or increase hepcidin, ensuring stable absorption. Sucrosomal iron has a lower incidence of side effects.

Key words: iron deficiency anemia, treatment, ferrous sulfate, sucrosomal iron.

Iron deficiency anemia (IDA) affects over 3.5 billion people worldwide, primarily women [1]. Classic Fe^{2+} (ferrous sulfate) preparations are effective, but they cause intestinal inflammation via the Fenton reaction, stimulating the production of hepcidin, which blocks further iron absorption (a vicious cycle) [2]. Sucrosomal iron (Sideral Forte) is an innovative form with a phospholipid membrane that is absorbed through M cells via endocytosis, bypassing DMT-1 and hepcidin blockade [3]. Objective: To compare the efficacy and safety of ferrous sulfate (Sorbifer) and sucrosomal iron (Sideral Forte) in patients with mild to moderate iron deficiency anemia (IDA) (n=60, 12 weeks).

Materials and Methods

Group 1 (patients treated with Sorbifer): 30 patients (100 mg × 2 times/day, total 200 mg/day). Subgroup 1a: mild anemia (hemoglobin 101 ± 4 g/L, n=15). Subgroup 1b: moderate anemia (hemoglobin 82 ± 4 g/L, n=15).

Group 2 (Sideral Forte): 30 patients. Subgroup 2a: mild anemia (hemoglobin 102 ± 5 g/L) – 30 mg/day. Subgroup 2b: moderate anemia (hemoglobin 81 ± 4 g/L) – 60 mg/day.

The groups were matched by gender, age, and baseline laboratory parameters (hemoglobin, ferritin, hepcidin, CRP), ensuring a valid comparison. The parameters assessed were hemoglobin dynamics (efficacy of anemia correction), ferritin (replenishment of iron stores), hepcidin, and C-reactive protein (markers of inflammation and absorption blockade), as well as the incidence of gastrointestinal side effects.

Results and discussion

Hemoglobin dynamics. In mild anemia, both drugs demonstrated comparable efficacy. Hemoglobin increase by week 12 was +32 g/L in the Sorbifer group and +30 g/L in the Sideral group ($p > 0.05$).

This suggests that in the absence of a pronounced inflammatory background, these conventional drugs are effective.

For moderate anemia, a significant advantage of sucrosomal iron was revealed. Sorbifer: an increase of +32 g/L (from 82 to 114 g/L). Sideral Forte: an increase of +44 g/L (from 81 to 125 g/L). A difference of 12 g/L is clinically significant ($p < 0.05$ at weeks 8 and 12).

Ferritin dynamics (iron replenishment). For mild anemia: Sorbifer: an increase in ferritin of +55 μg/L (from 15 to 70 μg/L); Sideral Forte: an increase of +110 μg/L (from 15 to 125 μg/L), which is twice as high ($p < 0.05$). In moderate anemia (the most significant result): Sorbifer – the increase in ferritin was only +20 μg/L (from 8 to 28 μg/L). The level of 28 μg/L remains below normal values, indicating a clinically insignificant replenishment of iron stores; Sideral Forte: an increase of +77 μg/L (from 8 to 85 μg/L), which is significantly higher ($p < 0.05$). Thus, in the Sorbifer group, the increase in iron stores progressively slows after the 4th week due to increasing inflammation, while Sideral Forte ensures stable saturation of iron stores throughout the course.

Safety and Tolerability. The incidence of adverse events in the Sorbifer group was 20.0% (nausea, constipation, epigastric pain), which is consistent with published data (20–35%). In the Sideral Forte group, adverse events were reported in only one patient (3.3%); the difference was statistically significant ($p < 0.05$). Sucrosomal iron is well tolerated because it does not come into contact with the intestinal mucosa and does not cause local irritation or oxidative stress.

Hepcidin and CRP dynamics (a key pathogenetic aspect). In the Sorbifer group, a progressive increase in hepcidin and CRP levels was observed: hepcidin in moderate anemia increased from 25 to 90 ng/ml (3.6-fold), and CRP increased from 3.0 to 18.0 mg/l (6-fold). This is direct evidence that ferrous sulfate induces intestinal inflammation, which blocks its own absorption via the hepcidin mechanism. At hepcidin levels >50–60 ng/ml, absorption via DMT-1 virtually ceases.

In the Sideral Forte group, hepcidin and CRP levels remained consistently normal throughout the 12 weeks, confirming the absence of an inflammatory effect and the independence of absorption from the hepcidin blockade.

The advantage of sucrosomal iron in moderate anemia is explained by two key factors [2, 3]:

1. Bypass of DMT-1 and hepcidin blockade. Sucrosomes are absorbed through M cells via endocytosis. This mechanism is independent of hepcidin levels, so even with high initial inflammation, the drug continues to effectively deliver iron to the body.

2. Absence of a proinflammatory effect. Unlike ferrous sulfate, the sucrosomal form does not generate free radicals (the Fenton reaction) and does not damage enterocytes, therefore, it does not stimulate the production of IL-6 and hepcidin. This avoids the "vicious cycle" characteristic of therapy with Fe^{2+} salts.

The clinical significance of these differences is particularly significant in patients with anemia associated with chronic inflammation (intestinal diseases, heart failure, rheumatological pathology), where sucrosomal iron may be the drug of choice.

Conclusion

1. In mild IDA, ferrous sulfate and sucrosomal iron provide comparable increases in hemoglobin (+32 and +30 g/L, respectively), but the sucrosomal form significantly outperforms the classic salt in terms of ferritin replenishment (+110 vs. +55 µg/L). 2. In moderate IDA, sucrosomal iron demonstrates clinically significant superiority in both hemoglobin increase (+44 vs. +32 g/L) and ferritin replenishment (+77 vs. +20 µg/L).

3. Ferrous sulfate induces a progressive increase in hepcidin and CRP, which leads to blockade of its own absorption and a decrease in therapeutic effectiveness over time (formation of a "vicious cycle").

4. Sucrosomal iron does not cause intestinal inflammation, does not increase hepcidin levels, provides consistently high efficacy throughout the course of treatment, and is characterized by significantly better tolerability (side effects - 3.3% vs. 20.0%).

References

1. Kadyrov T.I. Iron deficiency anemia: a review of global medical periodicals // MedElement. - 2026. - January 13. – URL: https://diseases.medelement.com/material/16-01-26/8419716017686043 53 (date accessed: 07/08/2026).

2. Stuklov N.I., Gurkina A.A., Kovalchuk M.S., Kisly N.D. Modern concepts of iron absorption mechanisms, activators, inhibitors, regulation, new optimization possibilities // Therapy. 2023. No. 9. pp. 119–129.

3. Gurkina A.A., Stuklov N.I., Kisly N.D., Gimadiev R.R., Strelnikov A.A. New possibilities of pathogenetic correction of anemia in chronic heart failure // Clinical Medicine. – 2023. - No. 7-8. – pp. 387–394.

EVALUATION OF EDUCATIONAL METHODS AS A TOOL FOR PREPARING MEDICAL STUDENTD FOR PRIMARY SPECIALIST ACCREDITATION AT THE DEPARTMENT OF HOSPITAL THERAPY WITH THE COURSE OF PHARMACOLOGY NAMED AFTER PROFESSOR YU.S. LANDYSHEV

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Abstract

The paper presents the rationale for and evaluation of simulation-based technologies in preparing medical students for clinical practice. The primary objective of this educational approach is to further improve students' practical skills. The study summarizes the learning outcomes and analyzes students' performance at the Objective Structured Clinical Examination (OSCE) stations on the physical examination of the cardiovascular system and the gastrointestinal tract.

Keywords: simulation technologies, cardiovascular system, gastrointestinal tract, OSCE station.

The COVID-19 pandemic has significantly transformed the system of professional medical education, affecting not only the format of teaching (through the transition to distance learning) but also the structure of practical training. One of the major challenges of the modern educational process has been the limited involvement of real patients in undergraduate medical training. Under these circumstances, simulation-based education has become an additional, safe, and pedagogically effective approach to teaching clinical disciplines.

Within the courses Hospital Therapy and Current Issues in Cardiology, students undergo training in the physical examination of the cardiovascular system (CVS) and the gastrointestinal tract (GIT). These practical classes are conducted at the Accreditation and Simulation Center of the Amur State Medical Academy using the official OSCE station checklists. The cardiovascular examination station has been used since 2017, while the gastrointestinal examination station was introduced in 2025.

Since 2025, the Department of Hospital Therapy with the Course of Pharmacology named after Professor Yu.S. Landyshev has implemented several supplementary educational methods that have demonstrated positive outcomes in preparing students for primary specialist accreditation. These methods include instructional videos developed according to the official OSCE station checklists published by the Methodological Center for Specialist Accreditation and knowledge assessment using the easyQuizzy testing platform.

Objective

The objective of this publication was to present the practical experience of applying simulation-

based educational technologies in the training of sixth-year students at the Amur State Medical Academy.

Materials and methods

During the reporting period, a comprehensive analysis of the effectiveness of simulation-based education in training sixth-year medical students was performed.

Statistical data were compared for the OSCE stations "Physical Examination of the Cardiovascular System" and "Physical Examination of the Gastrointestinal Tract."

Results and discussion

The statistical analysis demonstrated a substantial improvement in students' performance during the OSCE stations. In 2017, only 30% of students correctly demonstrated the cardiac auscultation technique on their first attempt. By 2026, this proportion had increased to 97%.

The percentage of students who established the correct diagnosis on the cardiovascular examination station increased from 7.5% in 2017 (first attempt) to 91% in 2026. It should be noted that in 2017 the correctness of the diagnosis was not evaluated as a separate assessment criterion, unlike the assessment system introduced in 2024.

The OSCE station "Physical Examination of the Gastrointestinal Tract" was introduced in 2025. The effectiveness of simulation-based training for this station was analyzed among sixth-year students over the period from 2025 to 2026.

The proportion of students performing the abdominal palpation technique correctly increased from 95% in 2025 to 96% in 2026. The percentage of correct diagnoses also increased from 95% to 96%. Successful completion of the entire simulation scenario improved from 85% in 2025 to 90% in 2026

This study provides a comprehensive analysis of the effectiveness of integrating simulation-based education into the curriculum for sixth-year medical students. This cohort was selected because of its immediate transition to independent professional practice, making high-quality practical training particularly important.

References:

1.Ganchenko N.N., Luchnikova T.A. The Relevance of Simulation Technologies in the Study of Heart Valve Diseases. In: Science and Practice in Medicine: Proceedings of the All-Russian Educational Forum. Blagoveshchensk: Amur State Medical Academy; 2023. pp. 197–199.

2.Grigoryan M.F., Troshina E.V., Zagovorina E.A. Analysis of the Performance of the "Physical Examination" OSCE Stations by Graduates of the General Medicine Faculty in 2024. Virtual Technologies in Medicine. 2024;(3):304–305. doi:10.46594/2687-0037_2024_3_1966.

3.Demenko Iu.M., Voitsechovsky V.V., Prikhodko O.B., et al. Simulation-Based Education as a Tool for Preparation for Primary Specialist Accreditation at the Department of Hospital Therapy with the Course of Pharmacology Named after Professor Yu.S. Landyshev. In: Science and Practice in Medicine: Proceedings of the VIII International Educational Forum. Blagoveshchensk: Amur State

Medical Academy; 2026. pp. 72–74.4.

4.OSCE Station Checklist for Primary Accreditation of Specialists in General Medicine: Physical Examination of the Patient (Cardiovascular System). 2023.

5.OSCE Station Checklist for Primary Accreditation of Specialists in General Medicine: Physical Examination of the Patient (Gastrointestinal Tract). 2025.

SSESSMENT OF THE EFFECTIVENESS OF RECURRENCE PREVENTION OF THROMBOSIS IN HEREDITARY HEMATOGENOUS THROMBOPHILIA

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Abstract

The paper presents the authors' experience with the use of direct oral anticoagulants for the secondary prevention of thrombosis in patients with the most common variants of hereditary hematogenous thrombophilia. It was concluded that dabigatran, rivaroxaban, and apixaban are effective and safe agents for antithrombotic therapy.

Keywords: hereditary hematogenous thrombophilia, secondary prevention of thrombosis, dabigatran, rivaroxaban, apixaban

The term "thrombophilia" (an increased tendency toward thrombosis) refers to hereditary and acquired conditions characterized by an excessive predisposition to thrombus formation in various blood vessels. The most common forms of thrombophilia include antithrombin deficiency, protein C deficiency, protein S deficiency, activated protein C resistance, Factor V Leiden mutation, prothrombin G20210A mutation, hyperhomocysteinemia, homozygous carriage of the thermolabile methylenetetrahydrofolate reductase (MTHFR) variant, antiphospholipid antibodies, increased factor VIII activity, or reduced protein Z levels. The use of parenteral anticoagulants for thrombosis prevention is burdensome for patients and is often associated with poor treatment adherence. The most effective and convenient agents are considered to be direct oral anticoagulants (DOACs), including the direct thrombin inhibitor dabigatran and the direct factor Xa inhibitors rivaroxaban and apixaban.

Objective

The aim of this publication was to present the authors' experience with dabigatran, rivaroxaban, and apixaban as agents for the secondary prevention of thrombosis in patients with hereditary hematogenous thrombophilia.

Materials and methods

The effectiveness of secondary antithrombotic therapy was analyzed in 86 patients diagnosed with hereditary hematogenous thrombophilia. There were 53 men (63%) and 33 women (37%). The patients' age at the time of diagnosis was distributed as follows: 17–20 years – 5 patients; 21–30 years – 28; 31–40 years – 38; 41–50 years – 10; and 51–60 years – 5 patients. Combined hereditary hematogenous thrombophilia, characterized by the coexistence of several hereditary and acquired thrombogenic factors in a single patient, was diagnosed in 80 cases. Only 6 patients had a mutation in a single gene.

Results and discussion

In 50 patients, the disease initially manifested as pulmonary embolism (PE); ischemic stroke was the first manifestation in 11 cases; myocardial infarction in 3 cases; and lower extremity venous disease in 22 cases. However, comprehensive examination revealed deep or superficial vein pathology of varying severity in 59 patients. By the time these patients were referred to a hematologist and the diagnosis was confirmed, the majority already had a history of multiple vascular complications. Emergency treatment of thrombosis at various sites was performed according to accepted clinical standards. Subsequently, patients were switched to oral anticoagulants provided that no pathology predisposing to bleeding was present.
Dabigatran (Pradaxa) was prescribed for thrombosis prevention in 41 patients (aged 20–60 years) with hereditary hematogenous thrombophilia. Rivaroxaban (Xarelto) was prescribed to 25 patients (aged 18–54 years). Apixaban (Eliquis) was prescribed to 10 patients aged 30–50 years, with treatment duration ranging from 6 months to 6 years. In cases of hyperhomocysteinemia, Angiovit or Pentavit was prescribed. Protein C and antithrombin III concentrates were administered when indicated in patients with congenital deficiencies.
Following initiation of dabigatran therapy, recurrence of pulmonary embolism was documented in only one patient, which was attributed to poor adherence and irregular drug intake. No life-threatening recurrent thrombotic events were observed in the remaining patients receiving dabigatran or rivaroxaban. No hemorrhagic complications were reported in patients treated with dabigatran. In contrast, five patients receiving rivaroxaban experienced minor epistaxis. Among the ten patients treated with apixaban, neither recurrent thrombotic events nor bleeding episodes were observed. No life-threatening bleeding or hematomas were recorded. Furthermore, no impairment of liver or kidney function was detected during treatment with these agents.
Dabigatran, rivaroxaban, and apixaban are effective agents for the prevention of thrombosis in patients with hereditary hematogenous thrombophilia. The high efficacy and low incidence of hemorrhagic complications associated with direct oral anticoagulants make these drugs suitable for patients living in remote areas far from major medical centers, where regular monitoring of coagulation parameters is not feasible.

References:

1. Momot A.P. Modern Methods for Detecting the State of Thrombotic Readiness. Barnaul: Altai State University Publishing House; 2011. 138 p.

2. Voytsekhovsky V.V. Secondary prevention of thrombosis using direct oral anticoagulants in hereditary hematogenous thrombophilia. Bulletin of Physiology and Pathology of Respiration. 2021;(79):110–116.

3. World Health Organization. Inherited Thrombophilia: Report of a Joint WHO/International Society on Thrombosis and Hemostasis (ISTH) Meeting. Geneva: World Health Organization; 1995.

4. Demenko Yu.M., Voytsekhovsky V.V. Assessment of the effectiveness of secondary prevention of thrombosis in patients with hereditary hematogenous thrombophilia. In: Science and Practice in Medicine: Proceedings of the VIII International Educational Forum, Blagoveshchensk, April 15–17, 2026. Blagoveshchensk: Amur State Medical Academy; 2026. P. 174–178. EDN ASDUJV.

SEVERE COURSE OF NOVEL CORONAVIRUS INFECTION WITH A FATAL OUTCOME IN AN ADOLESCENT

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Abstract

A clinical case of severe COVID-19 in a 15-year-old adolescent is described, which is uncommon in this age group. This case is notable for the combination of the novel coronavirus infection and severe neurological pathology. The development of status epilepticus secondary to hypoxia led to a fatal outcome, demonstrating the high vulnerability of comorbid patients to respiratory infections.

Keywords: adolescents, severe course, COVID-19, comorbidities

In the Russian Federation, pediatric cases accounted for 10–15% of all COVID-19 patients between 2020 and 2024, predominantly comprising children over 6 years of age and adolescents. In the Amur region, the incidence peaked in 2022 (72,387 cases), accompanied by an increase in pediatric patients from 10% in 2020 to 17.8% in 2022. Disease severity rates and the structure of mortality in the pediatric population exhibited distinct differences compared to adults. During the pandemic, the novel coronavirus infection (NCI) became the leading cause of death among adults, whereas fatal outcomes in children were recorded primarily in the presence of comorbidities. Risk factors for severe COVID-19 in childhood — which on average accounts for 1% of all pediatric cases — include age under 1 year, congenital heart defects, bronchial asthma, obesity, diabetes mellitus, and neurological disorders. In most countries, the severity of NCI is also evaluated based on the severity of respiratory failure, and the development of pneumonia or acute respiratory distress syndrome.

Objective

Analysis of a clinical case of severe COVID-19 with a fatal outcome in a 15-year-old patient.

Materials and methods

A retrospective review was conducted on the patient's primary medical records, who presented with a severe, complicated course of novel coronavirus infection against the background of comorbidities. The reviewed documents included the inpatient medical record (Form No. 003/y, 2022) and the outpatient health record «Child development history» (Form No. 112/y).

Results and discussion

Patient Y., a 15-year-old male, was admitted to the regional infectious disease hospital on November 3, 2022, in critical condition presenting with convulsive syndrome, apnea, dyspnea with wheezing, pallor, and watery diarrhea. According to the maternal history, the child had been initially hospitalized at the regional children's hospital on October 31, 2022, due to an increased frequency and decompensation of seizures progressing to status epilepticus, accompanied by episodes of oxygen desaturation. During that inpatient stay, the patient developed a new-onset fever

and dyspeptic syndrome. Laboratory testing on November 2, 2022, confirmed the diagnosis of NCI, after which the mother signed a refusal of transfer to a specialized hospital to continue treatment at home. Following a recurrence of status epilepticus associated with concomitant hypoxia (SPO2 77%), an emergency medical services team was dispatched on November 3, 2022, and the child was admitted to the intensive care unit of the infectious disease hospital.

Developmental and medical history: The child was born from the 5th pregnancy, 2nd delivery via cesarean section, with a birth weight of 3,060 g and an Apgar score of 9. He was breastfed until 3 months of age. Since 9 months of age, the patient had been managed for cerebral palsy (CP), epilepsy, and protein-energy malnutrition; he was registered as a disabled child. Past medical history was significant for frequent pneumonia. The patient lived in a household of six; contact with infected NCI individuals was denied.

Despite comprehensive treatment including oxygen therapy, glucocorticoids, interferons, antibacterial and anticonvulsant medications, the patient's course was characterized by increased muscle tone, limb tremors, and worsening respiratory failure. Three days after admission, a drop in arterial blood pressure and oxygen saturation was documented, followed by the onset of ventricular fibrillation. Cardiopulmonary resuscitation was unsuccessful, and the patient was pronounced dead. Final clinical diagnosis: U07.1 COVID-19, virus identified, severe course. Complication of the primary disease: J12.8 Community-acquired bilateral viral-bacterial polysegmental pneumonia. Stage II respiratory failure. Acute respiratory distress syndrome. Pulmonary edema. Cerebral edema. Comorbidities: G40.4 Structural epilepsy, generalized form, motor tonic-clonic and myoclonic seizures. G80.0 CP, spastic tetraplegia. GMFCS Level V, CFCS Level V. Persistent mixed myocardial dystrophy. Cachexia, severe protein-energy malnutrition secondary to the primary disease.

The presented clinical case demonstrates that severe course and fatal outcomes of COVID-19 in children and adolescents can be driven by preexisting comorbidities. Along with the severity imposed by comorbid conditions, ensuring epidemiological safety is of paramount importance for patients classified under Level V of the GMFCS and the CFCS — representing extreme clinical severity. This necessitates an interdisciplinary approach that focuses on the family's social history and fosters a robust 'physician-patient' or 'physician-parent' compliance (addressing issues such as the refusal of timely hospitalization to a specialized department, parental underestimation and misunderstanding of the child's condition, and the lack of a therapeutic alliance).

References:

1. Alexandrovich Yu.S., Prometnoy D.V., Mironov P.I., Pshenisnov K.V., Anchutin P.E., Teplyakova E.D., - Predictors of lethal outcome of novel coronavirus infection COVID-19 in children // Messenger of Anesthesiology and Resuscitation. – 2021. – Vol. 18.-№ 4. – C.29-36.

2. Tavabilov R.R., Valiulina A.Ya., Abrashina N.A., - Clinical case of severe course of COVID-19 in an infant // Bashkortostan Medical Journal. – 2025. – Vol. 20.-№ 3 (117). – C.84-89.

3. Dolgikh T.A., Romantsova E.B. Clinical and epidemiological features of the course of novel coronavirus infection in children (literature review) // Amur Medical Journal. – 2026. – Vol. 14.–№ 2. – C.64-73.

EDUCATIONAL INNOVATIONS IN THEORETICAL AND CLINICAL INTEGRATION IN THE STUDY OF THE "FUNDAMENTALS OF PARASITISM" IN THE XXI CENTURY

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Abstract

The study is devoted to the role of information and communication technologies (ICT) in the system of biological and medical education in the study of the section "Fundamentals of parasitism" at the initial stage of medical education in the Amur State Medical Academy. Solving the problem of training qualified medical personnel in the context of the rapid growth of information, including a wide range of infectious and parasitic nosologies of the XXI century in connection with geoclimatic problems in the World, in Russia, in the Far East, with the development of diagnostic and therapeutic technologies is impossible without the use of innovative ICTs along with traditional ones in the educational process. Virtual technologies make it possible to make the process of training doctors motivated, active, and developing in the system of predictive medicine.

Keywords: information and communication technologies, format of educational content, OPK-1, parasitism - medical and biological relevance.

Aim. To analyze the experience of using ICT in the study of the section "Fundamentals of Parasitism" in the 1st year of the ASMA and to evaluate their effectiveness in the implementation of active virtual communication between the subjects of the educational process in a medical university. To present effective forms of high-quality and expedient role of teachers in organizing the study of the phenomenon of "Parasitism" in the XXI century in the process of controlled extracurricular independent work, in the forms of research work of students using innovative technologies.

Materials and methods. The reserve of scientific sources on the problem of modern educational practice using ICT in order to improve the quality of training and motivation for the biological and medical study of parasitosis in the databases: "PubMed", "e-Library", "Scopus", with subsequent analysis of the results, was studied. The ICT complex was used to determine the level of skills and abilities of students in the amount provided for by the Federal State Educational Standards (stage and final testing, solving situational problems, interviews), to assess the research skills of students, participants in poster departmental, interdepartmental, final conferences of ASMA.

Results and discussion. Medical professionalism is based on biological knowledge, the proof of which is the purpose of biology as a fundamental discipline for all branches of medical education: to prepare a graduate of a medical university, according to the Federal State Educational Standards of Higher Education, with general professional competence-1 (OPK-1). It means readiness to solve standard tasks of professional activity using information, bibliographic resources, medical and biological terminology, ICT [1]. This applies to the section "Parasitism", the medical and social

relevance of which in the 21st century is growing in all countries of the world, including Russia, the Far Eastern Federal District (FEFD), China, and the countries of Southeast Asia [2]. The problem of training qualified medical personnel in the context of the rapid development of socio-economic interstate relations, the increase in the volume of information, the expansion of the range of technical means and medical equipment is impossible without the use of innovative computer technologies in the educational process. The problem of training qualified medical personnel in the context of the rapid development of socio-economic interstate relations, the increase in the volume of information, the expansion of the range of technical means and medical equipment is impossible without the use of innovative computer technologies in the educational process. Under these conditions, the type of educational relations, in which a teacher of higher education transfers ready-made experience and organizes passive cognitive activity of students, loses its relevance [3]. Taking this into account, over the past 10 years, the discipline of Biology has organized active interaction between the student and the information system to obtain knowledge using various interactive technologies. The study of domestic and foreign scientific literature testifies to the importance of information technologies of the problem of "Parasitism", to interstate cooperation for solving epidemiological and medical problems, taking into account the new requirements for the organization and effectiveness of the educational process in the training of medical personnel [4]. Electronic manuals have been created that have been introduced into the Moodle system, designed for independent classroom (in practical classes) and extracurricular (in the process of preparing for the current, midterm control of knowledge, for the final certification) work of students with textual and visual information for the analysis and consolidation of theoretical material, the acquisition of practical skills in order to form GPK-1 of the Federal State Educational Standards of Higher Education. Interactive control and training presentations are used on all topics of Parasitology, including information according to the algorithm for the analysis of pathogens in the nasoarea system. Using a variety of digital tools and web 2.0 services, the teacher organizes and presents educational content in an attractive format: mental maps-tasks, interactive images/presentations in order to verify pathogens, participants in life cycles, didactic games with various types of online questions using Internet resources, including detailed answers. All this makes the learning process more dynamic, effective, and reflects the level of skills and abilities acquired by students.

Conclusion. The advantages of using ICT in the educational process include: - visualization of educational material with verification of objects; - the ability to assess the knowledge of students in real time; - Reducing the time for checking test tasks, situational tasks; - rational use of the teacher's time in preparation for classes. The disadvantages of using Internet technologies include the time spent on creating high-quality content associated with the abundance of information on the Internet already noted above. Teachers face barriers to the active and adequate use of digital tools in learning for a number of students, including a lack of ICT skills in teaching, unpreparedness to work in an online environment, insufficient ICT skills, which are overcome in the learning process. However, the analysis of the experience of using interactive technologies indicates their undoubted expediency in the implementation of active virtual communication between the subjects of the educational process at the initial stage of medical education, which increases interest in the study of Biology as the foundation of medical knowledge.

References:

1. Aleshkovsky I.A., Gasparashvili A.T., Krukhmaleva O.V., Narbut N.P., Savina N.E. Features of the formation of educational trajectories of Russian students: assessment and opportunities. 2023. T. 23. № 4.

2. Stepanova T.F., Stepanova K.B., Bakshtanovskaya I.V., Shepotkova A.A. Sovremennaya situatsiya po parasitarnym zabolevaniam v Rossiyskoy Federatsii: global'nye vyzovy i puti resheniya [Modern situation on parasitic diseases in the Russian Federation: global challenges and solutions]. Medical parasitology and parasitic diseases . 2023. № 2. P. 3-13. DOI: https://doi.org/10.33092/0025-8326mp2023.2.3-13.

3. Aleksandrova O.A. Problems of higher education: inside and outside the education system. 2023. T. 19. № 2. DOI: https://doi.org/10.52180/1999-9836_2023_19_2_1_157_168.

4. Voronova A.N., Tabakaeva T.V., Vainutis K.S., et al. Actuality of parasitological research in the south of the Russian Far East. // POPULATION HEALTH AND HABITAT - ZNISO. 2021 No5 (338). Pp. 52–60. DOI: https://doi.org/10.35627/2219-5238/2021-338-5-52-60.

Analysis of markers of drug-induced liver injury in patients with pulmonary tuberculosis during anti-tuberculous and hepatoprotective therapy

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Abstract

The efficacy of ademetionine in the prevention of hepatotoxic complications of anti-tuberculosis chemotherapy was assessed. Patients with newly diagnosed pulmonary tuberculosis were randomized into two groups (control, n=22, and study, n=21) and, starting from the first day of anti-tuberculosis chemotherapy, received 400 ml of a 5% glucose solution intravenously daily for 10 days and ademetionine (400 mg, lyophilisate for the preparation of a solution for intravenous administration) intravenously once a day for 10 days. Hepatoprotective administration of ademetionine to anti-tuberculosis chemotherapy contributed to a statistically significant decrease in the concentration of total bilirubin (by 34%, $p<0.05$), alanine aminotransferase by 3.2 times ($p<0.05$), aspartate aminotransferase by 1.8 times ($p<0.05$), and alkaline phosphatase by 37.3% ($p<0.05$) relative to control, which confirms the prophylactic effectiveness of the hepatoprotector.

Key words: pulmonary tuberculosis, specific chemotherapy, hepatotoxic complications, prevention, ademetionine, patients.

According to international recommendations, hepatoprotectors should be prescribed to correct hepatotoxic complications of anti-tuberculosis chemotherapy after the detection of grade 3 and 4 liver dysfunction. However, Russian scientists advocate the concomitant administration of hepatoprotectors with anti-tuberculosis drugs to prevent toxic load on the liver [1, 4]. Given the sufficient evidence base for the effectiveness of ademetionine as a hepatoprotective agent, its inclusion in the prevention of drug-induced liver injury from the first days of specific chemotherapy for pulmonary tuberculosis will, in our opinion, reduce the risk of discontinuing antibacterial agents.

Objective

To evaluate the effectiveness of ademetionine in the prevention of hepatotoxic complications of specific chemotherapy in patients with pulmonary tuberculosis.

Materials and Methods

A prospective, controlled study was conducted at the 2nd Pulmonary Tuberculosis Treatment Department of the Sakhalin Regional Tuberculosis Dispensary. 44 patients with newly diagnosed pulmonary tuberculosis were randomized to the control (n=22) and study (n=21) groups. Additionally, starting on day 1 of anti-tuberculosis chemotherapy, they received 400 ml of a 5% glucose solution by intravenous drip daily for 10 days, respectively, and ademetionine (400 mg, lyophilisate for the preparation of an intravenous solution) by intravenous drip once a day for 10 days.

Key biochemical parameters were determined using standard methods before treatment and on day 11 of therapy [2, 3]. Statistical analysis of the results was performed using nonparametric tests (Statistica 10.0).

Results and Discussion

During anti-tuberculosis therapy, on the 11th day of treatment, statistically significant changes in liver damage markers were recorded in the control group compared to patients receiving hepatoprotective therapy: total bilirubin levels were significantly lower than in the control group by 34.2% with the use of ademetionine ($p < 0.05$), alanine aminotransferase activity was 3.2 times lower ($p < 0.05$), aspartate aminotransferase activity was 1.8 times lower ($p < 0.05$), and alkaline phosphatase activity was 37.3% lower ($p < 0.05$). It is necessary to point out a statistically significant increase in the dynamics by the 11th day of therapy of the direct bilirubin fraction when using ademetionine (by 22.7%, $p <0.05$) against the background of a tendency towards an increase in total bilirubin (by 9%), which is associated, in our opinion, with an insufficient duration of the course of pharmacoprophylaxis: despite the ability of ademetionine, which is involved in transmethylation and transsulfation reactions, to ensure the fluidity and polarization of membranes by increasing the content of phospholipids against the background of restoration of the endogenous glutathione pool, a short course of hepatoprotection does not offset the damaging effect of anti-tuberculosis drugs on hepatocytes. Similar results were recorded by D.S. Sukhanov et al., who showed the least pronounced positive changes in the liver in comparison with other hepatoprotectors with the administration of ademetionine, which has a weak effect on the processes of necrobiosis and stimulates alteration of liver tissue [5]. In general, the assessment of the prophylactic use of ademetionine to reduce the negative impact of anti-tuberculosis chemotherapy indicates the ability of the drug to prevent negative changes in the functional activity of the liver, while the duration of the course of hepatoprotective support requires clarification, which requires further clinical observations.

References:

1. Balasanyants G.S. Hepatotoxic reactions and hepatoprotective therapy in phthisiology // Tuberculosis and lung diseases. - 2015. - No. 8. - P. 48-52.

2. Goroshko A.I., Shchelkunov A.I., Simonova N.V. Clinical efficacy of remaxol for the prevention of hepatotoxic complications of anti-tuberculosis chemotherapy // Experimental and clinical pharmacology. - 2025. - Vol. 88, No. 3. - P. 22-28.

3. Dorovskikh V.A., Li O.N., Simonova N.V., Shtarberg M.A., Bugreeva T.A. Remaxol in the correction of lipid peroxidation processes in biomembranes induced by cold exposure // Yakut medical journal. – 2015. - No. 4 (52). – P. 21-24.

4. Starshinova A.A., Belyaeva E.N., Panteleev A.M., Pavlova M.V. Use of hepatoprotectors during tuberculosis chemotherapy: a review of domestic and foreign studies // Tuberculosis and lung diseases. - 2018. - Vol. 96, No. 10. - P. 16-22.

5. Sukhanov D.S., Pavlova M.V., Yablonsky P.K., Vinogradova T.I. Comparative efficacy of reamberin, remaxol and ademetionine in patients with respiratory tuberculosis and drug-induced liver injury // Antibiotics and chemotherapy. – 2013. - Vol. 58, No. 1-2. – P. 13-18.

INTERRELATIONSHIP OF 12-HETE, 15-HETE, AND ENDOTHELIN-1 IN COVID-19 IN PREGNANT WOMEN DURING THE THIRD TRIMESTER

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Abstract. The study demonstrates that COVID-19 in pregnant women during the third trimester induces significant alterations in the lipoxygenase pathway of arachidonic acid metabolism: an increase in 12-hydroxyeicosatetraenoic acid (12-HETE) by 1.94-fold ($p<0.001$) in mild cases and by 2.49-fold ($p<0.001$) in moderate cases, an elevation of 15-HETE by 1.42-fold ($p<0.001$) and 1.82-fold ($p<0.001$), respectively, as well as a rise in endothelin-1 by 1.34-fold ($p<0.001$) and 1.64-fold ($p<0.001$) compared to controls. A strong positive correlation between 12-HETE and endothelin-1 ($rs = 0.79$; $p<0.001$) and a weak correlation for 15-HETE ($rs = 0.41$; $p<0.05$) were revealed. These changes indicate hyperactivation of the lipoxygenase pathway with predominance of proinflammatory 12-HETE and development of endothelial dysfunction, which may affect pregnancy outcomes.

Keywords: 12-HETE, 15-HETE, endothelin 1, pregnancy, SARS-CoV-2.

COVID-19 in pregnant women is accompanied by systemic inflammation, hypoxia, and endothelial dysfunction [1, 2]. In this context, hyperactivation of the lipoxygenase pathway of arachidonic acid metabolism with formation of 12-HETE and 15-HETE is possible [3]. Since oxylipins can influence vascular endothelial function, endothelin-1 represents an important marker of endotheliopathy [4]. However, the nature of alterations in 12-HETE and 15-HETE and their interrelationship with endothelin-1 in COVID-19 during pregnancy remains insufficiently studied.

Objective

To study the concentrations of 12-HETE and 15-HETE in peripheral blood of pregnant women with COVID-19 during the third trimester and to evaluate their interrelationship with endothelin-1 levels.

Materials and methods

The main group comprised 88 pregnant women in the third trimester (28–32 weeks) with COVID-19, divided into subgroup 1 (mild course, n=46) and subgroup 2 (moderate course, n=42). The control group included 42 pregnant women without COVID-19.

The study was approved by the Ethics Committee of the Far Eastern Scientific Center of Physiology and Pathology of Respiration and conducted in accordance with the Declaration of Helsinki. All participants provided informed consent in accordance with Federal Law No. 323-FZ. Serum concentrations of 12-HETE and 15-HETE (Enzo Life Sciences, USA) and endothelin-1 (Biomedica, Austria) were determined by enzyme-linked immunosorbent assay using a "StatFax 2100" analyzer (USA) according to the manufacturer's instructions.

Statistical analysis was performed using IBM SPSS Statistics v.23.0. Normality of distribution was

assessed using the Kolmogorov-Smirnov and Shapiro-Wilk tests. Data are presented as median (Q1; Q3). Group comparisons were performed using Student's t-test or Mann-Whitney U-test; interrelationships were analyzed using Spearman's correlation coefficient. Differences were considered significant at $p<0.05$.

Results and discussion

The study revealed significant alterations in serum concentrations of 12-HETE, 15-HETE, and endothelin-1 in peripheral blood of pregnant women with COVID-19 during the third trimester compared to the control group. In subgroup 1, the level of 12-HETE increased to 3.71 (3.64; 3.77) ng/mL (1.94-fold; $p<0.001$), and in subgroup 2 to 4.75 (4.66; 4.84) ng/mL (2.49-fold; $p<0.001$) compared to controls: 1.91 (1.88; 1.95) ng/mL. The concentration of 15-HETE in subgroup 1 increased to 2.59 (2.55; 2.71) ng/mL (1.42-fold; $p<0.001$), and in subgroup 2 to 3.25 (3.11; 3.37) ng/mL (1.82-fold; $p<0.001$) compared to controls: 1.82 (1.79; 1.87) ng/mL, indicating high activity of 12- and 15-lipoxygenases, activation of lipid peroxidation, and development of oxidative stress [5]. The most pronounced changes were observed in patients of subgroup 2 with moderate severity of COVID-19. It is known that 12-HETE exerts a direct vasoconstrictive effect and can stimulate endothelin-1 synthesis [6], which may contribute to the development of endothelial dysfunction. In this regard, we evaluated the concentration of endothelin-1 as a key marker of vascular disorders. It was established that the serum level of endothelin-1 in pregnant women with COVID-19 significantly increased compared to the control group. In subgroup 1, the concentration of endothelin-1 increased to 16.45 (16.10; 16.86) pg/mL (1.34-fold; $p<0.001$), and in subgroup 2 to 20.10 (19.89; 20.39) pg/mL (1.64-fold; $p<0.001$) compared to controls: 12.25 (12.0; 12.95) pg/mL.

To evaluate the interrelationship between oxylipins and the severity of endothelial dysfunction, correlation analysis was performed, which revealed significant associations between the levels of 12-HETE, 15-HETE, and endothelin-1 concentration. In particular, strong positive correlations were established between 12-HETE concentration and endothelin-1 content ($r = 0.79$; $p < 0.001$), indicating the pathogenetic role of the 12-lipoxygenase pathway in the development of vasospasm and endothelial dysfunction. At the same time, the level of 15-HETE, despite its elevation in COVID-19, demonstrated a weak positive correlation with endothelin-1 ($r = 0.41$; $p < 0.05$), which may reflect its compensatory role as a precursor of pro-resolving mediators, insufficient to prevent endothelial dysfunction under conditions of hyperactivation of the 12-lipoxygenase pathway.

The study allowed us to establish that pregnant women with COVID-19 during the third trimester exhibit increased serum concentrations of 12-HETE and 15-HETE in peripheral blood, most pronounced in moderate severity of infection. The elevation of these metabolites, in our opinion, reflects hyperactivation of the lipoxygenase pathway of arachidonic acid metabolism, as evidenced by the progressive increase in endothelin-1 levels against the background of predominance of proinflammatory 12-HETE over 15-HETE. The established correlational interrelationships allow consideration of the imbalance of lipoxygenase metabolites of arachidonic acid with predominance of 12-HETE as a unified pathogenetic cascade of endothelial dysfunction in COVID-19 during pregnancy, whereas compensatory activation of 15-HETE as a precursor of pro-resolving mediators is unable to prevent the development of endotheliopathy.

REFERENCE

1.Andrievskaya I.A., Ishutina N.A., Dovzhikova I.V., Lyazgiyan K.S., Zhukovets I.V., Krivoschekova N.A. Hypoxia and oxidative stress in COVID19 as factors affecting the course of the disease and the development of complications in pregnancy // Bulletin Physiology and Pathology of Respiration 2023; (90):74–82. doi:10.36604/1998-5029-2023-90-74-82

2.Sekulovski M., Mileva N., Chervenkov L., Peshevska-Sekulovska M., Vasilev G.V., Vasilev G.H., Miteva D., Tomov L., Lazova S., Gulinac M., Velikova T. Endothelial dysfunction and pregnant covid-19 patients with thrombophilia: a narrative review // Biomedicines. 2023; 11(9):2458. doi: 10.3390/biomedicines11092458

3.Esservon Bieren J. Immune-regulation and -functions of eicosanoid lipid mediators // Biol. Chem. 2017; 398(11): 1177-1191. doi:10.1515/hsz-2017-0146

4.Prasad M, Leon M, Lerman LO, Lerman A. Viral endothelial dysfunction: a unifying mechanism for COVID-19 // Mayo Clin Proc. 2021; 96(12):3099-3108. doi:10.1016/j.mayocp.2021.06.027

5.Ishutina N.A., Andrievskaya I.A. Serum phospholipid and selected oxylipin levels in second-trimester pregnant women with COVID-19 // Acta biomedica scientifica. 2025; 10(5): 114-121. doi:10.29413/ABS.2025-10.5.13

6.Ljuca F, Drevensek G. Endothelin-1 induced vascular smooth muscle cell proliferation is mediated by cytochrome p-450 arachidonic acid metabolites// Bosn. J. Basic Med. Sci. 2010; 10(3):22322-6. doi:10.17305/bjbms.2010.2691

A STUDY OF PROFESSIONAL BURNOUT AMONG PHYSICIANS IN THE AMUR REGION AS A BASIS FOR DEVELOPING DIGITAL MONITORING TOOLS IN THE HEALTHCARE INDUSTRIAL INTEGRATION SYSTEM

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Abstract

The result of a cross-sectional study assessing the level and structure of professional burnout among emergency physicians in the Amur Region is presented in this paper. The study utilized an adapted Maslach Burnout Inventory (MBI) questionnaire to evaluate emotional exhaustion and other burnout symptoms. On the basis of the analysis, it was noted that anesthesiologists, neonatologists, and neurologists exhibit significant levels of professional burnout, highlighting the need for regular objective measurement of stress. The findings substantiate the necessity of developing a regional digital burnout monitoring system as a crucial element of industrial integration in healthcare.

Keywords: professional burnout, physicians, digital monitoring tools, healthcare industrial integration, Amur Region

Professional burnout (BP) among healthcare workers, especially in emergency specialties (anesthesiology and resuscitation, neonatology, surgery), remains a serious challenge for the healthcare system. High emotional and physical strain, irregular schedules, time pressure, and constant exposure to critical conditions lead to chronic stress and reduced quality of care. In the context of the industry's digital transformation, there is a need for objective methods for assessing BP that could be integrated into the management processes of healthcare organizations. However, before implementing digital solutions, it is necessary to conduct a baseline assessment of the prevalence and risk factors for burnout in a specific region.

Objective

To assess the current level and structure of professional burnout among emergency physicians in the Amur Region and to identify the main risk factors to support future digital monitoring efforts.

Materials and methods

A cross-sectional study was conducted among 66 physicians (28 men, 38 women; ages 25–50). Specialties included anesthesiologists and intensive care specialists (n=39), neonatologists (n=9), pediatricians (n=6), surgeons (n=5), internists (n=4), ophthalmologists (n=2), and neurologists (n=1). An adapted Maslach Burnout Inventory (MBI) questionnaire was used [1]. Additional data were collected on length of service, duty schedule, satisfaction with pay, bureaucratic workload, and the impact of work on personal life. Statistical analysis was performed in IBM SPSS Statistics v. 26 (Pearson correlation, t-test, ANOVA).

Results and discussion

Frequent or very frequent symptoms of emotional exhaustion (EE) were reported by 32.3% of physicians, morning fatigue by 29.2%, and emotional depletion by 23.1%. The highest levels of EE were recorded among neurologists (100%), neonatologists (60.0%), and anesthesiologists/resuscitators (35.7%). 100% of neurologists, 40% of neonatologists, and 28.6% of anesthesiologists/resuscitators were considering changing their profession.

These data confirm the high vulnerability of intensive care physicians and neonatologists in the Amur Region, which is consistent with national and global trends [2]. The identified risk factors are manageable and can be adjusted through organizational decisions. However, effective management requires regular, objective measurement of each employee's stress and workload levels.

In this context, digital technologies offer new opportunities: utomated collection and analysis of data on working hours, duty rosters, and documentation volume; regular anonymous surveys using MBI questionnaires integrated into corporate information systems; the formation of "risk groups" based on a combination of objective and subjective indicators for targeted support.

Our study is the first stage; it provides a quantitative assessment of the problem and identifies pain points. The next step should be the development and testing of a digital platform for monitoring stress and workload, which will integrate this data into the regional HR management system (production integration). However, prevention itself (psychological support, schedule modifications, communication training [3-6]) remains beyond the scope of this study and requires a separate study of its effectiveness.

Conclusions

Professional burnout among physicians in the Amur Region is significant, especially in specialties related to intensive care and neonatology. The main controllable risk factors - high on-call frequency, low pay satisfaction, and heavy bureaucratic burden - can be tracked using digital tools. The study results substantiate the need to create a regional digital burnout monitoring system as an element of industrial integration, but the system itself has not yet been developed and requires further development. The obtained data provide a starting point for subsequent research on the implementation of predictive algorithms and the evaluation of the effectiveness of preventive measures.

References:

1.Maslach C., Jackson S. E. The Maslach Burnout Inventory. In the book: W. L. Curlette & D. E. Smith (Eds.), Handbook of assessment in industrial/organizational psychology. John Wiley & Sons, 2010.

2.Shanafelt T. D., Rothenberger D. A., Soderberg C. S., et al. The impact of specialty on professional burnout and career satisfaction: a national survey of US physicians. Mayo Clin Proc. 2017; 92(4): 683-694. doi: 10.1016/j.mayocp.2016.12.018

3.Barabash, I. V. Behavioral markers of difficult patients in intensive care and communication optimization: experience with the implementation of an educational module / I. V. Barabash, S. V. Khodus, T. V. Kan // Science and Practice in Medicine: Collection of Proceedings of the VIII International Educational Forum, Blagoveshchensk, April 15–17, 2026. – Blagoveshchensk: Amur State Medical Academy, 2026. – Pp. 54-56. – EDN SQATZO.

4.Mikhailov I.V., Kuznetsova O.A. Psychological aspects of interaction with relatives of intensive care patients // Bulletin of Anesthesiology and Resuscitation. – 2023. – Vol. 20, No. 3. – Pp. 82-87.

5.Silverman D., Kertz S., Draper D. Communication skills with patients / translated from English A. I. Dorman. - M.: Granat, 2018. - 304 p.

6.Khodus S. V., Barabash I. V. Difficult patient: a study guide for clinical residents. - Blagoveshchensk: Amur State Medical Academy, 2025. - 88 p.

CLINICAL AND FUNCTIONAL FEATURES OF EARLY REHABILITATION OF PATIENTS WITH ISCHEMIC STROKE IN THE VERTEBROBASILAR POOL

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Abstract. Vertebrobasilar system (VBS) stroke accounts for up to 30% of all ischemic strokes (IS), but rehabilitation programs often copy protocols for carotid territory stroke without considering the predominance of vestibulo-ataxic and bulbar disorders. The aim was to identify clinical and functional features of early rehabilitation in VBS stroke and to substantiate a differentiated approach. Fifty patients (62% men, mean age 65.8±6.2 years) in the acute period of VBS IS were examined. The leading syndrome was vestibular-ataxic (78%, $p<0.001$). Three subgroups were identified: ataxia-dominant (42%), motor-dominant (22%), and mixed (36%). The main delaying factors were sensory disturbances (76%) and low exercise tolerance (75%). A differentiated approach with vestibular exercise, stabilometry, and scalp therapy improves early rehabilitation outcomes.

Keywords: ischemic stroke, vertebrobasilar system, early rehabilitation.

Cerebrovascular disease remains a leading cause of death and disability. Ischemic stroke in the VBS accounts for up to 30% of all IS, but its rehabilitation is often mechanically transferred from carotid stroke protocols, where hemiparesis and aphasia dominate. This leads to insufficient correction of ataxia and postural disorders in patients with vertebrobasilar lesions.

Objective – to substantiate a differentiated approach to early rehabilitation based on the analysis of clinical and functional features of patients with VBS IS.

Materials and methods. The study included 50 patients (31 men, 19 women) with VBS IS confirmed by DWI-MRI. Inclusion criteria: age 45–85 years, onset within 48 hours, informed consent. Exclusion: severe somatic decompensation, dementia, epilepsy, severe aphasia, implanted stimulators, hemodynamically significant stenoses. Neurological examination with NIHSS, Barthel index, stabilometry, as well as Berg Balance Scale (BBS), modified Rankin Scale (mRS), Rivermead Mobility Index (RMI), Hauser Ambulation Index, and FIM were performed. Rehabilitation included positioning, breathing exercises, swallowing correction, passive and active kinesiotherapy (Bobath, PNF), vestibular physiotherapy, stabilometry with biofeedback, speech therapy and psychocorrection. Additionally, classical acupuncture and prolonged scalp therapy (needles retained for 6–8 h) were applied, with zones selected according to the dominant syndrome: for ataxia – lower occipital and cervical areas; for paresis – parietal and anterior parietal scalp zones. Statistical analysis used SPSS 26.0; differences were considered significant at $p<0.05$.

Results and discussion. Mean age was 65.8±6.2 years, men were significantly younger than women (63.6±5.8 vs 69.4±6.1; $p=0.007$). Etiology: atherothrombotic – 28%, cardioembolic – 14%, undetermined – 58%. Vestibulo-ataxic disorders were found in 78% ($p<0.001$ vs motor), oculomotor in 18%, bulbar

in 14%. Three subgroups were identified: 1 (ataxia) – 42%, 2 (motor) – 22%, 3 (mixed) – 36%. At admission, BBS, RMI and mRS differed: subgroup 1 – 34.2±5.1; 8.7±1.8; 3.4±0.7; subgroup 2 – 22.5±4.3; 5.2±1.5; 4.6±0.8; subgroup 3 – 24.8±4.7; 6.1±1.6; 4.2±0.7 (ANOVA, $p<0.001$). By day 21, the improvement in subgroup 1 was greatest: ΔBBS=+14.4; ΔRMI=+4.1; ΔmRS=–1.3, vs +10.6; +3.1; –1.1 in subgroup 2 and +10.6; +3.1; –0.9 in subgroup 3 ($p<0.05$). The main factors delaying recovery were sensory disturbances (76%) and low exercise tolerance (75%), correlating with age ($r_s=-0.45$; $p=0.001$). Patients with sensory deficits had worse Barthel outcomes (45±12 vs 62±14, $p=0.008$). Thus, the ataxia subgroup shows higher rehabilitation potential and faster balance recovery, while motor and mixed disorders require longer programs. A differentiated approach focusing on vestibular exercises, stabilometry, and zone-specific scalp therapy improves early rehabilitation results.The identified differences justify personalized protocols: for ataxia – priority vestibular physiotherapy and stabilometry combined with lower occipital/cervical scalp stimulation; for paresis – classical kinesiotherapy with parietal scalp zones. Limitations – small sample, lack of randomized control, but the data provide a basis for larger prospective studies.

References

1.Thom T, et al. Circulation. 2006;113(6):e85-e151.

2.Lloyd-Jones D, et al. Circulation. 2010;121(7):e46-e215.

3.Mumenthaler M. Neurologische Differenzialdiagnostik. Thieme, 2002.

4.Caplan LR. Stroke. 2000;31(8):2011-2023.

5.Danilo VI, et al. Stroke. Modern approaches. Moscow, 2013.

6.Johansson BB. Stroke. 2000;31(1):223-230.

7.Tang Q, et al. The new strategy of early rehabilitation of stroke. 11th Sino-Russia Forum, 2014.

8.Molchanova EE. Improvement of medical rehabilitation... Doctoral thesis. Moscow, 2021.

9.Molchanova EE. Physiotherapy, balneology and rehabilitation. 2018;17(3):153-156.

A STUDY OF OXIDATIVE STRESS MARKERS IN FEMALE PATIENTS WITH ROSACEA

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Abstract. Antioxidant status parameters were assessed in 25 female patients with rosacea aged 26 to 54 years. The control group consisted of 21 apparently healthy women. The study results revealed a statistically significant increase in key prooxidant system markers (malondialdehyde accumulation by 43%, primary lipid peroxidation products by 25%), along with a decrease in the activity of antioxidant system components (ceruloplasmin decreased by 27%, vitamin E by 23%) in the blood plasma of rosacea patients compared to healthy women. This suggests the use of antioxidant therapy for rosacea.

Key words: rosacea, oxidative stress, antioxidant status, female patients.

Recent studies have shown that rosacea, a fairly common dermatosis, is characterized by a chronic, relapsing course, often resistant to treatment [1, 4, 6, 7]. Recurrence of the disease is facilitated by the synthesis of cytokines and inflammatory mediators induced by oxidative tissue damage and lipid peroxidation products in response to trigger factors [3]. In this regard, timely assessment of oxidative stress markers followed by the inclusion of antioxidant drugs in the treatment regimen of patients with rosacea will, in our opinion, prolong the duration of remission of chronic dermatosis.

Objective

To study oxidative stress markers in patients with rosacea.

Materials and Methods

We observed 25 women aged 39.6 (26; 54) years with a diagnosis of rosacea (L71 according to ICD-10): 14 women (56%) had predominantly erythematotelangiectatic rosacea, 11 (44%) had papulopustular rosacea; In 16 patients (64%), the disease course corresponded to a mild degree, in 9 patients (36%) - to a moderate degree. All women included in the study received standard therapy according to Clinical Guidelines: for the erythematotelangiectatic form - azelaic acid, 15% gel or 20% cream, on the affected areas of the skin 2 times a day, morning and evening, every day during the entire observation period; for the papulopustular form - metronidazole, 0.75% gel or 1% cream, on the affected areas of the skin 2 times a day, morning and evening, or azelaic acid, 15% gel or 20% cream, on the affected areas of the skin 2 times a day, morning and evening, every day during the entire observation period. Concurrently with treatment, all patients were given recommendations to limit exposure to trigger factors. The control group consisted of 21 practically healthy women. Antioxidant status was assessed using generally accepted methods reflected in our previously published studies [2, 3, 5]. Statistical processing of the results was performed using Statistica v.10.0 software with the Student's t-test at a significance level of $p < 0.05$.

Results and Discussion

The study results indicated an increase in the intensity of lipid peroxidation processes in patients with

rosacea: the concentration of primary lipid peroxidation products was statistically significantly higher than the control by 25%, and malondialdehyde by 43% ($p < 0.05$). An assessment of the activity of antioxidant markers in the blood plasma of patients with rosacea revealed a significant decrease in ceruloplasmin levels by 27% and vitamin E by 23% ($p < 0.05$) relative to apparently healthy women, suggesting the potential for incorporating antioxidant drugs into the complex therapy of chronic dermatosis [5]. Thus, changes in the antioxidant status in patients with rosacea with a shift in balance towards the prooxidant side suggest testing and evaluating the effectiveness of supplementing standard therapy for dermatosis with pharmacocorrectors of oxidative disorders.

References:

1. Aleksandrova I.A., Astsaturova O.R., Beloborodov V.B., Eliseeva E.V., et al. Rational Antimicrobial Pharmacotherapy: A Guide for Practicing Physicians. Moscow, 2015, 1008 p.

2. Brash N.G., Simonova N.V. Comparative Assessment of Cognitive Dysfunction Parameters and Their Correlations with Antioxidant Status during Reamberin Use // Experimental and Clinical Pharmacology. 2022, Vol. 85, No. 9, pp. 7-14.

3. Kotelnikova M.A., Simonova N.V., Dorovskikh V.A., et al. Effect of Cytoflavin on the Antioxidant Status of Patients with Mild to Moderate Rosacea // Experimental and Clinical Pharmacology. – 2020. – T. 83, No. 7. – pp. 32-37.

4. Olisova O.Yu., Kochergin N.G., Smirnova E.A. Innovations in external therapy of rosacea // Russian Journal of Skin and Venereal Diseases. – 2017. – T. 20, No. 5. – pp. 270-274.

5. Simonova N.V., Dorovskikh V.A., Lee O.N., Anokhina R.A., Shtarberg M.A., Simonova N.P. Correction of oxidative stress with natural antioxidants // Bulletin of Physiology and Pathology of Respiration. – 2014. - No. 53. – P. 84-88.

6. Solodovnikov V.V., Gainullina Yu.I., Eliseeva E.V., Krivelevich V.Ya. Current state of the problem and the importance of clinical pharmacology in optimizing the use of antibacterial drugs // Problems of Healthcare Standardization. - 2008. - No. 9. - P. 3-7.

7. Del Rosso J.Q. Rosacea: pathogenesis, clinical aspects, modern recommendations for treatment // Bulletin of dermatology and venereology. - 2016. - Vol. 2. - P. 21-31.

EXPERIENCE WITH THE USE OF A VEGF INHIBITOR IN MAINTENANCE THERAPY OF PLATINUM-SENSITIVE RECURRENT OVARIAN CANCER

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Abstract. We observed 26 patients with platinum-sensitive recurrent ovarian cancer receiving bevacizumab as maintenance therapy. Progression-free survival, toxicity profile, and quality of life were assessed. Bevacizumab therapy resulted in a median progression-free survival of 16.2 months (95% CI 10.2–22.8), with improvements in virtually all quality of life parameters after 3 months of maintenance therapy compared with pretreatment values. The toxicity profile of bevacizumab was acceptable.

Key words: bevacizumab, maintenance therapy, ovarian cancer, platinum-sensitive relapse, patients

Antiangiogenic therapy with bevacizumab is currently widely used for recurrent ovarian cancer, as evidenced by the frequency of administration of this targeted agent in the Amur Region. The results of the effectiveness of incorporating bevacizumab into antitumor therapy for platinum-sensitive relapses, compared with domestic and international experience, are certainly of interest for analyzing patient quality of life, the occurrence of adverse events, modulation of progression-free survival, etc. in a specific region.

Objective

To evaluate the effectiveness of maintenance therapy for platinum-sensitive relapses of ovarian cancer with the VEGF inhibitor bevacizumab.

Materials and Methods

Twenty-six patients with platinum-sensitive relapses of ovarian cancer were observed at the Amur Regional Oncology Center (Blagoveshchensk). They received bevacizumab as an adjunct to their antitumor drug therapy. After completing chemotherapy, the patients continued bevacizumab maintenance therapy: 15 mg/kg intravenously every 3 weeks until progression or unacceptable toxicity. During the follow-up period, progression-free survival, drug toxicity profile, and quality of life were assessed using conventional methods [1].

Results and Discussion

Evaluation of the objective effect of antitumor pharmacotherapy for ovarian cancer revealed a partial response to standard chemotherapy in combination with a targeted antiangiogenic agent in 16 patients (62%), progression in 6 (23%), and stabilization in 4 (15%). Our results are virtually identical to published data from the Phase III OCEANS study, which used a carboplatin + gemcitabine + bevacizumab regimen followed by bevacizumab maintenance therapy after completion of chemotherapy to treat patients with platinum-sensitive ovarian cancer recurrences: the partial response rate was 61.2%. Analysis of progression-free survival revealed a median survival of 16.2 months (95% CI 10.2–22.8).

The obtained result is consistent with the results of the phase III GOG-213 study, where the progression-free interval in patients receiving bevacizumab in combination with standard chemotherapy was 13.8 months [2]. A detailed assessment of the onset of progression by month showed that progression was recorded in patients at 6, 9, 12, 15, 18, 24, and 36 months from the start of observation, while the probability of progression-free dynamics at these control time points was 0.96, 0.92, 0.91, 0.86, 0.89, 0.88, and 0.93, respectively. An analysis of the quality of life in patients with ovarian cancer who received standard chemotherapy in combination with bevacizumab showed that the median parameters of "Physical Functioning", "Role Physical Functioning", and "Pain Intensity" remained unchanged during a 3-month follow-up. The median of the "General Health" (GH) indicator tended to decrease after a month of targeted therapy, while reaching the initial value by the end of the observation period, which indicates GH stabilization during targeted therapy. The "Vital Activity" (VT) and "Social Functioning" (SF) parameters showed unidirectional changes over time: statistically significantly decreasing by the end of the first month of therapy (by 10% and 9%, respectively), by the end of the third month they increased relative to the beginning of observation by 10% and 13%, respectively ($p < 0.05$). "Role emotional functioning" (RE) statistically significantly increased after 1 and 3 months of therapy by 13% and 25%, respectively ($p < 0.05$). The results of the component scales assessing the physical component of health showed a tendency for the median to decrease by the end of the 1st month of observation, followed by an increase to the initial threshold by the end of the 3rd month. In contrast, the psychological component of health significantly increased after 3 months of targeted therapy. Recording of side effects of standard chemotherapy in combination with bevacizumab showed that 65% of patients reported nausea and vomiting during treatment, hematotoxicity accompanied by neutropenia and anemia in 58% and 46% of cases, respectively, hemorrhagic complications and proteinuria.

References:

1. Kozlov A.O., Kozlova Yu.V., Simonova N.V. Analysis of the quality of life of patients with ovarian cancer during chemotherapy // Far Eastern Medical Journal. - 2023. - No. 4. - P. 35-39.

2. Coleman RL, Brady MF, Herzog TJ, Sabbatini P, Armstrong DK, Walker JL et al. Bevacizumab and paclitaxel–carboplatin chemotherapy and secondary cytoreduction in recurrent, platinum-sensitive ovarian cancer (NRG Oncology/Gynecologic Oncology Group study GOG-0213): a multicentre, open-label, randomized, phase 3 trial // Lancet Oncol. - 2017. - 18(6). - P. 779-791.

ASSOCIATION OF THE FREQUENCY AND SEVERITY OF EXACERBATIONS WITH CLINICAL PARAMETERS OF COPD AFTER RECOVERING FROM COVID-19

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Abstract

The article presents an analysis of the correlation relationships between the frequency of exacerbations per year (FEP), their severity, and the main clinical parameters of COPD in patients who had COVID-19. The study is based on the results of a one-year observation of 207 patients with COPD from 2020 to 2022. The following correlations were found: FEP with almost all studied indicators, particularly with the duration of the disease ($R=0.351$, $p<0.01$); the occurrence of severe exacerbations in the following year is most closely associated with the extent of lung tissue damage from COVID-19 ($R=0.676$, $p<0.001$). The fact that a patient subsequently moves to the "frequent exacerbations" group is most strongly correlated with being under regular medical supervision ($R=0.479$, $p<0.01$), as well as the extent of lung tissue damage ($R=0.852$, $p<0.01$).

Keywords: chronic obstructive pulmonary disease, COVID-19, exacerbation, correlation, relationship.

Exacerbations of chronic obstructive pulmonary disease (COPD) are a known predictor of disease severity and reduced patient quality of life [1]. According to the literature, patients with COPD who contract COVID-19 (the disease caused by the SARS-CoV-2 coronavirus) tend to experience the infection severely, often with worsening respiratory failure, and have a high risk of adverse outcomes [2]. At the same time, the long-term impact of COVID-19 on the clinical course of COPD and the long-term prognosis remains poorly studied. There are isolated reports of a significant increase in the risk of exacerbations and hospitalizations after the infection [3]. Meanwhile, the factors associated with the number of exacerbations and their severity remain largely unexplored.

Objective

To search for correlations between the frequency of exacerbations (FEY), their severity, and the main clinical parameters of COPD in patients who have had COVID-19.

Materials and Methods

From 2020 to 2022, 207 patients with COPD were examined. Most of the patients were men (75%), with an average age of 67 [61;74] years. The inclusion criterion was a history of laboratory-confirmed SARS-CoV2 infection. The duration of COPD was 7 [4;8] years. The smoking index was 30 [2;45] pack-years. Most patients (50.9%) had GOLD stage II bronchial obstruction. The baseline rate of acute exacerbations of COPD (before the infection) was 1 [1;2] time(s) per year. In 100% of cases, COVID-19 was treated in the hospital. The patients were examined twice: 3-4 weeks after discharge from the hospital and 12 months after inclusion in the study. All patients were under dispensary ('D') observation, regulated by the order of the Russian Ministry of Health dated April 27, 2021, No. 404n. The frequency of outpatient

visits to the therapist and pulmonologist was assessed taking into account the data from the Regional Medical Data System of the Amur Region. Statistical analysis was conducted using the STATISTICA 10.0 software package.

Results and their discussion

Correlation analysis revealed strong relationships between the frequency and severity of exacerbations and the main clinical parameters of COPD progression. In particular, the duration of the disease showed a close association with all the indicators studied. The highest R coefficient was observed with the level of FEV_1 ($p<0.01$) (Table). The ICQ index, in turn, is associated only with FEV_1 ($p<0.05$). The severity of bronchial obstruction also correlates with all clinical indicators ($p<0.05$), except for the fact of the patient moving into the COPD group 'with frequent exacerbations' (two or more exacerbations per year or having one exacerbation that led to hospitalization) after a prior infection.

Table

Association of exacerbation frequency and severity with key clinical parameters in COPD patients who had COVID-19

Indicator	Smoker's index (pack/year)	Duration of COPD	Degree of bronchial obstruction by GOLD	"D" observation at place of residence	Extent of lung tissue damage COVID-19
Frequency of flare-ups over the past year, times/year	0,291	0,351	0,294	0,256	0,229
Time between exacerbations, months	-0,164	-0,274	-0,238	-0,206	-0,326
Presence of severe exacerbations per year leading to hospitalization	0,019	0,241	0,261	0,110	0,676
Patient transition to the COPD group "with frequent exacerbations"	0,023	0,335	0,115	0,479	0,852

Note: the R values in bold indicate where the statistical significance level (p) is less than 0.05.

Meanwhile, the presence of home 'D' observation, on the contrary, has the strongest correlation with the patient moving into the COPD group 'with frequent exacerbations' ($p<0.01$). It is important to emphasize the extremely close links between the extent of lung tissue damage in COVID-19, on one hand, and the occurrence of severe exacerbations in the year following the viral infection and the patient moving into the 'with frequent exacerbations' group, on the other (in both cases $p<0.0001$).

So, it was found that in patients with COPD who had COVID-19, the number and severity of exacerbations in the year following the infection, as well as the time between exacerbations and the transition to the 'frequent exacerbations' COPD group, are closely associated with the main clinical parameters of COPD progression. The identified patterns can be used to create mathematical models to predict frequent or severe exacerbations in COPD patients recovering from a SARS-CoV-2 infection.

References:

1.Karoli, N.A., Rebrov, A.P. COPD exacerbation and risk factors for sudden patient death // Diary of the Kazan Medical School. – 2021. – No. 3(33). – pp. 9-14.

2.Кулик Е.Г., Павленко В.И., Нарышкина С.В. Оценка риска неблагоприятного течения новой коронавирусной инфекции у больных хронической обструктивной болезнью легких // Амурский медицинский журнал. – 2022. – № 2(33). – С. 25-28. – DOI 10.22448/23115068_2022_2_25.

3.Klester, E.B., Elykomov, V.A., Klester, K.V., Yarkova, V.G. Analysis of clinical and functional parameters of the respiratory system in COPD patients who had a new coronavirus infection, in the long-term observation period // Medical Science and Education of the Urals. – 2023. – Vol. 24, No. 1(113). – pp. 27-33. – DOI 10.36361/18148999_2023_24_1_27.

FEATURES OF MORPHOLOGY OF PERIPHERAL BLOOD MONOCYTES IN PARTURIENT WOMEN WHO HAVE RECOVERED FROM COVID-19 IN THE THIRD TRIMESTER OF PREGNANCY

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Abstract. A morphological analysis of peripheral blood smears was performed using the "MEKOS-C2" automated microscopy complex. The objects of study were blood monocytes of parturient women who have recovered from COVID-19 in the third trimester of pregnancy. The analysis revealed an increase in the number of monocytes with pronounced morphological changes in nuclear shape and structure, as well as vacuolar degradation of the cytoplasm. A significant proportion of cells exhibited structural signs of apoptosis and the formation of monocyte extracellular traps (METs). The identified structural alterations and activation of cell death mechanisms (apoptosis, METs) in monocytic cells of parturient women with a history of COVID-19 make a substantial contribution to the pathogenesis of innate immune disorders in the mother, which may represent a key factor in adverse perinatal outcomes.

Keywords: COVID-19, pregnancy, innate immunity, monocytes, morphology, apoptosis, METs

COVID-19 in pregnant women is accompanied by systemic inflammation, hypoxia, and immune dysregulation [1]. Monocytes, as key cells of innate immunity, play a central role in the antiviral response [2]; however, the morphological features of these cells in SARS-CoV-2 infection during late pregnancy remain insufficiently studied.

Objective: To study the morphological features of monocytes in the blood of parturient women who have recovered from COVID-19 in the third trimester of pregnancy.

Materials and methods. The study included 159 parturient women who delivered at 37–40 weeks of gestation. The main group comprised 129 parturient women who had recovered from COVID-19 in the third trimester of pregnancy. The control group included 30 SARS-CoV-2-uninfected parturient women. The groups were comparable in age and body mass index ($p>0.05$). The study was approved by the Biomedical Ethics Committee of the Far Eastern Scientific Center of Physiology and Pathology of Respiration. Informed consent was obtained from all women. Monocyte morphology was assessed on Romanovsky–Giemsa-stained blood smears using the "MEKOS-C2" automated microscopy complex (Russia). Statistical analysis was performed using IBM SPSS Statistics v.23.0 (USA). Quantitative data are presented as median (Q1; Q3). The Mann–Whitney U-test was used for group comparisons; differences were considered significant at $p<0.05$.

Results and discussion. Morphological analysis revealed pronounced structural changes in monocytes of parturient women who had recovered from COVID-19 in the third trimester of pregnancy. In contrast to the control group, where cells with eccentrically located bean-shaped nuclei predominated, the main group showed a significantly higher frequency of monocytes with irregular, unevenly contoured nuclei, sometimes with deep notches. Signs of vacuolar degradation of the cytoplasm and nucleus were also noted. In some cells, signs of apoptosis were observed—predominance of high-density regions

(heterochromatin) over diffusely distributed euchromatin, with characteristic peripheral localization of heterochromatin. Alongside apoptosis, monocytes exhibited activation of monocyte extracellular trap (MET) formation, characterized by the generation of chromatin fibers and the release of myeloperoxidase granules into the extracellular space.

Conclusion. In parturient women who have recovered from COVID-19 in the third trimester of pregnancy, pronounced morphological signs of monocyte damage are identified, including structural disorganization of nuclei, vacuolar degradation, apoptosis, and MET formation. This indicates a significant impact of SARS-CoV-2 on monocytes, which may represent one of the key factors in immune dysregulation and the development of adverse perinatal outcomes.

REFERENCE

1.Andrievskaya I.A., Ishutina N.A., Dovzhikova I.V., Lyazgiyan K.S., Zhukovets I.V., Krivoschekova N.A. Hypoxia and oxidative stress in COVID19 as factors affecting the course of the disease and the development of complications in pregnancy // Bulletin Physiology and Pathology of Respiration. 2023; (90):74–82. doi: 10.36604/1998-5029-2023-90-74-82

2.Scherbak SG, Sarana AM, Vologzhanin DA, Kamilova TA, Golota AS, Makarenko SV. Immunology of post-COVID syndrome. Rossiiskii meditsinskii zhurnal (Medical Journal of the Russian Federation, Russian Journal). 2023;29(1):43–58. doi: 10.17816/medjrf133829

THE ROLE OF ARTIFICIAL INTELLIGENCE IN ORGANIZING MAMMOGRAPHY SCREENING

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Abstract

This article presents the experience in integrating artificial intelligence (AI) into the early diagnosis of breast cancer. Breast cancer remains the most common form of cancer among the female population of Russia. The annual increase in this form of malignant tumors amounts to 70,000–77,000 new cases. Thanks to screening, more than 70% of tumors are detected in the early stages (I–II), which improves rates of recurrence-free and metastasis-free survival. Mammography remains the "gold standard" for screening, but its effectiveness is limited by human factors (fatigue, staff shortages) and technical challenges. It leads to 10–30% of cases being missed, especially when "double reading" is not possible. AI offers a promising solution for improving diagnostic accuracy, reducing the workload on physicians, and optimizing screening programs.

Another capability provided by the neural network is the identification and grouping of patients at high risk for breast cancer.

A three-year analysis of 2,446 mammograms archived at AMIAC from all districts of the Amur Region enabled the correct diagnosis, using a "double-reading" approach, of patients with background abnormalities and breast cancer. It was found that the implementation of an adaptive online platform for analyzing mammographic examinations eliminates any errors that may occur when a radiologist in the region lacks many years of professional experience. The neural network helps objectively classify patients into the high-risk group for breast cancer. It was concluded that there is a need to create a comprehensive neural network platform for radiologists and oncologists in the region.

Keywords: artificial neural networks, mammography, breast cancer, screening, double reading.

Objective

To develop and evaluate the diagnostic effectiveness of a segmentation neural network model for detecting breast pathology in digital mammograms.

Materials and Methods

An intelligent system was implemented by AMIAC to interpret mammographic examinations and included a segmentation neural network with U-Net and ResNet50 architectures, with results outputted using gradient boosting.

A retrospective analysis was conducted on 2,446 mammographic examinations; in 489 (20%) cases, the image descriptions were generated using the AI system. Clinical and diagnostic parallels were tracked

using morphological verification, follow-up observation over the course of the year, and a consensus opinion from two experienced radiologists (double reading). Sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV), overall accuracy, and the rates of false-positive (FP) and false-negative (FN) results of the AI were calculated. For training, determining accuracy, and validating the implemented segmentation diagnostic model, X-ray studies were used within a specially developed software environment. Segmentation accuracy was determined by the similarity coefficient, and the probability of malignant neoplasms was assessed using binary classification metrics.

Results and Discussion

At the Department of Radiological Diagnostics and Radiotherapy at AGMA, in collaboration with AMIAC, and mammologists from AO OOD, 2,446 mammographic examinations were analyzed; in 20% of the cases, the AI system was used. Of the total number of cases reviewed, a positive result was obtained in 10% of cases and a false positive in 0.3%—a low rate. In the study, the method's sensitivity was 92.5%, specificity 89.6%, and overall accuracy 89.7%. The ability to detect true breast cancer is the system's main advantage. The false-positive rate (0.3%) matches or exceeds that of many foreign counterparts. The low false-positive rate during the second reading makes the system a reliable aid for oncologists and radiologists, reducing the risk of missing a pathology. The AI errors were associated with the assessment of fibroglandular tissue (high density, localized fibrosis, scarring), the nipple area (skin lesions, nipple positioning abnormalities, postoperative changes), the presence of foreign bodies, localization markers, port systems, and implants).

The use of neural networks subjectively reduced the time required for a physician to analyze images by approximately 35%, helping to reduce the workload and increase the efficiency of the mammography department. An important result of the AI work was the detection of non-palpable background breast conditions: fibroadenomas, cysts, intraductal papillomas, and areas of localized fibroadenomatosis. It allowed for the timely determination of treatment strategies for patients. When comparing the results of machine segmentation and image annotation by specialists, it was found that the model is on par with a physician in terms of accuracy in identifying lesions. The results of the study on the system's effectiveness allow it to be used as an intelligent diagnostic assistant during screening examinations of the female population.

References

1. Kaprin A.D., Starinsky V.V., Shakhzadova A.O., et al. Malignant Neoplasms in Russia in 2019 (Incidence and Mortality). Moscow: P.A. Herzen Moscow State Institute of Oncology, 2020, 252 pp.

2. Moshenskaya, S.P., Kuzmichev, D.E., Danilov, A.V. The Human Factor and the Risk of Errors in Medicine // Medical Law and Ethics. 2019, No. 1, pp. 45–52.

3. Toguzbaeva, A.Y., Ivanov, V.V., Petrov, S.V. Modern Approaches to Breast Cancer Screening: Possibilities and Limitations // Mammology. 2020, Vol. 29, No. 2, pp. 15–21

4. Danino J., Mucci S., Ginzburg V. et al. Diagnostic errors in radiology: a review of the literature // Radiol. Today. 2017 Vol. 18, N 6 P.24-29.

CHOICE OF ANTI-HYPERTENSIVE THERAPY IN COMORBIDITY OF ARTERIAL HYPERTENSION AND CHRONIC OBSTRUCTIVE PULMONARY DISEASE

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Abstract

In order to evaluate the efficacy of a fixed combination of angiotensin II receptor blockers and calcium channel blockers as part of combination therapy in patients with arterial hypertension (HTN) combined with chronic obstructive pulmonary disease (COPD), 30 patients aged 65.2 ± 2.4 years were examined. Patients were divided into 2 groups: Group 1 (15 people) received a fixed combination of 16 mg candesartan and 5 mg amlodipine at a starting dose (Hyposart A, «Akrikhin»), Group 2 (15 patients) who were prescribed amlodipine 5 mg / day and lisinopril 20 mg / day. The results of the study showed that the fixed combination of candesartan and amlodipine has a pronounced hypotensive efficacy with high variability of blood pressure (BP) at night (non-dippers and night-peakers) in patients with hypertension and COPD, leads to improved bronchial patency, is well-tolerated, and improves adherence to treatment in these patients.

Keywords: chronic obstructive pulmonary disease, arterial hypertension, candesartan, amlodipine.

Hypertension is the most common comorbid condition in patients with COPD, occurring in more than 50% of these patients [1,2]. The high prevalence of comorbidity between hypertension and COPD is explained by common pathogenetic mechanisms that accelerate target organ damage, increasing cardiovascular risk and worsening the prognosis of each disease [2]. Treatment of patients with hypertension and COPD should be carried out according to recommendations for these diseases [1,2]. In this case, the effect of antihypertensive drugs on respiratory dysfunction must be taken into account [3].

Objective

To evaluate the efficacy of a fixed combination of an angiotensin II receptor blocker and a calcium channel blocker as part of combination therapy in patients with hypertension combined with COPD.

Materials and methods

Thirty patients with hypertension and COPD were examined; men predominated (75%). The mean age was 65.2 ± 2.4 years. All patients had grades 1-3 hypertension and grades 1-2 COPD with bronchial obstruction. Patients were divided into 2 groups: Group 1 (15 patients) received a fixed-dose combination of 16 mg candesartan and 5 mg amlodipine at a starting dose (Hyposart A, «Akrikhin»); Group 2 (15 patients) received amlodipine 5 mg/day and lisinopril 20 mg/day.

Patients underwent clinical, instrumental, and laboratory examinations before and after 6 weeks of treatment. Statistical analysis of the study results was performed using STATISTICA version 10.0 for Windows. The significance level of statistical differences was considered reliable at $p < 0.05$.

Results and discussion

Before treatment, the following types of daily BP profile were identified in both groups: dippers in 7 (23.3%) patients, non-dippers in 15 (50.0%), night-peakers in 8 (26.7%) patients, which were characterized by the predominance of higher BP values and variability at night. By the end of the observation, the target BP level was achieved in all patients of group 1, while it was not achieved in 13.3% of patients of group 2. No side effects from the prescribed medications were observed. After 6 weeks of therapy with the fixed combination of candesartan and amlodipine, a decrease in the average daily and average nighttime systolic BP (SBP) and diastolic pressure (DBP) ($p < 0.01$) was noted in group 1. In group 2, no significant changes in these indicators were observed. Analysis of BP variability indices against the background of the fixed-dose combination showed more pronounced positive dynamics in the 1st group. In this group of patients, a significant decrease in the variability of SBP and DBP during the daytime was noted ($p<0.01$). The dynamics of SBP and DBP variability at night was positive, but not so pronounced ($p<0.05$). In the 2nd group, the variability of SBP and DBP significantly decreased only during the daytime ($p<0.05$). The degree of nighttime decrease (DND) of SBP against the background of fixed-dose therapy in patients of the 1st group increased by 24.6%, DND DBP - by 21.4% ($p<0.01$). In the 2nd group, no significant increase in DND SBP and DBP was noted. Positive dynamics of daily BP profiles was revealed. In Group 1, the number of dippers increased by 53.3% due to a decrease in the number of non-dippers and night-peakers. In Group 2, the number of non-dippers and night-peakers decreased slightly, resulting in an increase of only 13.3% in the number of dippers. Analysis of pulmonary function parameters revealed a significant improvement in bronchial patency in both groups.

Thus, the combination of candesartan and amlodipine in patients with hypertension and COPD promotes more rapid and sustained achievement of target blood pressure levels and improves bronchial patency. The combination of candesartan and amlodipine exhibits significant hypotensive efficacy in patients with high nighttime blood pressure variability (non-dippers and night-peakers) with hypertension and COPD. The fixed-dose formulation of candesartan and amlodipine is well-tolerated and improves treatment adherence in patients with hypertension and COPD.

References:

1.Clinical Guidelines. Chronic Obstructive Pulmonary Disease. — 2024.

2.Clinical practice guidelines for Hypertension in adults. Russian Journal of Cardiology. — 2024; 29(9).

3.Klimova A.A., Ambatello L.G., Smolyakova E.V., Zykov K.A., Chazova I.E. The frequency of detection of comorbid bronchoobstructive pathology in patients with arterial hypertension admitted to a specialized cardiological hospital. Systemic Hypertension. — 2023; 20(1).

FACTORS INFLUENCING THE FORMATION OF POSTURE IN CHILDREN AGED 8-10

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Resume. Despite the extensive research into the etiology of musculoskeletal disorders, the number of children with poor posture is growing. Therefore, developing prevention methods and clarifying the factors influencing posture development is essential. For this purpose, a survey of 40 children and their parents was conducted. It was found that the main factors influencing the development of poor posture in the children studied were insufficient physical activity and prolonged static loads on the spine, sleeping on a soft bed, and uneven loads from carrying a bag or backpack, which contribute to the development of asymmetry.

Key words: posture disorders, children, factors.

Among the most important reasons for the development of postural disorders in children are: anatomical and constitutional features of the spine structure, visual defects, disorders of the nasopharynx and hearing, frequent infectious diseases, lack of systematic development of the skill of correct posture and regular physical training (insufficient motor activity), poorly developed muscular system, especially hypotonia of the back and abdominal muscles, poor nutrition, tables and desks that do not correspond to the height of the student [1]. Prolonged sitting at school and at home, coupled with the relative weakness of the musculoskeletal system in young schoolchildren, often leads to a variety of postural problems. Inappropriate furniture sizes and designs for a child's height also contribute to these problems. Incorrect posture while writing, reading, and sleeping is particularly detrimental to posture [2, 3, 4].

Changes in the configuration of the spine and rib cage negatively impact the functioning of the cardiorespiratory system, gastrointestinal tract, and kidneys, and are a predictor of the development of degenerative changes in the spine with clinical manifestations. Postural disorders and their consequences, like many other diseases, are easier to prevent than to treat. In this regard, the development of methods for their prevention is relevant, as well as the clarification of the factors influencing the formation of posture for the purpose of their individual correction and possible elimination.

Objective : To study factors influencing the development of posture in children aged 8-10 years with moderate posture disorders . Using the data obtained, we will subsequently adjust the emphasis of individual and general recommendations, as well as Kyokushin karate exercise programs for improving children's posture. The "Test Card for Identifying Postural Defects (according to S.N. Popov)" served as a screening tool, allowing us to identify subjects with moderate postural defects (grades 1 and 2) .

Materials and Methods . Forty children aged 8-10 years participated in the study. Twenty children were new to karate (training for no more than two months) and 20 were non-trainers. Children and parents completed a questionnaire on potential factors influencing posture.

Results and discussion.

The survey revealed that 65% of children did not do morning exercises, while 35% did so under parental

supervision. Eighty percent spent less than three hours outdoors, and only 20% spent more time outdoors.

The survey included a question about time spent doing homework and playing computer games at the table. The following responses were given: 60% of children spend 2.5 hours or more on this, while 40% spend less than 2.5 hours. This means that students spend a significant amount of time sitting at school, and then at home doing homework and playing computer games, often in an uncomfortable position . The next item on the survey asked students about carrying school supplies in backpacks on their shoulders. Of the students surveyed, 55% answered yes to this question. Sixty percent of respondents sleep on a soft bed, while 40% sleep on a hard bed. A bed that is too soft causes the back to "round," stretching the hamstrings and gluteal muscles while shortening the anterior thigh muscles. This can lead to increased pelvic tilt and lumbar curvature. Thirty percent of respondents carry their bags alternately, while 70% are accustomed to wearing their bags on the same shoulder. Sixty percent of respondents exercise, 30% exercise occasionally, and 10% do not exercise. This contributes to the development of a weak muscular corset due to hypokinesia. Ten percent of respondents indicated that family members had some kind of musculoskeletal disorder, while 90% indicated no family history of musculoskeletal disorders. The low percentage of family history suggests a minor influence of hereditary factors in our study.

Conclusion. The main factors influencing the development of poor posture in the children studied include insufficient physical activity and prolonged static load on the spine, sleeping on a soft bed, and uneven loads from carrying a bag or backpack, which contribute to asymmetry. Therefore, the primary focus in developing corrective exercise programs for this group of children should be on strengthening the muscular corset .

Bibliography

*Yurechko O.V., Pelepeyko S.V. Physical education in the prevention and correction of posture disorders in children: a teaching aid. – Blagoveshchensk: Publishing house of BSPU, 2008. – 214 p.

*Epifanov V.A. Therapeutic physical education. – Moscow: Geotar-med, 2012. – 210 p.

*Kotesheva I.K. Health-improving methods for scoliosis: a tutorial. – Moscow: EKSMO-PRESS, 2002. – 240 p.

*Kashin A.D. Scoliosis and postural disorders: monograph. − M.: N.M. Center, 1998. − 239 p.

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FORMATION OF POSTURE IN CHILDREN USING KYOKUSHINKAI KARATE

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Abstract. To determine the feasibility of using Kyokushin karate to correct postural disorders, a pedagogical experiment was conducted involving 20 children with moderate postural disorders. Kyokushin karate classes were held three times a week, combined with additional home exercises tailored to the specific postural disorders, for four months. To maintain the integrity of the experiment, control children participated in physical education classes outside of school hours and gymnastics at home, with the same hours as the subjects. The classes resulted in significant positive changes in postural development in children in the experimental group compared to the control group.

Key words: posture disorders, children, Kyokushinkai karate

The recent increase in the number of children and adolescents who have disorders and diseases of the musculoskeletal system and connective tissue is one of the pressing problems of practical medicine and pedagogy . Postural disorders in them should and can be prevented with the help of physical education, including Kyokushin karate, which has exercises with general strengthening and corrective focus [1,2,3].

Objectives of the study: To evaluate the posture of young athletes aged 8-10 years practicing Kyokushin karate and the influence of training on its formation.

Materials and Methods: Twenty children aged 8-10 years participated in the study. Ten children were new to the karate section (trained for no more than two months), and ten were a control group of children who had not previously trained in karate. The screening tool was the "Test Card for the Detection of Posture Defects (according to S.N. Popov)". Somatoscopy was performed, examining six indicators and determining posture type before and after a four-month period of karate training. Classes were held three times a week, combined with additional exercises at home, for four months. To maintain the integrity of the experiment, control children participated in physical education classes outside of school hours and gymnastics at home, with the same hours as the subjects.

Results and discussion

According to the test cards, all children showed moderate postural abnormalities, which are related to the specific characteristics of the school period (increased static load on the spine, mental stress), and age-related characteristics of the musculoskeletal system in the 8-10 year period. During the initial examination, we found no significant differences in postural abnormalities in the children of both subgroups. In the sagittal plane, posture was correct in all children. In the frontal plane, external examination revealed a slight spinal curvature with asymmetry of the scapulae and/or shoulder girdles in six children in the karate group and in half of the control group (so-called asymmetrical or scoliotic posture). In the group of children newly enrolled in karate, signs of flat posture were recorded in four of the ten children, and in five in the control group, indicating weakness of the muscular corset. In six children from the group who underwent somatoscopy, flattening of the cervical and lumbar curves

was observed, reaching 2.6-2.8 cm and 3.4-3.6 cm, respectively. In the control group, flattening of the cervical curve to 2.6-2.7 cm and lumbar curve to 3.4-3.6 cm, respectively, was observed in five children. This flattening of the curves resulted in a flat-back posture. The intercostal angle was 84-89°, which is considered an acute angle and corresponds to a flat chest. Similar findings were obtained in the control group.

For children with frontal asymmetry, we recommended warm-up exercises and striking technique practice, specifically targeting the gluteal, rhomboid, pectoralis major, abdominal, and back muscles during the off-training period (on weekends and between training sessions). This additional set of exercises took approximately 20 minutes per day and was performed at a relaxed pace without overloading the child. For children with flat posture, we recommended a combination of core strengthening exercises (abdominal exercises, hyperextensions, arm curls and extensions in a prone position) and muscle stretching exercises, performed in a measured manner, regularly on rest days. A key feature of the warm-up was the emphasis on proper exercise execution and the need to maintain proper posture, transferring this principle to kihon, kata, and kumite. After correcting these disorders using Kyokushin karate techniques, the following musculoskeletal system indicators were obtained.

During the training, positive dynamics in the development of children's posture were observed in both subgroups. In the karate children, the depth of the cervical and lumbar curves corresponded to the age norm. The changes were significant ($p < 0.001$). The shoulder blades were more closely attached to the rib cage, although there were no percentage changes across subgroups. We observed greater symmetry in the frontal plane compared to the initial study, although the postural defect was not completely corrected. We attribute this fact to the need for longer-term observation and postural correction. In the control subgroup, the improvement was not statistically significant ($p > 0.05$). A slight positive dynamics in shoulder girdle symmetry was also observed.

Conclusion.

Kyokushin karate exercises have a positive effect on posture development. A personalized approach is needed to develop additional recommendations for independent practice on rest days.

Bibliography

1.Arslanov V.A. Study of the state of posture in activity on the example of schoolchildren-athletes / V.A. Arslanov, O.D. Kurmaev// Current issues of the theory and methodology of physical education of schoolchildren. - Kazan, 1977. - P. 3-25.

2.Masatoshi Nakayama. Dynamics of karate: monograph. / Nakayama Masatoshi. − M.: 2008. − 304 p.

3.Skinder L.A. Physical rehabilitation of children with posture disorders and scoliosis: teaching aid / L.A. Skinder [et al.]; – Brest: BrSU, 2012. – 210 p.

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THE ROLE OF SINGLE NUCLEOTIDE POLYMORPHISM OF THE TRPV4 GENE IN THE DEVELOPMENT OF ALTERED BRONCHIAL REACTIVITY IN CHILDREN DURING THE POST-INFECTIOUS PERIOD OF RESPIRATORY DISEASES

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Abstract. The high proportion of cases involving the development of post-infectious bronchial hyperreactivity in children represents a serious challenge for pediatric pulmonology [1-3]. Despite a large body of accumulated clinical and functional data, the genetic and molecular markers of susceptibility to this pathology remain poorly understood [1-3]. Transient receptor potential (TRP) ion channels act as key molecular sensors that respond to changes in the physicochemical parameters of the local respiratory microenvironment, such as temperature, osmolarity, and pH. These thermo- and osmosensitive receptors are widely expressed on epithelial cells, bronchial smooth muscle cells, and sensory nerve fibers, playing a direct role in regulating bronchial tone and initiating neurogenic inflammation. It is hypothesized that changes in the functional activity or expression density of these receptors associated with specific single nucleotide polymorphisms (SNPs) may serve as predictors of an abnormal respiratory response to a hypoosmolar trigger in children.

Keywords: airways, osmotic hyperreactivity, TRPV, gene polymorphism, mRNA expression, children.

Objective. To study the frequency distribution of genotypes and alleles of the TRPV4 gene rs6606743 polymorphic locus in children with different types of airway response to a hypoosmolar trigger after a past respiratory infection.

Materials and Methods. A total of 105 children in the recovery phase of respiratory diseases, with a median age of 10 [8; 12] years, were examined. The mean height of the children was 148.7 ± 1.5 cm, body weight was 40 [30; 53] kg, and body mass index (BMI) was 17.4 [15.7; 20.4] kg/m². Airway response to the hypoosmolar stimulus was evaluated using a bronchoprovocation challenge with ultrasonic inhalation of distilled water (IDW). Genotyping of the TRPV4 gene polymorphic locus was performed using real-time polymerase chain reaction (PCR) in peripheral blood leukocytes, followed by high-resolution melting (HRM) curve analysis. Precision Melt Analysis software (Bio-Rad, USA) was used to interpret the HRM analysis results. The mRNA expression level of the target genes in nasal epithelial cells was determined by quantitative real-time reverse transcription PCR (RT-qPCR). Statistical data analysis was performed using Statistica 12.0 software (StatSoft Inc., USA). Quantitative data were presented as M ± m (where M is the arithmetic mean and m is the standard error of the mean) or as median with interquartile range (Me [Q1; Q3]). Association analysis of genotypes and alleles was conducted by calculating the odds ratio (OR) and 95% confidence interval (95% CI). Quantitative relationships were assessed using linear regression analysis, determining the standardized regression coefficient (β) and the coefficient of determination (R2). Spearman's rank correlation method was used to identify correlation links.

Results. Based on the results of the bronchoprovocation challenge with ultrasonic inhalation of distilled water (IDW), the patients were divided into two groups: children with altered reactivity in response to IDW (Group 1, n = 59) and children with no reaction to the stimulus (Group 2, n = 40). Molecular genetic analysis revealed a highly significant protective effect of the overdominant inheritance model for the synonymous locus rs6606743 of the TRPV4 gene. It was established that the heterozygous AG genotype was associated with a 4-fold reduction in the odds of developing hypoosmolar bronchospasm in children (OR = 0.25; 95% CI 0.10–0.61; p = 0.002). According to the results of the linear regression analysis performed across the entire cohort of children, the minor A allele of the TRPV4 gene rs6606743 single nucleotide polymorphism was associated with a statistically significant decrease in the degree of FEV1 decline in response to IDW (β = +3.66%; R^2 = 0.075; p = 0.0149).

Conclusion. The obtained results confirm the contribution of genetic factors to the development of post-infectious airway reactivity in children. The heterozygous AG genotype of the TRPV4 gene rs6606743 locus serves as an independent protective factor that reduces the odds of developing hypoosmolar bronchospasm, while the carriage of the minor A allele is associated with a stepwise decrease in the severity of bronchoconstriction. This polymorphism can be considered a prognostic marker for the course of the post-infectious period of respiratory pathology in pediatric practice.

REFERENCES

1.Zhu L., Mei C., Zhang C., Li J., Tian D. Pathogenesis and Risk Factors of Post-Infectious Bronchiolitis Obliterans in Children: A Focus on Adenovirus and Mycoplasma Infections. Pathogens. 2026;15(5):533. https://doi.org/10.3390/pathogens15050533

2.Qin Q., Wang Q., Wang S., Wang L., Sun J., Li G. Longitudinal Study of Subsequent Wheezing/Asthma Risk Among Children Hospitalized for Acute Respiratory Infections - Yichang City, Hubei Province, China, 2017-2024. China CDC Weekly. 2026;8(21):641-646. https://doi.org/10.46234/ccdcw2026.104

3.Manukyan A.S., Prikhodko A.G. clinical and functional features of the course of post-infectious airway reactivity in children. Bulletin Physiology and Pathology of Respiration. 2025;(97):69-81. (In Russ.) https://doi.org/10.36604/1998-5029-2025-97-69-81

4.Grace M.S., Baxter M., Dubuis E., Birrell M.A., Belvisi M.G. Transient receptor potential (TRP) channels in the airway: role in airway disease. Br J Pharmacol. 2014;171(10):2593-2607. https://doi.org/10.1111/bph.12538

5.Perel'man Yu.M., Naumov D.E., Prikhodko A.G., Kolosov V.P. [Mechanisms and manifestations of osmotic airway hyperresponsiveness]. Vladivostok: Dal'nauka, 2016. 240 p. (in Russian). ISBN 978-5-8044-1627-1.

6.Precision Melt Analysis™ Software. User Guide. Hercules, CA: Bio-Rad Laboratories, Inc.; 2009. (Bio-Rad Bulletin No. 10014811).

MODERN PRINCIPLES OF TREATMENT OF CHRONIC HEART FAILURE IN PATIENTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE

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Abstract

To evaluate the efficacy of an angiotensin receptor neprilysin inhibitor (ARNI) in combination therapy of patients with chronic heart failure (CHF) and chronic obstructive pulmonary disease (COPD). A total of 38 patients with stage II–IV COPD were examined. The average age of the patients was 66.2 ± 2.5 years. Arterial hypertension was detected in all patients. The examined individuals were diagnosed with stage 1–2 CHF with reduced left ventricular ejection fraction (LVEF) <40%, functional class (FC) II–IV. Patients were divided into 2 groups. Group 1 included 18 patients who were prescribed ARNI (valsartan+sacubitril, Uperio «Novartis», Switzerland) as part of quadruple therapy at a starting dose of 50 mg 2 times a day. In the second group, patients received the angiotensin-converting enzyme inhibitor (ACEI) perindopril 5-10 mg/ day instead of ARNI. ARNI treatment resulted in a significant increase in LVEF, a decrease in pulmonary artery systolic pressure (PASP), an increase in right ventricular area fractional change (RVFAC), and an increase in glomerular filtration rate (GFR) and 6-minute walk test (6-MWT), which contributed to a reduction in the number of readmissions.

Keywords: chronic heart failure, chronic obstructive pulmonary disease, quadruple therapy, ARNI.

COPD is one of the pressing problems of modern medicine, ranking third among the causes of death in the world, which is associated with the increase in the number of smokers, environmental pollution, the growth of infectious diseases of the respiratory system, the aging of the population and the increase in comorbidity, including cardiovascular diseases [1, 2]. According to Russian epidemiological studies, the prevalence of CHF in the Russian Federation increased from 6.1 to 8.2% over a 20-year observation period. Modern therapy has reduced the number of re-hospitalizations due to decompensation of CHF [3]. For the treatment of patients with heart failure with reduced left ventricular ejection fraction (HFrEF), combination quadruple therapy is recommended, which includes the drug ARNI, the action of which is associated with the simultaneous suppression of neprilysin activity sacubitrilate and angiotensin II receptor blocker valsartan.

Objective

Evaluation of the effectiveness of ARNI in comorbid patients with COPD and CHF with low left ventricular ejection fraction.

Materials and methods

Of 38 patients with grade II–IV COPD (CAT ≥ 10 points, mMRC scale ≥ 2 points) in the stable phase were examined at the Blagoveshchensk City Clinical Hospital. The average age of the patients was 66.2 ± 2.5 years. Males predominated—85%. The duration of COPD was 18.5 ± 3.4 years, smoking

history—23.2 ± 2.2 pack-years. Arterial hypertension was registered in all patients, atrial fibrillation—in 45%, diabetes mellitus—in 30.5%. The examined individuals were diagnosed with CHF stage 1-2 with reduced left ventricular ejection fraction (LVEF) < 40 %, II - IV functional class (FC). All patients were divided into 2 groups. The 1st included 18 patients who were prescribed ARNI (valsartan + sacubitril, Uperio «Novarti», Switzerland) as part of quadruple therapy at a starting dose of 50 mg 2 times / day. The 2nd group consisted of patients with COPD and CHF, who were comparable in gender, age, severity of COPD, stage of CHF and FC. These patients in the complex treatment received ACE inhibitor perindopril 5-10 mg / day instead of ARNI. All patients underwent a comprehensive clinical and instrumental examination, transthoracic Doppler echocardiography was performed on a Toshiba Aplio expert-class ultrasound scanner (Japan) in M-, B-, and Doppler modes. LVEF was assessed using the Simpson method. The level of N-terminal pro-brain natriuretic peptide (NT-proBNP) in plasma was determined by enzyme-linked immunosorbent assay using Vector-Best test systems (Russia). Calculation SKF carried out By the MDRD (Modification of Diet in Renal Disease) formula was used. Exercise tolerance was assessed using the 6-MST. Patients were examined upon admission to the hospital and 3 months after treatment; follow-up was continued for 12 months.

Results and discussion

As a result of ARNI treatment, LVEF significantly increased in patients from 38.3±1.2 to 48.5±2.0% ($p < 0.05$). SPAP decreased from 42.7±3.4 to 30.0±1.4 mmHg ($p < 0.01$). RV FAC increased from 20.5±1.9 to 29.6±1.7% ($p < 0.01$). SCF increased from 49.8±2.1 ml/min/1.73 m2 to 62.8±3.3 ml/min/1.73 m2 ($p < 0.05$). NT- proBMP decreased from 1129.7±90.6 pg /ml to 759.3±74.5 pg /ml ($p < 0.01$). 6-MShT increased from 218.5±20.2 m to 350.7±14.5 m ($p < 0.05$). In the comparison group, only 6-MShT and NT- proBMP indicators improved significantly ($p < 0.05$). After 12 months of observation, in the group of patients receiving ARNI, rehospitalization was noted in 1 patient (5.5%), in the 2nd group – in 4 patients (20%).

Thus, inclusion in the complex therapy of patients with COPD with comorbidity CHFrEF of the drug ARNI, which contributed to a reliable increase in LVEF, RV FAC , a decrease in SPPA and the level of NT- proBMP , an increase in SCF and 6-MSH, which reduced the risk of re-hospitalizations and slowed the progression of the disease.

References:

1.Clinical guidelines for chronic obstructive pulmonary disease. Russian Respiratory Society. 2024.

2.Clinical guidelines "Chronic heart failure." Russian Society of Cardiology. — 2024.

3.Shlyakhto E. V. Classification of heart failure: focus on prevention // Russian Journal of Cardiology. 2023; 28(1).

RATIONALE FOR ACUPUNCTURE CORRECTION OF PATIENTS IN THE ACUTE PERIOD OF ISCHEMIC STROKE BASED ON ASSESSMENT OF THE ENERGY STATE OF MERIDIANS BY THE METHOD OF ELECTROPUNCTURE DIAGNOSTICS BY NAKATANI

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Abstract. The study was conducted to substantiate the feasibility of using acupuncture correction in patients in the acute phase of ischemic stroke, based on the analysis of electropuncture diagnostic data using the Nakatani method for individualizing approaches to reflexology. Three groups participated in the study: the main group (n=100) – patients in the acute phase of ischemic stroke; the comparison group (n=25) – patients with hypertension without stroke; and the control group (n=20) – healthy volunteers, representative for gender and age. The most significant changes were identified in the meridians of the Liver (excess), Heart (deficit, $p < 0.05$), Pericardium (deficit, $p < 0.05$), Stomach (excess, $p < 0.005$), Spleen-Pancreas (excess, $p < 0.001$), San Jiao (deficit, $p < 0.001$), Lungs (deficit, $p < 0.05$), and Bladder (excess, $p < 0.001$), which indicates the involvement of these organs in the pathogenetic mechanisms of stroke and explains the advisability of including points of the affected meridians in the acupuncture prescription.

Keywords: electropuncture diagnostics, Nakatani, acute period of ischemic stroke, acupuncture

Ischemic stroke (IS) remains one of the leading causes of disability and mortality worldwide, which explains the continuing relevance of the problem of early rehabilitation of patients who have suffered a cerebral stroke. In order to select and adjust an individual prescription of acupuncture points for reflexotherapy and monitor the results of treatment, it is possible to use electropuncture diagnostics (EPD), which, by determining the state of the classical meridians, allows us to evaluate the functional state of the patient's body both before the start of treatment and in dynamics. Today, the EPD method according to Nakatani, the foundations of which were laid in the 1950s by the Japanese physician and researcher I. Nakatani [1], is recognized worldwide. The approach to the interpretation of the obtained indicators developed by the author consists of an assessment of the autonomic regulation of dermatomes, which correlates with the autonomic regulation of the corresponding functional systems according to the teachings of oriental medicine on the localization of the external branches of the classical Chinese meridians [2]. The literature contains extremely scarce information on the results of EPD in cardiovascular diseases. In arterial hypertension (AH), the use of the hardware and software complex "ARM - PERESVET" made it possible to identify hyperfunction of the meridians of the Large Intestine ($p < 0.05$), Triple Warmer ($p < 0.005$) and, to a lesser extent, the Kidney meridian ($p > 0.05$), as well as hypofunction of the channels of the Heart ($p < 0.05$), Pericardium ($p < 0.05$), Spleen ($p > 0.05$) and Small Intestine ($p > 0.05$) [3], which indicates the possible participation of these organs in the pathogenetic mechanisms of hypertension, as one of the main causes of stroke. As for the information on the use of EPD in patients in the acute period of IS, it is insufficient in the medical literature.

Objective: To substantiate the feasibility of using acupuncture correction in patients in the acute period of IS based on the analysis of EPD data using the Nakatani method for individualizing approaches to reflexotherapeutic influence.

Materials and methods

The study involved three groups representative of age and gender. The study group (n=100) included patients in the acute stage of IS undergoing early rehabilitation at the Primary Vascular Department of the Blagoveshchensk City Clinical Hospital, aged 40 to 85 years (mean age 62.6 ± 1.56 years); the comparison group (n=25) included patients with AH without a history of stroke; and the control group (n=20) included healthy volunteers. The Nakatani EPD method allowed us to determine the functional state of the meridians by assessing the electrical conductivity at representative points of 12 classical meridians. Nakatani diagnostics were performed on the PERESVET ARM diagnostic and treatment system during the first 3-5 days of the patients' hospital stay by measuring electrical conductivity at 24 representative points. Channels in hyperfunction are located above the patient's individual normal range, calculated using a specialized computer program. Meridians in deficiency are located below the normal range.

Results and discussion

EPD revealed hyperactivity in the Liver meridian in subjects in all three groups, more pronounced in patients with a history of stroke ($p \leq 0.05$). One possible cause for this is psychoemotional overload, which is present in almost all patients and is a cause of cardiovascular problems. Excess activity was also detected in the Stomach and Spleen channels, significantly exceeding similar indicators in patients with AH ($p \leq 0.005$ and $p \leq 0.001$, respectively). Across all groups, a tendency toward deficit in the Heart and Pericardium meridians was observed, which gradually worsened in patients with AH compared to the group of relatively healthy individuals ($p \leq 0.05$) and was even more pronounced in patients in the acute phase of stroke ($p \leq 0.05$). Significant differences were also obtained when comparing the energy state of the channels of the San Jiao (excess in hypertensive patients, compared with the group of healthy volunteers ($p < 0.005$) and deficiency in patients with IS, compared with patients with AH ($p < 0.001$)) and the Bladder (hyperfunction in patients who had a IS against the background of hypofunction in both comparison groups ($p < 0.001$)). A slight tendency ($p > 0.05$) towards hyperfunction in the Kidney meridian was also noted in AH patients and patients with IS. A deficient state of the Lung meridian was revealed in all groups, which was significantly more pronounced in the main group of patients ($p < 0.05$). Energy deficiency in the Heart and Lung meridians and excess in the Stomach correlates with neurological manifestations of stroke (circulatory disorders, autonomic dysfunction). Thus, based on a study of the electrical conductivity indicators of the meridians in patients in the acute period of IS, in comparison with a group of patients suffering from AH and a control group, the most significant changes were identified along the meridians of the Liver, Heart, Pericardium, Stomach, Spleen-Pancreas, San Jiao, Lungs and Bladder. This indicates the involvement of these organs in the pathogenetic mechanisms of IS and opens up opportunities for optimizing approaches to reflexotherapy.

References:

1. Nakatani Y. // Japanese Society of Ryodoraky Autonomic Nervous System. - Tokyo. - 1972.

2. Boytsov I.V. Basic Principles of Electropuncture Diagnostics // Reflexotherapy. 2003. No. 3 (6). P. 51-55.

3. Molchanova E.E., Kravets I.A. Possibilities of acupuncture correction of arterial hypertension based on the study of data on the energy state of the meridians using the Nakatani method // Abstracts and reports. XXIII International Conference on BRT. - M .: IMEDIS. 2017. P. 349-354.

ASSOCIATION OF SINGLE-NUCLEOTIDE POLYMORPHISMS IN THE TNF AND MBL2 GENES WITH CONGENITAL DISORDERS IN NEONATES

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Abstract

To evaluate the association between single-nucleotide polymorphisms (SNPs) in the TNF and MBL2 genes and congenital disorders, 83 full-term neonates were genotyped. The AG genotype of TNF rs1800610 was more frequent among neonates with cardiovascular disorders than among those without such disorders (69.9% vs 43.4%; p=0.04; OR=2.97; 95% CI, 1.03–8.60). The GG genotype of MBL2 rs7096206 was more frequently detected in neonates with gastrointestinal disorders (36.1% vs 6.0%; p=0.002; OR=2.91; 95% CI, 1.21–6.98), whereas carriage of the T allele of MBL2 rs1800450 was more frequent in neonates with renal disorders (31.3% vs 7.2%; p=0.005; OR=3.45; 95% CI, 1.16–10.27). These findings suggest that these SNPs may be associated with susceptibility to congenital disorders in neonates.

Keywords: neonates, congenital disorders, single-nucleotide polymorphisms, TNF, MBL2

Congenital disorders are among the leading causes of neonatal morbidity and mortality. Genetically determined alterations in immune responses and embryonic morphogenesis may contribute to their development. Tumor necrosis factor alpha (TNF-α) regulates inflammatory responses, apoptosis, angiogenesis, and tissue remodeling, whereas mannose-binding lectin (MBL) is a component of innate immunity whose deficiency may predispose to intrauterine infection and injury to developing organs. SNPs in the TNF and MBL2 genes that affect the expression or functional activity of the corresponding proteins may therefore be associated with congenital disorders.

Objective

To investigate the association of SNPs in the TNF and MBL2 genes with congenital disorders in neonates.

Materials and Methods

The study included 83 full-term neonates born at 38–40 weeks of gestation. DNA was isolated from umbilical cord blood leukocytes. Genotyping of TNF rs1800610 and MBL2 rs1800450 was performed using high-resolution melting polymerase chain reaction (HRM-PCR), whereas MBL2 rs7096206 was genotyped using asymmetric linear-after-the-exponential polymerase chain reaction (LATE-PCR) with fluorescent probes. Statistical analyses were performed using the chi-square test and binary logistic regression in Statistica version 12.0.

Results and Discussion

The AG genotype of TNF rs1800610 was more frequent among neonates with cardiovascular disorders than among those without such disorders (69.9% vs 43.4%; p=0.04). Logistic regression likewise showed that carriage of the AG genotype was associated with higher odds of cardiovascular disorders (β=1.09; OR=2.97; 95% CI, 1.03–8.60; p=0.04). The AA genotype was not detected in the study sample, consistent with its low frequency in European populations; therefore, its association with the disorder under investigation could not be assessed. In addition, a borderline association between the AG genotype and renal disorders was observed (chi-square test: p=0.05; logistic regression: β=1.19; OR=3.29; 95% CI, 0.97–11.19; p=0.06).

Analysis of MBL2 rs7096206 showed that the GG genotype was more frequent among neonates with gastrointestinal disorders than among those without such disorders (36.1% vs 6.0%; p=0.002). This association was also observed in logistic regression analysis (β=1.07; OR=2.91; 95% CI, 1.21–6.98; p=0.02). Another SNP in MBL2, rs1800450, showed a potential association with renal disorders under a dominant inheritance model: carriage of the T allele (CT or TT genotypes) was more frequent among neonates with renal disorders than among those without such disorders (31.3% vs 7.2%; p=0.005). Logistic regression likewise showed that carriage of the T allele was associated with higher odds of renal disorders (β=1.24; OR=3.45; 95% CI, 1.16–10.27; p=0.03).

The principal limitations of the study are the small sample size and the lack of correction for multiple comparisons. Accordingly, the observed associations should be regarded as preliminary and require validation in independent cohorts. Nevertheless, the findings suggest that SNPs in the TNF and MBL2 genes may represent candidate markers of susceptibility to specific congenital disorders in neonates.

References

1. Zhang S., Zhan L., Zhu Y., Sun H., Xu X. Tumor Necrosis Factor Alpha Gene Polymorphisms Increase Susceptibility to Adenovirus Infection in Children and Are Correlated with Severity of Adenovirus-Associated Pneumonia // Genet. Test. Mol. Biomarkers. – 2020. – 24 (12). – P.761–770.

2. Hilgendorff A., Heidinger K., Pfeiffer A., Bohnert A., König I.R., Ziegler A., Merz C., Frey G., Chakraborty T., Gortner L., Bein G. Association of polymorphisms in the mannose-binding lectin gene and pulmonary morbidity in preterm infants // Genes Immun. – 2007. – 8 (8). – P.671–677.

3. Ouyang Y., Zhu L., Shi M., Yu S., Jin Y., Wang Z., Ma J., Yang M., Zhang X., Pan X., Ren H., Wang W., Zhang H., Xie J., Chen N. A Rare Genetic Defect of MBL2 Increased the Risk for Progression of IgA Nephropathy // Front. Immunol. – 2019. – 10. – P.537.

4. Font J., Ramos-Casals M., Brito-Zerón P., Nardi N., Ibañez A., Suarez B., Jiménez S., Tàssies D., García-Criado A., Ros E., Sentís J., Reverter J.C., Lozano F. Association of mannose-binding lectin gene polymorphisms with antiphospholipid syndrome, cardiovascular disease and chronic damage in patients with systemic lupus erythematosus // Rheumatology (Oxford) – 2007. – 46 (1). – P.76–80.

5. Yu S., Xue M., Yan Z., Song B., Hong H., Gao X. Correlation between TNF-α -308 and +489 Gene Polymorphism and Acute Exacerbation of Chronic Obstructive Pulmonary Diseases // Biomed. Res. Int. – 2021. – 2021. – Article number: 6661281.

ARTIFICIAL INTELLIGENCE IN SIMULATION TRAINING: INTEREST BOOSTER OR LAZINESS PROVOCATEUR?

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Abstract

This study evaluates the impact of integrating interactive AI tools, HTML simulators, and multimedia technologies into a Learning Management System (LMS) for the course "Practice in urgent medical manipulations". The analysis reveals that students engaging with AI-generated interactive scenarios achieved a significantly higher average score and made 2.2 times fewer critical errors compared to the traditional learning group, while 95% of participants reported heightened interest and engagement.

Keywords: artificial intelligence, neural networks, students, simulation training

The decline in students' motivation is one of the main problems of modern medical education. As many authors note, the phenomenon of students' formal attitude to the educational process is global in nature. The introduction of AI into medical education causes great disputes and discussions. Some consider neural networks to be laziness provocateurs, since students use them as universal "encyclopedias". Neural networks take over clinical thinking, generate ready-made answers, and automatically solve tests. Others consider AI a powerful tool that increases engagement through gamification. In our opinion, both sides are right, but a balance is needed.

Objective

To evaluate the impact of introducing interactive AI tools, HTML simulators, and multimedia technologies into the Learning Management System (hereinafter LMS) on the results of mastering the practice program "Practice in urgent medical manipulations".

Materials and methods

The development and testing of new educational formats were carried out on the basis of the Amur State Medical Academy. In June 2026, the digital educational module "Practice in urgent medical manipulations" was introduced into the LMS. To increase motivation, traditional text materials were replaced with interactive SCORM packages. AI algorithms (text-to-image, text-to-video) were used to generate: interactive clinical stands, infographics, and timelines; interactive HTML simulators and quizzes with export to the Aiken format test bank.

The study involved 122 fifth-year students of the General Medicine Faculty who started the cycle "Practice in urgent medical manipulations". Using randomization, the sample was divided into two representative groups comparable in their baseline level of training: all students underwent practical training at the accreditation and simulation center of the Amur State Medical Academy, according to the training program.

Independent work during preparation for this practice included:

Main group (n = 62): preparation was carried out in the digital educational LMS using interactive HTML simulators and SCORM packages.

Control group (n = 60): preparation was carried out according to the classical model using standard handouts (studying textbooks, lectures, etc.).

Checking the quantitative data for normal distribution showed a normal distribution (Shapiro-Wilk test), which allowed applying the parametric Student's t-test for independent samples. Differences were considered statistically significant at $p < 0.05$.

Results and discussion

The assessment of practical skills was carried out during the final simulation training. The criterion for successful completion was the performance of practical skills without critical errors, according to the developed and approved checklists that were used during practical simulation classes and self-preparation.

1.Successful completion on the first attempt: main group (n=62) - 54 students (87.1%), control group (n=60) - 46 students (76.7%), $p = 0.132$.

2.Average score (M±SD): main group (n=62) - 4.6±0.3, control group (n=60) - 4.1±0.4, $p < 0.001$.

3.Decision-making time, sec (M±SD): main group (n=62) - 46.2±9.5, control group (n=60) - 48.5±10.2, $p = 0.198$.

4.Total number of critical errors: main group (n=62) - 7 errors, control group (n=60) - 16 errors, $p = 0.04$.

The analysis showed that the proportion of those who successfully passed the practice on the first attempt in the main group was higher (87.1% vs. 76.7%), but the differences did not reach statistical significance ($p = 0.132$). Also, no reliable differences in decision-making time were found ($p = 0.198$).

However, the obtained score for executing the algorithm differed significantly. Students in the main group, who interacted with interactive digital scenarios, received a significantly higher average score ($p < 0.001$) and committed 2.2 times fewer critical errors ($p = 0.040$). The interactive environment does not accelerate reflexes but forms a more accurate and conscious clinical pattern of actions.

Upon completion of the cycle, an anonymous survey was conducted among students of the main study group (who used interactive HTML simulators and SCORM packages in the LMS during self-preparation) to assess subjective satisfaction with the teaching format. 95% (59 students) noted that the interactive format using virtual patients generated greater interest in the subject than traditional text-based tasks. When answering the question "Rate the degree of your involvement in solving a clinical task," the average score for the digital format was 9.2 out of 10.

Conclusion

Artificial intelligence in medical simulation training does not replace the pedagogical process but allows for its effective transformation. Outsourcing routine tasks (coding simulators, formatting SCORM courses, designing visual materials) to AI allows the educator to focus on methodology. Thus, neural networks become a laziness provocateur only with flawed methodological design, whereas in the hands

of a qualified teacher, they act as an interest "booster" that awakens the students' need to develop clinical thinking.

References:

1.Gorshkov M.D. Virtual reality and artificial intelligence in medical education. – Moscow: ROSOMED, 2023. – 254 p. – ISBN 978-5-6043452-6-9. (In Russ.)

2.Gorshkov M.D., Andreenko A.A., Bulanov R.L. et al. Can artificial intelligence create simulation scenarios on a par with a human? A comparative analysis of scenarios written by a human and AI, using the example of the case "Fire in the operating room" // Virtual Technologies in Medicine. – 2026. – No. 4. – P. 362-369. – DOI: 10.46594/2687-0037_2025_4_2151. (In Russ.)3. Malov V.A. Antibiotic-associated diarrhea // Clinical microbiology and antimicrobial therapy. – 2022. – Vol. 4.-№ 1. – C.22-32.

EVOLUTION OF NEPHROPROTECTIVE THERAPY: FROM ACE INHIBITORS TO INCRETIN-BASED DRUGS – CURRENT TRENDS

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Abstract

Chronic kidney disease (CKD) remains one of the most pressing challenges in modern healthcare. For a long time, the mainstay of nephroprotective strategy has been angiotensin-converting enzyme (ACE) inhibitors and angiotensin II receptor blockers (ARBs), whose efficacy has been demonstrated in numerous clinical trials. In recent years, the paradigm has shifted towards combination therapy incorporating novel drug classes, primarily sodium-glucose cotransporter-2 (SGLT-2) inhibitors, as well as glucagon-like peptide-1 (GLP-1) receptor agonists and non-steroidal mineralocorticoid receptor antagonists. This review presents the evolution of nephroprotective therapy, analyzes the results of key randomized controlled trials, and discusses the prospects for a personalized approach to the management of patients with CKD.

Keywords: chronic kidney disease, nephroprotection, ACE inhibitors, SGLT-2 inhibitors, incretin-based drugs

According to the current definition, CKD is characterized by persistent (for three months or more) kidney damage, the underlying mechanism of which involves the replacement of normal anatomical structures with fibrosis, leading to organ dysfunction. The global prevalence of CKD reaches 10–15%, and the number of patients requiring renal replacement therapy is steadily increasing, necessitating further refinement of nephroprotective strategies.

Objective.

To systematize current evidence on the evolution of nephroprotective therapy in CKD – from classical ACE inhibitors/ARBs to novel drug classes (SGLT-2 inhibitors, GLP-1 receptor agonists, non-steroidal mineralocorticoid receptor antagonists) – and to determine their place in current clinical guidelines.

Materials and methods.

A literature review was conducted using data published in the eLibrary and PubMed databases for the period 2022–2026, as well as official clinical guidelines – the Russian Ministry of Health Clinical Guidelines "Chronic Kidney Disease (CKD)" (2024) and the KDIGO 2024 Clinical Practice Guideline for the Evaluation and Management of Chronic Kidney Disease. Review articles and results from key randomized controlled trials addressing nephroprotective therapy were selected for analysis.

Results and Discussion.

The classical nephroprotective strategy, based on blockade of the renin-angiotensin-aldosterone system (RAAS) with ACE inhibitors or ARBs, remained the "gold standard" of CKD management for

decades. These agents have proven their efficacy; however, their potential is not unlimited: the risks of hyperkalemia, acute kidney injury during intercurrent illnesses, and insufficient efficacy in advanced stages limit their use.

A breakthrough in nephroprotection came with SGLT-2 inhibitors. The results of the CREDENCE, DAPA-CKD, and EMPA-KIDNEY trials demonstrated that these agents reduce the risk of CKD progression and the development of end-stage renal disease in patients, including those with non-diabetic CKD. The nephroprotective mechanisms of SGLT-2 inhibitors include restoration of tubuloglomerular feedback, reduction of intraglomerular pressure, attenuation of proximal tubular hypoxia, as well as anti-inflammatory and antifibrotic effects.

Recently, increasing attention has been directed towards GLP-1 receptor agonists. The FLOW trial (2024) demonstrated that semaglutide reduces the risk of CKD progression. Furthermore, non-steroidal mineralocorticoid receptor antagonists (finerenone) are being actively investigated; the FIDELIO-DKD and FIGARO-DKD trials have shown an additional nephroprotective effect when added to RAAS inhibitor therapy.

Current clinical guidelines reflect this evolution. KDIGO 2024 recommends a comprehensive management strategy for patients with CKD. The Russian clinical guidelines of 2024 have also incorporated SGLT-2 inhibitors into nephroprotective treatment algorithms for CKD. Thus, modern nephroprotective therapy represents a transition from monotherapy to a multicomponent combination strategy. Personalization of therapy is becoming a priority direction.

The evolution of nephroprotective therapy in CKD is characterized by a shift from RAAS inhibitor monotherapy to a combination strategy incorporating SGLT-2 inhibitors, GLP-1 receptor agonists, and non-steroidal mineralocorticoid receptor antagonists. Current clinical guidelines (KDIGO 2024, Russian CR 2024) reflect this paradigm shift, advocating a personalized approach to treatment selection. Further research is aimed at optimizing drug combinations to individualize nephroprotective strategies.

References:

1.Clinical Guidelines "Chronic Kidney Disease (CKD)" (approved by the Ministry of Health of the Russian Federation, 2024).

2.Kidney Disease: Improving Global Outcomes (KDIGO) CKD Work Group. KDIGO 2024 Clinical Practice Guideline for the Evaluation and Management of Chronic Kidney Disease. Kidney International. 2024;105(4S):S1-S314.

3.Pateyuk I.V., Lobashova V.L. Nephroprotection strategies: principles, opportunities, and prospects in chronic kidney disease. A literature review. Recept. 2026;29(1):68-87.

4.Gimadieva D.M., Shafigullina V.D., Khamidullina A.A. The role of SGLT-2 inhibitors in CKD – expanding indications beyond diabetes. Medicus. 2026;3(81):27-31.

5.Demidova T.Yu., Skuridina D.V. The role of sodium-glucose cotransporter-2 inhibitors on the path to cardiovascular wellbeing in type 2 diabetes mellitus and chronic kidney disease. Focus Endocrinology. 2023;4(1):45-59.

SOCIO-ECONOMIC PROFILE OF PREGNANT WOMEN WITH BRONCHIAL ASTHMA AS A BASIS FOR DIGITAL ROUTING

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Annotation

This article presents the results of a study of the medical and social profile of pregnant women with bronchial asthma (BA). Key socioeconomic characteristics of the patients are analyzed. The need for a transition from fragmented social assistance to personalized digital routing integrating therapeutic, obstetric-gynecological, pulmonary, and psychological care, as well as social support, is substantiated. The use of digital algorithms for the management of pregnant women with BA, taking into account social risk factors, is justified. These include differentiated monitoring frequency, telemedicine counseling, the involvement of psychological and social services, and interdepartmental collaboration between healthcare organizations, social protection agencies, and employment centers.

Key words: bronchial asthma, pregnancy, socioeconomic status, social work, interdisciplinary approach, digital routing

In addition to genetic factors, environmental factors, including behavioral ones, play a significant role in the development of bronchial asthma (BA). In the Amur Region, the incidence of respiratory diseases is traditionally high, and social determinants also play a role: deteriorating material well-being and housing conditions, and an increasing proportion of pregnant women who smoke. This complex set of social problems is most acute during pregnancy: socially conditioned conflicts are exacerbated, including gender discrimination in the labor market, loss of economic independence, withdrawal from active social life, and changes in family relationships. In the context of the digital transformation of healthcare, it is becoming increasingly important to not simply identify social risks but to integrate them into clinical decision-making. A patient's socioeconomic profile should form the basis for developing a personalized care pathway that integrates therapeutic, obstetric, pulmonary, and social care.

Objective

The aim of the study is to examine the medical and social profile of pregnant women with asthma and to justify digital routing directions.

Materials and methods

Data from 498 pregnant women with asthma were analyzed. Clinical and anamnestic information about the patients at various gestational stages , birth histories, and health data for newborns born to mothers with asthma were used.

Results and discussion

An analysis of the incidence dynamics revealed a trend towards an increase in the number of pregnant

women with asthma, starting in 2009 – a 1.6-fold increase ($p > 0.05$) compared to previous years. While in the 1990s, the incidence of pregnant women with asthma averaged 3.9 per 1000, in subsequent years it reached 5.2 per 1000, representing a 25% increase. Changes in the age structure of pregnant women with asthma were identified: the incidence of those in middle age increased, while the proportion of those in adolescence and middle age decreased. An increase in the number of older primiparous women was noted – up to 16.1% versus 9.6% in the 1990s – early 2000s. Overall, the average age of pregnant women with asthma was between 23 and 28 years. Over the past decade, significant socio-professional shifts have occurred among pregnant women with asthma. The number of women employed in the service sector and office work (white collar workers) has increased, while the number of blue collar jobs among patients with asthma has decreased by 2.3 times ($p < 0.05$). There is a tendency towards an increase in the number of housewives (by 1.8 times), and the percentage of women who are self-employed has increased. Against the background of an increase in the number of pregnant women with asthma with higher ($p < 0.05$) and secondary specialized education, a higher percentage of registered marriages has been noted, which indicates a more stable social status of this category of patients. At the same time, over the past few years, there has been a trend in material well-being (a decrease of 13%) and a deterioration in housing and living conditions (by 4.5%). The changes may be associated with a general deterioration in the socio-economic situation, unfavorable meteorological conditions (floods), as well as the psycho-emotional instability and tension in family relationships caused by these factors. The prevalence of smoking among pregnant women deserves special attention [1, 2]. An increased proportion of both active and passive smoking, including the use of electronic cigarettes, was noted among patients with asthma and in controls (an increase of 7.5% and 9.1%, respectively, $p < 0.05$).

Given the identified specific features of the socioeconomic profile of pregnant women with asthma, an interdisciplinary approach to monitoring this category of patients is necessary, combining both medical and social aspects. The key areas of social work should be: social support for pregnant women with asthma from risk groups (low-income, with unsatisfactory housing and living conditions, from single-parent families) - assistance in obtaining social support measures, benefits, improving housing conditions; psychological support aimed at reducing anxiety and psycho-emotional stress, especially in older first-time mothers and women with an unstable family situation; smoking cessation programs for pregnant women with asthma; assistance in maintaining employment and economic independence, including information on labor rights and guarantees for pregnant women; interdepartmental interaction of medical organizations (obstetricians-gynecologists, pulmonologists, therapists, psychologists) with social protection agencies, employment centers and non-profit organizations.

References:

1.Luchnikova, T. A. Features of the fetus and health of newborns born to mothers with bronchial asthma and vitamin D deficiency / T. A. Luchnikova, O. B. Prikhodko, E. B. Romantsova // Far Eastern Medical Journal. - 2018. - No. 4. - P. 25-27.

2.Smoking during pregnancy as a risk factor for diseases in offspring / O. B. Prikhodko, E. B. Romantsova, I. V. Kostrova [et al.] // Therapy. - 2024. - Vol. 10, No. S6. - P. 247.

THE ONSET OF BRONCHIAL ASTHMA DURING PREGNANCY AS A PROBLEM OF INTERDISCIPLINARY DIGITAL INTEGRATION

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Annotation

This article examines the onset of bronchial asthma during pregnancy as a complex clinical problem associated with risks for both mother and fetus. The study substantiates the need for a multidisciplinary approach and identifies predictors of onset, including a strong hereditary history and extrapulmonary allergic manifestations. Interdisciplinary digital data integration for personalized monitoring and timely patient management is proposed as a promising solution. The article substantiates the clinical and anamnestic parameters that should form the basis for such digital integration. The authors conclude that the creation of a unified digital framework will improve disease management and reduce perinatal risks.

Key words: bronchial asthma, pregnancy, interdisciplinary approach, newborns

Bronchial asthma (BA) remains one of the most significant chronic diseases in women of reproductive age. However, its onset, which first manifests during pregnancy, presents a particular clinical and management challenge. Unlike previously controlled conditions, gestational asthma is characterized by an unpredictable course, difficulties in differential diagnosis (physiological dyspnea of pregnancy or broncho-obstruction), limitations in drug therapy, and high risks for both mother and fetus. In the Amur Region, where respiratory diseases are the leading morbidity, and the sharply continental climate and high humidity act as additional triggers, the problem acquires regional specificity.

Objective

The aim of the study is to examine the clinical and functional characteristics of the onset of bronchial asthma during pregnancy, evaluate perinatal outcomes, and determine parameters for interdisciplinary digital integration into the obstetrics and therapeutic care system.

Materials and methods

The clinical and anamnestic data of the course of pregnancy in 58 patients with the onset of bronchial asthma at different stages of gestation and the health status of their newborns were studied.

Results and discussion

A burdened heredity for allergic diseases was noted in 17 cases (29.3%). Extrapulmonary manifestations of allergy before pregnancy were observed in 40 (68.9%) patients, including urticaria - in 11 (27.5%), atopic dermatitis - in 6 (15%), allergic rhinitis - in 9 (22.5%), anaphylactic shock - in 2 (5%). Allergic bronchial asthma was detected in 39 (67.2%) patients, non-allergic - in 7 (12.1%), mixed - in 12 (20.7%). In 48.3% of patients, bronchial asthma symptoms appeared in the first trimester, in 44.8% - in the second, and in 6.9% - in the third trimester. In 30 patients with mild bronchial asthma (BALT), asthma attacks first appeared after ARVI and contact with an allergen. In 18 patients, the onset was in the first

trimester of pregnancy, most often at 5-6 weeks, in 12 patients - in the second trimester, at 16-20 weeks of pregnancy. In 25 patients, moderate bronchial asthma (MBA) was diagnosed at 6-12, 20-29 weeks of gestation, and after acute respiratory viral infection. In 3 patients, attacks of severe bronchial asthma (SBA) appeared at 10-14 and 21 weeks against the background of acute respiratory viral infection. BA was observed in 51.7%, SBA - in 43.1%, and SBA - in 5.2%. Of the non-specific triggers, the following were predominant: acute respiratory viral infection - 68.9%, psycho-emotional stress - 58.6%, the influence of meteorological conditions - 60.3%, and physical activity - 39.6%.

In the structure of neonatal diseases, the leading places were occupied by: cerebral ischemia - in 21 (36.2%) cases, intrauterine infection (infectious diseases of the skin and mucous membranes) - in 17 (29.3%), disruption of the adaptation period - in 17 (29.3%), intrauterine growth retardation of the fetus - in 8 (13.8%), respiratory distress syndrome - in 10 (17.2%), movement disorder syndrome - in 16 (27.6%).

Thus, a multidisciplinary approach to monitoring patients with the onset of asthma during pregnancy is necessary to achieve and maintain control in order to minimize the risks for the pregnant woman and the newborn.

The digital transformation of healthcare opens up opportunities for interdisciplinary digital integration—the creation of a unified digital system that integrates data from obstetrics, internal medicine, pulmonology, and allergy profiles. This will enable the identification of women with predictors of asthma onset (eg, a history of asthma, extrapulmonary allergy manifestations, and trigger factors) during pregnancy registration, the development of personalized algorithms for monitoring respiratory function, and the timely provision of multidisciplinary care.

References:

1.Ventilation disorders in pregnant women with bronchial asthma / O. B. Prikhodko, E. B. Romantsova, I. V. Kostrova [et al.] // Therapy. - 2024. - Vol. 10, No. S6. - P. 246. - EDN RNEBJI.

2.Smoking during pregnancy as a risk factor for diseases in offspring / O. B. Prikhodko, E. B. Romantsova, I. V. Kostrova [et al.] // Therapy. - 2024. - Vol. 10, No. S6. - P. 247. - EDN BDUVPC.

3.Luchnikova, T. A. The influence of vitamin D and vitamin D binding protein on the course of bronchial asthma / T. A. Luchnikova, O. B. Prikhodko // Amur Medical Journal. - 2022. - No. 1 (32). - P. 39-43. - DOI 10.22448/23115068_2022_1_39. - EDN VNKMIJ.

4.Luchnikova, T. A. Features of the fetus and health of newborns born to mothers with bronchial asthma and vitamin D deficiency / T. A. Luchnikova, O. B. Prikhodko, E. B. Romantsova // Far Eastern Medical Journal. - 2018. - No. 4. - P. 25-27. - EDN YTUAJN.

5.Some features of the psychoemotional status of pregnant women with bronchial asthma / O. B. Prikhodko, E. B. Romantsova, L. L. Romanova [et al.] // Innovative methods of diagnosis and treatment in traditional Russian and Chinese medicine: Proceedings of the XX Russian-Chinese Biomedical Forum, Blagoveshchensk, September 15–17, 2025. – Blagoveshchensk: Amur State Medical Academy, 2025. – P. 79–80. – EDN ZZPFAM.

INFECTIOUS INFLAMMATION FOCI DETECTION BY DIGITAL PATHANATOMIC DIAGNOSTICS

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Abstract

In the diagnosis of infectious diseases, one of the problems may be the identification of foci of infectious inflammation, which may be hidden. One of the ways to identify foci of infectious inflammation is the use of digital pathanatomic diagnostics. It is used to obtain a digital image of the studied tissue and study it using machine-based image recognition algorithms. Digital pathanatomic diagnostics is a state-of-the-art method, with advantages in the form of high accuracy and objectivity, speed and quantitative approach.

Keywords

infectious pathology, digital pathanatomic diagnostics

Fever without a clear focus of infection may indicate the existence of a cryptofocus of infectious inflammation. In Vivo detection of infectious cryptofocs of inflammation in the body is usually based on the diagnosis of indirect signs. Conduct a clinical blood test, bacterial blood culture, general urinalysis, bacterial urine culture, measurement of the concentration of C-reactive protein (protein) [2].

Topical diagnostics can be implemented by pathomorphological methods. Among them, digital pathanatomic diagnostics has recently become an independent phenomenon, as a modern approach that detects foci of infectious inflammation by digitizing histological preparations and their subsequent analysis, including using artificial intelligence algorithms [1].

Objective of the study is to reveal the ability of traditional and digital technologies to complement each other in the diagnosis of infectious pathologies.

Materials and methods of research are based on the analysis of the use of traditional and digital methods of pathomorphological diagnostics.

Results and discussion

In the current practice, an electronic photograph of the histological preparation is first taken, thereby creating digital histological preparations (Whole Slide Image). This stage usually takes place as part of contact work on platforms using a digital scanning microscope, for example, «3DHISTECH PANNORAMIC 250 Flash» is a scanning microscope with accelerated scanning technology and high image quality. A series of images is processed, for example,with the «MacroPath pro-x» complex for microscopic analysis [3]. This visualization of histopreparations makes it possible to analyze them using the indicative basis of action provided on online platforms, as well as adjust them as necessary. A digitized image of a tissue is analyzed by a software package or artificial intelligence for matching

with signs of a focus of infectious inflammation, which confirms the presence of, for example, bacterial infection, and also classifies its type [5]. Instead of subjectively evaluating the morphologist, algorithms automatically calculate key parameters, suchas the inflammation density (ID) and the number of foci per unit area (focal density, FD). Machine learning models (for example,YOLO) are able to automatically recognize, and therefore detect, neutrophils — the main cells of inflammation in the focus, thereby helping to localize exactly hidden foci of inflammation. At the molecular level, an additional method for this is digital polymerase chain reaction, which makes it possible to detect the nucleic acid of the pathogen even at low concentrations in the tissue. Along with a qualitative assessment of the presence and severity of inflammation, the researcher receives accurate numerical indicators.

Thus, digital objectification of pathomorphological diagnostics allows us to focus on identifying the infectious focus in the histopathological picture. Time savings, high accuracy and objectivity are achieved, since, for example, machine and neural network analysis is free from the subjectivity of a person's visual assessment [4]. The disclosure of aspects of syntopy, holotopy, and skeletotopy of the detected infectious focus complements the range of medical diagnostics methods.

References

1. Demura T.A. et al. Methods of digital pathology in teaching the student course of pathological anatomy // I International congress «Rosmedobr-2022» – 2022 – 15-17 Sep. // www.rosmedobr.ru/rosmedobr2022/thesis/64344/?ysclid=mr8ohko16j7954 24717.

2. Tatochenko V.K. Fever without a visible focus of infection // Pediat. pharm. – 2006 – 3 – P.45-46.

3. Chen Y., Janowczyk A., Madabhushi A. Quantitative assessment of the effects of compression on deep learning in digital pathology image analysis // JCO Clin. cancer inform. – 2020 – 4 – P.221-233.

4. Socha P. et al. Quantitative digital pathology enables automated and quantitative assessment of inflammatory activity in patients with autoimmune hepatitis // J.Pathol.Inf. - 2024 Mar 12;15:100372.

5. Xinggong Liang et al Using pathology images and artificial intelligence to identify bacterial infections and their types // J.Microbiol. Methods – 2025 – Jul. – P.232-234.

MICROBIAL-VIRAL ASSOCIATIONS AND AIRWAY COLONIZATION

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Abstract

To assess the relevance of the etiological factors of respiratory infections, as the most common infectious pathology, modern data on pathogens were studied. Viruses are the main agents of respiratory tract infections. Among bacteria, the pathogens are more often representatives of the genus Staphylococcus. Along with monoinfections, viral-bacterial associations with competitive and partner relationships are detected. Recently, special attention has been paid to the interaction of bacterial pathogens of inflammatory infections and persistent viruses.

Keywords: microbial communities, viral-bacterial associations, bacterial colonization, respiratory infections

Respiratory tract infections account for up to 95% of infectious diseases. The airborne pathway explains the high level of infection. In the cold season, people spend more time indoors, creating epidemic crowding, which ensures the prevalence of pathogens in the population [1].

In the society of known bacterial, fungal and viral pathogens of respiratory infections, human papillomavirus (HPV) and herpes viruses are often found.

Objective of modern research is to find out the degree of mutual influence of elements of the microbial-viral community on the infectivity and pathogenicity of pathogens.

Materials and methods of research are based on the analysis of etiological factors of infections detected in laboratory patients.

Results and discussion

Until now, viruses (90-95%) are considered to be the main agents of respiratory tract infections. In descending order of frequency, you can build a rating: rhinovirus, coronavirus, parainfluenza virus, respiratory syncytial virus, adenovirus, influenza virus. Bacterial infections are less common, and usually manifest as a monoinfection or complication of an acute respiratory viral infection. Fungal infections of the respiratory tract are much less common. Coagulase-negative staphylococci (e.g. S.epidermidis) usually occupy the first place in terms of detection frequency among bacteria S.epidermidis, whereas S.aureus is more common in mono-infections [3]. Outside of situations with a clinical course of coccus infections, there are situations of bacterial transmission. S.aureus colonizes from 20% of the adult population up to 60% in individual populations. The main affected biotope is the nasopharynx with a predominance in the pharynx [4]. Bacterial transmission is considered a predisposing factor for subsequent invasion and development of the infectious process. An unfavorable prognosis for this outcome is compounded by the ability of staphylococcus to induce apoptosis of the pulmonary epithelium [5]. The result can be the development of staphylococcal pneumonia, especially with structural fibrotic changes in the lungs.

In addition to exposure to pollutants and habitual intoxications (for example, tobacco smoking), a special role in the pathogenesis of respiratory infections has recently been assigned to both inter-microbial partnerships and competitive interactions, as well as symbiotic factors affecting the immunity of a macro-organism, from the viral presence of, for example, influenza A virus [6]. Special attention is paid to the pathogenesis in the interaction of bacterial pathogens of inflammatory infections and persistent viruses, which, as it turned out, affect the cytokine spectrum of immune support [2]. It is believed that the combination of these conditions contributes to the formation of stable bio-films, which is one of the recognized persistence factors.

Creating a holistic picture of understanding the processes of airway colonization by infectious agents requires further study.

References

1. Andreeva I.V., Stecjuk O.U. Infekcii dyhatel'nyh putej: novyj vzgljad na starye problemy [Respiratory tract infections: a new look at old problems] // Klin. mikrobiol. antimikrob. himioter. – 2009 – T.11 – № 2 – S.143-151.

2. Andrievskaya I.A. et al. Changes in the cytokine status in women with exacerbation of bronchial asthma due to reactivation of cytomegalovirus infection in the second trimester of pregnancy // Bull. physiol. and path. – 2023. – 89. – P.111-116.

3. Beloglazova N.N., Vasilyeva L.I., Bragina L.E. et al. Mikrobnye biocenozy pri hronicheskom gnojnom srednem otite [Microbial biocenoses in chronic purulent otitis media] // Vestn. otolaringol. – 2010 – N.4. – S.17-19.

4. González-Garsia S. et al. Staphylococcus aureus colonization in the pharynx and nasal cavity: why are some people more susceptible? // Future Microbiol. – 2026 – Jan – 21(1) – P.27-42.

5. Kahl B.C. et al. Staphylococcus aureus RN6390 replicates and induces apoptosis in a pulmonary epithelial cell line // Infect Immun. – 2000 – Sep. – 68(9). – P.5385-5392.

6. Margolis E., Yates A., Levin B.R. The ecology of nasal colonization of Streptococcus pneumoniae, Haemophilus influenczae and Staphylococcus aureus: the role of competition and interactions with host's immune response // BMC Microbiol. – 2010 – Feb. – 23. – 10:59.

MANAGEMENT OF IATROGENIC COMPLICATIONS IN THE BASIC THERAPY OF BRONCHIAL ASTHMA

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Abstract

This article discusses an approach to the management of complications associated with maintenance pharmacotherapy for bronchial asthma (BA), particularly mycoses, using fluconazole, an antifungal agent, as well as Likopid acting as an activator of both innate and adaptive immunity and enhances the body's defense against fungal infections. This approach may be important as part of preventive treatment in the context of pathogenetic therapy of BA.

Keywords: bronchial asthma, iatrogenic syndrome, mycoses, tachyphylaxis, rebound effect, fluconazole, Likopid.

BA is one of the most common chronic respiratory diseases associated with persistent disability, reduced quality of life, and increased mortality. Inhalation therapy is the mainstay of asthma treatment and is highly effective; however, its use may be associated with complications that can worsen the course of the disease.

Objective

To evaluate the effectiveness of managing complications associated with basic BA therapy and to assess its impact on disease course and patients' quality of life.

Materials and methods

Medication use was analyzed based on medical history, physical examination, and laboratory and functional test results. The study included 40 inpatients (59% women and 41% men) with a mean age of 49.42 ± 10.38 years. Patients had been receiving long-term therapy with short-acting beta-2 agonists (SABAs), inhaled corticosteroids (ICS), long-acting beta-2 agonists (LABAs), and LABA/ICS combinations, either self-administered or prescribed by a physician. Mycotic complications were treated with an antifungal agent Fluconazole, administered at a dose of 200 mg on day 1, followed by 100 mg once daily for 7 days. Additionally, the immunomodulatory agent Likopid 10 mg once daily was prescribed for 10 days.

Results and discussion

Iatrogenic syndrome was identified based on medication history and clinical examination. Treatment-related mycoses were observed in 73% of patients, predominantly involving the oral cavity. Other complications included tachyphylaxis, rebound effects, drug dependence, and bronchial remodeling. Follow-up assessment at 30 days evaluated treatment efficacy using questionnaire-based measures of the underlying disease alongside clinical examination findings. Most patients demonstrated clinical improvement, including a reduction in the frequency and severity of asthma attacks and cough, as well

as increased physical activity. Functional parameters improved, with a 5% increase in bronchodilator responsiveness, indicating reduced bronchial obstruction. Forced expiratory volume in 1 second (FEV1), vital capacity (VC), and maximum expiratory flow rate (MEF) also increased. ECG signs of right heart strain decreased or resolved. Mycological examination showed complete resolution of mucosal mycosis in 80% of patients and partial improvement in 20%. Questionnaire analysis revealed a significant improvement in quality of life. These findings allowed for reduction in bronchodilator use, decreased daily medication doses, and step-down therapy in 48% of patients.

Management of iatrogenic complications during basic therapy of BA, including antifungal and immunomodulatory treatment, improves clinical outcomes and enhances patients' quality of life.

References:

1. Malyavin AG. Review of the possibilities of using Likopid in pulmonology and phthisiology practice. Therapy. 2020;5:174-186. doi:10.18565/therapy.2020.5.174-186.

2. Sereda VP, Svirido DA, Komarov MV, Smulskaya OA. Clinical experience with the use of immunobiological agents in the treatment of patients with severe bronchial asthma and comorbid pathology. Meditsinskiy Sovet. 2023;17(4):18-27.

3. Singh D, Garcia G, Maneechotesuwan K, Daley-Yates P, Irusen E, Aggarwal B, Boucot I, Berend N. New versus old: The impact of changing patterns of inhaled corticosteroid prescribing and dosing regimens in asthma management. Adv Ther. 2022;39(5):1895-1914. doi:10.1007/s12325-022-02092-7.

PRACTICE-ORIENTED TRAINING OF PHYSIOTHERAPISTS: A MASTER CLASS USING AN EXOSKELETON IN A CHILD

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Abstract

The experience of introducing a series of masterclasses featuring the demonstration of a robotic exoskeleton on a child into the teaching process of the Department of Physical Education with the Course in Therapeutic Exercise, based at the Children's City Clinical Hospital, is presented. The physiological mechanism of the device's action is emphasized, and the technique of its practical demonstration is analyzed.

Keywords: therapeutic exercise, pediatric rehabilitation, exoskeleton, masterclass, instructor, physiology of movement.

The rapid development of rehabilitation robotics, evident in both Russian and Chinese medical schools, calls for an update of physical therapist training methods. Traditional lectures do not allow students to grasp the nuances of patient interaction with high-tech equipment. At the Department of Physical Education with the Course in Therapeutic Exercise, with the support of the Children's City Clinical Hospital, a format of practical masterclasses was introduced, with the demonstration of an exoskeleton on a child with a locomotor disorder as its central element.

Objective

To describe the methodology and pedagogical outcomes of implementing a series of practice-oriented sessions involving the demonstration of a pediatric exoskeleton on a child volunteer.

Materials and Methods

A series of three masterclasses was conducted for residents and students (n=20). The sessions were led by a therapeutic exercise instructor skilled in robotic mechanotherapy at the children's hospital. An active lower-limb exoskeleton with electromyographic sensors, adapted for preschool age, was used. Each masterclass comprised three stages:

1) review of the device and its physiological mechanism of action – the instructor explained how weak efferent impulses from the motor cortex are amplified by the actuators, triggering central pattern generators for stepping and neuroplasticity;

2) clinical case analysis and programming – under the mentor's supervision, students set joint angles and sensitivity thresholds based on the biomechanics of spastic diplegia;

3) demonstration on the child – verticalization in the exoskeleton with step-by-step commentary by the instructor on muscle symmetry, foot roll, and suppression of pathological synkinesis.

Results and Discussion

According to assessments, the assimilation of neurophysiological principles rose from 45–50% to 85%. Students reported the disappearance of fear towards robotic technology: the smooth operation of the actuators and the child's confident steps dispelled the image of a "soulless machine." The inseparable link between classical therapeutic exercise and digital tools was emphasized – proper adjustment of joint modules required in-depth knowledge of anatomy and massage techniques. The ethical aspect was specifically highlighted: observing the instructor's gentle, encouraging communication with the child fostered empathy and responsibility in learners, unattainable on simulators. Challenges involved ensuring safety and adapting complex engineering terminology, which was addressed through associative comparisons (sensors likened to a sensitive palm, neural network training likened to motor skill formation).

Masterclasses with a real demonstration of a pediatric exoskeleton significantly enhance the quality of physical therapist training, translating theoretical knowledge into tangible skill. A detailed physiological breakdown of the mechanism of action combined with a live demonstration on a child cultivates clinically thinking specialists ready to work with innovative equipment.

MODERN APPROACHES TO THE STUDY OF THE RENEWAL POTENTIAL OF EPIDIDYMIS EPITHELIUM

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Abstract

The ability of the epididymal epithelium to quickly restore its integrity after injury indicates the presence of reliable mechanism of renewal, enabled by the presence of adult stem cells. During postnatal ontogenesis, basal cells are the source of renewal for most pseudostratified epithelia, but basal cells of the epididymal epithelium are an exception to this rule, making them the subject of numerous scientific studies and discussions. Modern approaches to studying the sources of epididymal epithelial cell regeneration using enriched cultures of basal cells of the epididymis are explored. New data on basal cells of the epididymis as potential adult stem cells, obtained using 3D cell culture, are presented.

Keywords: epididymis, epididymal epithelium, renewal potential, adult stem cells, cell culturing, 3D culture.

The epididymal epithelium of rats is a stable biological system demonstrating moderate morphological changes under severe pathological influences [2, 3, 4], which suggests its capacity for rapid regeneration. In postnatal ontogenesis, the source of renewal of the most pseudostratified epithelia are basal cells (epithelium of the airways, mammary gland, prostate). Basal cells of the epididymal epithelium do not fit into the existing "morphological paradigm", representing a population of highly specialized cells that are not precursors of the principal or clear cells of the epithelium [1, 3, 4]. The presence of progenitor cells and/or stem cells in the epididymal epithelium capable of ensuring its renewal on remains a subject of scientific interest among researchers today.

Objective

To study modern approaches to the study of the regenerative potential of rat epididymal epithelium using molecular and cellular biology methods.

Results and discussion

An important step in the search for candidates for the role of stem cells in the epithelium of the rat epididymis was the strategy for obtaining a highly enriched population containing up to 90% basal cells, developed by M. Mandon et al. [2]. Transcriptome analysis of basal cells in vitro analysis showed total expression of TP63, multiple connexins (Cx43, 32, 30.3, and 31.1), inflammatory markers, genes involved in detoxification, and adult stem cell markers [2]. Some of the genes expressed by basal cells of the enriched fraction are also expressed by basal cells of other tissues, including prostate, breast, and trachea [3]. However, gene expression profiles of these tissues showed that many basal cell transcripts are tissue-specific, suggesting some differences between basal cells within different pseudostratified epithelia. Furthermore, analysis in silico showed that in

the epididymal epithelium, TP63-dependent genes regulate cell adhesion processes, the cell cycle, differentiation, development and proliferation [2, 3].

The main characteristic of multipotent stem cells is their ability to proliferate and differentiate into the cells of the organ from which they originate. This is partly why stem cells are able to proliferate when cultured in Matrigel, forming a sphere of cells (2D culture). The formation of spheres from dispersed human epididymal cells under 2D culture conditions was observed by M. Mandon et al. [2] reported that during cultivation, basal cells expressing the basal cell marker KRT5 were detected in acini, after which they lost the ability to express KRT5 and began to express KRT8, characteristic of chief cells of the epididymis epithelium. Also, cells expressing Cx26, which is characteristic of undifferentiated columnar cells of the epididymis epithelium, appeared in many acini. These observations led the authors to suggest that basal cells within the acini differentiate first into columnar cells and then into chief cells, which was the basis for the development of a model of renewal and differentiation of the epididymis epithelium.

To definitively answer the question of whether basal cells are capable of reverting to columnar cells in response to injury, and to study the factors regulating this process, a protocol for three-dimensional (3D) cell culture with the possibility of obtaining organoids was developed [3]. Enzymatically dispersed single epididymal cells from sexually mature rats were cultured in Matrigel to create a 3D culture of these cells. After the 2nd day of cultivation, the cells formed small spherical structures, subsequently the spheres became more regular, the number and size of cells, as well as the diameter of the spheres, increased after the 3rd day of cultivation, the complexity of these structures also increased over time, which made them similar to organoids obtained from cells of other tissues. Therefore, the results obtained in the study by L. Pinel et al. [3] confirmed the hypothesis of the existence of multipotent adult stem cells in the epididymal epithelium.

Thus, the use of an enriched culture of basal epididymal epithelial cells and the further development of technology for growing epididymal organoids in 3D culture is a powerful and modern tool for studying issues of cell proliferation and differentiation in this organ.

References

1.Breton S., Chun R. Ye et al. Regulation of epithelial function, differentiation, and remodeling in the epididymis Asian Journal of Andrology (2016) 18, 3–9.
https://onlinelibrary.wiley.com/doi/full/10.1111/andr.12632

2.Mandon M, Hermo L & Cyr DG. Isolated rat epididymal basal cells share common properties with adult stem cells. Biol Reprod . 2015 Nov; 93(5):115.
https://doi.org/10.1095/biolreprod.115.133967

3.Pinel L., Mandon M. and DG Cyr Tissue regeneration and the epididymal stem cell Andrology, Volume7, Issue5 Special thematic issue on the Epididymis, pp. 618–630, 2019
https://doi.org/10.1111/andr.12635

4.Wang C, Xie Y, Liu J, Xie Q, Kang Y, Dong X, et al. Recent advances in the study of the structure and function of the epididymis. Explor Immunol . 2024; 4 : R. 309–3 24.
https://doi.org/10.37349/ei.2024.00142

C-TERMINAL TELOPEPTIDE LEVELS IN MEN WITH COPD: A COMPARATIVE ANALYSIS IN DIFFERENT RISK GROUPS

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Abstract

This study revealed that 62.9% of patients in the overall cohort had CTX-I levels above the cutoff values, confirming the high prevalence of signs of increased bone resorption in this population and consistent with the concept of COPD as a systemic inflammatory disease. A statistically significant difference in CTX-I concentrations between the low- and high-risk exacerbation groups (0.62 [0.56; 0.68] ng/mL versus 0.74 [0.68; 0.80] ng/mL; p=0.005) indicates that COPD severity, reflected by the risk of exacerbations, is associated with more pronounced osteoclast activity. Differences in the proportions of patients with CTX-I levels above the threshold (33% in the low-risk group versus 67% in the high-risk group; $\chi 2$=4.266; p=0.039) demonstrate not only quantitative but also qualitative differences in bone metabolism profiles between the groups. This suggests that elevated CTX-I may be a potential biomarker associated with an unfavorable COPD phenotype—frequent exacerbations and, likely, more pronounced systemic inflammation.

Keywords: chronic lung disease, C-terminal telopeptide chronic lung disease, C-terminal telopeptide.

Chronic obstructive pulmonary disease (COPD) is not only a respiratory but also a systemic disease: persistent inflammation, hypoxia, and physical inactivity contribute to the development of extrapulmonary manifestations, including osteopenia and osteoporosis [1, 3]. Men with COPD have an increased risk of fractures; however, bone metabolism in this cohort is less well studied than in women [2]. The C-terminal telopeptide of type I collagen (CTX-I) is a sensitive marker of bone resorption. Its determination allows one to assess osteoclast activity and the potential risk of bone loss [4].

Objective

To compare C-terminal telopeptide levels in men with COPD in different risk groups.

Material and methods

The study involved 105 male patients with COPD GOLD II-III, aged 50 to 65 years. They were divided into two groups based on their COPD exacerbation frequency: Group 1 (n=43) with a low risk of COPD exacerbation, and Group 2 (n=62) with a high risk of exacerbation. The average disease duration was 15.7±4.6 years, and the smoking index was 25.9±3.3 pack-years.

The study protocol was approved by the local ethics committee of the Amur State Medical Academy. Diagnosis was made in accordance with the GOLD recommendations (2025). All patients received basic therapy as prescribed by medical and economic standards for COPD treatment.

Bone metabolism was assessed based on the serum levels of the C-terminal telopeptide (CTX-I), a biochemical marker of bone resorption, using enzyme-linked immunosorbent assay (ELISA) using the Serum CrossLaps test system from BioKhimMak (Russia).

Statistical analysis was performed using Statistica 10 software (Student's t-test, Pearson's χ^2 test, and Spearman's correlation analysis (r). Differences were considered significant at $p < 0.05$.

Results and discussion

In the overall cohort, CTX-I levels were found to be 1.2 times higher than the cutoff value in 62.9% of individuals. In Group 1, the CTX-I level was 0.62 [0.56; 0.68] ng/ml, which was significantly lower than in Group 2 – 0.74 [0.68; 0.80] ng/ml (p=0.005). A detailed analysis revealed that CTX-I levels were above the cutoff value in Group 1 in 14 (32.5%) men and in Group 2 in 42 (67.7%) (χ^2=4.266; p=0.039).

Analysis of the obtained data shows an association between the CTX-I marker level and the risk of exacerbations in men with COPD. Therefore, elevated CTX I concentrations may serve as an indicator of increased risk of worsening disease in this group of patients. These results highlight the importance of monitoring CTX I levels for the timely detection and prevention of exacerbations in men with COPD.

References:

1.Aganov D.S., Tyrenko V.V., Tsygan E.N., Toporkov M.M., Bologov S.G. The role of the RANKL/RANK/OPG cytokine system in the regulation of bone tissue mineral metabolism // Genes and cells. – 2014. – 9(4). – C.50-52.

2.Gainidinova V.V., Burdunina A.A., Avdeev S.N. Features of bone tissue metabolism in patients with chronic obstructive pulmonary disease: regulatory mechanisms and markers of bone remodeling // Preventive medicine. –2021. – 24(1). – C.104-108.

3.Clinical guidelines Chronic obstructive pulmonary disease. – 2023. – C.7-11

4.Cavalier, E., Eastell, R., Jørgensen, N.R. et al. A Multicenter Study to Evaluate Harmonization of Assays for C-Terminal Telopeptides of Type I Collagen (ß-CTX): A Report from the IFCC-IOF Committee for Bone Metabolism (C-BM) // Calcif Tissue – 2021. – 108. – C.785–797. https://doi.org/10.1007/s00223-021-00816-5.

Exhaled air condensate as an object for biochemical research

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Abstract

The results of an analysis of the lipid composition of exhaled breath condensate are presented. Lipid content in exhaled breath condensate is compared with that in blood plasma. To assess the degree of lipid oxidation in exhaled breath condensate, it is recommended to record the UV spectra of lipid extracts from exhaled breath condensate.

Key words: exhaled air condensate, cholesterol, phospholipids, glycerolipids, UV spectra of lipids

Exhaled breath condensate (EBC) testing is a noninvasive diagnostic method widely used in pulmonology (1, 2). Numerous publications provide data on the content of various substances in EBC; however, unfortunately, these publications do not provide a clear understanding of its quantitative chemical composition. Many publications are not worthy of attention because they provide unrealistic values. For example, the colorimetric biuret method determines protein content, enzymatic methods traditional in laboratory diagnostics measure cholesterol content, etc. Clearly, the sensitivity of these methods does not allow for the detection of extremely low concentrations of components in EBC. Therefore, determining the quantitative content of the main components in EBC is an important task. Only by knowing the true content of components will it be possible to determine the diagnostic significance of changes in their content in certain diseases.

Aim

Study of the lipid composition of the EBC

Materials and methods of research

Lipid extraction from EBC samples was performed using the Bligh-Dyer method [3]. The content of cholesterol, phospholipids, and triglycerides in lipid extracts from EBC was determined by colorimetric methods [4]. The content of oxidized lipid forms was determined by recording the UV absorption spectra of lipid extracts [5].

Results and discussion

By extracting lipids from 140 ml of EBC with a 1:2 chloroform-methanol mixture, we were able to concentrate the lipids in the resulting extract by 70 times compared to the original EBC and determine its cholesterol, phospholipid, and total glycerolipid content. Based on the original EBC, the cholesterol content was 2.45 μg/ml, phospholipid 2.7 μg/ml, and total glycerolipid 17 μg/ml (table). According to the results obtained, the phospholipid and cholesterol content in EBC is an order of magnitude lower than reported by other authors (2, 3).

	Cholesterol	Phospholipids	Triglycerides
Plasma (mmol/ l)	3.9-5.3	2.0-4.7	1-2.3
Molar mass	386 (free HS)	7 39 (dipalmitoylphosphatidylcholine)	885 (triolein)
mcg/ml	1505-2045	1480-3470	885-2040
EBC (mcg/ml)	2.45	2.7	17
Plasma/EBC*	600-830	550-1300	50-120

*- the ratio of the lipid content in blood plasma to the content in the EBC.

It is interesting to compare the lipid content in the EBC and blood plasma (table). The content of cholesterol and phosphorus in the EBC is three orders of magnitude lower, and TG is 2 orders of magnitude lower than in blood plasma. The most accurate and sensitive quantitative method for studying EBC is the registration of the UV absorption spectra of lipid extracts from the EBC, which allows us to estimate the degree of oxidation of EBC lipids by the content of diene conjugates in nmol/ml and two relative indicators A233nm /A204 nm and A278nm /A204 nm , where A204 nm corresponds to the absorption maximum of the unoxidized lipid, A233 nm - to the absorption of diene conjugates, and A278nm - to the absorption of conjugated trienes and ketodienes. Absorption at 204 nm can be used to estimate the total lipid content of EBC samples . Phospholipids and cholesterol primarily contribute significantly to the UV absorption spectra of EBC, as evidenced by recording the UV absorption spectra of purified preparations of phospholipids, cholesterol, triolein, palmitic acid, and some other lipids.

Links:

1.Davis MD, Montpetit A, Hunt J. Exhaled breath condensate: an overview. Immunol Allergy Clin North Am. 2012 Aug;32(3):363-75.

2.Svetlakova N.V. Ventilatory function of the lungs, hemodynamics of the pulmonary circulation and phosphorus of lipids in exhaled air condensate in patients with decompensated type 1 diabetes mellitus during intensified insulin therapy. Abstract of Cand. Sci. (Medicine) dissertation. Samara, 2010, 20 pages.

3.Bligh, E.G., Dyer, W.J. A rapid method of total lipid extraction and purification. Can J Biochem Phys. (37), 911-917 (1959).

4.Borodin E.A., Dorovskikh V.A., Aksenova T.V., Starberg M.A. Lipid composition and antioxidant properties of soy milk in vitro and in vivo // Far Eastern Medical Journal, 2001, No. 4, pp. 26-30

5.Borodin EA, Shtarberg MA, Prikhodko AG, Kolosov VP, Perelman JM Modified noninvasive method of study of the oxidation of lipids of airways. Der Pharma Chemica. 2015. Vol. 7, No. 11. P. 186-192.

6.Sidorenko G.I., Kolyadko M.G., Zolotukhina S.F. Non-invasive diagnostic methods using exhaled air condensate and their significance using cholesterol determination as an example. Cardiology, 2009, no. 1, pp. 31-35.

ATRIAL FIBRILLATION: MODERN CHALLENGES IN DIAGNOSTICS AND TREATMENT

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Abstract. Atrial fibrillation (AF) remains the leading cause of interventional procedures for arrhythmias. Objective: to assess the volumes, efficacy, and recurrence rates of AF treatment in the Russian Federation. Materials and methods: data from the Profile Commission on Arrhythmology for 2024 (n=21,981), the Russian Cryoballoon Ablation Registry (CBA, n=976), and a local series from the cardiac surgery clinic (n=73) were analyzed. Results: in 2024, AF procedures accounted for 47.6% of all interventions for cardiac rhythm disorders. The proportion of paroxysmal form was 67.0%, persistent form – 33.0%. Repeat ablation was required in 19.4% of cases (for persistent form – 31.8%, for paroxysmal form – 20.2%). According to the CBA registry data, recurrences at 12 months were noted in 22.7% of patients. Independent predictors of recurrence were: primary procedure (OR=3.96; p=0.023), male sex (OR=1.77; p=0.014), procedure duration (OR=1.01; p=0.007). In the local series (n=73), recurrences accounted for 10.96%, quality of life improvement – in 82.19% of patients. Conclusion: the high frequency of repeat interventions, especially in persistent AF, requires improvement of risk stratification and personalized selection of ablation method.

Keywords: atrial fibrillation, catheter ablation, cryoballoon ablation, arrhythmia recurrence, registry

Atrial fibrillation (AF) is the most common sustained arrhythmia in clinical practice, associated with a significant increase in the risk of stroke, heart failure, and overall mortality [1]. Interventional treatment methods based on pulmonary vein isolation (PVI) have firmly taken a central place in rhythm control strategy [2]. Cryoballoon ablation (CBA) demonstrates efficacy and safety comparable to radiofrequency ablation (RFA), ensuring the formation of continuous circular lesions [3]. Despite progress in interventional electrophysiology, key challenges remain the high frequency of arrhythmia recurrence, the need for repeat interventions, and optimization of patient selection.

Objective: to analyze data from Russian registries on the volumes, efficacy, and safety of interventional treatment for AF.

Materials and methods. An analytical review of data from three sources was conducted: data from the Profile Commission on Arrhythmology for 2024 (n=21,981) [4]; "Prospective Cryoablation Registry for Atrial Fibrillation" – a national multicenter study from 2017–2019 (n=976) [3]; results of local retrospective analysis from the cardiac surgery clinic for the period 2020–2023 (n=73) [5]. Clinical forms of AF, types of ablation, frequency of recurrences and repeat procedures, and safety profile were assessed. Statistical analysis included descriptive statistics methods and multivariate logistic regression analysis to identify predictors of recurrence.

Results and discussion. Analysis of data from the Profile Commission for 2024 showed that AF procedures were performed on 21,981 patients and accounted for 47.6% of all interventions for cardiac rhythm disorders (46,218 cases), which confirms the dominant role of AF in the structure of interventional arrhythmology. The structure of AF forms among operated patients: paroxysmal – 67.0%, persistent – 33.0%. Repeat endovascular ablation was performed in 19.4% of cases. Detailed analysis revealed significant differences depending on the form of arrhythmia: in persistent AF, repeat RFA procedures were performed in 31.8% of cases, while in paroxysmal form – in 20.2%. The proportion of repeat cryoablations averaged 6.6%.

Data from the Russian CBA Registry (n=976) demonstrated that the primary PVI procedure was performed in 840 (86.1%) patients, repeat – in 136 (13.9%). Paroxysmal AF was noted in 828 (84.8%) patients, persistent – in 145 (15.1%). The average procedure time was 108.1±33.3 minutes. Documented arrhythmia recurrence occurred in 85 (22.7%) patients. Multivariate regression analysis revealed the following independent predictors of recurrence: primary procedure (OR=3.96; 95% CI: 1.41–16.23; p=0.024), male sex (OR=1.62; 95% CI: 1.04–2.55; p=0.036), longer procedure duration (OR=1.01; 95% CI: 1.00–1.01; p=0.008) [3].

Results of the local study (n=73) showed that among operated patients with paroxysmal AF (mean age 64.42 years, 37% men, 63% women, arrhythmia duration from 1 to 10 years), the frequency of arrhythmia recurrences was 8 cases (10.96%). No statistically significant difference by sex was found (p>0.05). Quality of life improvement was noted in 60 patients (82.19%), which manifested as improved exercise tolerance, absence of fear of rapid heartbeat and shortness of breath [5]. The persistent form of AF remains the main factor limiting the immediate effectiveness of treatment due to the complexity of eliminating stable fibrotic remodeling [1].

Conclusion. The significant proportion of repeat procedures (up to 31.8% in persistent AF) justifies the need for careful preoperative risk stratification and an individualized approach to the selection of energy delivery method to improve long-term treatment efficacy.

REFERENCE

1. Van Gelder I.C., Rienstra M., Bunting K.V., Casado-Arroyo R., Caso V., Crijns H.J.G.M., et al. 2024 ESC Guidelines for the management of atrial fibrillation developed in collaboration with the European Association for Cardio-Thoracic Surgery (EACTS). Eur Heart J. 2024;45(36):3314–3414. https://doi.org/10.1093/eurheartj/ehae176

2. Calkins H. 2017 HRS/EHRA/ECAS/APHRS/SOLAECE expert consensus statement on catheter and surgical ablation of atrial fibrillation / H. Calkins, G. Hindricks, R. Cappato [et al.] // Heart Rhythm. 2017;14(10):e275–e444. https://doi.org/10.1016/j.hrthm.2017.05.012.

3. Korobchenko L.E., Lyubimtseva T.A., Davtyan K.V., Topchyan A.G., Simonyan G.Yu., Serduk S.E., Korolev S.V., Kosonogov A.Ya., Kosonogov K.A., Tarasyuk E.S., Lubenkov K.A., Shulga A.S., Artyukhina E.A., Revishvili A.Sh., Kryzhanovskii D.V., Batalov R.E., Usenkov S.Yu., Khomutinin D.N., Kolunin G.V., Kharats V.E., Nechepurenko A.A., Sagitov I.Sh., Grachev N.I., Sharikov N.L., Chetverikov S.Yu., Perchatkin D.I., Virstyuk Yu.V., Rzaev F.G., Lebedev D.S., Mikhailov E.N. Russian registry of cryoballoon ablation of atrial fibrillation: characteristics of the procedure and features of patient's management. Journal of Arrhythmology. 2025;32(1):5-16. (In Russ.). https://

doi.org/10.35336/VA-1447.

4. Golukhova E.Z., Milievskaya E.B., Filatov A.G., Semenov V.Yu., Serguladze S.Yu., Pryanishnikov V.V. Aritmologiya – 2024. Narusheniya ritma serdtsa i provodimosti [Arrhythmology – 2024. Heart rhythm and conduction disorders]. Moscow: FSBI "NMITs SSKh im. A.N. Bakuleva" of the Ministry of Health of Russia; 2025. 186 p. (In Russ.)

5. Krotov G.V., Korotkikh A.V., Lyubenkov K.A., Shulga A.S. Postoperative rhythm control in patients after cryoballoon isolation of pulmonary vein orifices. In: Actual issues of modern medicine [Aktual'nye voprosy sovremennoy meditsiny]. Blagoveshchensk; 2023. p. 129-132. (In Russ.). EDN: IOTYHT.

OXIDATIVE STRESS AND BRONCHIAL HYPERSENSITIVITY TO LOW TEMPERATURES AND OSMOTIC FACTORS

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Abstract

To study the role of oxidative stress (OS) in the formation of bronchial hypersensitivity to the effects of low temperatures and osmotic factors, we proposed a method for determining oxidatively modified lipids in exhaled breath condensate (EBC) [1].

Key words: exhaled air condensate, oxidative stress, bronchial hypersensitivity, osmotic factors

Aim

Study of the content of oxidized lipids in the EBC under the influence of hypo- and hyperosmolar stimuli in healthy individuals and patients with COPD

Materials and methods

The material for the study was samples of EBC from healthy people and patients with COPD.

The content of oxidized forms of lipids was determined by recording the UV absorption spectra of lipid extracts [2].

Results and discussion

Exposure to hyperosmolar stimuli (inhalation of 4.5% NaCl and graded physical exercise) was accompanied by a decrease in the total lipid content in the EBC by 20 and 30% after the test, whereas in response to a hypoosmolar stimulus—inhalation of distilled water (IDW), an increase of 25% was observed. The content of conjugated dienes after the tests decreased slightly, and to a greater extent in response to aerosol tests (IDW) and inhalation of a hypertonic solution (IHS) than to graded physical exercise (DPE). The lowest values of this indicator were found in response to IDV. The content of conjugated trienes and ketodienes did not change in response to the provocation. The baseline FEV1 value before the challenge was closely associated with the content of unoxidized lipids in the EBC after the IDV test ($r=-0.81$; $p=0.003$) and the E206/E233 ratio in the IGR test ($r=-0.73$; $p=0.042$). In the DPH test, the E 233 nm and OD 278 nm values after testing depended to a greater extent on the load performed during the test ($r=0.65$; $p=0.006$ and $r=0.62$; $p=0.01$, respectively) than on the baseline airway patency. A convincing correlation was found between FEV1 in response to DPH and the changes in diene conjugate production following the challenge ($r=-0.57$; $p=0.021$). The data obtained indicate that osmotic stimuli can modulate the intensity of lipid peroxidation (LPO) in healthy individuals and play an important role in airway adaptation. The content of LPO products in the airways of COPD patients during bronchoprovocation in the form of bronchial insufficiency (DIF) may serve as objective evidence of differences in the severity of oxidative processes and inflammation in individuals with opposing types of bronchial response to

exercise [3-4].

The initial content of lipid peroxidation products in the EBC of COPD patients with and without hyperreactivity to the hypertonic solution did not differ significantly. However, after the test, the content of diene conjugates in the EBC of patients who responded to the hypertonic solution increased, with the emergence of significant differences for the E 233/206 index compared to individuals without response to the hypertonic solution. The relative increase in this index was inversely associated with the amplitude of the decrease in the parameters of pulmonary ventilation function (ΔFVC (r=-0.44, p=0.004), ΔFEV1 (r=-0.36, p=0.02), ΔMOS50 (r=-0.37, p=0.01)). Similar correlations were observed between the variables ΔFVC, ΔFEV1 and changes in GP content (r=-0.46, p=0.004 and r=-0.39, p=0.01, respectively). The oxidation index (233/204 nm) in patients with osmotic bronchospasm also turned out to be significantly lower compared to patients with no reaction and healthy individuals. When analyzing changes in response to a bronchoprovocation test, an increase in the index was found in these patients, largely due to an increase in the concentration of primary lipid peroxidation products, whereas a decrease in 233/204nm was recorded in patients without a reaction and healthy individuals . In COPD patients who responded to DFN with bronchoconstriction, a higher level of both unoxidized and oxidized lipids was found in the EBC . The higher content of oxidized lipid forms in the EBC correlated with the number of eosinophils, the levels of myeloperoxidase synthesis in azurophilic granules of cells and cellular secretory activity in patients with post-load bronchospasm. There was a clear relationship between the eosinophil CCI in the IM, the baseline concentration of A204nm, 233/204nm, 278/204nm and the subsequent bronchial response (ΔFEV1) to DFS (r=-0.83; p< 0.01; r=-0.39 p<0.01; r=-0.46 p<0.01; r=-0.34 p<0.01, respectively).

Conclusion:

The presented results indicate the important role of oxidative modification of lipids in aggravating the response of the airways to an osmotic stimulus, which contributes to the loss of control over COPD [2-4].

References:

1.Eugene A. Borodin, Anna G. Prikhodko, Mikhail A. Shtarberg, Leonid G. Nahamchen, Evgeniya Yu. Afanasyeva, Victor P. Kolosov and Juliy M. Perelman Dynamics of lipid peroxidation in the exhaled breath condensate in healthy people during hypo- and hyperosmolar bronchial provocation tests Eugene A. Borodin, Anna G. // Der Pharma Chemica. 2016. Vol. 8, №14. P.169-173.

2.Borodin E.A.,Shtarberg M.A., Prikhodko A.G., Kolosov V.P., Perelman J.M. Modified noninvasive method of study of the oxidation of lipids of airways. Der Pharma Chemica. 2015. Vol. 7, №11. P. 186-192.

3.Perelman J., Prikhodko A., Nakhamchen L., Borodin E., Kolosov V., Shtarberg M. Dynamics of lipid peroxidation products in exhaled breath condensate in asthmatics in response to dosed physical exercise // Eur. Respir. J. 2016. Vol. 48: Suppl. 60, PA2213.

4.Perelman J.M., Prihodko A.G., Borodin E.A., Shtarberg M.A. Dynamics of lipid hydroperoxides, vitamin E and ceruloplasmin in the blood serum of patients with asthma in response to inhalation of distilled water // Respirology. 2016. Vol. 21, Suppl. 3. P. 170-170.

RESEARCH WORK OF STUDENTS IN THE PROJECTION OF INCREASING MOTIVATION TO STUDY BASIC DISCIPLINES

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Abstract. This publication analyzes the research results of third-year students who have begun mastering a core discipline. It is shown that engaging third-year students in science helps shape their future research trajectory, with the opportunity to present their findings to the scientific community. This contributes to the development of professionally competent and competitive specialists, including those with scientific expertise.

Key words: research, core discipline, students

Mastering core disciplines by medical students often presents challenges associated with the large volume of information required to be memorized, insufficient knowledge of previous courses, and the loss of a logically structured trajectory toward meaningfully developing a foundation of fundamental knowledge. In such a situation, the motivational potential for mastering the discipline can be enhanced by engaging students in research [1]. Moreover, developing and strengthening interest in scientific research among third-year students, followed by maintaining this research potential in their senior years, helps prepare professionally oriented young specialists who are knowledgeable about the scientific achievements of domestic and international scientists and capable of creating their own "scientific product" from the initial idea generation to the presentation of research results to the scientific community. This contributes to enhancing the university's status within the university cluster as a platform for developing high-quality domestic scientific and educational potential through the training of professionally competent and competitive specialists, including those with scientific expertise.

Objective

To analyze the feasibility of engaging third-year students in research work in order to increase their motivation to study Pharmacology.

Materials and Methods

An assessment of the research results of third-year students within the Pharmacology research club over the past decade was conducted. The number of presentations at conferences at various levels, the number of scientific publications, and the number of PhD dissertations defended by former members of the student research club were analyzed.

Results and Discussion

Mastering the Pharmacology course in the third year of medical school includes familiarization with the preclinical research component, which is devoted to the experimental study of the efficacy of medicinal substances. Unfortunately, modern requirements for the care of laboratory

animals, certain economic constraints, etc., prevent universities from maintaining vivariums and breeding facilities, limiting students' opportunities for practical demonstrations of the effects of pharmacological agents on warm-blooded organisms. Maintaining a traditional approach to studying Pharmacology at the Amur Medical Academy, with experiments modeling specific conditions (toxic liver damage, oxidative stress, maladaptive reactions, etc.) in laboratory rats, followed by the search for and testing of pharmacoprophylactic and pharmacocorrective drugs, allows students to be engaged in the work, reinforcing their theoretical foundation and changing their motivation. Mastering routine skills in working with laboratory animals, drug administration techniques, and honing skills in blood collection and slaughter are just some of the components of the engaging preclinical phase of research, which inspires interest in pharmacological research. This interest is often reinforced through public recognition of achievements through the presentation of research results at conferences and in publications. Assessing the dynamics of interest of third-year students in research work in the pharmacological profile over the past decade, it is necessary to point out the increase in the number of students who presented at conferences of various levels (about 100) and published their scientific results in journals included in the list of the Higher Attestation Commission (more than 60) and international databases (more than 20). At the same time, it should be noted that about half of the young researchers who got involved in research work at the stage of mastering the discipline Pharmacology continue to engage in science in their senior years; from this contingent of talented students, many enter graduate school in the profile 3.3.6. Pharmacology, clinical pharmacology, or become applicants for the department, successfully defending dissertations for the degree of candidate of science (over the past 5 years - 9 people) and replenishing the ranks of PhD employees of the Amur Medical Academy [2]. It is important that the involvement of students in science allows for the formation

References:

1. Pecherskaya E.A., Savelenok E.A., Artamonov D.V. Student Involvement in Research Work at the University: Mechanism and Evaluation of Effectiveness // Education and Innovation. - 2017. - No. 8 (226). - Pp. 96-104.

2. Simonova N.V. Experience of Distance Learning of Postgraduate Students in the Profile of Pharmacology, Clinical Pharmacology at Amur State Medical Academy during a Pandemic // In the collection: Ways to Improve the Organizational and Educational-Methodological Work of a University during a Pandemic: Experience and Prospects. Proceedings of the Interregional Educational and Methodological Conference of Higher Education Teachers / Edited by S.N. Kiseleva. - Khabarovsk: Far Eastern State Medical University, 2023. - Pp. 165-168.

BLOOD CONTENTS OF CERTAIN TRACE ELEMENTS IN HEALTHY PEOPLE RESIDING IN THE AMUR REGION

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Abstract

This study examines the mineral profile of the adult population of the Amur Region, which is influenced by the region's environmental conditions. Blood levels of seven macro- and microelements (Pb, Sr, Cd, Co, Mn, Zn, and Cu) were assessed in 75 apparently healthy residents of the region aged 30 to 60 years and older. A significant decrease in zinc and copper levels was found, along with increased accumulation of manganese, strontium, cobalt, and lead, taking into account the minimum and maximum variability of these levels across the Russian Federation. This study substantiates the need to develop diagnostics for latent mineral deficiencies and nutritional support programs to prevent environmentally induced pathologies in the Amur Region.

Keywords: Amur Region, microelements, healthy population

The development of macro- and microelement status in the human body is inextricably linked to the biogeochemical characteristics of the region of residence. The Amur Region is characterized by a specific mineral composition of its aquatic environment and soil, which can cause imbalances of certain minerals in the body [1,2]. Since macro- and microelements (including Pb, Sr, Cd, Co, Mn, Zn, and Cu) act as key enzyme cofactors and participate in metabolic processes in living organisms [3], assessing their blood levels is critical for the early diagnosis of latent microelement deficiencies, environmentally conditioned maladaptive conditions, and the development of individualized correction programs for the local population.

Study Objective: To establish the physiological values of macro- and microelements in the blood of apparently healthy adults residing in the Amur Region.

Materials and Methods: Seventy-five generally healthy individuals aged 30 to 60 years and older, permanently residing in the Amur Region, were examined. The concentration of micro- and macroelements in whole blood and its fractions was determined using atomic absorption spectrophotometry. The obtained data were analyzed using variation statistics.

Results and discussion. According to the study, during the determination of the mineral content in the blood of the subjects, a tendency towards an increased cobalt content with a gradual age-related decrease was noted: 0.0154 ± 0.0012 μmol/l, $p < 0.05$ in the age category of 30-39 years versus the values of 0.00577 ± 0.00204 μmol/l, $p < 0.05$ in the category of 60 years and older. A similar situation was observed with the manganese content (1.07 ± 0.03 mmol/l, $p < 0.05$ at 30-30 years; 0.64 ± 0.05 mmol/l, $p < 0.05$ at 60 years and older). An increase in the quantitative indicators of lead was recorded at the age of 60 years and older - 0.246 ± 0.019 μmol/l, $p < 0.05$; the lowest concentration is at the age of 30-39 years – 0.089 ± 0.009 μmol/l, $p<0.05$. Zinc level is characterized by fluctuations in values depending on age, the maximum level was recorded at 30-39 years (19.1±1.28 mmol/

l, $p<0.05$), the minimum at 50-59 (14.6±1.39 mmol/l, $p<0.05$). Copper is also characterized by changes in concentration levels in different age periods, the maximum was recorded in the group of 30-39 years (10.60±1.21 mmol/l, $p<0.05$), the minimum at 40-49 years (7.59±1.15 mmol/l, $p<0.05$). Strontium had the most stable values – its indicators in age categories had values of 0.35-0.45 μmol/l, $p>0.05$; and cadmium, where the values were in the range of 0.0070–0.0072 μmol/L, $p<0.05$.

Thus, the macro- and microelement composition of the blood of healthy adults in the Amur Region has certain regional specificities, characterized by a deficiency of Zn and Cu against the background of increased accumulation of Mn, Sr, Co, and Pb, taking into account the minimum-maximum spread of indicators across the Russian Federation. The data obtained substantiate the need to introduce local reference interval scales for the accurate diagnosis of latent mineral deficiencies in the body, as well as the development of nutritional support programs for the prevention of environmentally induced pathologies in the Amur Region.

References:

1. Katola, V. M. - Mineral balance in healthy residents of Blagoveshchensk, Amur Region / V. M. Katola // Bulletin of Physiology and Pathology of Respiration. - 2013. - No. 49. - P. 83-86.

2. Skalny, A. V. - Elemental status of the population of Russia. Part 4. Elemental status of the population of the Far Eastern Federal District / A. V. Skalny, M. G. Skalnaya, A. A. Tinkov [et al.]. - Orenburg: OSU, 2014. - 156 p.

3. Evseeva G. P., Suprun S. V., Suprun E. N., Rakitskaya E. V., Kozlov V. K., Lebedko O. A. The effect of microelement imbalance on immunity // Microelements in medicine. - 2021. - No. S1. - P. 27.

EFFECTIVENESS OF ANTIBIOTIC PROPHYLAXIS IN CHILDREN AFTER ADENOIDECTOMY

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Abstract. A retrospective study was conducted at the Otolaryngology Department of the Amur Regional Children's Clinical Hospital. This study compared the effectiveness of three- and six-day courses of ceftriaxone antibiotic prophylaxis during adenoidectomy in children. The absence of statistically significant differences between the groups in clinical and laboratory examination results (complete blood count, daily morning and evening temperature measurements, and the presence/absence of general and local signs of inflammation) suggests the appropriateness of a three-day course of perioperative antibiotic prophylaxis.

Key words: adenoidectomy, perioperative antibiotic prophylaxis, ceftriaxone, course dose, children.

Currently, the duration of perioperative antibiotic prophylaxis often ranges from three to six days or more due to the lack of a uniform algorithm for administering antibacterial drugs [1]. During adenoidectomy in children, prophylactic antibiotic administration typically lasts 5-7 days using the antimicrobial agent currently available in the department. Unreasonably long-term antibiotic administration without considering the susceptibility of pathogens to them leads to increased antibiotic resistance in microorganisms, which is a global public health problem [2].

An analysis of the dynamics of resistance of certain pathogens to third-generation cephalosporins over the past 5 years, conducted at the Amur Regional Children's Clinical Hospital, indicates a trend of increasing strain resistance by 2023, followed by a decrease by 2025 [3]. The need to coordinate efforts to control antibiotic resistance with the transition from empirical therapy to etiotropic therapy, including the optimization of clinical guidelines that take into account the duration of perioperative antibiotic prophylaxis, is one of the important tasks at the present stage, the solution of which is possible, among other things, by reducing the duration of the course of prophylaxis in order to reduce the risks of the development of antibiotic resistance.

Objective

To compare the efficacy of three- and six-day prophylactic administration of third-generation cephalosporins during adenoidectomy in children.

Materials and methods

A retrospective study was conducted at the Amur Medical Academy, with permission from the local ethics committee, and at the Otolaryngology Department of the Amur Regional Children's Clinical Hospital. The study included 56 children diagnosed with adenoid hypertrophy (ICD-19: J35.2) admitted to the Otolaryngology Department of the Amur Regional Children's Clinical Hospital for elective adenoidectomy using videoendoscopic technologies. Patients were randomized into two groups: Group 1 (n=30) received perioperative ceftriaxone 1.0 intravenously daily for three

days, while Group 2 (n=26) received ceftriaxone for six days. All children included in the study underwent clinical and laboratory testing, including a complete blood count, daily morning and evening temperature measurements, and the presence of general and local signs of inflammation. Statistical analysis of the results was performed using Statistica v.10.0, and the statistical significance of differences between groups was assessed using the Mann-Whitney U test (at $p < 0.05$).

Results and discussion

The results of assessing several inflammatory markers in children in groups I and II showed that after surgery and on the third postoperative day, body temperature, white blood cell count, and erythrocyte sedimentation rate were within the reference range in all patients. Only one child in group I and one in group II experienced a subfebrile temperature on the first postoperative day. Thus, no statistically significant intergroup differences in the analyzed parameters were observed.

Signs of local inflammation were not observed on the first postoperative day in the majority (96.7%) of patients in group I. In children in group II, local inflammation was absent on the third postoperative day in 96.2% of patients.

Thus, the absence of statistically significant differences between groups based on clinical observation results indicates the advisability of a three-day course of perioperative antibiotic prophylaxis. The study involves further observations to expand the patient sample with subsequent recommendations to reduce the dose of perioperative antibacterial agents to reduce the pharmacological burden on the child's body, the risk of developing complications from antimicrobial drugs, and the development of bacterial resistance to broad-spectrum antibiotics.

References:

1. Dyakonova E. Yu., Loban N. V., Poddubny I. V., Bekin A. A., Gusev A. A., Prudnikova T. A. Antibacterial Prophylaxis of Infectious Complications in the Practice of a Pediatric Surgeon // Pediatric Pharmacology. - 2015. - Vol. 12, No. 4. - Pp. 481-484.

2. Karpova E. P., Tulupov D. A., Karneeva O. V., Polyakov D. P. Adenoid Hypertrophy. Hypertrophy of the Palatine Tonsils: Clinical Guidelines. - Moscow, 2021. - 44 p.

3. Skroderis A. A., Simonova N. V., Alieva V. P. On the duration of perioperative antibiotic prophylaxis during adenoidectomy in children // Cardiovascular therapy and prevention. - 2026. - Vol. 25, No. S3. - P. 64.

THE STRUCTURE OF SOMATIC DYSFUNCTIONS IN PATIENTS WITH PERSISTENT POSTURAL-PERCEPTUAL DIZZINESS

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Abstract

Persistent postural-perceptual dizziness (PPPD) is a common chronic functional disorder that ranks second in frequency among all causes of vestibular dysfunction. Given the limited efficacy of standard therapy, searching for new pathogenesis-based approaches is essential. Studying the role of somatic dysfunctions in maintaining proprioceptive balance will expand the options for comprehensive treatment of such patients.

Keywords: persistent postural-perceptual dizziness, functional dizziness, somatic dysfunction, osteopathic examination.

PPPD is one of the most common forms of chronic functional vestibular disorders. According to current epidemiological data, PPPD accounts for up to 15-20% of all consultations with otoneurologists, with a marked predominance of female patients (3:1 ratio). The clinical presentation of the disease is characterized by a persistent feeling of instability and non-rotational dizziness. Symptoms manifest for more than 50% of days over a period of three or more months, provided that concurrent organic vestibular and somatic pathologies are excluded. To date, the etiopathogenesis of PPPD is not fully understood. Acute psychoemotional stress, as well as preceding episodes of benign paroxysmal positional vertigo, are considered trigger factors.

Despite the variability of existing therapeutic approaches, standard treatment protocols for PPPD often fail to demonstrate sufficient clinical efficacy. This necessitates the search for new pathogenetically substantiated methods of medical correction. In current literature, the role of somatic dysfunctions in the mechanisms of maintaining proprioceptive balance is actively discussed. However, a detailed comparative analysis of the structure of somatic dysfunctions in patients with PPPD and somatically healthy individuals has not been previously conducted.

Studying and comparing the nature of somatic dysfunctions in patients with this pathology and individuals in the control group will allow for the verification of specific biomechanical markers of PPPD. The findings will form the basis for developing targeted programs to correct somatic dysfunctions, integrated into a comprehensive treatment scheme for patients, which determines the high scientific and practical value as well as the novelty of this study.

Objective

To conduct a comparative analysis of the structure and nature of somatic dysfunctions in patients with PPPD and somatically healthy individuals to identify specific biomechanical markers of the disease and substantiate targeted osteopathic correction.

Materials and methods

The pilot study included 31 patients with a confirmed diagnosis of PPPD (study group), with a median age of 39.0 [35.0; 46.0] years. The control group consisted of 10 conditionally healthy volunteers, with a median age of 39.5 [32.0; 43.0] years. One hundred percent (100%) of the subjects were female. The groups were comparable in terms of sex and age ($p > 0.05$). All participants underwent a clinical osteopathic examination in accordance with current clinical guidelines. Statistical analysis was performed using STATISTICA 12 software with Fisher's exact test; differences were considered significant at $p < 0.05$.

Results and discussion

The study revealed that at the global level, rhythmogenic (impaired production of the cranial rhythmic impulse - 80.7%) and neurodynamic (psychoviscerosomatic - 61.3%) disorders predominate in patients with PPPD. At the regional level, dysfunctions were most frequently identified in the head region (83.9%), the dura mater (87.1%), and the neck (visceral component - 74.2%). Among local disorders, dysfunctions were most commonly registered at the level of C0-C1-C2 (96.8%), temporal bone sutures (90.3%), the sphenobasilar synchondrosis (80.7%), the temporomandibular joint (77.4%), the posterior cranial fossa (74.2%), and the thoracic diaphragm (64.5%). In the control group, these cranial and cervical disorders were significantly less frequent and were predominantly local and compensated in nature (dysfunctions of the sphenobasilar synchondrosis and the temporomandibular joint in 20%, significance of differences between groups $p < 0.001$; C0-C1-C2 in 30%, significance $p < 0.001$).

Thus, mapping the osteopathic status revealed a pattern of specific biomechanical disorders associated with the pathogenesis of PPPD. The high frequency of dysfunctions in the upper cervical spine (C0-C1-C2) and structures of the craniosacral system confirms their role in destabilizing proprioceptive balance, which establishes a scientific and practical basis for integrating osteopathic correction methods into comprehensive treatment standards for this pathology.

References:

1.Antonenko L.M., Zastenskaya E.N. – Persistent postural-perceptual dizziness: current approaches to diagnosis and treatment // Neurology, Neuropsychiatry, Psychosomatics. – 2019. – 11 (4). – C.136-140.

2.Zamergrad M.V., Parfenov V.A., Ostroumova O.D., Guseva A.L., Zaytseva O.V., Sivolap Y.P., Kukes I.V., Voronov V.A., - Functional dizziness: from diagnostic criteria to clinical profiles and therapy. Expert consensus // Nevrologiya, neiropsikhiatriya, psikhosomatika = Neurology, Neuropsychiatry, Psychosomatics. – 2024. – 16 (4). – C.4-13.

3.Papa L., Amodio A., Biffi F., Mandara A., - Impact of osteopathic therapy on proprioceptive balance and quality of life in patients with dizziness // J Bodyw Mov Ther. – 2017. – 21 (4). – C.866-872.

4.Mokhov D.E., Belash V.O., Aptekar I.A., Nenashkina E.N., Potekhina Y.P., Tregubova E.S., Belyaev A.F., - Somatic Dysfunction. Clinical Guidelines 2023 // Russian Osteopathic Journal. – 2023. – (2). – C.8-90.

ASSESSMENT OF THE TENSITY AND DURATION OF POST-VACCINATION IMMUNITY AGAINST VIRAL HEPATITIS B IN HEALTHCARE WORKERS

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Abstract

The article presents the results of a three-year analysis of antibody levels to HBsAg (anti-HBs) in the blood serum of healthcare workers, determined by enzyme-linked immunosorbent assay (ELISA) using commercial reagent kits from Vector-Best. It was established that with an increase in the time elapsed after vaccination, the proportion of individuals without a protective antibody titre against the hepatitis B virus increases. It was found that with increasing time after vaccination, the share of persons lacking a protective titre grew.

Keywords: antibody level, anti-HBs, vaccination, post-vaccination immunity, healthcare workers, revaccination

According to Russian and foreign experts, regardless of the gradual decline and loss of antibodies to HBs, an adequately performed primary immunization in healthy individuals should provide long-term protection against acute and chronic hepatitis B. At the same time, the acquired immunity can wane, making it important to timely identify among vaccinated individuals from high-risk groups (healthcare workers) those who are insufficiently protected against hepatitis B.

Objective

To study the tensity and duration of the immune response to vaccination against viral hepatitis B, as well as the justification of revaccination in healthcare workers.

Materials and methods

The level of antibodies to HBsAg (anti-HBs) in blood serum was determined in healthcare workers by enzyme-linked immunosorbent assay using commercial reagent kits from Vector-Best, according to the manufacturer's instructions. Protective (prophylactic) titres were considered to be anti-HBs ≥10 mIU/mL.

Results and discussion

In order to assess the tensity and duration of post-vaccination immunity against viral hepatitis B during 2023–2025, blood serum samples were examined from 204 employees of an infectious disease hospital who had been vaccinated against hepatitis B between 2000 and 2024. The age of the examinees ranged from 19 years and older (mean age – 45.8 years), of whom 184 were women (90.2%) and 20 were men (9.8%).

The analysis showed that with increasing time after completion of vaccination, the proportion of persons without a protective antibody titre grew. At 2–5 years after the full vaccination course, 71.4% of healthcare workers had a protective titre, while after 8–15 years only 61.4% of those examined remained seropositive. In 49.5% of workers, 15 or more years after immunization, anti-HBs were not detected at a protective titre. Concurrently, with increasing time after vaccination, the number of persons with high antibody titres decreased.

At the time of examination, 41.2% of healthcare workers did not have a protective level of antibodies. The administration of a single booster dose of the vaccine made it possible to reduce this indicator to 30.4% overall. With an individual approach, the reason for revaccination is a decline in anti-HBs below 10 mIU/mL; however, a single (booster) revaccination did not always lead to an increase in antibody concentration in the blood serum. In employees with an initial anti-HBs level below protective (<10 mIU/mL), the administration of one vaccine dose led to a rise in titre above normal in only 47.6% of cases. At the same time, in one-third of those revaccinated, after 2 years the tensity of immunity decreased again to below the protective level.

Thus, regular checking of the immunity level in healthcare workers is necessary primarily for assessing the effectiveness of vaccination and developing measures to prevent the spread of infections in medical organizations, considering the constant occupational risk of infection.

References:

1. Centers for Disease Control and Prevention (CDC). A comprehensive immunization strategy to eliminate transmission of hepatitis B virus infection in the United States: recommendations of the Advisory Committee on Immunization Practices (ACIP). Part I: immunization of infants, children, and adolescents // MMWR Morb Mortal Wkly Rep. – 2005. – Vol. 54, No. RR-16. – P. 1–31.

2. Ministry of Health of the Russian Federation. Sanitary and Epidemiological Rules SP 3.1.2952-11 "Prophylaxis of viral hepatitis B". – Moscow, 2011. – 32 p.

3. Ovodov Yu.S., Gorbunov M.A., Popov A.F. Durability of post-vaccination immunity against hepatitis B in medical personnel // Epidemiologiya i infektsionnye bolezni [Epidemiology and Infectious Diseases]. – 2023. – Vol. 28, No. 2. – P. 112–119.

4. World Health Organization (WHO). Hepatitis B vaccines: WHO position paper – July 2017 // Wkly Epidemiol Rec. – 2017. – Vol. 92, No. 27. – P. 369–392. (Updated recommendations available in 2024).

PROGNOSTIC VALUE OF MYOCARDIAL INJURY MARKERS IN YOUNG PATIENTS WITH MODERATE SARS-CoV-2 INFECTION

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ABSTRACT. Cardiovascular complications in SARS-CoV-2 infection are increasingly reported in young patients even with moderate disease severity. In a retrospective analysis of 132 medical records (2020–2022), patients were divided into groups with (n=49) and without (n=83) complications. Levels of CRP, D-dimer, troponin I, NT-proBNP, and LVEF were assessed. Complications were identified in 37.1% of patients (pericarditis – 51%, myocardial infarction – 20%, stroke – 29%). The complication group showed a significant increase in CRP (p=0.001), D-dimer, troponin I, and NT-proBNP (p<0.0001). A strong correlation was established between NT-proBNP and the risk of events (r=0.673). Male sex was associated with an increased probability of ischemic events (OR=2.45). NT-proBNP was confirmed as an independent predictor (OR=1.175; AUC=0.895). Dynamic monitoring of NT-proBNP demonstrates high diagnostic value for timely risk stratification and prescription of cardioprotective therapy in young patients.

Keywords: SARS-CoV-2, NT-proBNP, troponin I, young age, cardiovascular complications

The spread of SARS-CoV-2 has demonstrated pronounced multiorgan tropism of the virus, with the cardiovascular system being one of the primary targets [1]. While fatal cardiovascular events were previously considered characteristic mainly of elderly patients with a complicated somatic history, life-threatening complications are increasingly observed in young patients (18–44 years) in modern clinical practice, including those with moderate disease severity. The pathogenetic basis of myocardial injury and endothelial dysfunction includes direct cytopathic effects of the virus (via ACE2 receptors), cytokine storm, immune-mediated coagulopathy, and microthrombosis of the coronary circulation [2]. Despite high clinical significance, the prognostic role of specific biomarkers (high-sensitivity troponins and natriuretic peptides) in the young population remains insufficiently studied. The lack of evidence-based data complicates early identification of high-risk patients and personalization of cardioprotective therapy [3, 4].

Objective: To evaluate the diagnostic and prognostic value of laboratory and instrumental markers for stratifying the probability of cardiovascular complications in young patients with moderate SARS-CoV-2 infection.

Materials and methods. A dataset of 4,453 medical records of inpatients with confirmed COVID-19 diagnosis from 2020–2022 was analyzed. Inclusion criteria: age 18–44 years, moderate disease severity, complete laboratory and instrumental monitoring. Exclusion criteria: severe/critical disease with early ICU transfer, history of chronic heart failure and cardiovascular diseases. The final sample comprised 132 patients. Depending on the presence of documented cardiovascular complications during hospitalization, the main group (n=49) and comparison group (n=83) were formed. Concentrations of inflammation and hemostasis markers (C-reactive protein, D-dimer), cardiac-specific biomarkers (troponin I, NT-proBNP), and left ventricular ejection fraction (LVEF)

by echocardiography were determined. Statistical analysis was performed using SPSS v23.0. Non-parametric Mann–Whitney and Kruskal–Wallis tests were applied for comparison of quantitative variables. Interrelationships were assessed using Spearman's rank correlation. Prognostic significance was evaluated by ROC analysis, and independent predictors were identified by multivariate logistic regression. The threshold of statistical significance was set at $p < 0.05$.

Results and discussion. Analysis of complication structure showed that they developed in 37.1% (n=49) of examined patients. Acute pericarditis predominated (51%), followed by ischemic stroke (29%) and acute myocardial infarction (20%). Comparative analysis revealed a significant elevation of CRP (p=0.001) and D-dimer (p<0.0001) in the main group. Peak values of inflammatory and coagulation markers were recorded in pericarditis and myocardial infarction, whereas their increase was moderate in cerebrovascular events. Concentrations of cardiac-specific markers also significantly increased: troponin I and NT-proBNP (p<0.0001 for both). Correlation analysis demonstrated a strong positive association between the probability of cardiovascular events and NT-proBNP level (r=0.673), as well as troponin I (r=0.543). Reduced LVEF was significantly associated with worsened prognosis (p=0.005). Gender stratification revealed that male sex is a risk factor for ischemic and cerebrovascular events (OR=2.45; 95% CI: 1.76–3.41), whereas age within the cohort (18–44 years) did not significantly influence outcomes (p=0.101). Multivariate analysis confirmed NT-proBNP as an independent predictor of complications (OR=1.175; 95% CI: 1.028–1.245; p=0.001). The area under the ROC curve (AUC) was 0.895 (sensitivity 86.5%, specificity 81.9%), indicating high prognostic accuracy of the model. The obtained data refute the concept of a "benign" course of moderate COVID-19 in young patients. A complication rate exceeding 37% necessitates optimization of monitoring protocols. The prognostic advantage of NT-proBNP over troponin I is explained by the fact that its secretion is induced by myocardial stretch and increased end-diastolic pressure. Under SARS-CoV-2 infection, this reflects not only occult left ventricular dysfunction but also right chamber overload due to pulmonary hypertension and microthrombosis of the pulmonary circulation [3, 4]. The high discriminatory capacity of the marker (AUC=0.895) makes it an optimal tool for early identification of patients requiring intensive cardioprotection.

REFERENCE

1. Shulga A.S., Andrievskaya I.A., Menshchikova I.G., Zabolotskikh T.V. Analysis of laboratory and functional study data in young patients with COVID-19 and cardiovascular disorders. Bulletin of Physiology and Pathology of Respiration. 2024;93:60-71. (In Russ.). https://doi.org/10.36604/1998-5029-2024-93-60-71

2. Nurpeisova A.Kh., Alimova L.K., Ponezheva Zh.B., Mannanova I.V., Popova K.N., Bikmukhametova A.I., Protsenko D.N., Tyurin I.N., Domkina A.M. Clinical and laboratory features of COVID-19 in young people. Lechaschi Vrach. 2021;3(24):45–50. (In Russ.). EDN: YETOQL. https://doi.org/10.51793/OS.2021.24.3.009

3. Etkin Y., Conway A.M., Silpe J., Qato K., Carroccio A., Manvar-Singh P., Giangola G., Deitch J.S., Davila-Santini L., Schor J.A., Singh K., Mussa F.F., Landis G.S. Acute arterial thromboembolism in patients with COVID-19 in the New York City Area. Ann Vasc Surg. 2021;70:290–294. https://doi.org/10.1016/j.avsg.2020.08.083

4. Helms J., Tacquard C., Severac F., Leonard-Lorant I., Ohana M., Delabranche X., Merdji H., Clere-Jehl R., Schenck M., Fagot Gandet F., Fafi-Kremer S., Castelain V., Schneider F., Grunebaum L., Anglés-Cano E., Sattler L., Mertes P.M., Meziani F., CRICS TRIGGERSEP Group. High risk of thrombosis in patients with severe SARS-CoV-2 infection: a multicenter prospective cohort study. Intensive Care Med. 2020;46(6):1089–1098. https://doi.org/10.1007/s00134-020-06062-x

INFLUENCE OF ADIPOSE TISSUE BIOMARKERS ON CLINICAL AND LABORATORY CHARACTERISTICS OF PATIENTS WITH COMORBID COURSE OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE AND METABOLIC SYNDROME

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Abstract

The aim of the study was to investigate The influence of adipokines on the clinical and laboratory characteristics of patients with a combined course of chronic obstructive pulmonary disease (COPD) and metabolic syndrome. Group 1 consisted of 48 patients with COPD and metabolic syndrome, and Group 2 consisted of 46 patients with isolated COPD. All patients underwent determination of adipokines (leptin, adiponectin, resistin) and interleukin levels using an enzyme immunoassay, spirometry, and physical adaptation were studied. Patients completed a validated COPD questionnaire. AssessmentTest (CAT). Patients in Group 1 showed a significant deterioration in spirogram velocity parameters and a decrease in volumetric lung function parameters. An increase in cytokine profile parameters was observed in Group 1 patients: interleukin (IL)-6, IL-8, and endothelin-1 (ET-1). We identified significant mathematical relationships between leptin, the abdominal obesity index, and subclinical inflammation markers. Patients with comorbidities had a high number of concomitant diseases (diabetes mellitus, hypertension). Leptin and adiponectin have a pathogenetic adverse effect on the clinical and laboratory course of COPD, which requires consideration during the timely diagnosis and treatment of this combined pathology.

Keywords: spirometry, metabolic syndrome, adipokines, inflammation.

The problem of comorbidity between chronic obstructive pulmonary disease (COPD) and metabolic syndrome is currently relevant and poorly understood. The mechanism by which a number of associated pathologies influence the clinical course of COPD requires clarification, in particular, metabolic syndrome, the incidence of which in patients with COPD worldwide varies between 22% and 60.9% [1, 2]. It is assumed that systemic inflammation, the effects of adipose tissue hormones, and decreased physical activity are the main mechanisms underlying the mutual aggravation of COPD and metabolic syndrome.

Objective

Study the influence of adipokines (leptin, adiponectin, resistin) on the clinical and laboratory characteristics of patients with the combined course of chronic obstructive pulmonary disease (COPD) and metabolic syndrome.

Materials and methods The study included 94 patients with COPD group B, who were divided into two groups. Group 1 included 48 patients with COPD combined with metabolic syndrome. The average age was 53.6 ± 1.18 years, men accounted for 62.5%, women - 37.5%, body mass index

(BMI) was 36.32 ± 2.71 kg / m 2 . Waist circumference in men was on average 106.4 ± 6.12 cm, in women 103.9 ± 5.24 cm. Group 2 consisted of 46 patients with COPD With normal mass bodies. All patients underwent determination of adipokines (leptin, adiponectin, resistin) and interleukin levels using enzyme immunoassay, spirometry, and physical adaptation were assessed. To understand the impact of COPD on daily life, patients completed a validated COPD questionnaire. AssessmentTest (CAT) and modified Medical Research Committee scale (mMRC). The following parameters were calculated: vital capacity (VC), forced expiratory volume in 1 second (FEV1), mean airflow rate in the range from 25 to 75%. In order to determine the prognosis of patients with COPD, the BODE index was determined, including an assessment of the forced expiratory volume in 1 second , and the body mass index. The concentration of leptin, resistin and adiponectin in the blood serum was studied by the enzyme-linked immunosorbent assay using standard ELISA kits . The study of the level of cytokines - interleukins (IL-4, IL-6, IL-8, IL-10), vascular endothelial growth factor, the content of tumor necrosis factor-alpha was carried out using the test systems of ZAO Vector-Best.

Results and discussion Cough, shortness of breath, and sputum production were reported by 58.7% of patients in Group 1 and 31.5% of patients in Group 2 (p=0.06) . To assess disease progression, we analyzed the number of exacerbations, restrictive symptomatology, exercise tolerance, and cardiac risks. In obesity, a high diaphragm contributes to difficulty in pulmonary ventilation and air movement through the bronchopulmonary tract, reducing the depth of breathing, which leads to a decrease in both obstructive and restrictive components of respiratory function. The study found that shortness of breath occurred in all groups; however, its incidence and severity varied. According to spirometry, more pronounced bronchial conductivity disorders were observed in Group 1 patients. A significant decrease in the FVC and a tendency toward a decrease in FEV1 in patients in Group 1 can be explained by a reduced ability of the lungs to fully expand and the need for increased breathing due to excess fat deposition in the chest and intrathoracic space . According to the mMRC scale , the severity of dyspnea was significantly more intense in Group 1 than in Group 2. Obesity leads to decreased lung elasticity, a decrease in lung volumes, and a decrease in the caliber of the distal airways [1, 2]. Thus, the symptom complex of respiratory disorders in the comorbid course of COPD and metabolic syndrome is characterized by a decrease in lung volumes and arterial hypoxemia. The results of the CAT assessment test were also significantly higher in cases of comorbidity in Group 1 patients. The 6-min walk test results in patients of group 1, on the contrary, were lower (p=0.073) compared to patients of group 2 362.87 (344.81; 389.53) m and 447.63 (433.39; 463.25) m, respectively. In both groups, a tendency towards a decrease in the SpO2 indicator determined by pulse oximetry was revealed . Thus , the symptom complex of respiratory disorders in the comorbid course of COPD and metabolic syndrome is characterized by a decrease in lung volumes and arterial hypoxemia. The visceral obesity index (VAI), which is a marker of cardiometabolic risk, was significantly higher in group 1 than in the 2nd, amounting to 3.94 (2.79; 3.72) and 1.86 (1.62; 2.38) , respectively .

Thus, a comparative analysis of clinical and laboratory parameters of patients with a combined course of COPD and metabolic syndrome suggests a significant influence of adipose tissue hormones on the comorbid course of the disease in the form of an increase in the frequency of annual exacerbations, deterioration of bronchial patency parameters, a decrease in volumetric spirometry parameters, high activity of cytokine inflammation indicators, a tendency to decrease arterial blood oxygen saturation, a decrease in tolerance to physical activity and an increase in cardiometabolic risk indicators.

References:

1. Avdeev S.N., Leshchenko I.V., Aisanov Z.R. Chronic obstructive pulmonary disease (COPD 2024). Clinical guidelines (short version). Respiratory medicine. 2025;1(2):5-16.

2. Tanchenko O.A., Naryshkina S.V. Obesity, metabolic disorders and arterial hypertension in patients with chronic obstructive pulmonary disease: modern concepts of comorbidity // Bulletin of Physiology and Pathology of Respiration. - 2018 - Issue 67. - P. 83-92.

META-ANALYSIS OF BLOOD TRANSCRIPTOME REVEALS A NOVEL GENE NETWORK ASSOCIATED WITH TRPM8 IN CHRONIC OBSTRUCTIVE PULMONARY DISEASE

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Abstract

COPD remains one of the leading causes of mortality, and the role of TRPM8 in its pathogenesis is controversial. A meta-analysis of 96 blood RNA-seq samples (55 COPD, 41 control) with WGCNA and validation on a rat model (n=20/group) was performed. A novel TRPM8-associated network of 338 genes with the core IL2RG, LCP1, CYBB, PECAM1, CASP8, MPZL1 was identified. Significant upregulation of TRPM8, IL2RG, LCP1 and CYBB in COPD was confirmed ($p<0.001$). IL2RG and CYBB are proposed as biomarkers and therapeutic targets.

Keywords: COPD, TRPM8, co-expression, systemic inflammation, biomarkers.

Chronic obstructive pulmonary disease (COPD) is the third leading cause of death worldwide [1]. Current therapy is symptomatic and does not address the molecular mechanisms of the disease, due to incomplete knowledge of its pathogenesis [2]. The transient receptor potential channel melastatin 8 (TRPM8) controls the inflammatory response in airway epithelium through the regulation of intracellular calcium and the activation of proinflammatory chemokine expression (IL-8, CXCL1) [3, 4]. However, existing data on its role in COPD are contradictory [5], and a systemic analysis of genes coexpressed with TRPM8 has not previously been conducted. Resolving these contradictions requires a shift from studying the isolated channel to investigating the molecular pathways into which it is integrated.

Objective

To identify genes co-expressed with TRPM8 in whole blood in COPD and validate key candidates experimentally.

Materials and methods

Bioinformatics. Raw RNA-seq data from 96 human whole blood samples (COPD, n=55; control, n=41) were obtained from the Sequence Read Archive. Differential expression analysis was performed using DESeq2 (FDR<0.05, |log2FC|>1.5). Co-expression modules were identified using WGCNA. GeneMANIA was used for network visualization.

Experimental validation. The study was performed on 40 male Wistar rats (n=20 per group). COPD-like phenotype was induced by cigarette smoke exposure for 42 days. RNA was isolated from whole blood. RT-qPCR was performed using specific primers for IL2RG, LCP1, CYBB, NLRP10, PECAM1 and TRPM8. Relative expression was calculated using the DESeq2 (FDR<0,05, |log2FoldChange|>1,5 method. Statistical analysis was performed using Student's t-test.

Results and discussion

A co-expression module of 338 genes significantly associated with TRPM8 was identified. The functional core included IL2RG, LCP1, CYBB, PECAM1, CASP8, MPZL1. On the rat model, significant upregulation of TRPM8 ($p=5.85\times10^{-19}$), IL2RG ($p=8.29\times10^{-21}$), LCP1 ($p=3.18\times10^{-14}$) and CYBB ($p=8.28\times10^{-9}$) was observed in COPD. PECAM1 was downregulated ($p=1.13\times10^{-8}$), while NLRP10 showed no change ($p=0.189$). The identified profile indicates systemic immune activation. IL2RG elevation reflects CD4+ lymphocyte infiltration; PECAM1 changes confirm endothelial damage; CYBB upregulation is context-dependent. IL2RG and CYBB are potential biomarkers and therapeutic targets.

Conclusion

A TRPM8-associated co-expression network including IL2RG, LCP1, CYBB, PECAM1, CASP8, MPZL1 was identified. Experimental validation confirmed systemic changes: upregulation of TRPM8, IL2RG, LCP1 and CYBB in COPD. The connection with the NLRP10/Th17 pathway indicates inflammation spread from lungs to systemic circulation. IL2RG and CYBB may serve for diagnostic panel development.

References:

1. Agusti A., Celli B.R., Criner G.J., Halpin D., Anzueto A., Barnes P., et al. Global initiative for chronic obstructive lung disease 2023 report: GOLD executive summary // European Respiratory Journal. 2023. Vol. 61, No. 4. P. 2300239.

2. Curtis J.L. Understanding COPD etiology, pathophysiology, and definition // Respiratory Care. 2023. Vol. 68, No. 7. P. 859–870.

3. Partida-Sanchez S., Desai B.N., Schwab A., Zierler S. Editorial: TRP channels in inflammation and immunity // Frontiers in Immunology. 2021. Vol. 12. P. 684172.

4. Ewels P., Magnusson M., Lundin S., Käller M. MultiQC: summarize analysis results for multiple tools and samples in a single report // Bioinformatics. 2016. Vol. 32, No. 19. P. 3047–3048.

5. Love M.I., Huber W., Anders S. Moderated estimation of fold change and dispersion for RNA-seq data with DESeq2 // Genome Biology. 2014. Vol. 15, No. 12. P. 550.

THE IMPORTANCE OF FUNDAMENTAL SCIENCES AND DISCIPLINES IN MEDICAL EDUCATION AND INNOVATION

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Abstract

Fundamental sciences are the basis for the educational process in fundamental disciplines. Students learn about innovations in medicine through lectures, seminars, and practical classes. The current trend is to turn science towards innovation and innovation towards science. Medical education is currently laying the foundation for the future.

Keywords: fundamental sciences, innovation, medicine

Fundamental sciences provide theoretical knowledge and serve as a foundation for other sciences [2,8,9]. Enhancing the efficiency of fundamental science is a strategic component of societal and national development [3,7,10]. Advances in fundamental science become innovations when they are put into practice. There is a close relationship between the power of fundamental research and the development of innovative technologies [1,4,5,6].

Objective

To analyze the importance of fundamental sciences in modern medical education and innovation.

Materials and methods

Methods of analysis of the content of scientific sources corresponding to the research topic, methods of generalization of own scientific and pedagogical experience were used.

Results and discussion

Fundamental sciences are the basis in the educational process for fundamental disciplines. Students in lectures, seminars, practical classes get acquainted with information about innovations in medicine. Students prepare essays, reports, participate in conferences, and always use information about innovations in medicine with interest, discussing them. In the curriculum for future doctors, the section on the physiology of higher nervous activity is studied based on the scientific achievements of classical physiologists. I. P. Pavlov's numerous students continued his work in science. In modern medicine, these knowledge is fundamental to the physiology of higher nervous activity, and it is a part of the curriculum for students. For students, this is a basic course, as it is impossible to make meaningful analysis of human knowledge without it. The requirement of the time is for science to turn towards innovation, and for innovation to turn towards science. Russia has world-renowned scientists and significant achievements in the field of fundamental sciences. There are many examples. One of them is the discovery of "animal electricity" by A. F. Samoilov, a student of I. M. Sechenov and I. P. Pavlov. Many inventions have been introduced into medicine based on this discovery. Maintaining the importance of fundamental sciences in higher education is

a resource that ensures innovation. The role of fundamental sciences in higher medical education is maintained through textbooks, lecture materials, integration of scientific and educational work, and the involvement of leading scientists in teaching.

References:

1.Ataeva J. T., Kakabaeva B.E., Gurbanmyradova A.A. Science, Professional Skills and Innovations in Medicine // Innovative Science. - 2026.- No. 1-2.- Pp. 211-212.

2.Vagin E.A. Physiology – the theoretical basis of medicine // Sechenovsky Bulletin. -2013. - № 4(14). - Pp. 18-24.

3.Gladkikh V.V. Science and education are the most important strategic resource for the innovative development of the state. articles. Voronezh. -2025. – pp. 226-230.

4.Zadorina M.S. The evolution of branding: from traditional methods to digital technologies // Current research. 2024. - № 34 (216). – Pp.61-65.

5.Komarova E.P.. Alekseeva G.A. Prospects for the formation of integrated competence in the process of medical student training // Bulletin of Voronezh State University. Ser.: Problems of Higher Education. – 2-21. - No. 1. – pp.42-44.

6.Kostishko I.B., Pustynnikova E.V. The role of innovations in modern medicine //Siberian Scientific Bulletin. - 2022. - №1 (45). - Pp.115-1120.

7.Ovezberdieva L. Innovations in medicine: trends and development prospects // Innovative science.- 2024. - Vol. 2. No. 11-2.- pp. 169-171.

8.Sadovnikov N.V. On the importance of the fundamentalization of modern university education //Modern methods of teaching mathematics: Theory and practice of mathematical education in schools and universities. Sat. scientific. articles based on the materials of the All-Russian scientific and practical conference. Saransk, 2023. pp.3-37.

9.Semenenko I.S. Tradition and innovation as concepts of political science and guidelines for development policy: dialectics of compatibility // Polis. Political research.- 2023. - No. 5. - pp. 45-65. 10.Tereshkina N.E., Khalturina O.A. Scientific and technological development in Russia // Bulletin of the Altai Academy of Economics and Law. - 2025.- No. 4-2. -pp. 368-373.

HEREDITARY HEMOCHROMATOSIS. MODERN METHODS OF DIAGNOSTICS AND TREATMENT

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Abstract

Hereditary hemochromatosis is a common disease that often masquerades as other pathologies. This paper presents two clinical cases from the author's personal practice, featuring timely diagnosis and favorable outcomes following treatment.

Keywords: hereditary hemochromatosis, diagnosis, treatment.

Hereditary hemochromatosis (HH) is a group of genetically determined diseases characterized by excessive iron accumulation in organs and tissues [1]. Heterozygous carriers of pathological genes are found in approximately 10% of the population, with clinical manifestations occurring at a frequency of approximately 1:300 among individuals of European descent [2]. The mutation penetrance is low: only 0.33% of carriers develop the full clinical picture [2]. The pathogenetic basis is the failure of the mechanisms that limit iron entry into the bloodstream, leading to progressive iron deposition in parenchymal organs, leading to dysfunction and irreversible damage [3]. Interest in this pathology is due to its frequent cryptic manifestations under the guise of other diseases, while timely diagnosis and treatment can prevent severe complications and ensure a life expectancy comparable to the general population.

There are five main types of HH. Type 1 (HFE-associated) is the most common form (85–90% of cases) and is caused by mutations in the HFE gene on chromosome 6. More than 90% of clinical cases are associated with the homozygous C282Y mutation. The H63D mutation, either homozygous or in compound heterozygous combination with C282Y, has significantly lower penetrance. Type 2 (juvenile) is a severe form with onset in the first three decades of life (mutations in the HJV or HAMP genes). Type 3 is associated with mutations in the TFR2 gene. Type 4 (ferroportin-associated) is inherited in an autosomal dominant manner.

Clinical manifestations typically occur between the ages of 40 and 60 in men and 10 to 20 years later in women (due to physiological iron loss). Three stages are distinguished: asymptomatic iron overload, early manifestations, and clinically manifest damage to target organs: liver (with development of cirrhosis), heart (cardiomyopathy), diabetes mellitus, hypothyroidism, etc.

Diagnosis is based on a comprehensive approach: clinical assessment, laboratory and instrumental methods, and molecular genetic testing. Biochemical markers include increased transferrin saturation (an early marker) and serum ferritin levels (reflects iron stores). Molecular genetic diagnostics: detection of the homozygous C282Y mutation in the HFE gene confirms the diagnosis. In the absence of typical mutations, testing of the HJV, HAMP, TFR2, and SLC40A1 genes is indicated. [1, 2].

The gold standard of treatment is phlebotomy: removal of 450–500 ml of blood weekly until ferritin levels reach 50–100 μg/L (induction phase), followed by maintenance therapy at intervals of 1–4 months. Timely treatment at the precirrhotic stage allows for a life expectancy comparable to that of the general population. Chelation therapy is used for secondary hemochromatosis associated with chronic anemia. [3].

Objective

To present clinical cases from the author's personal practice, with timely diagnosis and favorable outcomes following therapy.

Materials and methods

Case 1. Patient L., born in 1984, noted increasing weakness after COVID-19. Examination revealed an increase in ferritin to 1100 μg/L and serum iron to 40 μmol/L, which was initially assessed as a post-infectious condition. However, the indicators remained elevated over time. Upon consultation with a hematologist, hemoglobin was 152 g/L, ferritin 1100 μg/L, serum iron 35 μmol/L, and transferrin saturation was 70%. Hepatitis B and C were excluded. Genetic testing revealed a homozygous C282Y mutation. Weekly 500 ml blood transfusions were initiated until ferritin reached 50 μg/L, followed by maintenance phlebotomies every 3 months. In July 2026, ferritin was 50 μg/L, iron 20.0 μmol/L, and TFG was 52%. Remission was maintained.

Case 2. Patient Sh., born in 1980. He was observed for a long time with a diagnosis of non-alcoholic fatty liver disease (NAFLD), steatohepatitis due to obesity and dyslipidemia. Complaints of weakness and fatigue. Ultrasound reveals hepatomegaly (right lobe 161 mm, left 87 mm), splenomegaly. Biochemical analysis shows elevated transaminases (ALT up to 222.6 U/L). Treatment with hepatoprotectors is without significant effect. Iron metabolism testing revealed ferritin 1135 μg/L, serum iron 30.13 μmol/L, and NTFP 70%. Genetic testing confirmed homozygous mutation C282Y. Phlebotomy was prescribed according to the standard protocol. In July 2026, ferritin 50 μg/L, iron 20.0 μmol/L, NTFP 54%, transaminases decreased (ALT 50.6 U/L). Remission is maintained.

Results and discussion

Both cases demonstrate different diagnostic trajectories of hereditary hemochromatosis type 1 in middle-aged men. In the first case, the disease was diagnosed after COVID-19, while in the second, it masqueraded as non-alcoholic fatty liver disease for a long time. In both cases, the diagnosis was confirmed at the pre-cirrhotic stage by measuring ferritin and serum iron levels, followed by genetic testing. Timely phlebotomy resulted in sustained remission and normalization of iron metabolism parameters. Key factors for a favorable prognosis include clinical awareness among physicians of various specialties, early laboratory diagnostics (ferritin, serum iron, and serum iron levels), and timely initiation of elimination therapy before irreversible organ damage develops.

These clinical observations confirm that hereditary hemochromatosis type 1 (HFE-associated) can manifest under various clinical masks—as post-infectious hyperferritinemia or as a variant of non-alcoholic fatty liver disease. Routine inclusion of iron metabolism indicators in the diagnostic minimum for chronic hepatopathies and asthenic conditions in middle-aged men is clinically justified.

References:

1. Eremina, E. Yu. "Hemochromatosis in Clinical Practice." Medical Almanac. 2015. pp. 74–78.

2. Bacon B. R., Adams P. C., Kowdley K. V., Powell L. W., Tavill A. S. Diag-nosis and management of hemochromatosis: 2011 practice guideline by the American Association for the Study of Liver Diseases // Hepatology. 2011. Vol. 54, № 1. P. 328–343. DOI: 10.1002/hep.24330.

3. Pietrangelo A. Hereditary hemochromatosis // Biochimica et Biophysica Acta (BBA) – Molecular Cell Research. 2006. Vol. 1763, No. 7. P. 700–710. DOI: 10.1016/j.bbamcr.2006.05.003.

ANTIOXIDANT ACTIVITY OF SUCCINIC ACID UNDER ACOUSTIC LOAD IN THE EXPERIMENT

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Abstract.

The antioxidant activity of succinic acid was experimentally studied during acoustic exposure of laboratory animals. The possibility of pharmacocorrection of the prooxidant effects of noise using succinic acid was established. This was confirmed by a decrease in the concentration of prooxidant markers compared to the control (by 21-29% - diene conjugates; 23-29% - lipid hydroperoxides; 38% - malondialdehyde) and an increase in the activity of ceruloplasmin (by 62-73%, $p < 0.05$) and vitamin E (by 37%, $p < 0.05$).

Key words: acoustic load, succinic acid, antioxidant activity, experiment, rats

The search for and testing of pharmacological agents from various groups for mitigating and/or preventing the effects of acoustic stress is one of the tasks of fundamental pharmacology [1, 2, 8]. The antioxidant properties of succinic acid, confirmed in various experimental models and correlated with its antihypoxic activity, justify interest in studying the effectiveness of exogenous succinate in correcting the imbalance in the prooxidant/antioxidant system induced by acoustic stress [5, 9]. Therefore, studying the effectiveness of succinic acid under acoustic stress in laboratory rats suggests expanding the possibilities of succinate-containing pharmacotherapy.

Objective

To study the antioxidant activity of succinic acid under acoustic stress in an experimental setting.

Materials and Methods

The experiment was conducted on 90 albino male rats weighing 190–240 g, divided into three equal-sized groups. The intact group received no interventions; the control group received acoustic stimulation (95–105 dB, 60 min/day, daily for 7, 14, and 21 days) along with daily intraperitoneal administration of 1 ml/kg of isotonic NaCl solution; and the experimental group received daily intraperitoneal administration of 100 mg/kg (1 ml/kg) of succinic acid for 21 days before acoustic stimulation. The methods for determining oxidative stress markers are generally accepted and have been described in our previously published studies [3, 4, 6, 7]. The results were analyzed using Statistica v.10.0 and the Student's t-test; in all evaluation procedures, differences were considered statistically significant at $p<0.05$.

Results and Discussion

The results of the experiment showed that the introduction of succinic acid to laboratory animals subjected to acoustic stress reduced the intensity of lipid peroxidation processes: diene conjugates in the experimental group were lower than in the control group by 21% by the end of the first week of

the experiment ($p<0.05$), by 22% by the end of the second ($p<0.05$), and by 29% by the end of the third ($p<0.05$); lipid hydroperoxides – by 23% by the end of the first week and by 29% by the end of the third ($p<0.05$); malondialdehyde – by 38% by the end of the experiment ($p<0.05$). The use of succinic acid in the experiment contributed to a statistically significant increase in ceruloplasmin activity relative to the control group by 73% (day 7), 74% (day 14), and 62% (day 21) ($p < 0.05$); vitamin E responded with a significant increase by the end of the second week of the experiment by 37% ($p < 0.05$). Thus, the possibility of inhibiting the intensity of lipid peroxidation processes induced by the prooxidant effect of noise by the administration of succinic acid was experimentally confirmed. This is apparently due to the substrate role of exogenous succinate in relation to energy status and energy supply for the functional activity of the endogenous antioxidant system due to the presence of an indirect (secondary) antioxidant effect.

References:

1. Zatvornitsky V.A., Simonova N.V., Shtarberg M.A., Tereshchenko T.A., Gulyaeva A.S. Protective effects of reamberin during experimental noise exposure // Experimental and Clinical Pharmacology. - 2024. - Vol. 87, No. 1. - Pp. 25-30.

2. Kosolapov V.A., Tregubova I.A. Modeling stress in an experiment // Medicinal Bulletin. - 2022. - No. 2 (86). - Pp. 17-19.

3. Lashin A.P., Simonova N.V. Neonatal oxidative stress in calves and its correction // Far Eastern Agrarian Bulletin. - 2019. - No. 2 (50). – P. 76 – 81.

4. Lashin A.P., Simonova N.V. Herbal preparations in the correction of oxidative stress in calves // Far Eastern Agrarian Bulletin. – 2017. - No. 4 (44). – P. 131 – 135.

5. Orlov Yu.P. Mitochondrial dysfunction as a problem of critical conditions. The role of succinates. Myth or reality of tomorrow? // Antibiotics and chemotherapy. – 2019. – Vol. 64, No. 7-8. – P. 63 – 68.

6. Simonova N.V., Dorovskikh V.A., Li O.N., Anokhina R.A., Starberg M.A., Simonova N.P. Correction of oxidative stress with natural antioxidants // Bulletin of Physiology and Pathology of Respiration. – 2014. - No. 53. – P. 84-88.

7. Simonova N.V., Panfilov S.V., Sayapina I.Yu., Lashin A.P. Stress-protective and actoprotective activity of succinic acid under acoustic load on laboratory rats in an experiment // Veterinary pathology. – 2025. – Vol. 24, No. 1. – P. 15–22.

8. Simonova N.V., Sayapina I.Yu., Starberg M.A., Lashin A.P. Efficiency of modeling oxidative stress in rats by exposure to noise in comparison with hyperthermia and a magnetic field // Veterinary pathology. – 2025. – Vol. 24, No. 4. – P. 64–73.

9. Torkunova O.V., Shabanov P.D. Pharmacological correction of the adverse effects of low-frequency acoustic vibrations // Reviews of clinical pharmacology and drug therapy, 2014. - V. 12, No. 3. - P. 20-25.

INFLUENCE OF DURATION OF EXPOSURE TO ACOUSTIC LOAD ON THE INTENSITY OF LIPID PEROXIDATION PROCESSES IN THE EXPERIMENT

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Abstract

The effect of acoustic exposure with varying durations on the intensity of lipid peroxidation processes in laboratory animals was experimentally studied. The benefits of daily acoustic exposure for 60 minutes over three weeks were established in terms of modeling oxidative stress. This was confirmed by a statistically significant accumulation of lipid peroxidation products and a decrease in the activity of the main components of the antioxidant system in rat blood plasma by the end of the first, second, and third weeks of noise exposure, compared to similar parameters in intact animals.

Key words: acoustic exposure, exposure duration, lipid peroxidation processes, experiment, rats.

Modeling oxidative stress in laboratory animals using acoustic exposure requires substantiation and confirmation of the optimal duration of exposure to the stress factor, which will induce persistent statistically significant changes in the body, in particular a shift in the balance of antioxidant status toward the prooxidant side, with a minimum duration of exposure, taking into account the pharmacoeconomic components of the experimental design and support [1, 6]. Therefore, studying the effect of acoustic exposure over various time periods on the intensity of lipid peroxidation processes in laboratory animals is a prerequisite for recommending the optimal duration of noise exposure for modeling oxidative stress in vivo [2].

Objective

To study the effect of acoustic exposure duration on the intensity of lipid peroxidation processes in an experiment.

Materials and Methods

The experiment was conducted on 120 albino male rats weighing 190–240 g, divided into four equal-sized groups. The animals in the first (intact) group were not exposed to any stimulation, while the rats in the second, third, and fourth (experimental) groups were exposed to acoustic exposure for three weeks for 30, 60, and 90 minutes daily, respectively. The methods for determining oxidative stress markers are generally accepted and have been described in our previously published studies [3–5]. The results were analyzed using Statistica v.10.0 and the Student's t-test; in all evaluation procedures, differences were considered statistically significant at $p<0.05$.

Results and Discussion

The results of the experiment showed that daily acoustic exposure of rats for 30 minutes leads to a tendency toward the accumulation of lipid peroxidation products, with a statistically significant difference compared to the intact group in malondialdehyde levels only by the end of the second week of the experiment (increased by 52%, $p<0.05$) and ceruloplasmin activity by the end of the third week (decreased by 38%, $p<0.05$). Exposure to noise for 60 minutes daily allowed us to record a reliable increase in lipid peroxidation products in the blood plasma of rats compared to intact animals: the concentration of diene conjugates by the end of the first and second weeks of the experiment was 31% higher ($p<0.05$), and by the end of the third – 48% higher ($p<0.05$); The content of lipid hydroperoxides increased by 39% (the first and second weeks of the experiment, $p<0.05$) and 42% (the third, $p<0.05$); the level of malondialdehyde decreased by 48%, 44% and 64%, respectively ($p<0.05$). At the same time, the activity of ceruloplasmin decreased by 45%, 48% and 44%, respectively ($p<0.05$), and the concentration of vitamin E decreased by 26% (day 14, $p<0.05$) and 29% (day 21, $p<0.05$). Acoustic load on laboratory animals with an exposure duration of 90 minutes led to a statistically significant increase in the concentration of prooxidant markers at all control time points, with the exception of a two-week exposure (differences in diene conjugation of lipids and malondialdehyde with the intact group are not significant): the level of lipid hydroperoxides was higher by 41% (7 and 14 days of the experiment, $p < 0.05$), 46% (21 days, $p < 0.05$); the content of diene conjugates - by 38% and 45% (7 and 21 days, respectively, $p < 0.05$); malondialdehyde - by 50% and 62% (7 and 21 days, respectively, $p < 0.05$). Moreover, ceruloplasmin responded to acoustic stress with a statistically significant decrease of 51% by the end of the first week of the experiment ($p<0.05$), 47% by the end of the second ($p<0.05$), and 43% by the end of the third ($p<0.05$). A 90-minute daily acoustic exposure of rats did not reveal any statistically significant differences in vitamin E levels between the experimental groups. However, the antioxidant marker concentration was lower than in the intact group only toward the end of the experiment (by 29%, $p<0.05$). Thus, the absence of statistically significant differences in oxidative stress markers after 60 and 90 minutes of daily acoustic exposure for three weeks suggests that the optimal duration of noise exposure should be chosen in favor of a daily hourly exposure, taking into account the economics of the experiment.

References:

1. Zatvornitsky V.A., Simonova N.V., Shtarberg M.A., Tereshchenko T.A., Gulyaeva A.S. Protective effects of reamberin during experimental noise exposure // Experimental and Clinical Pharmacology. - 2024. - Vol. 87, No. 1. - Pp. 25-30.

2. Kosolapov V.A., Tregubova I.A. Modeling stress in an experiment // Medicinal Bulletin. - 2022. - No. 2 (86). - Pp. 17-19.

3. Lashin A.P., Simonova N.V. Neonatal oxidative stress in calves and its correction // Far Eastern Agrarian Bulletin. - 2019. - No. 2 (50). – P. 76 – 81.

4. Simonova N.V., Dorovskikh V.A., Li O.N., Anokhina R.A., Starberg M.A., Simonova N.P. Correction of oxidative stress with natural antioxidants // Bulletin of Physiology and Pathology of Respiration. – 2014. - No. 53. – P. 84-88.

5. Simonova N.V., Panfilov S.V., Sayapina I.Yu., Lashin A.P. Stress-protective and actoprotective activity of succinic acid under acoustic load on laboratory rats in an experiment // Veterinary pathology. – 2025. – Vol. 24, No. 1. – P. 15–22.

6. Torkunova O.V., Shabanov P.D. Pharmacological correction of the adverse effects of low-frequency acoustic vibrations // Reviews of clinical pharmacology and drug therapy, 2014. - Vol. 12, No. 3. - P. 20-25.

TREATMENT FEATURES OF INFERIOR VENA CAVA TUMOR INVASION

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Abstract

The study presents the results of treatment of 40 patients with tumor invasion of the inferior vena cava against the background of malignant neoplasms of the kidneys. Among them, there were 31 men and 9 women, with a median age of 61 years. four patients had a 0 level of tumor invasion of the inferior vena cava, ten had a 1 level, thirteen had a 2 level, ten had a 3 level, and three had a 4 level (classification of the Mayo clinic). The fourth stage of the oncological process was diagnosed in 20 patients: due to distant oligometastasis or locally advanced growth. All patients were operated. No neoadjuvant therapy did not comply. At the supradiaphragmatic level of invasion, sternolaparotomy was chosen as the operative access, in the rest - median total laparotomy. The intervention option on the inferior vena cava in 29 patients was thromboectomy from the inferior vena cava with plastic or suturing, in the remaining 10 patients thromboectomy with prosthetics of the inferior vena cava, including in two with replantation of the contralateral renal vein into the prosthesis. Nephrectomy was performed in all cases after removal of the tumor thrombus and reconstruction of the inferior vena cava. All patients were discharged in satisfactory condition. Adjuvant drug treatment was given to 12 people.

Key words: kidney, tumor invasion, inferior vena cava.

A typical sign of the course of some types of malignant neoplasms of the kidneys is the ability to grow along the lumen of the renal vein and the formation of tumor thrombosis of the inferior vena cava, which occurs up to 4-14.25%. Radical nephrectomy with thrombectomy from the inferior vena cava is accompanied by 2.7-13% surgical mortality and a 5-year survival rate of patients up to 72%. The higher the level of thrombosis, the higher the probability of pre-, intra- and postoperative death. Unfortunately, if a patient has a tumor invasion of the inferior vena cava, this already corresponds to at least stage III of the disease (T3b-T3c), and 30% of patients already have distant metastases (stage IV).

Objective

To identify the features and to analyze the results of surgical treatment of patients with tumor clots in the inferior vena cava.

Materials and methods

The study included 40 patients with tumor invasion of the inferior vena cava against the background of malignant neoplasms of the kidneys. Among them, there were 31 men and 9 women, with a median age of 61 years. The fourth stage of the oncological process was diagnosed in 20 patients: due to distant oligometastasis or locally advanced growth. To distribute patients according to the

level of tumor invasion of the inferior vena cava, the widely used Mayo Clinic classification was used, according to which there are 5 levels of invasion. Based on this classification, four patients had a 0 level of tumor invasion of the inferior vena cava, ten had a 1 level, thirteen had a 2 level, ten had a 3 level, and three had a 4 level. In most cases, the source of tumor growth was the right kidney (78%).

Results and discussion

All patients underwent elective surgery after appropriate preoperative preparation. No neoadjuvant therapy did not comply. During the preoperative period, one patient died due to massive pulmonary embolism. As the first stage of surgical treatment, three patients underwent renal artery embolization, and one patient with impaired function of the second kidney underwent preventive arteriovenous fistula formation. At the supradiaphragmatic level of invasion, sternolaparotomy was chosen as the operative access, in the rest - median total laparotomy. The intervention option on the inferior vena cava in 29 patients was thromboectomy from the inferior vena cava with plastic or suturing, in the remaining 10 patients thromboectomy with prosthetics of the inferior vena cava, including in two with replantation of the contralateral renal vein into the prosthesis. Nephrectomy was performed in all cases after removal of the tumor thrombus and reconstruction of the inferior vena cava. Prostheses made of polytetrafluoroethylene were used for prosthetics and plastics of the inferior vena cava. Prosthetics was performed when the tumor grew into the wall of the inferior vena cava. The time of the inferior vena cava compression was 17.1±4.6 min. In the presence of regional metastases, the operation was supplemented with aortocaval lymphodissection. In the case of locally advanced process and solitary distant intra-abdominal or retroperitoneal metastases, the compromised organs were resected. Full artificial circulation was not used. Centrifugal venovenous bypass was used at the supradiaphragmatic level of invasion. The average blood loss was 1450 ml. The average duration of surgery was 3 hours and 50 minutes. All patients were discharged on the 10th-14th day of the postoperative period. Adjuvant drug treatment was given to 21 patients with hypernephroma.

Surgical treatment remains the main method of treating tumor thrombosis in the inferior vena cava, which aims not only to achieve oncological radicality, but also to restore blood flow in the inferior vena cava. Radical nephrectomy with reconstructive operations on the inferior vena cava and modern adjuvant drug treatment have no alternatives in the treatment of malignant neoplasms of the kidneys with tumor invasion of the inferior vena cava. Treatment tactics must be individualized: the operation is chosen not "according to a template," but according to clinical logic.

References:

1. Chen M., Xu B., Liu N., Jiang H. et al. Precise control of caval and hepatic vessels: Surgical technique to treat level III caval thrombus concomitant to renal cell carcinoma // Can Urol Assoc J. - 2015. - Vol.9. - No.11-12. - P.808-813. https://doi.org/10.5489/cuaj.3074

2. Castelli P., Caronno R., Piffaretti G. et al. Surgical treatment of malignant involvement of the inferior vena // Int Semin Surg Oncol. - 2006. - Vol.16. - No.3. - P.19. https://doi.org/10.1186/1477-7800-3-19

3. Zavaruev A.V., Mazurenko A.A., Komarov R.N. Immediate results of treatment of tumor thrombosis of the inferior vena cava // Angiology and vascular surgery. - 2024. - Vol.30. - No.2. - P.176-178.

4. Komarov Roman N., Rapoport Leonid M., Belov Yuri V. et al. Surgical treatment of renal cell carcinoma with tumor thrombosis of the inferior vena cava and the right heart: How we do it // Urologia Journal. - 2023. https://doi.org/10.1177/0391560322114356

5. Polotbek Uulu J., Chevina A.A., Raguzina V.Yu. et al. Surgery of tumor thrombi of the inferior vena cava // Experimental and Clinical Urology. - 2022. - Vol.15. - No.4. - P.18-31. https://doi.org/10.29188/2222-8543-2022-15-4-18-31

6. Kotov S.V., Kiriyenko A.I., Yusufov A.G. et al. Intraoperative and oncological results of treatment of patients with renal cell carcinoma and the spread of a tumor thrombus through the venous system // Oncourology. - 2018. Vol.14. - No.1. - P.57-67.

GENOTYPE VARIABILITY OF HEPATITIS C VIRUS AMONG THE POPULATION OF THE AMUR REGION

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Abstract

The paper presents the results of a retrospective analysis of the hepatitis C virus (HCV) genotype spectrum in patients from the Amur Region over a 15-year period (2010–2025). A dynamic shift of the dominant genotype from 1b to 3 was established, associated with changes in the gender structure of morbidity (shift towards males) and aggravation of liver fibrosis. A significant decrease in the proportion of medical invasive procedures as a transmission route and an increase in chronic hepatitis C (CHC) incidence exceeding the average Russian rates were demonstrated. The obtained data substantiate the need for regional genotype monitoring to optimize antiviral therapy strategies.

Keywords hepatitis C virus, genovariants, genotypes, liver fibrosis, elastography, Amur Region

On the territory of the Amur Region, cases of acute and chronic viral hepatitis are registered annually. In the structure of newly identified chronic forms, hepatitis C dominates (84.2%), with its incidence in 2024 exceeding that of hepatitis B by 5.3 times. Over the long-term dynamics, a steady increase in CHC is observed (growth rate 8.9%). In 2025, the incidence rate was 44.3 per 100,000 population, which is 29.6% higher than the multi-year average, 2.6% higher than the national average, and 12.4% higher than in the Far Eastern Federal District. The adult population is predominantly affected (children under 18 years account for only 5.8%). The highest incidence was recorded in age groups 40–49 years (29.2%), 50–59 years (26.4%), and 60 years and older (24.1%).

Objective

To analyse the dynamics of the ratio of different HCV genotypes among the population of the Amur Region; to evaluate gender-age indicators and the severity of liver fibrotic changes in patients with different genotypes.

Materials and methods

A retrospective cross-sectional study was conducted on 461 patients with chronic hepatitis C (CHC) who were hospitalized at the Amur Regional Infectious Diseases Hospital in 2010, 2015, and 2025. Genotype verification was performed by PCR. The degree of liver fibrosis was assessed by ultrasound elastography with classification according to the METAVIR scale. Statistical analysis was performed using software packages (descriptive statistics, χ^2, t-test).

Results and discussion

Over the study period, a significant transformation of the genotype spectrum was observed: in 2010, 8 genovariants were detected with absolute dominance of genotype 1b; in 2015 – 4 variants with genotype 1b remaining the leader; in 2025 – 7 variants, with a shift to genotype 3 as the

dominant one. The change of the dominant genotype from 1b to 3 indicates an alteration in the epidemiological characteristics of the viral population in the region. The gender distribution of patients with different genotypes was as follows: in 2010–2015, females predominated among the affected, whereas in 2025 a male predominance was recorded. When associating genotype with demographic characteristics: in 2010, genotype 1b was associated with females (mean age 44.8 years), in 2015 – with males (45.4 years), and in 2025 the dominant genotype 3 was also characteristic of males (mean age 46.2 years). In the structure of risk factors, medical invasive procedures still lead, but their share decreased by 2.3 times (from 68% in 2010 to 29.4% in 2025). The share of blood transfusions also tends to decrease, while dental and non-medical invasive practices remain at the same level. A clear correlation was revealed between genotype 3 and the severity of fibrotic changes. In 2015, genotype 3 was detected in 23.8% of patients with METAVIR stages F3–F4; in 2025 this figure reached 43.2%, which is 1.5 times more frequent than with genotype 1. These data confirm a more aggressive course of fibrosis in genotype 3, requiring special attention in the choice of patient management tactics.

A shift of the dominant HCV genotype from 1b to 3 has been recorded in the Amur Region, which coincides with a change in the gender composition of the affected (male predominance) and necessitates a revision of regional monitoring programmes. The rise in CHC incidence, exceeding the average national and federal district rates, along with a decrease in the share of medical interventions in transmission, indicates the activation of alternative routes of infection and the need to strengthen preventive measures. The high detection rate of genotype 3 at advanced fibrosis stages (F3–F4) justifies the priority of early screening and timely prescription of pangenotypic DAA regimens in the region. Regular genotypic monitoring is an essential tool for epidemiological surveillance, allowing prediction of morbidity trends and optimisation of healthcare resources.

References:

1. Ignatova T.Y., Nikitin I.G. Fibroz pecheni pri khronicheskom gepatite C: faktory progressirovaniya [Liver fibrosis in chronic hepatitis C: progression factors] // RZhGGK [Russian Journal of Gastroenterology, Hepatology, Coloproctology]. – 2024. – Vol. 34, No. 1. – P. 45–52.

2. Kuzmin V.N., Lvov D.K., Mikhailov M.I., Shakhgildyan I.V. Epidemiologiya virusnykh gepatitov v Rossiyskoy Federatsii [Epidemiology of viral hepatitis in the Russian Federation]. – M.: GEOTAR-Media, 2023. – 320 p.

3. Kurganova O.P. O sostoyanii sanitarno-epidemiologicheskogo blagopoluchiya naseleniya v Amurskoy oblasti v 2025 godu [On the state of sanitary-epidemiological well-being of the population in the Amur Region in 2025] / Office of the Federal Service for Supervision of Consumer Rights Protection and Human Welfare in the Amur Region. – Blagoveshchensk, 2026. – 45 p. [Electronic resource]. – URL: http://28.rospotrebnadzor.ru (accessed: 17.07.2026).

4. Pawlotsky J.M. Hepatitis C virus genetic variability: pathogenic and clinical implications // Clinics in Liver Disease. – 2023. – Vol. 27, No. 2. – P. 261–275.

MIGRAINE-CHAMELEON: A CLINICAL CASE OF CHRONIC MIGRAINE WITH AURA MIMICKING TRANSIENT ISCHEMIC ATTACK

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Abstract. Transient ischemic attack (TIA) and migraine with aura are conditions with overlapping clinical presentations, which create significant diagnostic challenges, especially during the first episode of neurological symptoms. This paper presents a clinical case of a 30-year-old female patient with chronic migraine with aura whose recurrent episodes of focal neurological deficits mimicked TIA. The diagnostic algorithm included a detailed neurological examination, brain MRI with diffusion-weighted imaging (DWI), MR angiography, laboratory screening, and consultations with related specialists. Differential diagnosis was based on the criteria of the International Classification of Headache Disorders, 3rd edition (ICHD-3). This case demonstrates the importance of applying alternative diagnostic criteria for migraine with aura, which have significantly higher specificity compared to the main criteria, as well as the need for a comprehensive approach to exclude cerebrovascular pathology in middle-aged patients.

Keywords: migraine with aura, chronic migraine, transient ischemic attack, differential diagnosis, diagnostic criteria, ICHD-3, cortical spreading depression, neuroimaging.

Migraine with aura is one of the most common "mimics" of transient ischemic attack in neurological practice. The prevalence of migraine among patients with TIA is significantly higher than in the general population. The aura of migraine is based on the phenomenon of cortical spreading depression – a wave of reduced neuronal activity slowly propagating across the cerebral cortex. This process causes the sequential appearance of visual, sensory, or speech disturbances that precede or coincide with the headache. According to ICHD-3, typical migraine with aura is characterised by gradual development of symptoms over ≥5 minutes, duration of each symptom between 5 and 60 minutes, the presence of at least one unilateral symptom, and subsequent or concomitant headache. In contrast, TIA is characterised by sudden onset (within 1 minute), absence of gradual progression, and static neurological deficit. Headache accompanies TIA in 20% of cases, which further complicates differential diagnosis. Moreover, a new type of headache or a change in the characteristics of a pre-existing headache within 24 hours before the episode may serve as a "sentinel" symptom of an impending TIA.

Objective. To demonstrate a clinical case of chronic migraine with aura mimicking transient ischemic attack in a 30-year-old female patient, and to analyse the diagnostic algorithm using alternative ICHD-3 criteria.

Materials and methods. Patient B., 30 years old. Observation was conducted at the Department of Neurology. History taking, neurological examination, laboratory tests (complete blood count, coagulation profile, lipid profile, glucose), brain MRI with DWI, MR angiography, and electroencephalography were performed. Consultations with an ophthalmologist and a cardiologist

(echocardiography, 24-hour ECG monitoring) were carried out. The diagnosis was established based on ICHD-3 criteria, with the application of alternative diagnostic criteria for migraine with aura.

Results and discussion. The patient complained of recurrent episodes of transient neurological deficits occurring 2–3 times a month over the past 8 months. The episodes began with a scintillating scotoma in the left visual field, gradually spreading over 5–10 minutes; this was followed by paraesthesias in the right upper limb, and in some episodes, transient speech difficulties. The symptoms lasted from 20 to 50 minutes and were replaced by intense pulsating hemicranial headache with nausea and photophobia. She had a history of migraine without aura since the age of 20 (1-2 attacks per month); over the last 8 months, the aura phase appeared, and the attack frequency increased to 2-3 times per week, meeting the criteria for chronic migraine. Vascular risk factors were absent. Neurological examination between attacks revealed no focal deficits. MRI with DWI showed no acute or chronic ischaemia; MR angiography excluded vascular malformations. Laboratory parameters were within normal limits. EEG showed no epileptiform activity. Ophthalmoscopy and cardiac evaluation were unremarkable. The diagnosis of chronic migraine with typical aura (ICHD-3) was established. Features supporting migraine with aura included: gradual development of symptoms ≥5 min, sequential "march" of symptoms, duration within 5-60 min, presence of positive symptoms (scintillating scotoma, paraesthesias), stereotypical aura, history of migraine, and characteristic post-aura headache. This case confirms that the presentation of a patient with a history of migraine and focal neurological deficit poses a complex clinical challenge. Of particular importance is the use of alternative diagnostic criteria for migraine with aura: their specificity is significantly higher than that of the main criteria, especially during the first episode. According to a study by Lebedeva E.R. et al., the specificity of the main ICHD-3 criteria for a single episode of migraine with aura is 75%, whereas that of the alternative criteria is 96%. Management was conservative: prophylactic anti-migraine therapy was prescribed, and the patient was educated on acute attack management. At the 3-month follow-up, a reduction in both frequency and intensity of attacks was noted, and the aura did not recur.

References:

1. Headache Classification Committee of the International Headache Society (IHS). The International Classification of Headache Disorders, 3rd edition. Cephalalgia. 2018;38(1):1-211.
2. Лебедева Е.Р., Гурарий Н.М., Олесен Е.С. Диагностические критерии транзиторной ишемической атаки // КиберЛенинка. — 2018.
3. Лебедева Е.Р., Гурарий Н.М., Олесен Е. Новые альтернативные диагностические критерии мигрени с аурой и мигрени с типичной аурой и их тестирование у больных с транзиторными ишемическими атаками в сравнение с основными критериями // Уральский медицинский журнал. — 2017. — Т. 153, № 9. — С. 3–9.
4. Галанина А.С. Аура мигрени или транзиторная ишемическая атака: как их отличить и вовремя среагировать // Университетская клиника головной боли. — 2025.
5. Транзиторная ишемическая атака или мигрень с аурой: как не ошибиться в диагностике? // MedQ.ru — 2025.
6. Мигрень с длительной аурой vs мигренозный инсульт: серия клинических случаев // Электронная библиотека ДВГМУ.
7. Transient focal neurological symptoms and headache: is it TIA or migraine with aura? // The Journal of Headache and Pain. — 2025.

MORPHOLOGICAL MARKERS OF PLACENTAL INJURY IN EXACERBATION OF CHRONIC HERPES VIRUS INFECTION IN THE SECOND AND THIRD TRIMESTERS OF PREGNANCY

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Abstract. Chronic herpesvirus infection (CHVI) is one of the most common infectious diseases that can adversely affect pregnancy and the fetoplacental system. Exacerbation of chronic infection in the second and third trimesters of gestation is accompanied by activation of inflammatory and immunopathological mechanisms, which can lead to disruption of the structural and functional organization of the placenta. This study examined morphological markers of placental damage in 40 women who experienced an exacerbation of CHVI in the second and third trimesters of pregnancy (study group), as well as 20 placentas from women with a normal pregnancy (control group). Morphological examination of placentas in the study group revealed dissociated villous maturation in 68%, stromal edema and sclerosis in 45% and 53%, respectively, fibrinoid deposition in 51%, and vascular changes with compensatory restructuring characteristic of chronic inflammation associated with exacerbation of chronic viral hepatitis. Local inflammatory process was confirmed by focal lymphocytic infiltration of the stroma (villitis, 65%) and intervillous space (intervillusitis, 37%), as well as the presence of syncytial nodules (39%) and thinning of the syncytiotrophoblast (11%).

Keywords: herpes simplex virus, exacerbation of CHVI, placenta, herpetic placentitis, morphology, perinatal outcomes.

Chronic herpesvirus infection, caused by herpes simplex virus types 1 and 2, is one of the leading infectious diseases in women of reproductive age. Due to the lifelong persistence of the pathogen and its tendency to reactivate against the background of physiological immunosuppression, pregnancy becomes a critical period when the risk of vertical transmission of the virus to the fetus increases. Morphological examination of the placenta allows not only to confirm infection but also to identify early prognostic signs of placental insufficiency and perinatal disorders.

Objective. To determine the nature and severity of morphological changes in the placenta in women who experienced an exacerbation of chronic herpesvirus infection in the second and third trimesters of pregnancy.

Materials and Methods. A retrospective morphological study of the placentas of 60 women who delivered at 38-40 weeks of gestation was conducted. The study group consisted of 40 women with laboratory-confirmed exacerbations of chronic herpesvirus infection in the second and third trimesters of pregnancy. The control group consisted of 20 women with normal pregnancies and no clinical or laboratory signs of exacerbation of herpesvirus infection. For histological examination, placental fragments were fixed and processed using standard histological techniques, followed by hematoxylin and eosin staining. The condition of the villous tree, intervillous space, stroma, and vascular bed of the villous tissues were assessed, as well as the presence of inflammatory, degenerative, and sclerotic changes. Morphological assessment took into account the severity of

fibrinoid deposition, edema and sclerosis of the villous stroma, impaired villous tree maturation, changes in the number and distribution of terminal villus capillaries, syncytial nodules, and signs of syncytiotrophoblast damage. Particular attention was paid to identifying signs of chronic inflammatory placental lesions, including chronic villitis and intervillusitis, as well as vascular changes reflecting impaired microcirculation and compensatory and adaptive responses in the placenta. Statistical analysis was performed using the IBM SPSS Statistics 18.0 software package.

Results and discussion. Morphological examination of the placentas of women in the main group revealed a complex of structural changes indicating the development of chronic inflammation against the background of exacerbation of chronic viral infection. The most characteristic morphological manifestations were disturbances in the architecture of the villous tree with signs of dissociated maturation of the villi (68%), changes in the stromal component of the villi in the form of edema (45%) and subsequent sclerosis (53%), as well as pronounced deposition of fibrinoid in the intervillous space (51%). In the terminal villi, changes in the vascular component were noted, manifested by a disturbance in the density of the capillary network and a change in the nature of its distribution. The identified vascular disturbances were represented by an increase in the number of syncytial nodules (39%) and thinning in certain areas of the syncytiotrophoblast (11%). In a number of observations of the main group, inflammatory changes were determined with a predominant lesion of the villi and intervillous space. The morphological picture was characterized by focal villitis (65%) and intervillusitis (37%), reflecting the development of a localized inflammatory process in the placenta. The severity of the inflammatory changes was accompanied by impaired differentiation and maturation of the villous tissue. In the control group, the morphological structure of the placentas was characterized by regular maturation of the villous tree, preservation of the vascular bed of the terminal villi, and the absence of inflammatory changes.

Conclusion. Exacerbation of chronic herpesvirus infection in the second and third trimesters of pregnancy is accompanied by the development of a complex of morphological changes in the placenta, including chronic inflammation in the villous tree, impaired villous maturation, edematous-sclerotic changes in the stroma, excessive fibrinoid deposition in the intervillous space, and microcirculatory disorders. These structural changes can be considered morphological markers of placental damage during exacerbation of chronic herpesvirus infection and a pathogenetic basis for the development of placental insufficiency.

References:

1. Deftereou T.E., Trypidi A., Alexiadi C.A., et al. Congenital herpes simplex virus: a histopathological view of the placenta. Cureus. 2022;14(9):e29101.

2. De Rose D.U., Bompard S., Maddaloni C., Bersani I., Martini L., Santisi A., Longo D., Ronchetti M.P., Dotta A., Auriti C. Neonatal herpes simplex virus infection: from the maternal infection to the child outcome // J. Med. Virol. 2023. Vol.95, No.8. Article number:e29024. https://doi.org/10.1002/jmv.29024.

IMPLEMENTATION AND DEVELOPMENT OF SURGICAL SKILLS IN MEDICAL ACADEMY STUDENTS

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Abstract. The paper presents the experience of extracurricular surgical training through the student surgical club "Lancet". It highlights the role of weekly interdisciplinary meetings, simulation training, practice on cadaveric material, and participation in regional olympiads in building sustainable surgical competencies. The model may be of interest to medical universities in Russia and China within the framework of academic exchange.

Keywords: surgical skills, student surgical club, cadaver training

Introduction. Early formation of practical surgical skills is a priority task in medical education. The curriculum does not always allow sufficient time for manual training, thus increasing the role of student scientific and practical associations. Since 2023, the Surgical Club "Lancet" has been operating at our academy, focusing on the systematic acquisition of surgical skills.

Aim. To present the experience of implementing and developing surgical skills in students through the work of the "Lancet" club, with an emphasis on cadaver training and olympiad activity, and to evaluate the effectiveness of this model.

Materials and Methods. Club meetings are held weekly and cover all key areas of surgery: general, abdominal, thoracic, cardiovascular, neurosurgery, traumatology, and others. Each session includes a theoretical review and a practical part. In addition to simulation equipment (practicing sutures, knots, laparoscopy), a crucial component of training is performing training operations on cadaveric material. Coronary artery bypass grafting (CABG) has been chosen as the key operation for mastering the basic principles of vascular and cardiac surgery, as it allows students to refine precision vascular anastomosis technique, work with surgical optics, and understand the topographic anatomy of the heart. The training sessions are conducted with the participation of experienced cardiovascular surgeons. Furthermore, club members actively participate in regional surgery olympiads, where they demonstrate the acquired skills.

Results and Discussion. During the analyzed period (2025–2026), 36 meetings were held, with an average attendance of 25–30 students from different years of study. 36 cadaver training sessions were carried out, including 4 involving the practice of CABG steps. Participants mastered the technique of performing "end-to-side" and "side-to-side" vascular anastomoses on cadaveric vessels and hearts. According to a survey, 94% of students noted that working on cadaveric material significantly increased their confidence in understanding three-dimensional surgical anatomy and improved their motor skills. The club annually participates in regional surgery olympiads: over two years, the teams have won prizes in competitions in "Traumatology", "Abdominal Surgery", "Endovideosurgery", "Neurosurgery", "Gynecology", "Plastic Surgery", and "Maxillofacial Surgery", objectively confirming the quality of training. Participation in olympiads motivates students for continuous improvement and allows benchmarking against other universities in the

region. Discussion: The club model demonstrates that combining regular simulation, cadaver training, and competitive practice builds surgical competencies demanded in clinical practice. For the Russian-Chinese Forum, such experience is particularly relevant as a platform for joint student exchanges, summer schools in surgery, and international olympiads with unified assessment standards.

Conclusion. The Surgical Club "Lancet" ensures the systematic development of surgical skills from basic to highly specialized levels, including training on cadaveric material. The effectiveness of the club-based form of education, confirmed by results at regional olympiads, can be recommended for replication and joint Russian-Chinese educational projects.

FROM CLASSICAL DOSIMETRY TO DIGITAL TWINS: PROSPECTS FOR INTEGRATION BETWEEN THE RUSSIAN FEDERATION AND CHINA IN THE FIELD OF PRECISION PROTON RADIOTHERAPY.

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Abstract. Proton radiotherapy utilizes the Bragg peak to concentrate the dose in the tumor to achieve maximum therapeutic effect while minimizing impact on healthy tissues. Dosimetric quality control in this area traditionally relies on static, measurement-based verification performed before the start of treatment. This approach does not account for physiological and anatomical changes occurring over time. The concept of a digital twin represents a continuously updated computational model of the individualized treatment process. This paper analyzes the barriers to implementing a digital twin in clinical practice and proposes a model for strategic cooperation between Russia and China aimed at updating standards for digital quality control and creating cross-border datasets.

Keywords: proton therapy, digital twin, adaptive radiotherapy, dosimetry, Russian-Chinese cooperation.

Proton therapy is the "gold standard" for precision irradiation of tumors of the head and neck, central nervous system, and is widely used in pediatric oncology. However, its main advantage, the steep dose fall-off beyond the Bragg peak, is also a risk factor: even minor shifts in organs or changes in tissue density can lead to a critical reduction in tumor irradiation and negative effects on healthy tissues. For decades, dosimetric safety in proton therapy has been ensured by measurement verification: arrays of ionization chambers and Monte Carlo calculations, performed once before the start of the treatment course. This method does not account for anatomical changes occurring during treatment. This is why interest in the digital twin has grown: a high-frequency virtual copy of the patient that integrates anatomical imaging data (CT, MRI, CBCT), beam physical parameters, and biological tissue response. Such a model, in turn, provides daily data collection, automatic updates, calculation of the actually delivered dose, prediction of toxicity (NTCP), and adjustment of the treatment plan in real-time.

Objective

To analyze modern trends in dosimetry of proton therapy based on digital twins, determine the possibility of Russian-Chinese scientific cooperation in this field, and propose realistic forms of its implementation.

Materials and methods

A narrative review of publications from 2020 to 2026 indexed in PubMed, Scopus, and Google Scholar was conducted, using combinations of the terms "digital twin," "proton therapy," "adaptive radiotherapy," and "dosimetry," supplemented by open institutional and regulatory data on proton therapy centers in Russia and China. Since the review is narrative rather than systematic, the selection of sources was not exhaustive, and the analysis was limited to Russian and English

language sources.

Results and discussion

In the studies by Chang et al. (2025), it was shown that digital twins based on CBCT allow for the formation of several treatment plan options within a single fraction, selecting the one most appropriate to the patient's anatomy on that day without additional radiation exposure from imaging. At the same time, Sumini et al. (2024) classified the applications of digital twins in radiotherapy dosimetry into three areas: predictive dose modeling, personalized fractionation planning, and monitoring treatment response. However, the systematic review by Mastroleo et al. (2026) showed that out of more than 900 reviewed publications, only six studies met strict inclusion criteria, and identified three recurring barriers: heterogeneous use of the term "digital twin," insufficient external validation, and lack of common reference datasets between institutions.

According to institutional reports, the Russian proton infrastructure includes three operational centers: MIBS in St. Petersburg, the Federal Center for Medical Radiology of the FMBA in Dimitrovgrad, and the "Prometheus" complex in Obninsk. By 2022, approximately 3,000 patients had been treated at MIBS, of which about 40% were children, with a planned capacity of 800–1,000 patients per year. These centers utilize pencil beam scanning technology with traditional quality control measurements. The implementation of digital twins there is at an early stage.

The network in China has developed on a significantly different scale: since the launch of the Shanghai Proton and Heavy Ion Therapy Center in 2015, dozens of centers have been built or are under construction in various provinces of the country, most of which were equipped from the outset with the latest pencil beam scanning technology. In December 2025, Chinese national regulatory authorities approved unified clinical guidelines and quality control standards for ion therapy, creating a unified regulatory framework for this extensive network for the first time.

A realistic model of collaboration could include: a common reference dataset for cross-validation of dose prediction algorithms based on digital twins across various accelerator platforms; joint protocols for pediatric proton therapy; a bilateral working group for harmonizing quality control standards.

Thus, the integration between Russia and China in precise proton radiotherapy technically seems feasible, but institutionally immature. The evidence most convincingly supports collaborative work on standardized dosimetry, adaptive imaging, verification, virtual trials, and compatible twin architectures, while the weakest part is the management system necessary to make common digital twins at the patient level routine across borders.

References:

1.Chang C-W, Tian Z, Qiu RLJ, McGinnis HS, Bohannon D, Patel P, Wang Y, Yu DS, Patel SA, Zhou J, Yang X. Exploration of an adaptive proton therapy strategy using CBCT with the concept of digital twins. Phys Med Biol. 2025;70:025010.

2.Sumini M, Teodori F, Isolan L. Digital twins in dosimetry and radiotherapy, a survey and some applications. Radiat Phys Chem. 2024;218:111649.

3.Mastroleo F, Borras-Osorio M, Patel SP, Routman DM, Moseley DJ, Shiraishi S, Foong AYK, Waddle MR. Translational barriers to digital twins in radiation oncology. Clin Transl Radiat Oncol. 2026 (in press).

4.Zhang, Yang, Tan, Guo, Wang, Zhu, Jing, Ma, Hou. Advances in proton therapy technology and global clinical applications. Front Oncol. 2026;16:1718677.

WU XING THEORY AND GENETIC PREDISPOSITION TO DISEASE: INTEGRATION OF TRADITIONAL AND MODERN APPROACHES TO HEALTH

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Abstract

This study compares modern medical genetics methods with the practice of diagnosing genetic predispositions to diseases using traditional Chinese medicine. This article aims to highlight both the similarities and differences, as well as how these two practices harmoniously complement each other, creating the foundation for integrative medicine of the future, as Wu Xing theory and genetics are two powerful tools for understanding health.

Keywords: genetics, Wu Xing theory, five primary elements, genetic predisposition.

Modern medicine is increasingly turning to individualization of diagnostics and prevention, striving to take into account the unique characteristics of each individual. In this context, it is particularly interesting to compare two seemingly completely different approaches: medical genetics and traditional Chinese medicine based on the theory of Wu Xing. Despite the differences in methodology and language, both approaches share a common goal of identifying individual risks and developing personalized strategies for maintaining health.

Objective

To compare the practice of Wu Xing and modern medical genetics as worldviews and to compare their clinical approach to the diagnosis, therapy, and prevention of genetic diseases

Materials and methods

The materials used included scientific works on modern genetics and fundamental treatises on traditional Chinese medicine. The theoretical analytical methods employed included a sequence of logical operations: defining comparison criteria, comparing differences, identifying similarities, and forming correct conclusions about the interaction of clinical approaches.

Results and discussion

The following comparison criteria were selected: 1) philosophical basis; 2) diagnostic focus; 3) patient perception; 4) diagnostic methods; 5) predisposition assessment.

The main differences between the two worldviews are:

1. Medical genetics is materialistic: diagnostics are based on the study of DNA, karyotype, genes, and the genome; Wu Xing practice is idealistic, based on the theory of the five elements (Wood, Fire, Earth, Metal, Water) and their two cyclical interactions;

2. Medical genetics is the identification of polymorphisms and mutations based on molecular mechanisms, epigenetics, and the expression of genetic series; Wu Xing practice is the identification of imbalances of Wu Xing elements and the patient's constitutional characteristics;

3. Medical genetics is the carrier of certain alleles of genes that predispose the body to disease; Wu Xing practice – the innate energy characteristics of the five primary elements, each of which represents organs and systems;

4. Medical Genetics – genetic testing (DNA analysis), identification of polymorphisms, gene expression assessment, family history analysis; Wu Xing practice – interview (symptoms, lifestyle, emotions), examination (complexion, tongue, skin), palpation (pulse, points), auscultation and olfaction;

5. Medical Genetics – the study of the presence of certain genetic variants associated with disease risk, the influence of epigenetics; Wu Xing practice – through constitutional type (element dominance or weakness), external and behavioral characteristics, and emotional characteristics.

Despite these clear differences, modern medical genetics and traditional Chinese medicine share a number of similarities in their methods and approaches to diagnosing and treating patients:

1. Both approaches recognize the individuality of the patient: genetics refers to a unique set of genes, while Wu Xing refers to an innate set of constitutional and psycho-emotional traits;

2. Both approaches study the influence of the environment on a person's innate predispositions: genetics through epigenetics, while Wu Xing uses the natural energy of the primary elements in the patient's environment;

3. Both approaches aim to treat and prevent disorders in the body that arise from innate predispositions combined with environmental factors [1].

These approaches complement each other and allow for more comprehensive patient treatment, leveraging the strengths of both practices. Medical genetics enables accurate diagnosis of diseases and the establishment of their etiology, complementing the diagnostic methods offered by traditional Chinese medicine. In turn, thanks to a holistic view of the body and the interrelationships between organs and systems, Wu Xing complements the conservative treatment and prevention methods offered by modern medical genetics with the centuries-old practice of the Chinese people. These relationships are clearly evident in the example of Gilbert's syndrome: the presence of TA repeats in the UGT1A1 gene leads to a decrease in the ability to conjugate bilirubin. Gilbert's syndrome is benign in nature and has a high prevalence in the population. In modern genetics, this pathology is contested and is considered a normal variant rather than a disease state, as the antioxidant properties of unconjugated (not bound to glucuronic acid) bilirubin may have a cardioprotective effect [2]. Here we can see a tendency towards integration with the holistic approach of traditional Chinese medicine, since according to the teachings of the Wu Xing cycle of creation of the elements, the element of wood (liver) nourishes and "kindles" fire (heart).

Referense:

1. Wang X. A socio-philosophical view of traditional and modern medicine in China // Mission of Confessions 2020. No. 9. Pp. 777-782.

2. Diagnosis of Gilbert's syndrome. Laboratory for the Diagnosis of Autoimmune Diseases. Center for Molecular Medicine of the Russian Ministry of Health [Electronic resource] URL:

https://autoimmun.ru/guide/patologya-pecheni/diagnostika-sindroma-zhilbera-utg/ (accessed on 13.04.2026).

DIFFERENT TRAJECTORIES OF UPPER LIMB FUNCTION RECOVERY AFTER ISCHEMIC STROKE DURING LOW-FREQUENCY rTMS: A CASE SERIES

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Abstract

Upper limb dysfunction is one of the most significant consequences of ischemic stroke, limiting patients' independence and their ability to perform activities of daily living. Repetitive transcranial magnetic stimulation is considered an adjunctive method of post-stroke rehabilitation capable of modulating motor cortex excitability and facilitating neuroplastic changes. This paper presents three clinical cases of patients with post-stroke hemiparesis who underwent a comprehensive rehabilitation program including 10 sessions of low-frequency rTMS. Changes were assessed using the Fugl-Meyer Assessment for the upper extremity, the Box and Block Test, and the Nine-Hole Peg Test. In all cases, improvement was observed in individual components of motor function; however, the pattern of recovery depended on the initial severity of paresis. The findings demonstrate the heterogeneity of post-stroke recovery and the need for the simultaneous assessment of overall motor control, gross manual dexterity, and fine motor skills.

Keywords: ischemic stroke, repetitive transcranial magnetic stimulation, rTMS, neurorehabilitation.

Upper limb motor impairments after ischemic stroke may include muscle weakness, restricted selective movements, the development of abnormal motor synergies, impaired coordination, and loss of the ability to perform precise hand movements. Recovery of upper limb function is often slower and less complete than recovery of walking ability, which substantially limits patients' independence in self-care and daily activities.

One of the current approaches in neurorehabilitation is the use of repetitive transcranial magnetic stimulation. Low-frequency rTMS is commonly used to reduce motor cortex excitability in the unaffected hemisphere and to decrease presumed excessive interhemispheric inhibition. Of particular interest is the combination of neuromodulation with active motor training aimed at consolidating functionally relevant movements.

A comprehensive assessment of the upper limb requires tests evaluating different levels of motor function. The Fugl-Meyer Assessment reflects the severity of post-stroke motor impairment, the Box and Block Test evaluates gross manual dexterity, and the Nine-Hole Peg Test assesses the speed and coordination of fine hand and finger movements.

Objective

To describe different patterns of upper limb function recovery in three patients after ischemic stroke who underwent comprehensive medical rehabilitation involving low-frequency rTMS.

Materials and Methods

Three clinical cases of patients with upper limb motor impairments following ischemic stroke were analyzed. rTMS was administered as part of a comprehensive medical rehabilitation program. All patients received 10 stimulation sessions according to the same protocol: a frequency of 1 Hz, an intensity of 90% of the resting motor threshold, and 1,800 pulses per session. The stimulation target was the hand area of the primary motor cortex (M1) in the unaffected hemisphere.

The function of the paretic upper limb was assessed before and after the treatment course using three outcome measures:

the upper extremity motor section of the Fugl-Meyer Assessment, with a maximum score of 66 points;

the Box and Block Test, expressed as the number of blocks transferred with the paretic hand within 60 seconds;

the Nine-Hole Peg Test, expressed as the time required to complete the task.

An increase in the Fugl-Meyer Assessment and Box and Block Test scores was regarded as a positive outcome. For the Nine-Hole Peg Test, a reduction in completion time or the acquisition of the ability to complete the task was considered an improvement. Due to the small number of cases, no statistical analysis was performed; individual changes in the outcome measures were evaluated.

Results and Discussion

Clinical case 1

A 56-year-old woman underwent rehabilitation 34 days after an ischemic stroke in the territory of the right middle cerebral artery. Clinical examination revealed left-sided hemiparesis. Before treatment, the upper extremity Fugl-Meyer Assessment score was 49 points. In the Box and Block Test, the patient transferred 3 blocks with her left hand within 60 seconds. She was unable to perform the Nine-Hole Peg Test.

After 10 rTMS sessions, the Fugl-Meyer Assessment score increased to 61 points, corresponding to an absolute improvement of 12 points. The Box and Block Test score increased to 21 blocks, representing an improvement of 18 blocks. After treatment, the patient was able to complete the Nine-Hole Peg Test for the first time, with a completion time of 2 minutes 48 seconds.

In this case, consistent improvement was observed at all assessed levels: a reduction in overall motor impairment, a substantial increase in gross manual dexterity, and the acquisition of the ability to perform precise coordinated finger movements. The transition from being unable to perform the Nine-Hole Peg Test to completing it successfully may be regarded as a functionally meaningful outcome, despite the persistent marked slowing of fine motor movements.

Clinical case 2

A male patient with right-sided hemiparesis following ischemic stroke had severe upper limb motor impairment. His baseline upper extremity Fugl-Meyer Assessment score was 11 points. In the Box

and Block Test, the patient was unable to transfer any blocks with his right hand. The Nine-Hole Peg Test could not be performed.

After the rTMS course, the Fugl-Meyer Assessment score increased to 27 points, representing an improvement of 16 points. In the Box and Block Test, the patient was able to transfer 6 blocks. He remained unable to complete the Nine-Hole Peg Test after treatment.

These findings demonstrate a marked improvement in overall motor control and the emergence of the ability to perform object-related movements with the paretic hand. Nevertheless, the achieved level of recovery was insufficient to perform a task requiring a precise pinch grip, coordination of individual fingers, and a high degree of distal motor control. This case demonstrates that, in patients with initially severe paresis, improvement in proximal movements and gross grasping ability may precede the recovery of fine motor skills.

Clinical case 3

A 67-year-old woman underwent rehabilitation 37 days after an ischemic stroke in the territory of the right middle cerebral artery, accompanied by left-sided hemiparesis. Her baseline upper extremity Fugl-Meyer Assessment score was 55 points, while her Box and Block Test score was 20 blocks transferred with the left hand. She was unable to perform the Nine-Hole Peg Test.

After the rTMS course, the Fugl-Meyer Assessment score increased to 58 points, representing an improvement of 3 points. The Box and Block Test score decreased to 18 blocks. At the same time, the patient was able to complete the Nine-Hole Peg Test for the first time, with a completion time of 2 minutes.

Thus, the changes in the different outcome measures were multidirectional. A slight increase in the Fugl-Meyer Assessment score and a reduction in the Box and Block Test score were accompanied by the acquisition of the ability to perform a complex fine motor task. The reduction of two blocks in the Box and Block Test may have been within the range of individual variability and could have depended on fatigue, attention, or testing conditions. At the same time, successful completion of the Nine-Hole Peg Test for the first time indicated a qualitative improvement in hand function that was not fully reflected by the other two assessment methods.

Before rehabilitation, none of the three patients were able to perform the Nine-Hole Peg Test. After the treatment course, two female patients were able to complete the task. The median Fugl-Meyer Assessment score increased from 49 to 58 points, while the median individual improvement was 12 points. The median Box and Block Test score increased from 3 to 18 blocks, and the median individual change was 6 blocks.

The presented cases demonstrate different trajectories of recovery. In the first case, improvement involved all assessed components of upper limb function. In the second case, recovery of overall motor control and gross manual dexterity was not accompanied by sufficient recovery of fine motor skills. In the third case, the most significant outcome was the acquisition of the ability to perform precise finger movements despite minimal changes in the other measures.

The observed changes occurred during the early recovery period, when considerable potential for spontaneous and rehabilitation-induced recovery remains. Therefore, the positive outcomes

cannot be attributed exclusively to rTMS. They may have resulted from a combination of natural neuroplastic processes, comprehensive motor rehabilitation, and neuromodulatory intervention. The absence of a control group, the small number of cases, and incomplete clinical and anamnestic data do not allow the independent contribution of rTMS to be determined.

Conclusion

The use of low-frequency rTMS as part of a comprehensive rehabilitation program was accompanied by positive changes in individual components of upper limb function in all three patients after ischemic stroke. The pattern of recovery depended on the initial severity of motor impairment and varied considerably among the patients.

The simultaneous use of the Fugl-Meyer Assessment, the Box and Block Test, and the Nine-Hole Peg Test makes it possible to identify changes at different levels of motor function. Improvement in overall motor control is not always accompanied by simultaneous recovery of fine motor skills, while the acquisition of a functionally meaningful movement may not be reflected by a substantial increase in the total assessment score. These observations support the need for further investigation of rTMS in controlled studies involving larger patient samples and long-term outcome assessment.

References

1.Lefaucheur J.P., Aleman A., Baeken C. et al. Evidence-based guidelines on the therapeutic use of repetitive transcranial magnetic stimulation: an update (2014–2018). Clinical Neurophysiology. 2020;131(2):474–528. doi: 10.1016/j.clinph.2019.11.002.

2.Safdar A., Smith M.C., Byblow W.D., Stinear C.M. Applications of repetitive transcranial magnetic stimulation to improve upper limb motor performance after stroke: a systematic review. Neurorehabilitation and Neural Repair. 2023;37(11–12):837–849. doi: 10.1177/15459683231209722.

3.Li R., Liu S., Li T., Yang K., Wang X., Wang W. The stratified effects of repetitive transcranial magnetic stimulation in upper limb motor impairment recovery after stroke: a meta-analysis. Frontiers in Neurology. 2024;15:1369836. doi: 10.3389/fneur.2024.1369836.

ELECTRICAL STORM IN MYOCARDIAL INFARCTION (CLINICAL CASE)

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Abstract. This article presents a clinical case of acute transmural ST-segment elevation myocardial infarction of the inferior wall in a 62-year-old patient with delayed hospitalization (>10 hours from the onset of pain syndrome), complicated by recurrent ventricular fibrillation and clinical death during transportation to the catheterization laboratory. Coronary angiography revealed three-vessel coronary artery disease with occlusion of the right coronary artery (infarct-related artery). Emergency percutaneous coronary intervention with drug-eluting stent implantation in the right coronary artery (two stents) was performed. The article discusses the management strategy for reperfusion in the setting of circulatory arrest, the choice of antithrombotic regimen in a patient with a history of hemorrhagic stroke (2019), the strategy of staged revascularization in multivessel disease, as well as antiarrhythmic prophylaxis for recurrent ventricular fibrillation in the acute period. This case demonstrates the critical role of reducing "symptom-to-balloon" time, the importance of patient-related behavioral delay, and the necessity of a multidisciplinary approach in comorbid patients.

Keywords: acute myocardial infarction, primary percutaneous coronary intervention, ventricular fibrillation, clinical death, three-vessel coronary artery disease, delayed hospitalization, history of hemorrhagic stroke, antiarrhythmic therapy.

Acute ST-segment elevation myocardial infarction remains the most life-threatening form of coronary artery disease: ventricular fibrillation develops within the first 24 hours in 5–10% of patients, and with late reperfusion (>12 hours), the risk of electrical instability increases manifold. A history of hemorrhagic stroke further limits the standard antithrombotic strategy.

Objective. To analyze the strategy of emergency reperfusion in the setting of circulatory arrest and the choice of antithrombotic regimen in a patient with inferior ST-segment elevation myocardial infarction complicated by ventricular fibrillation, with delayed hospitalization and a history of hemorrhagic stroke.

Materials and methods. A retrospective analysis of the medical records of patient G., aged 62, hospitalized on 03.04.2026 at the Regional Vascular Center of the Amur Regional Clinical Hospital (medical history, electrocardiography, biomarkers, coronary angiography, percutaneous coronary intervention, intensive care unit monitoring).

Results and discussion. The onset of retrosternal pain occurred on 02.04.2026 at 23:00; the patient did not seek medical attention for >10 hours. Electrocardiography revealed atrial fibrillation and ST-segment elevation in leads II, III, and aVF. The pain was refractory to morphine (ongoing ischemia). Medical history: hemorrhagic stroke (2019), stage III hypertension, class I obesity. During transportation to the catheterization laboratory, ventricular fibrillation occurred; defibrillation at 200

J → 300 J restored sinus rhythm after the second shock. Coronary angiography: the right coronary artery was occluded (culprit lesion), the left anterior descending artery had a 50% stenosis, and the circumflex artery had a 60% stenosis. Percutaneous coronary intervention with drug-eluting stent implantation in the right coronary artery (two stents) was performed. The patient was started on clopidogrel 600 mg loading dose followed by 75 mg/day, acetylsalicylic acid 100 mg/day, atorvastatin 80 mg/day; antiarrhythmic therapy included lidocaine 200 mg intravenously, potassium chloride and magnesium sulfate. The paroxysm of atrial fibrillation resolved spontaneously.

This case illustrates three key issues: behavioral delay of >10 hours as a major modifiable factor influencing disease severity; persistent electrical instability until reperfusion, justifying the need for defibrillator availability at all stages of the patient pathway; and three-vessel disease requiring staged revascularization; however, the history of hemorrhagic stroke limits the duration of dual antiplatelet therapy and makes multistage stenting associated with an unacceptably high risk.

References:

1. Barbarash O.L., Kashtalap V.V., Gruzdeva O.V. et al. Clinical guidelines "Acute ST-segment elevation myocardial infarction". Russian Society of Cardiology, 2024.

2. Irgizova D.A., Arutyunov G.P., Barbarash O.L. et al. Delayed hospitalization in ST-segment elevation acute coronary syndrome: predictors, outcomes, and solutions. Cardiology. 2022;62(4):15–24.

3. Gordeev M.L. – Complicated forms of coronary artery disease. Surgery of the remodeled left ventricle / M.L. Gordeev. – Moscow: Publishing House of the Academy named after N.E. Zhukovsky, 2019. – 432 p.

4. Roitberg G.E. – Internal medicine. Cardiovascular system: textbook / G.E. Roitberg, A.V. Strutynsky. – 10th ed. – Moscow: MEDpress-inform, 2023. – 904 p.

5. Hensley F.A. – Practical cardioanesthesiology / ed. F.A. Hensley, Jr., D.E. Martin, G.P. Gravlee; translated from English under the editorship of A.A. Bunyatyan; translated by E.A. Khomenko, A.A. Nikitin, S.A. Tsiklinsky, A.N. Dyachkov; scientific editors Yu.A. Shneider, M.L. Gordeev, A.E. Bautin. – 5th ed. – Moscow: LLC "Publishing House 'Medical Information Agency'", 2017. – XX - 1084 p.

TRANSVENOUS LEAD EXTRACTION AS A TREATMENT METHOD FOR SECONDARY INFECTIVE ENDOCARDITIS ASSOCIATED WITH A CARDIAC PACEMAKER (CLINICAL CASE)

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Abstract. The paper presents a clinical case of successful treatment of secondary infective endocarditis (IE) associated with pacemaker leads. It demonstrates the difficulties in diagnosing and managing a patient with absolute dependence on a pacemaker and vegetations on the leads. The only radical method for eliminating the infection focus was transvenous extraction of the endocardial system, performed at a federal center in accordance with current clinical guidelines.

Keywords: infective endocarditis, pacemaker, lead extraction, intracardiac devices, clinical case.

In their daily practice, a general practitioner (family medicine specialist) frequently encounters patients with implanted intracardiac devices, particularly pacemakers. One of the most severe and challenging complications to diagnose is infective endocarditis associated with pacemaker leads. This condition warrants particular vigilance, as its classic clinical manifestations may be attenuated—especially in patients with significant comorbidities. It is crucial to recognize that managing such patients requires navigating complex clinical decisions: on the one hand, the patient's absolute dependence on the pacemaker; on the other, the presence of vegetations that represent a potential source of sepsis and thromboembolic events.

Objective. To demonstrate the diagnostic features and the staged delivery of high-tech medical care to a patient with a complicated course of infective endocarditis associated with an implanted intracardiac device (ICD).

Materials and Methods. A retrospective analysis was conducted of the patient's medical records (case history, telemedicine consultation data) for patient G., a 70-year-old male who was followed up at the State Autonomous Healthcare Institution of the Amur Region "City Polyclinic No. 3" in Blagoveshchensk between 2024 and 2026.

Results and Discussion. Patient G. has a history of sick sinus syndrome (SSS) since 2013, which necessitated the implantation of a cardiac pacemaker. In April 2024, a planned replacement of the device was performed. The postoperative period was complicated by the development of secondary infective endocarditis associated with the pacemaker leads. The course of the underlying disease was aggravated by a substantial comorbid burden: class 3 obesity (BMI 41.5 kg/m^2), NYHA class IIA chronic heart failure (left ventricular ejection fraction [LVEF] 73.8 %), significant pulmonary hypertension (right ventricular systolic pressure 50 mmHg), and chronic kidney disease (CKD).

According to current clinical guidelines, complete removal of the device is indicated for patients with confirmed infective endocarditis related to a cardiac implantable electronic device (CIED).

Despite adequate infection control, the risks of sepsis recurrence and thromboembolic events remained high due to the presence of vegetations on the retained leads in the right cardiac chambers. Given the technical complexity of the intervention—including long-standing leads and the patient's obesity—in accordance with contemporary management approaches, the patient was referred for a telemedicine consultation board hosted by the Federal State Budgetary Institution "Almazov National Medical Research Centre" (Saint Petersburg). The telemedicine board confirmed the need for urgent surgical intervention.

In December 2025, at the Almazov Centre, the patient successfully underwent transvenous extraction of both passively and actively fixed leads. At the follow-up examination in March 2026, the patient's condition was stable; no recurrence of infection was detected, and the function of the newly implanted pacemaker was satisfactory.

This clinical case illustrates that the management of patients with CIED-related infections requires a multidisciplinary approach. The presence of vegetations on leads in a pacemaker-dependent patient constitutes an absolute indication for transvenous lead extraction. The timely use of telemedicine technologies enabled effective patient referral to a federal centre for a highly specialized high-tech intervention, thereby preventing potentially fatal complications.

References

1.Romanovich MS, Chikilev IM, Nikolaeva NV. Secondary infective endocarditis associated with pacemaker leads. Russian Journal of Cardiology. 2023;(28 Suppl 5). DOI: 10.15829/1560-4071-2023-5501.

2.Russian Society of Cardiology. Clinical guidelines: Infective endocarditis and cardiac device infections. 2025:90–95. Section 3.4.2.

3.Podolyak DG, Kiprensky AYu, Mironovich SA. Modern approaches to transvenous lead extraction. Moscow: Petrovsky National Research Centre of Surgery; 2025. ID: 53765988.

4.Chumachenko NV, Kizhvatova NV, Kosmacheva ED, Tatarintseva ZG. Infective endocarditis caused by Cutibacterium avidum in a patient with an endocardial pacemaker. Clinical Microbiology and Antimicrobial Chemotherapy. 2024;26(2):208–214. DOI: 10.36488/cmac.2024.2.208-214.

5.Shoradzhabov N, Nikishin T, Akramov M, Yoldashov Kh. Sinus node dysfunction: causes, symptoms, and therapy. ID: 77941062.

6.Buziashvili YI, Asymbekova EU, Tugeeva EF. Clinical case analysis of diagnosis and treatment in a patient with atrial fibrillation, sinus node dysfunction, and signs of congestive heart failure. ID: 82750349.

A RARE SYMPTOM IN CLINICAL PRACTICE: A REVIEW AND CASE REPORT OF HEMOLACRIA

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Abstract

A clinical case of a child presenting with hemolacria is reported. The unknown etiology, rarity, and insufficiently studied nature of hemolacria are demonstrated. Episodes of spontaneous bloody discharge from the upper lacrimal punctum occurred with no apparent association with trauma, physical exertion, or an infectious process. A comprehensive diagnostic workup was performed, including laboratory exclusion of coagulopathies, radiological imaging to rule out space-occupying lesions, vascular malformations, and paranasal sinus pathology, as well as microbiological and cytological examination of the discharge. This case underscores the necessity of a multidisciplinary approach and a conservative surgical strategy once life-threatening conditions have been ruled out in children.

Keywords: hemolacria, bloody tears, children, prepubertal age, idiopathic hemolacria, lacrimal drainage system, differential diagnosis, coagulopathy, vascular malformations, pediatric ophthalmology.

Hemolacria is an extremely rare clinical condition characterized by the discharge of blood from the lacrimal drainage system, producing a dramatic presentation of "bloody tears." This syndrome has been known in the history of medicine since ancient times; however, due to its exceptional rarity, it long remained on the periphery of scientific research and was often perceived as a stigma or a manifestation of mysticism. Modern ophthalmology classifies hemolacria not as an independent nosological entity, but as a symptom with a wide spectrum of underlying etiological factors. These include infectious diseases of bacterial and viral origin, traumatic injuries to the conjunctiva, vascular malformations, coagulation disorders, and idiopathic cases associated with hormonal changes. Differential diagnosis between organic causes and the rarely encountered psychosomatic or factitious disorders presents a particular challenge. The symptom may be accompanied by epistaxis, headache, bleeding from the scalp, ocular redness and irritation, and discomfort or pain in the eye region.

Objective. To present a clinical case of a rare pathology—spontaneous recurrent hemolacria of unknown etiology in a somatically healthy female patient—and to analyze the diagnostic algorithm and substantiate the management strategy following the exclusion of life-threatening conditions.

Materials and methods: Patient Yu., a 10-year-old female. The observation was conducted at the pediatric ophthalmology department and the pediatric inpatient unit. Detailed history taking (including gynecological history); Ophthalmological examination; Laboratory tests and instrumental methods; Consultations with related specialists.

Results and discussion: The patient complained of periodic bloody discharge from both eyes, more frequently the right eye, occurring without any apparent cause. Episodes began suddenly, against

a background of full health, without physical strain. The initial episodes lasted for one week, with intermittent decreases in visual acuity in both eyes noted. A few minutes before the appearance of bloody discharge, the patient reported tenderness in the lower eyelid, followed by the appearance of white, thread-like discharge in the conjunctival sac, and, after a few more minutes, the emergence of blood admixed with mucus. During examination at the time of an attack, the outflow of hemorrhagic discharge, identical in composition to whole blood, from the inferior lacrimal punctum was documented. No signs of injury to the conjunctiva, cornea, or eyelid skin were detected. Pressure over the lacrimal sac area intensified the discharge. Laboratory investigations: complete blood count, biochemical blood analysis, and urinalysis—all unremarkable. CT scan of the orbits: no pathological contrast enhancement was identified. Ophthalmological examination: no pathology detected. Gynecological examination: physical development consistent with age; premenarchal. Based on the exclusion of organic, oncological, and coagulopathic etiologies, the diagnosis of "Hemolacria of unknown etiology" was established. In children, hemolacria is exceedingly rare and requires a high index of suspicion for malignancy. Unlike in adults, in premenarchal female patients, the concept of hormone-dependent "vicarious menstruation" is entirely ruled out, necessitating a more in-depth investigation of local causes. In this case, the primary objective was to differentiate true hemolacria from: 1. Munchausen syndrome. This was ruled out during inpatient observation and confirmed by the isolated discharge from the lacrimal punctum, which is inaccessible for self-induced trauma by the child without damaging the conjunctiva. 2. Hemangiomas and juvenile nasopharyngeal angiofibromas. These were excluded by MRI and endoscopy findings. 3. Idiopathic intracranial hypertension, capable of causing venous blood reflux via the cavernous sinus. The child exhibited no changes in the fundus (optic disc margins were sharp) and no headache. According to the literature, idiopathic forms in children are often associated with a transient increase in pressure within the venous system of the ocular angle or immaturity of the autonomic regulation of conjunctival vascular tone. The complete spontaneous cessation of bleeding without coagulation or progression supports a functional rather than organic nature. A strategy of active surveillance was chosen, with parental education on episode management techniques. Hemolacria in the prepubertal period requires the exclusion of juvenile vascular neoplasms and factitious Munchausen syndrome by proxy as priority diagnostic considerations. Given normal systemic hemostasis parameters and the absence of evidence for intracranial hypertension, local vascular dysregulation of the conjunctiva or lacrimal drainage system is the likely underlying cause. The management of idiopathic pediatric hemolacria should be conservative, with an emphasis on psychological support for the family to prevent nosophobia.

References:

1. Baskin B., Öztürk M. Childhood hemolacria: Diagnostic challenges and etiology. Journal of AAPOS. 2019;23(4):232-234.

2. Murube J. Etiology and management of bloody tears in children. Ophthalmic Plastic and Reconstructive Surgery. 2017;33(2):81-86.

3. Serova N.K., Lasunin N.V. Hemolacria as a symptom in neuro-ophthalmological practice. Russian Pediatric Ophthalmology. 2020;15(2):34-38. (In Russ.)

4. Özcan A., Esen E. Vascular dysregulation as a cause of idiopathic hemolacria in a pediatric patient. Turkish Journal of Pediatrics. 2022;64(1):167-170.

A CLINICAL CASE OF INTERSTITIAL TUBAL PREGNANCY: DIAGNOSTIC AND SURGICAL MANAGEMENT CHALLENGES

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Abstract

Pregnancy located in the interstitial portion of the fallopian tube is a rare and potentially life-threatening form of ectopic pregnancy characterized by diagnostic challenges and a high risk of severe hemorrhagic complications. This paper presents a clinical case of a 33-year-old patient with a progressing ectopic pregnancy localized in the interstitial portion of the right fallopian tube. Timely diagnosis and emergency laparoscopy enabled surgical treatment consisting of salpingotomy of the interstitial portion of the fallopian tube, with minimal blood loss and preservation of the myometrium at the uterine cornu.

Keywords: ectopic pregnancy, interstitial pregnancy, rare implantation site, laparoscopy, interstitial salpingotomy.

Rare forms of ectopic pregnancy remain a significant clinical challenge because their early manifestations may be nonspecific, whereas delayed diagnosis can result in massive hemorrhage and maternal death. Interstitial pregnancy, in which implantation occurs within the intramural segment of the fallopian tube traversing the myometrium, is particularly dangerous. The thick, highly vascularized surrounding myometrium may allow the pregnancy to progress for a relatively prolonged period before rupture occurs, potentially resulting in massive blood loss. Surgical management commonly involves cornual resection combined with salpingectomy.

Objective

To present a clinical case of interstitial ectopic pregnancy and demonstrate the diagnostic and surgical management features of this rare condition.

Materials and methods

The presented case demonstrates that, despite its potentially life-threatening location, interstitial pregnancy at an early gestational stage may present with only mild and nonspecific symptoms. A history of tubal pathology, the absence of an intrauterine gestational sac on ultrasonography, and early referral to a specialized gynecological department are of critical importance for timely diagnosis.

In this case, laparoscopy served simultaneously as the definitive diagnostic and therapeutic modality, enabling removal of the ectopic pregnancy with minimal blood loss. Laparoscopic salpingotomy of the interstitial portion of the fallopian tube may offer an advantage over cornual resection by allowing preservation of a substantial portion of the myometrium.

Results and discussion

The presented case demonstrates that, despite its potentially life-threatening location, interstitial pregnancy at an early gestational stage may present with only mild and nonspecific symptoms. A history of tubal pathology, the absence of an intrauterine gestational sac on ultrasonography, and early referral to a specialized gynecological department are of critical importance for timely diagnosis.

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References:

1.Ministry of Health of the Russian Federation. Ectopic pregnancy: clinical guidelines. Moscow: Ministry of Health of the Russian Federation; 2021.

2.Sokalska A, Rambhatla A, Dudley C, Bhagavath B. Nontubal ectopic pregnancies: overview of diagnosis and treatment. Fertil Steril. 2023;120(3 Pt 2):553-562. doi:10.1016/j.fertnstert.2023.07.014.

3.Dhanju G, Goubran A, Zimolag L, Chartrand R, Matthew F, Breddam A. Distinguishing between cornual, angular and interstitial ectopic pregnancy: a case report and a brief literature review. Radiol Case Rep. 2023;18(7):2531-2544. doi:10.1016/j.radcr.2023.04.028.

4.Van M, Smet ME, Cash S, Noori N. Interstitial pregnancy: a retrospective case series of surgically managed patients over a ten-year period. Aust N Z J Obstet Gynaecol. 2025;65(1):91-100. doi:10.1111/ajo.13850.

5.Royal College of Obstetricians and Gynaecologists. Diagnosis and management of ectopic pregnancy: Green-top Guideline No. 21. BJOG. 2016;123(13):e15-e55. doi:10.1111/1471-0528.14189

NEURONAL MIGRATION DISORDERS AS A STRUCTURAL BASIS OF EPILEPTOGENESIS: FROM DEVELOPMENTAL MECHANISMS TO CLINICAL DIAGNOSTICS

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Abstract

Neuronal migration disorders represent an important structural substrate of early-onset and drug-resistant epilepsy. Abnormal neuronal positioning, cortical dyslamination, altered interneuron distribution, and disrupted synaptic organization create networks prone to pathological hypersynchronization. This review integrates developmental mechanisms involving PAFAH1B1/LIS1, DCX, RELN, FLNA, ARX, PCDH19, DEPDC5, and mTOR-related pathways with clinically relevant malformations of cortical development. Particular attention is given to the practical value of combining epilepsy phenotype, high-resolution MRI, EEG findings, and genetic testing for earlier recognition of developmental structural epilepsies.

Keywords: neuronal migration, epileptogenesis, cortical malformations, drug-resistant epilepsy, neuroimaging, genetic testing.

Malformations of cortical development are important structural causes of epilepsy, particularly in patients with early seizure onset, developmental impairment, and resistance to antiseizure medications. Disruption of radial or tangential neuronal migration may alter cortical lamination, connectivity, interneuron distribution, and excitation-inhibition balance. Therefore, epileptogenesis may arise within developmentally abnormal neural networks rather than result solely from increased neuronal excitability.

Objective

To systematize current evidence on the relationship between neuronal migration disorders and epileptogenesis and to determine the practical diagnostic significance of integrating developmental mechanisms with neuroimaging and molecular genetic findings.

Materials and methods

A narrative analytical review of literature on neuronal migration, malformations of cortical development, and epilepsy was performed. Publications addressing cellular migration mechanisms, PAFAH1B1/LIS1, DCX, RELN, FLNA, ARX, PCDH19, DEPDC5 and mTOR-related pathways, structural phenotypes, neuroimaging, genetic diagnosis, and drug-resistant epilepsy were analyzed. Evidence was synthesized according to the sequence "developmental defect-structural phenotype-network dysfunction-epileptogenesis-clinical implication."

Results and discussion

The analyzed evidence indicates that neuronal migration disorders contribute to epileptogenesis through interconnected structural and molecular mechanisms. PAFAH1B1/LIS1 and DCX abnormalities disrupt microtubule-dependent migration and are associated with lissencephaly-spectrum malformations. Altered RELN signaling interferes with terminal neuronal positioning and cortical layer organization, FLNA dysfunction is associated with periventricular nodular heterotopia, and ARX abnormalities may impair interneuron development and excitation-inhibition balance.

At the network level, cortical dyslamination and ectopic neuronal positioning coexist with abnormal synaptic organization, disturbed interneuron distribution, and aberrant connectivity, facilitating pathological synchronization. Contemporary evidence extends the classical migration model: dysregulation of the mTOR pathway contributes to abnormal cortical organization and intrinsic epileptogenicity in focal cortical dysplasia, while DEPDC5- and PCDH19-associated disorders illustrate links between molecular developmental abnormalities and epileptic network dysfunction.

The principal practical implication is the need for a multimodal diagnostic strategy. Early seizure onset, developmental delay, recurrent focal seizures, focal neurological findings, or inadequate response to appropriately selected antiseizure medications should increase suspicion of an underlying malformation of cortical development. High-resolution epilepsy-protocol MRI is central to structural phenotyping, while EEG findings should be interpreted in relation to lesion localization and network organization. When phenotype, family history, or imaging suggests a developmental genetic disorder, molecular genetic testing may provide etiological clarification. In patients with drug-resistant focal seizures and a potentially epileptogenic structural lesion, timely recognition is essential for referral to comprehensive presurgical evaluation.

Thus, neuronal migration disorders constitute a clinically relevant bridge between developmental neurobiology and precision diagnostics in epilepsy. Integration of seizure phenotype, high-resolution neuroimaging, electrophysiological findings, and molecular genetics may improve etiological classification, facilitate recognition of patients at increased risk of pharmacoresistance, and support timely referral to specialized epilepsy centers.

References:

1.Barkovich AJ, Guerrini R, Kuzniecky RI, Jackson GD, Dobyns WB. A developmental and genetic classification for malformations of cortical development: update 2012. Brain. 2012;135(Pt 5):1348-1369. doi:10.1093/brain/aws019.
2.Stouffer MA, Golden JA, Francis F. Neuronal migration disorders: focus on the cytoskeleton and epilepsy. Neurobiol Dis. 2016;92(Pt A):18-45. doi:10.1016/j.nbd.2015.08.003.
3.Hatten ME. New directions in neuronal migration. Science. 2002;297(5587):1660-1663. doi:10.1126/science.1074572.
4.Nadarajah B, Parnavelas JG. Modes of neuronal migration in the developing cerebral cortex. Nat Rev Neurosci. 2002;3(6):423-432. doi:10.1038/nrn845.
5.Lim JS, Kim WI, Kang HC, et al. Brain somatic mutations in MTOR cause focal cortical dysplasia type II leading to intractable epilepsy. Nat Med. 2015;21(4):395-400. doi:10.1038/nm.3824.
6.Kozina AA, Okuneva EG, Baryshnikova NV, et al. Two novel PCDH19 mutations in Russian patients with epilepsy with intellectual disability limited to females: a case report. BMC Med Genet. 2020;21:209. doi:10.1186/s12881-020-01119-6.

A TWO-BY-TWO FACTORIAL RANDOMIZED PLACEBO-CONTROLLED TRIAL OF ORAL PROGESTERONE AND CHINESE HERBAL MEDICINE IN WOMEN WITH THREATENED MISCARRIAGE IN THE FIRST TRIMESTER

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Abstract

Background

Threatened miscarriage is strongly associated with pregnancy loss. At present, there are no effective treatments to improve live birth rates. We evaluated oral progesterone and Chinese herbal medicine in a randomised double-blind trial.

Methods

In this multi-center 2-by-2 factorial randomized double-blind placebo-controlled trial, we recruited pregnant women who had vaginal bleeding between 5-10 weeks of gestation. After informed consent, participants were randomly allocated to receive either Oral Progesterone (Progesterone Soft Capsules, 100 mg thrice daily) or placebo and either Chinese herbal medicine (new "Shoutai Wan" granules, 14.5g twice daily) or placebo, until 12 weeks of gestation. Primary outcome was a live birth at or beyond 20 weeks of gestation. The data was analyzed by modified Intention-To-Treat (mITT).

Results

Between October 20, 2017 and March 20, 2025, we randomized 1,656 women, of which 1,612 women (97.3%) were included in analysis. Live birth rates were 83.7% after Oral Progesterone plus Chinese herbal medicine, 80.2% after Oral Progesterone plus Chinese herbal medicine placebo, 80.5% after Oral Progesterone placebo plus Chinese herbal medicine and 73.0% after double placebo. There was no statistically significant interaction between 2 interventions (P=0.37). This resulted in a treatment benefit for Oral progesterone (relative risk [RR], 1.07; 95% confidence interval [CI], 1.02 to 1.13; P=0.003), Chinese herbal medicine (RR, 1.07; 95% CI, 1.02 to 1.12; P=0.006) and the combination (RR, 1.16; 95% CI, 1.08 to 1.24; P<0.001). Sensitivity analyses using modfied intention-to-treat with multiple imputations and Per-Protocol analysis resulted in similar findings. Incidence of adverse events was comparable between groups.

Conclusions

Among women suffering from threatened miscarriage in the first trimester, both Oral Progesterone and Chinese herbal medicine alone improve live birth with no major side-effects. The combination of both treatments shows larger benefit than either treatment.

Keywords: threatened miscarriage, Chinese herbal medicine, progesterone, randomized trial, two-by-two factorial design

ANTI-DIABETIC ACTIVITY OF COMPOUND LABISIA PUMILA ORAL LIQUID

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Abstract

This study evaluated the in vitro inhibitory effects of Compound Labisia pumila Oral Liquid on α-glucosidase and α-amylase. The IC50 values were 2.73 mg/mL for α-glucosidase and 2.41 mg/mL for α-amylase, demonstrating effective inhibition of both enzymes, with slightly stronger activity against α-amylase. Enzyme inhibition increased in a concentration-dependent manner, suggesting potential for postprandial blood glucose regulation. These findings support the development of Compound Labisia pumila Oral Liquid as a natural hypoglycemic candidate and highlight the role of digital technologies in advancing smart pharmaceutical innovation and China-Russia industrial collaboration.

Keywords: Smart pharmaceuticals; Digital healthcare; Compound Labisia pumila Oral Liquid; α-Glucosidase; α-Amylase.

Diabetes mellitus has become one of the most serious global public health challenges,1 and effective regulation of postprandial blood glucose is essential for preventing diabetes-related complications.2 Although the α-glucosidase inhibitors currently used in clinics work well for lowering blood sugar, using them long-term can cause gastrointestinal side effects. 3 So, developing safe, effective, and naturally derived new blood sugar-lowering drugs has become a hot research topic.

China and Russia both possess rich resources of medicinal plants and extensive experience in traditional medicine. In recent years, digital technologies such as artificial intelligence, big data analytics, digital twins, bioinformatics, and cloud computing have transformed the research paradigm of natural medicines.4By optimizing the guidance on questions and methods, automatically generated literature reviews can significantly boost research efficiency and ensure the content stays relevant and logically coherent. 5Digging deeper into the in vitro enzyme inhibition activity of traditional compound formulations is not only a modern scientific verification of their traditional effects but also a lively practice of the revitalizing tradition concept.

Objective

To evaluate the in vitro hypoglycemic activity of Compound Labisia pumila Oral Liquid and provide experimental evidence supporting the digital development and industrial innovation of traditional medicines through China-Russia smart pharmaceutical collaboration.

Materials and Methods

Compound Labisia pumila Oral Liquid was evaluated for its inhibitory activities against α-glucosidase and α-amylase using the p-nitrophenyl-β-D-glucopyranoside (PNPG) assay and the 3,5-dinitrosalicylic acid (DNS) assay, respectively. Five concentration gradients (7.5, 15.0, 22.5,

30.0, and 37.5 mg/mL) were tested. Enzyme activities were measured spectrophotometrically, and IC50 values were calculated. Digital data analysis was applied to evaluate concentration–response relationships.

Results and Discussion

Compound Labisia pumila Oral Liquid significantly inhibited both α-glucosidase and α-amylase, with IC50 values of 2.73 mg/mL and 2.41 mg/mL, respectively. The stronger inhibition of α-amylase suggests a dual-enzyme regulatory effect on carbohydrate digestion. Enzyme activities decreased in a concentration-dependent manner, demonstrating promising in vitro hypoglycemic activity. Digital analytical tools improved data processing efficiency and provide a foundation for AI-assisted screening and smart pharmaceutical development, highlighting opportunities for China-Russia collaboration in the modernization of traditional medicines.

The increasing integration of artificial intelligence, big data, and digital platforms into pharmaceutical research is accelerating the transformation of traditional medicines into standardized and internationally competitive products. These technologies offer new opportunities for resource sharing, intelligent drug development, and industrial cooperation between China and Russia.

Conclusion

Compound Labisia pumila Oral Liquid exhibited significant inhibitory activities against α-glucosidase and α-amylase, indicating its potential as a natural hypoglycemic candidate. Digital technologies can further facilitate the modernization of traditional medicines and support China-Russia smart pharmaceutical innovation and industrial integration.

References:

1.Hossain M J, Al-Mamun M, Islam M R. Diabetes mellitus, the fastest growing global public health concern: Early detection should be focused[J]. Health science reports, 2024, 7(3): e2004.

2.Osunde R N, Olorunfemi O, Edwards O S, et al. Transforming Diabetes Management: Optimizing Blood Glucose Control through Lifestyle Strategies for Better Health Outcomes–Scoping Review[J]. Bangladesh Journal of Endocrinology and Metabolism, 2025, 4(1): 18-25.

3.Pan G, Lu Y, Wei Z, et al. A review on the in vitro and in vivo screening of α-glucosidase inhibitors[J]. Heliyon, 2024, 10(18).

4.Suriyaamporn P, Pamornpathomkul B, Ngawhirunpat T, et al. The future trends of artificial intelligence and innovative technologies in the new era of pharmaceutical sciences and industry 4.0[J]. Drug development and industrial pharmacy, 2026, 52(2): 183-196.

5.Li P, Lu W, Cheng Q. Generating a related work section for scientific papers: an optimized approach with adopting problem and method information[J]. Scientometrics, 2022, 127(8): 4397-4417.

APPLICATION AND PROSPECT OF DIGITAL MOLECULAR PREDICTION IN EVALUATING THE EFFICACY OF SCHISANDRA COMPOUND FOR COLD-REGION SLEEP DISORDERS

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Abstract

Cold-region sleep disorders are typical sub-health problems induced by low temperature, polar daylight and geomagnetic disturbances, which seriously threaten the physical and mental health of populations in high-latitude areas. As a classic traditional Chinese medicinal formula, Schisandra compound exerts reliable sedative and hypnotic effects by regulating neuroinflammation, HPA axis balance and neurotransmitter secretion. This review systematically summarizes the material basis, pharmacological mechanisms and clinical progress of Schisandra compound in improving cold-region sleep disorders. The application value, limitations and prospects of digital molecular prediction technologies, including molecular docking, network pharmacology and machine learning, are concluded in the efficacy evaluation of cold-region traditional Chinese medicine.

Keywords: digital molecular prediction; Schisandra compound; cold-region sleep disorder; efficacy evaluation; traditional medicine industrialization

Introduction

Special geographical and climatic conditions in high-latitude cold regions easily induce circadian rhythm disorder, neuroinflammation and autonomic nervous imbalance, resulting in high incidence of sleep disorders. As a typical cold-region herbal formula, Schisandra compound is widely used to improve cold-induced insomnia and sub-health conditions. Currently, its efficacy evaluation still adopts subjective scoring and empirical judgment, lacking objective digital quantitative criteria and limiting TCM standardization and cross-border promotion. With the rapid development of digital medicine, digital molecular prediction has become a core method for exploring herbal material basis and pharmacological mechanisms. This review summarizes the advantages and deficiencies of digital molecular prediction in evaluating Schisandra compound efficacy, providing new insights for digitally empowered traditional medicine integration.

Materials and Methods

This review systematically collects and analyzes recent domestic and foreign studies on artificial intelligence, machine learning and chemical identification of traditional herbal medicines. Literature data are retrieved from PubMed, Web of Science and CNKI with keywords related to digital molecular prediction, Schisandra chinensis and cold-region sleep disorders.

Results and Discussion

Existing studies confirm that lignans and polysaccharides are the core active components

of Schisandra compound, which regulate GABA and 5-HT neural pathways and inhibit neuroinflammation to improve cold-region circadian rhythm disorders. Compared with traditional qualitative evaluation, digital molecular prediction can quantitatively assess drug efficacy, target affinity and pharmacological pathways, effectively reducing subjectivity and inconsistent evaluation standards. However, current digital models are established based on conventional laboratory data, lacking targeted optimization for cold-region pathological characteristics. Differences in component efficacy contribution and individual response also restrict model accuracy and universality. With the upgrading of artificial intelligence and multi-omics technology, digital molecular prediction will realize precise and individualized efficacy evaluation for cold-region herbal medicines.

Conclusion

Digital molecular prediction effectively compensates for the deficiencies of traditional empirical evaluation, realizing digital and quantitative analysis of Schisandra compound's therapeutic efficacy on cold-region sleep disorders and promoting the standardization of herbal evaluation systems. Digital medical technology breaks cross-border industrial cooperation barriers, accelerates the innovative inheritance of TCM resources, and provides reliable theoretical and technical support for the integrated development of cold-region traditional medicine and digital medical innovation.

References:

1. Nieoczym D., Banono N.S., Stępnik K., et al. In Silico Analysis, Anticonvulsant Activity, and Toxicity Evaluation of Schisandrin B in Zebrafish Larvae and Mice [J]. International Journal of Molecular Sciences, 2023, 24(16): 12949.

2. Mokhtari T., ElMeghawry E.K.A. Molecular mechanisms of Schisandra chinensis in treating depression-neuropathic pain comorbidity by network pharmacology and molecular docking analysis [J]. Neuroscience, 2024, 555: 92-105.

3. Su D., Luo J., Ge J., et al. Raw and wine processed Schisandra chinensis regulate NREM-sleep and alleviate cardiovascular dysfunction associated with insomnia by modulating HPA Axis [J]. Planta Medica, 2022, 88(14): 1311-1324.

ARTIFICIAL INTELLIGENCE-DRIVEN CHEMICAL COMPOSITION ANALYSIS OF TRADITIONAL CHINESE MEDICINE: FROM EMPIRICAL SCREENING TO INTELLIGENT DISCOVERY

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Abstract

Traditional Chinese medicine (TCM) contains a large and diverse biologically active compound library. However, conventional analytical approaches struggle to comprehensively characterize its complex chemical composition. The integration of artificial intelligence (AI) with high resolution mass spectrometry and multi-omics technologies has reconstructed the research paradigm of natural product chemistry. This paper systematically summarizes the latest applications of AI technology in TCM chemical constituent identification, bioactivity prediction and digital quality evaluation. It analyzes the limitations of traditional empirical research modes and the existing challenges of intelligent TCM chemical research. Furthermore, this study prospects the development trend of AI-enabled intelligent discovery of TCM active components, aiming to provide references for the digital upgrading and modern research of traditional Chinese medicine chemical basis.

Keywords: artificial intelligence; chemical constituents of traditional Chinese medicine; digital omics; intelligent screening; natural product discovery; modernization of TCM

TCM contains diverse chemical components that underpin its clinical efficacy. Traditional chemical research relies on repetitive experimental separation and manual identification, which is inefficient and prone to missing trace active substances, limiting the in-depth exploration of TCM material basis. With the rapid development of digital pharmaceutical technology, artificial intelligence has reformed TCM chemical research workflows. The integration of deep learning, digital omics and network pharmacology enables automated component recognition and data-driven active substance mining, effectively overcoming the drawbacks of conventional empirical research. This paper systematically reviews the application advantages, current challenges and future development strategies of AI in modern TCM chemical research, aiming to promote the intelligent and digital modernization of TCM basic research.

Objective

This review aims to summarize the core artificial intelligence technologies for the identification and analysis of TCM chemical constituents, clarify the technical advantages of AI intelligent screening over traditional empirical research methods, analyze the main technical bottlenecks existing in current AI-driven TCM chemical research, and propose feasible development strategies to promote the intelligent and digital innovation of modern TCM chemical research.

Materials and Methods

This review integrates the relevant literature in recent years, focusing on the application of AI,

machine learning and deep learning methods in the chemical analysis of traditional Chinese medicine. Relevant publications were identified through searches in PubMed, Web of Science, and CNKI using keywords including artificial intelligence, machine learning, deep learning, traditional Chinese medicine, mass spectrometry, compound identification, and natural products.

Results and Discussion

The application of artificial intelligence in the chemical component elucidation of traditional Chinese medicine now spans the entire pipeline from data acquisition to functional annotation, demonstrating significant advantages over conventional approaches in highefficiency mass spectrometry data processing, intelligent compound identification, bioactivity prioritization, and quality marker discovery. In the realm of MS data interpretation, AI algorithms automatically perform spectral denoising, peak alignment, and feature extraction, and by learning fragmentation rules they enable rational structural assignment for novel compounds, effectively compensating for the limited coverage of reference standards and spectral libraries. For activity prediction, deep learning models establish structure–activity relationships that allow rapid prioritization of promising candidates among a vast number of components, substantially reducing the need for blind experimental screening. In quality evaluation, AI facilitates the establishment of mathematical correlations between chemical profiles and pharmacological effects, shifting quality control from singleindicator assessment toward a multicomponent synergistic framework. Nevertheless, several core bottlenecks remain, including the scarcity of highquality standardized databases, the poor interpretability of deep learning models, and the difficulty of integrating heterogeneous multiomics data. Future efforts should focus on constructing openaccess chemical databases for TCM, developing interpretable and chemically intuitive intelligent algorithms, and building multiomics integration platforms, so as to truly realize the paradigm shift from experiencedriven to datadriven research.

Artificial intelligence is driving the chemical component elucidation of traditional Chinese medicine from empirical screening toward data-driven intelligent discovery, revolutionizing the research paradigm through mass spectrometry interpretation, compound identification, and activity prediction. Despite remaining challenges in data standardization and model interpretability, AI is reshaping TCM research into a predictive science, paving the way for its modernization and global acceptance.

References

1. Ma T.Y., Xu Z.X., Lin Y.G., et al. From fragments to function: a review of AI-driven mass spectrometry and fragment-based strategies. Acupuncture and Herbal Medicine, 2026, 6(1): 28-41.

2. Li Z.T., Dai Y. From biological potency absorbed components to artificial intelligence mining: a review of analytical strategies for the discovery and validation of quality marker in traditional Chinese medicine in the past decade. Guidelines Stand Chin Med, 2024, 2(4): 156-166.

3. Xu J., Bai L., Yang M., et al. Advances in the application of artificial intelligence in mass spectrometry-based analysis of traditional Chinese medicine: compound identification and metabolic pathway elucidation. Analytical and Bioanalytical Chemistry, 2026, 418(7): 1829-1844.

ASPSCR1 promotes osteosarcoma progression through the upregulation of glycolysis

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Abstract

Osteosarcoma (OS), the most common primary bone malignancy, is highly metastatic and difficult to treat. Although ASPSCR1 is implicated in multiple cancers, its role and mechanism in OS remain unclear. This study aims to clarify ASPSCR1 function in OS progression.ASPSCR1 expression and prognosis were evaluated via immunohistochemistry and statistics in clinical cohorts. Lentiviral shRNA-mediated ASPSCR1 knockdown in OS cells enabled functional assessments of proliferation, apoptosis, migration/invasion. Gene Set Enrichment Analysis (GSEA) identified pathways enrichment, further corroborated by glucose, lactate, and ATP assays. In vivo tumorigenicity was assessed using subcutaneous xenograft.ASPSCR1 was overexpressed in OS tissues and associated with poor survival. ASPSCR1 knockdown inhibited proliferation and migration while inducing apoptosis in OS cells. GSEA revealed significant enrichment of ASPSCR1-associated genes in the glycan biosynthesis. PKM2 inhibition (PKM2-IN-3) abolished ASPSCR1-driven glycolytic activity and proliferation. Consistent with in vitro findings, in vivo experiments robustly supported the pivotal role of ASPSCR1 knockdown in reducing glycolytic activity and inhibiting OS tumor growth. ASPSCR1 promotes OS progression via upregulating glycolysis, representing a potential therapeutic target.

Keywords: Osteosarcoma, ASPSCR1, Proliferation, PKM2, glycolysis

Osteosarcoma (OS) is an aggressive primary bone tumor with fast progression and frequent lung metastasis. Standard surgery, chemo- and radiotherapy have limitations including drug resistance, making novel targeted therapies urgently needed. Tumor cells rely heavily on glycolysis for energy and metastasis, a promising therapeutic target for OS. ASPSCR1 (TUG) mediates GLUT4 trafficking and transcriptional regulation. Its TFE3 fusion drives oncogenic signaling in multiple cancers, while ASPSCR1 mutations correlate with poor prognosis in several malignancies. This study explores ASPSCR1's glycolysis-related mechanism in OS to identify new therapeutic targets.

Objective

To comprehensively explore ASPSCR1's role and mechanisms in OS.

Materials and methods

This study adopted ethically approved 80 osteosarcoma (OS) and 9 normal bone tissue samples. Human OS cell lines and normal osteoblasts were cultured, and ASPSCR1 was knocked down via lentiviral transfection. IHC, HE staining, qPCR and Western blot were used for molecular detection. CCK-8, colony formation, flow cytometry, scratch and Transwell assays evaluated cell

proliferation, apoptosis, migration and invasion. Cellular glycolysis levels were detected, and nude mouse tumorigenicity assay was performed. All data were statistically analyzed, with $P<0.05$ as the significant threshold.

Results and discussion

Bioinformatics analysis and clinical tissue verification confirmed high ASPSCR1 expression in OS, which served as an independent prognostic factor for poor survival and correlated with malignant clinicopathological features. Stable ASPSCR1-knockdown OS cell lines were successfully constructed. ASPSCR1 silencing significantly suppressed OS cell proliferation, colony formation, migration and invasion, while promoting cell apoptosis. It also markedly reduced cellular glycolytic levels. Rescue experiments verified ASPSCR1 facilitates OS progression in a PKM2-dependent glycolysis manner. Nude mouse xenograft assays further validated its pro-tumor and glycolysis-promoting effects in vivo.

This study firstly identifies a non-fusion oncogenic role of ASPSCR1 in OS, establishing a novel ASPSCR1-glycolysis axis driving tumor progression. Different from classic glycolytic regulators, ASPSCR1 exerts tumor-specific effects with fewer side effects, and its expression correlates with patient demographic characteristics. Combined targeting of ASPSCR1 and glycolysis provides a promising therapeutic strategy. This study has limitations in clinical samples, in vivo models and molecular mechanisms. It innovatively defines ASPSCR1 as a reliable prognostic biomarker and therapeutic target for refractory OS.

References:

1.Estrada-Villaseñor E, Pichardo-Bahena R, Cedeño-Garcidueñas AL, Delgado-Cedillo EA, Marín-Arriaga N, Arguelles-Pérez DA. Parosteal osteosarcoma with low grade chondrosarcoma and liposarcoma components. A rare histologic variant. Case report and literature review. Acta Ortop Mex. 2024; 38: 113-118.

2.Wittig JC, Bickels J, Priebat D, et al. Osteosarcoma: a multidisciplinary approach to diagnosis and treatment. Am Fam Physician. 2002; 65: 1123-1132.

3.Li S, Zhang H, Liu J, Shang G. Targeted therapy for osteosarcoma: a review. J Cancer Res Clin Oncol. 2023; 149: 6785-6797.

DATA-DRIVEN INTEGRATION OF TRADITIONAL CHINESE AND RUSSIAN PHYTOTHERAPY FOR URATE METABOLISM DISORDERS: A DIGITAL-ERA REVIEW

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Abstract

Hyperuricemia (HUA) is a prevalent metabolic disorder requiring novel therapeutic strategies. Both Traditional Chinese Medicine (TCM) and Russian phytotherapy offer rich herbal resources. This review synthesizes data-driven approaches—including data mining, network pharmacology, and metabolomics—that have elucidated the multi-target mechanisms of TCM herbs against HUA,and discusses the underexplored potential of Russian medicinal plants. Digital methodologies offer a promising framework for integrating these two traditional systems.

Keywords: Hyperuricemia, data mining, network pharmacology, Traditional Chinese Medicine, Russian phytotherapy.

Hyperuricemia (HUA) is defined by serum uric acid >420 μmol/L (males) or >360 μmol/L (females). It drives gout, cardiovascular and kidney diseases. Current drugs have adverse effects. TCM and Russian phytotherapy provide resources, while digital tools offer new ways to study their mechanisms.

Objective

To review data-driven TCM and Russian phytotherapy research on urate disorders and assess their integration potential.

Materials and Methods

We searched PubMed, Google Scholar and Web of Science using: "hyperuricemia", "data mining", "network pharmacology", "metabolomics", "traditional Chinese medicine", and "Russian phytotherapy".

Results and Discussion

Data mining of TCM prescriptions identified Paeonia veitchii as a high-frequency herb for HUA/gout, with network pharmacology and experimental validation confirming that it lowers UA by inhibiting XOD activity and regulating renal urate transporters (URAT1, GLUT9, OAT1, ABCG2). Similarly, network pharmacology of Phyllanthi Fructus revealed multi-target actions on lipid metabolism, insulin resistance, and inflammatory signaling. In another TCM study, Perillae Folium was investigated via integrated metabolomics, network pharmacology, and molecular dynamics simulations; among 328 compounds screened against 25 HUA-related targets, XDH showed the highest binding affinity, and scutellarein was identified as a promising XDH inhibitor with stable

binding in MD simulations. Meanwhile, Aronia melanocarpa (black chokeberry), a representative Russian phytotherapy, demonstrated significant UA-lowering effects in hyperuricemic mice by inhibiting XOD and adenosine deaminase activities, with efficacy comparable to allopurinol. While this supports its therapeutic potential, its methodology is limited to conventional pharmacological approaches, contrasting with the TCM studies above that extensively employed network pharmacology and metabolomics. Applying such data-driven methods to Russian phytotherapy represents a promising direction for future research.

Data-driven approaches have advanced the understanding of TCM for hyperuricemia, revealing multi-target mechanisms involving XOD inhibition and urate transporter regulation. Russian phytotherapy shows therapeutic potential but remains underexplored through digital methods. Integrating these two systems via digital tools may yield novel strategies for urate metabolism disorders.

References:

1. Liu C.Y., Liu W.Y., Shi Y.C., et al. Unveiling the therapeutic benefits of black chokeberry (Aronia melanocarpa) in alleviating hyperuricemia in mice [J]. Frontiers in Nutrition, 2025, 12: 1556527.

2. Du J., Wang N., Yu D., et al. Data mining-guided alleviation of hyperuricemia by Paeonia veitchii Lynch through inhibition of xanthine oxidase and regulation of renal urate transporters [J]. Phytomedicine, 2024, 124: 155305.

3. Liang S., Xu D., Wu J., et al. Phyllanthi Fructus ameliorates hyperuricemia and kidney injure via inhibiting uric acid synthesis, modulating urate transporters, and alleviating inflammation [J]. Scientific Reports, 2024, 14(1): 27605.

4. Wu C., Wong A.R., Chen Q., et al. Identification of inhibitors from a functional food-based plant Perillae Folium against hyperuricemia via metabolomics profiling, network pharmacology and all-atom molecular dynamics simulations[J]. Frontiers in Endocrinology, 2024, 15: 1320092.

DIGITAL EMPOWERMENT TRADITIONAL RENEWAL — A REVIEW OF DIGITAL TECHNOLOGIES DRIVING SINO-RUSSIAN SMART MEDICAL INNOVATION AND INDUSTRIAL INTEGRATION

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Abstract

This review summarizes the application status of digital technologies in smart medicine, sorts out research progress in digital pharmaceutical quality control, telemedicine and industrialized development of northern medicinal herbs, analyzes existing bottlenecks in bilateral industrial cooperation, and explores feasible paths for digital-enabled collaborative innovation of traditional medicine, so as to offer literature support for joint biomedical research, standard formulation and commercial transformation of scientific achievements between China and Russia.

Keywords: digital empowerment; smart medicine; Sino-Russian pharmaceutical cooperation; traditional medicine; industrial integration; literature review

Against the background of global digital transformation in biomedicine and cross-border collaborative development of regional medical industries, traditional pharmaceutical R&D, drug quality control, clinical diagnosis and treatment as well as industrial models are urgently required to upgrade. China and Russia have deepened cooperation in Far East biomedicine, northern medicinal resource exploitation, standardization of traditional herbal medicines and telemedicine in recent years. Digital technologies including big data, artificial intelligence, IoT, spectral detection and blockchain traceability break information, technical and standard barriers between the two countries, transforming extensive exploitation of medicinal resources into refined, digital and collaborative industrial development, which fits the forum theme perfectly. This paper systematically reviews domestic and foreign research to provide theoretical references for industry-university-research cooperation and cross-border pharmaceutical industrial integration between China and Russia.

Objective

This paper takes digital technology as the core perspective, adopts bibliometric and systematic review methods to sort out relevant domestic and Russian literature from 2018 to 2025. It aims to summarize the practical application effect of big data, artificial intelligence, spectral detection and blockchain in Sino-Russian smart medicine cooperation, clarify three major bottlenecks restricting bilateral industrial collaborative innovation, and propose targeted digital development paths for the integrated development of traditional medicine industry. The research intends to provide theoretical references and literature support for the two countries to jointly unify pharmaceutical testing standards, build cross-border medical big data platforms, transform scientific research achievements and carry out long-term biomedical industrial cooperation.

Materials and methods

Bibliometric and systematic analysis methods were adopted in this study. Literature was retrieved from CNKI, Web of Science, PubMed and the Russian State Electronic Library with keywords of digital medicine, intelligent detection of medicinal materials, Sino-Russian pharmaceutical cooperation, machine learning, blockchain traceability and northern medicinal resource development, covering publications from 2018 to 2025. A total of 426 papers were initially searched, and 87 high-quality literatures were finally screened after eliminating duplicates, conference abstracts and popular science articles. Documents were reviewed from four dimensions: digital quality inspection of medicinal herbs, intelligent clinical diagnosis, pharmaceutical big data sharing and cross-border industrial collaboration, to summarize the strengths, limitations and research gaps in current Sino-Russian pharmaceutical cooperation.

Results and discussion

Literature review demonstrates that abundant medicinal plant resources and complementary medical technologies create great cooperation potential between China and Russia. Future work should focus on unifying pharmaceutical testing and clinical data standards, expanding multi-regional herbal sample databases to optimize intelligent diagnosis algorithms. Meanwhile, it is necessary to improve the transformation mechanism of scientific achievements, build a cross-border pharmaceutical big data and traceability platform based on blockchain, and realize coordinated policy layout to promote digital exploitation of traditional medicinal resources and joint medical technological innovation.

Digital transformation can greatly stimulate bilateral biomedical cooperation, accelerate the standardized development of northern medicinal industry, telemedicine and cross-border pharmaceutical trade. Relying on university joint forums and collaborative research projects, China and Russia can continuously carry out digital medical research, jointly establish smart medical technical standards and industrial cooperation platforms, so as to realize digital upgrading of traditional pharmaceutical industries and high-quality coordinated innovation in regional biomedicine.

References:

[1] Li M Y, Zhang Y. Research on the international development path of traditional Chinese medicine industry empowered by digital technology[J]. Chinese Herbal Medicines, 2023, 54(12): 3789-3796.

[2] Ivanov A V, Sokolova E N. Digital development and intelligent quality evaluation of medicinal plant resources in the Russian Far East[J]. Far Eastern Biomedical Journal, 2024, 15(2): 62-69.

[3] Wang J, Liu S Y. Application progress of near-infrared spectroscopy combined with machine learning in rapid identification of Sino-Russian authentic northern medicinal herbs[J]. Spectroscopy and Spectral Analysis, 2022, 42(9): 2765-2772.

[4] Chen L, Zhao W B. Blockchain technology for cross-border herbal traceability and Sino-Russian pharmaceutical trade supervision[J]. International Trade, 2023(7): 45-53.

[5] Petrov S M. Advances in cross-border telemedicine and AI-assisted diagnosis between China and Russia[J]. Eurasian Journal of Medical Informatics, 2025, 10(1): 23-31.

[6] Research Group on Coordinated Development of Sino-Russian Biomedical Industry. Bottlenecks and Countermeasures for Smart Pharmaceutical Industrial Integration in the Sino-Russian Far East[R]. Harbin: Sino-Russian Pharmaceutical Innovation Research Institute, 2024.

[7] Huang X L. Standardization and internationalization of traditional medicine under big data background[J]. China Journal of Chinese Materia Medica, 2022, 47(18): 5012-5019.

[8] Sokolova E N. Progress and prospects of Sino-Russian joint research on digital quality control of medicinal plants[J]. Far Eastern Journal of Pharmaceutical Sciences, 2023, 14(3): 89-97.

DIVERGENT PROCESSING PHILOSOPHIES IN TCM AND RUSSIAN PHYTOTHERAPY

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Abstract

Botanical processing transforms raw plant materials into therapeutic preparations through techniques reflecting distinct cultural frameworks. This review compares processing philosophies in Traditional Chinese Medicine and Russian phytotherapy. Both traditions share aqueous decoction and alcoholic maceration as fundamental extraction principles. However, thermal processing diverges fundamentally: TCM employs pao zhi to actively modify therapeutic properties, while Russian traditions minimize thermal intervention to preserve volatile constituents.

Keywords: botanical processing, pao zhi, traditional medicine

Processing techniques optimize efficacy, reduce toxicity, and improve stability. The theoretical frameworks governing these techniques vary substantially between traditions. Traditional Chinese Medicine formalized botanical processing into pao zhi, with methods for hundreds of substances. Russian phytotherapy possesses extensive empirical knowledge across diverse ecological zones.

Objective

To compare the processing philosophies of TCM and Russian phytotherapy, identifying shared principles and divergent theoretical frameworks.

Materials and Methods

This review employed comparative analysis of classical processing texts, pharmacopeial monographs, and ethnobotanical literature. Techniques were categorized by physical mechanism and theoretical purpose. Chemical rationales were assessed through examination of documented transformation pathways.

Results and Discussion

Aqueous decoction represents the most convergent principle. Both traditions use hot water to solubilize polar constituents including glycosides and polysaccharides, controlling temperature and duration to optimize yield.

Alcoholic maceration shows comparable convergence for lipophilic constituents, with differences in ethanol concentrations reflecting divergent target profiles.

Thermal processing reveals the most significant divergence. TCM pao zhi systematically applies heat through stir-frying, steaming, boiling, and calcination. The rationale extends beyond extraction to active modification of therapeutic properties, redirecting orientation, reducing toxicity, or

enhancing compatibility.

Russian traditions employ thermal processing conservatively. Heat serves drying or brief blanching rather than active modification, prioritizing preservation of volatile and thermolabile constituents.

This divergence reflects different conceptualizations. TCM views processing as active therapeutic intervention transforming substance nature. Russian traditions conceptualize processing as preservation and extraction optimization.

TCM and Russian phytotherapy share extraction principles but diverge in thermal processing philosophy. Active therapeutic modification contrasts with preservation-oriented minimal processing, with implications for botanical pharmaceutical standardization.

References:

1. Aryakia E. Uncovering the Key Factors Influencing Phytochemical and Phytopharmacological Properties During Medicinal Plant Processing [J]. eFood, 2026, 7(1): e70105.

2. Marquis N.N.L., Zabo I.A., Jacques N.N., et al. Ethnobotanical Study of Medicinal Plants Used in the Treatment of Diseases in the Kangu Grouping[J]. Asian Plant Research Journal, 2026, 14(1): 30-47.

3. Kim S.K., Kim G.S., Chae K.S., et al. Analysis on Patent Trends in Nonthermal Processing Technologies for Medicinal Herbs [J]. Journal of Physiology & Pathology in Korean Medicine, 2013, 27(4): 367-373.

4. Eapen A.S., Bhosale Y.K., Roy S. A review on novel techniques used for drying medicinal plants and its applications [J]. International Journal of Biomaterials, 2025, 2025(1): 4533070.

EMPOWERING TRADITIONAL MEDICINE WITH DIGITAL INTELLIGENCE: A STUDY ON THE PATH OF SMART HEALTHCARE INNOVATION AND INDUSTRIAL INTEGRATION

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Abstract

With the deep penetration of digital and intelligent technologies such as artificial intelligence and big data, traditional medicine like traditional Chinese medicine (TCM) is undergoing a historic transformation from being "experience-driven" to being "data-driven and intelligence-driven". This article systematically explores feasible paths for digital and intelligent technologies to empower the intelligent diagnosis and treatment of TCM and the upgrading of the TCM industry chain. Research shows that AI-assisted diagnosis and treatment systems have achieved remarkable results in TCM syndrome differentiation and the digital inheritance of the experience of renowned physicians. Smart TCM pharmacies and intelligent pharmaceutical factories have promoted the standardization and precision of TCM production. Further innovation in the field of digital health services should be deepened to promote the transformation towards smart medicine.

Keywords: digital empowerment; traditional Chinese medicine; artificial intelligence; smart healthcare; industrial convergence

With the vigorous development of the global digital economy, digital and intelligent technologies are profoundly reshaping the landscape of the medical and health field. In July 2024, the Chinese National Traditional Chinese Medicine Administration issued the "Several Opinions on Promoting the Development of Digital Traditional Chinese Medicine," proposing to accelerate the construction of informatization, digitization, and intelligentization of TCM. In 2025, State Council issued the "Implementation Opinions on Promoting and Regulating the Application and Development of 'Artificial Intelligence + Medical and Health Care'," requiring the strengthening of intelligent TCM diagnosis and treatment applications and promoting the intelligent upgrading of TCM equipment. This article aims to explore how digital technology empowers the modernization transformation of TCM diagnosis and treatment and the TCM industry.

Objective

This study aims to systematically analyze the current application status and development trends of digital technology in the intelligent diagnosis and treatment of TCM and the full-chain upgrade of the TCM industry. It explores the pathways for promoting the digital transformation and industrial integration of traditional medicine, providing theoretical references for promoting the intelligent development of traditional medicine.

Materials and methods

The method of combining literature review and case analysis is adopted. By retrieving and sorting out recent literature on the application of artificial intelligence and big data in the field of TCM, representative typical cases such as intelligent TCM diagnosis and treatment systems, intelligent TCM pharmacies, and smart pharmaceutical factories are selected for in-depth analysis, summarizing the main directions and achievements of digital technology empowering traditional medicine.

Results and discussion

(1) Intelligent transformation of TCM diagnosis and treatment. Based on the experience and knowledge passed down by renowned physicians in the hospital over 70 years, the large model has amassed 4.07 million clinical case data to build a TCM clinical knowledge base. This model has been deeply integrated into the entire medical process. After the launch of intelligent triage and pre-consultation functions, the average waiting time for patients has been reduced by nearly 30%. (2) Full-chain digital and intelligent upgrade of the TCM industry. In the research and development phase, the large model integrates massive data from over 8,000 ancient books, 120 million journal articles, 300,000 medical cases, and other sources to construct a TCM knowledge graph. In the production and quality control phase, the smart TCM pharmacy has established an AI processing decision-making system, digitizing over 200 traditional processing parameters, controlling the effective component variation between batches within 5%, and achieving an accuracy rate of 99.97% for fully automated herbal dispensing equipment.

However, the digital transformation of TCM still faces several challenges: the TCM data standardization system is not yet perfect, and the structuring and digitization of TCM knowledge are relatively difficult. In response, a normalized research mechanism for the digitization of TCM should be established to promote the construction of digital service platforms for TCM.

Digital empowerment serves as a crucial driving force for the inheritance, innovation, and industrial upgrading of TCM. Practices demonstrate that digital technology can achieve standardization, precision, and universalization in diagnosis and treatment, while maintaining the core principle of "treatment based on syndrome differentiation" in TCM.

References:

1. Sun Yongjian. Special Focus on Health and Sanitation Services: Technological Innovation and Industrial Development: Inviting Fortune Global 500 Companies and Leading Enterprises in the Industry, with a Participation Rate of 54% [N]. China Business Times, 2025-08-18(004)

2. Wu Wei. "AI+ Activates New Productivity in Pharmaceutical Industry" [N]. Economic Information Daily, 2026-05-25(004).

3. Zhong Ding, Wang Dongbo. Research on the inheritance and innovation mechanism and development path of AI empowerment from the perspective of the evolution of traditional Chinese medicine policies [J]. China Medical Education Technology, 2026, 40 (1): 28-32.

FULL-ENDOSCOPIC TRANSFORAMINAL DISCECTOMY WITH ANNULAR SUTURE FOR SINGLE-LEVEL L4–5 LUMBAR DISC HERNIATION: A RETROSPECTIVE COHORT STUDY WITH MINIMIZED SELECTION BIAS

Abstract

Objective: Compare efficacy and safety of full-endoscopic transforaminal discectomy (FETD) with versus without annular suture for single-level L4–5 lumbar disc herniation (LDH) with annular defect ≤5 mm.

Methods: 86 consecutive patients (43 FETD+suture, 43 FETD alone) operated by one surgeon (2020.1–2024.6). VAS back/leg, ODI, modified MacNab and MRI-confirmed reherniation were assessed preoperatively and at 1, 3, 6, 12 months. Baseline data were matched.

Results: The suture group had longer operation time (P=0.005), equivalent blood loss and hospitalization. At 6 and 12 months, it showed superior VAS/ODI improvement (P<0.001). Its 12-month recurrence rate (2.33%) was far lower than controls (13.95%, P=0.019), with higher excellent-good MacNab rate (95.35% vs 81.40%, P=0.042). Minor complications were similar between groups.

Conclusions: For L4–5 LDH patients with small annular defects, FETD combined with annular suture safely lowers 1-year reherniation risk and improves long-term function without extra complications.

Keywords: Lumbar disc herniation; Full-endoscopic transforaminal discectomy; Annular suture; Reherniation; Minimally invasive spine surgery

Keywords: Lumbar disc herniation; Full-endoscopic surgery; Transforaminal discectomy; Annular suture; Reherniation; Minimally invasive spine surgery

Introduction

Lumbar disc herniation (LDH) is a leading cause of radicular pain and functional disability. Full-endoscopic transforaminal discectomy (FETD) is widely used due to minimal invasion, rapid recovery, and satisfactory short-term outcomes. However, reherniation remains a common complication, with rates ranging from 8% to 15%. The main cause is an unrepaired annular defect, which allows residual nucleus pulposus to re-protrude.

Recurrence after endoscopic discectomy remains a key clinical challenge. Recently, annular suture has been introduced to restore the anatomical barrier and reduce recurrence. Although several studies have reported promising results, high-quality comparative studies with strict, homogeneous patient selection remain limited.

To minimize bias, this study enrolled only consecutive patients with single-level L4–5 LDH and an intraoperative annular defect ≤5 mm, using a single surgeon, consistent technique, and uniform

follow-up protocol. This study aimed to evaluate whether annular suture can reduce reherniation and improve long-term clinical outcomes.

Discussion

This study demonstrates that FETD combined with annular suture yields better functional outcomes and lower reherniation rates than FETD alone in carefully selected patients with single-level L4–5 LDH and small annular defects.

The most important strength of this study is its high internal validity:

Consecutive patient enrollment

Single surgeon, standardized technique

Strict inclusion criteria (annular defect ≤5 mm)

Uniform follow-up protocol

No crossover or dropout

These measures significantly reduced selection bias, performance bias, and detection bias, making the results reliable.

The 12-month recurrence rate was only 2.33% in the suture group, which is lower than most previous reports. This benefit may be attributed to anatomical reconstruction of the annulus, reduced intradiscal pressure, and accelerated tissue healing.

The slight increase in operation time did not compromise safety or recovery. Complication rates were low and comparable between groups, confirming the safety of endoscopic annular suture.

References

1.Ruetten S, Komp M, Merk H, et al. Full-endoscopic transforaminal discectomy: update on indications, technique, and outcomes. J Orthop Trauma. 2022;36(Suppl 1):S45-S51.
2.Kim HJ, Park JH, Lee JH, et al. Risk factors for recurrence after full-endoscopic lumbar discectomy: a 3-year cohort analysis. Global Spine J. 2022;12(7):987-994.
3.Vollmer D, Rosendahl F, Schleicher P, et al. Endoscopic transforaminal discectomy with annular suture reduces reherniation in small annular defects: a prospective cohort study. Eur Spine J. 2025;34(5):1123-1131.
4.Peng YX, Zhang Y, Yang Y, et al. Clinical effect of full endoscopic lumbar annulus fibrosus suture for single-level L4–5 herniation. J Orthop Surg Res. 2024;19:261.
5.Ahn Y, Lee S. Uniportal versus biportal endoscopic spine surgery: a comprehensive review. Expert Rev Med Devices. 2023;20(7):549-556.
6.Burkett D, Brooks N. Advances and challenges of endoscopic spine surgery. J Clin Med. 2024;13(5):1123.
7.Chen KT, Kim JS, Huang AP, et al. Current indications for spinal endoscopic surgery and potential for future expansion. Neurospine. 2023;20(1):33-42.

HOW CAN COMPUTATION UNDERSTAND THE "INEFFABLE" ART OF HEALING?

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Abstract The intersection of artificial intelligence and traditional Chinese medicine (TCM) has attracted growing attention, yet the profound "tacitness" embedded in core clinical skills—such as pulse diagnosis and syndrome differentiation—stands in fundamental epistemological tension with the explicit computational paradigm of AI. Employing Polanyi's theory of tacit knowledge as an analytical lens, this paper traces the fourstage evolution of knowledge representation, dissects application bottlenecks, identifies four structural dilemmas, and proposes pathways such as neurosymbolic integration and human–AI collaboration.

Keywords artificial intelligence in TCM; tacit knowledge; knowledge representation; large language models; human–AI collaboration

Introduction

TCM, with holism and treatment based on syndrome differentiation at its core, is inherently nonlinear, contextsensitive, and highly individualised, thus long resisting complete encoding in the language of modern science. In recent years, AI–TCM research has surged, but the most essential skills—pulse discrimination, tongue interpretation, pattern integration, and flexible formula modification—are steeped in what Polanyi termed "tacit knowledge": we know more than we can tell. These judgments, embedded in sensory experience and embodied practice, stand in ontological opposition to the explicit rules and statistical patterns on which AI relies. Using tacit knowledge as a lens, this paper examines technological evolution, application bottlenecks, and structural dilemmas, and explores future directions.

1. Technological Evolution: Four Stages of Knowledge Representation

The history of AI–TCM integration is essentially a narrative of evolving knowledge representations. In the symbolic knowledge engineering phase (2006–2010), expert rules were translated into ifthen logics, but soon exposed the bottleneck that articulable rules fall far short of actual clinical judgment. In the traditional machine learning phase (2011–2015), datadriven approaches circumvented explicit codification yet remained trapped in manual feature engineering, losing the holistic gestalt of pulse qualities[1]. In the deep learning phase (2016–2020), endtoend representation learning enabled a "neural simulation" of tacit knowledge, capturing global patterns that even experts struggle to verbalise, but at the cost of turning the model itself into a new black box. In the current phase of large models integrated with knowledge graphs (2021–present), neural representations and symbolic constraints have begun to converge, yet LLMs still rely essentially on lexical cooccurrence and remain far from genuine causal reasoning. Across these four stages, each advance pushes the fundamental question deeper: when a model replicates expert judgment, have we gained intelligible knowledge or merely a highperformance simulator?

2. Core Applications: Progress and Bottlenecks

In diagnostic intelligence, inspection has progressed furthest—tongue diagnosis now has a full pipeline—yet the holistic integration of the "four examinations" remains hampered by crossmodal semantic alignment. Pulse diagnosis is even more challenging: sensors can barely capture the "momentum" among the four dimensions, and the tactile tacit knowledge accumulated over years of practice has yet to be touched by any algorithm. Inquiry faces similar limitations: LLMs can conduct dialogues but cannot reproduce the empathetic and cognitive flexibility required for "intentionguided adjustment." In Chinese materia medica, network pharmacology combined with graph neural networks has shown promise in target prediction, yet at its core it remains a reductionist overlay of omics data, unable to capture the emergent properties of the pattern–formula correspondence. Formula optimisation algorithms can generate new prescriptions, but whether they accord with TCM principles ultimately requires clinical expert review—the creative "living method" of prescribing cannot be algorithmically appropriated[2]. Acupuncture faces similar issues: acupoint localisation is accurate, but the tactile perception of "palpating for tender points" and the dynamic wisdom of "treating according to the pattern" are far beyond the reach of fixed templates.

3. Structural Dilemmas: Four Fundamental Contradictions

First, the knowledge transformation dilemma: endtoend learning is essentially a behaviourist functionfitting—it replicates outcomes without capturing the cognitive process. TCM tacit knowledge, however, is grounded in a gestaltlike holistic perception that cannot be reduced to weighted parameters; neural representations, though seemingly holistic, remain impenetrable, creating a dual chasm of interpretability and trust. Second, the data dilemma: clinical data are highly heterogeneous and poorly standardised, highquality multimodal longitudinal samples are scarce, and they are scattered across institutions as isolated islands[3]. Federated learning offers theoretical possibilities, yet data alignment and the privacy–utility tradeoff remain formidable obstacles. Third, the interpretability crisis: TCM reasoning has an inherently explicit structure, whereas deep networks are opaque by nature; posthoc attribution provides only fragmented local explanations and is particularly inadequate for counterfactual causal inference. Fourth, the human–technology tension: the rapid response of AI may predispose clinicians to automation bias, gradually dulling their dialectical acuity; the affective bond established through the four examinations risks being diluted, while ethical questions of liability and bias mitigation remain unresolved.

4. Future Pathways

In the face of these entangled difficulties, four strategic directions merit priority. First, build a standardised, privacypreserving, multimodal data ecosystem for TCM, leveraging federated learning to break down silos. Second, develop neurosymbolic fusion and causal inference frameworks that embed interpretable reasoning chains into model outputs. Third, redefine the division of cognitive labour: assign formalisable tasks to AI, while reserving intuitive and creative judgments for the physician, and design interactive systems that "guide" rather than "replace" clinical reasoning[4]. Fourth, establish clinical evaluation and ethical governance systems for specialised medical AI, assessing not only accuracy but also its realworld impact on decision quality, patient outcomes, and healthcare equity, ensuring that intelligent systems remain humancentred.

Conclusion

From rulebased systems to large pretrained models, the underlying thread of AI's reshaping of TCM is the continuous upgrade of representational capacity, yet the ontological chasm erected by tacit knowledge has not been closed. The true challenge of modernising TCM does not lie in using algorithms to displace experience, but in building a bridge between the two cognitive paradigms that allows mutual mapping and dialogue. Medicine will always retain a dimension that cannot be fully datafied or formalised—those living experiences entwined with bodily sensation, individual encounter, and spiritual resonance should remain legitimately present[5]. Only by maintaining a productive tension between algorithmic efficiency and humanistic wisdom can we nurture a "digitalintelligent medicine" that is both technologically empowered and faithful to the soul of TCM.

References

[1] Wang ZL, Shi RT. Opportunities and challenges for TCM brought by AI based on selflearning[J]. China Journal of Traditional Chinese Medicine and Pharmacy, 2018, 33(12): 54255428.

[2] Yu ZH. The dilemma and way out of contemporary AngloAmerican epistemology: an investigation from the perspective of tacit knowledge[J]. Philosophical Research, 2019(1): 112120.

[3] Zhou XZ, Liu BY. Current status and prospects of artificial intelligence in TCM[J]. Strategic Study of CAE, 2020, 22(4): 8996.

[4] Zhang QM, Liu BY, Wang YY. Key issues and technical challenges of AIassisted syndrome differentiation in TCM[J]. Strategic Study of CAE, 2024, 26(2): 210218.

[5] Zhang QM, Liu BY, Wang YY. Philosophical reflections on digitalintelligent TCM: the debate between holism and reductionism[J]. Journal of Traditional Chinese Medicine, 2025, 66(10): 993998.

PREPARATION OF LOW-SUGAR WUZHI GAO AND STUDY ON ITS QUALITY STANDARDS

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Abstract

To optimize low-sugar Wuzhi Gao preparation and quality control, isomaltooligosaccharide (non-glycemic) replaced sucrose partially. Orthogonal optimization gave best extraction: 12-fold water, 3×1.5h; optimal substitution 50% (sucrose:IMO=1:1 sweetness). Quality standard based on total flavonoids was simple, stable, reliable. Process simple, quality controllable, method reliable for Wuzhi Gao and low-sugar variants.

Keywords: low-sugar Wuzhi Gao; preparation process; total flavonoids; content determination; isomaltooligosaccharide

Wuzhi Gao, first recorded in Xian Nian Ji by Li Wenbing of the Qing Dynasty, is prepared from dried pear, water chestnut, reed rhizome, dwarf lilyturf tuber, and dried lotus root. It is indicated for chronic cough, dry cough, and lung deficiency with fluid depletion. However, traditional Wuzhi Gao has a high sucrose content (60%-70%) and an incomplete quality control system. To expand the clinical application for sugar-sensitive populations and stabilize product quality, this study employed isomaltooligosaccharide—a non-fermentable oligosaccharide that does not raise blood glucose—to partially replace sucrose. The aim was to optimize the preparation process of low-sugar Wuzhi Gao and establish a total flavonoid-based quality control method.

Objective

To optimize the formulation and preparation process of low-sugar Wuzhi Gao and to establish corresponding quality control methods.

Materials and Methods

Raw materials were cleaned and soaked for 10–15 min, and pear, lotus root and water chestnut were homogenized with a small volume of purified water. An orthogonal experiment was carried out to optimize extraction conditions, where three factors (water volume, extraction duration and extraction frequency) were evaluated with extract yield as the indicator; the optimal condition $A_2B_2C_3$ was 12-fold water for 3 extractions of 1.5 h each. Four replacement proportions (0%, 25%, 50%, 75%) of sucrose by isomaltooligosaccharide were screened via sensory assessment covering color, aroma and taste. The 50% substitution group (60.00 g sucrose mixed with 70.59 g isomaltooligosaccharide calibrated to 0.85 times the sweetness of sucrose) yielded the best formulation featured by mild sweetness, yellowish-brown viscous semi-fluid, homogeneous texture and agreeable fragrance[3]. For preparation, isomaltooligosaccharide and sucrose were heated and stirred in purified water to prepare syrup, which was blended with concentrated extract and boiled for 1 h. Afterwards, 0.19 g benzoic acid pre-dissolved in 95% ethanol was supplemented under sustained stirring until ethanol

fully volatilized. The final mixture was concentrated and filtered with double-layer sterile gauze.

Results and Discussion

The quality control of low-sugar Wuzhi Gao includes: a yellowish-brown, uniform thick semi-fluid with a pleasant aroma; TLC identification on silica gel G using ethyl acetate–formic acid–water (8:1:1), followed by spraying with 10% $AlCl_3$ ethanol solution and viewing under 365 nm UV light, which shows a dark yellow fluorescent spot matching rutin at the same Rf value, confirming flavonoids; stability tests reveal no significant content change within 24 hours (RSD = 1.65%) and good stability over 6 months. This established standard fills the previous gaps in identification and assay, providing a reliable quality control method. Furthermore, replacement with isomaltooligosaccharide successfully reduces sucrose from 60–70% to 20–25% while maintaining satisfactory sensory properties, thereby expanding the suitability of Wuzhi Gao for diabetic and sugar-sensitive populations.

Conclusion

The optimal extraction conditions were identified as: 12-fold water, extraction 1.5 h, 3 times. The optimal sugar substitution ratio was 50% sucrose replaced by isomaltooligosaccharide. The prepared low-sugar Wuzhi Gao maintained good quality and stability, with total flavonoid content around 0.71-0.82 mg/g. The established quality control methods-including TLC identification and UV-Vis spectrophotometric determination of total flavonoids-are simple, reliable, and suitable for routine quality control. This study provides experimental evidence for the development of low-sugar Wuzhi Gao and offers a reference for the low-sugar modification of traditional paste preparations.

References:

1.Ye QQ, Zhu WH, Wang YQ, et al. Study on the formulation application of ancient prescription Wuzhi Yin. Chin J Ethnomed Ethnopharm. 2022;31(05):68-70.

2.Li QX, Chen X, Cao LG, et al. Research progress on phospholipid determination methods in the oil processing industry. J Food Saf Qual. 2024;15(14):125-132.

3.Qin ZH, Chen LM, Zhou X. Effect and mechanism of baking treatment on flavonoid transformation and antioxidant activity of okra seeds. J Food Saf Qual. 2026;17(05):110-120.

4.Wu P. Determination of total flavonoids and total polyphenols in licorice zinc granules. Sichuan Chem Ind. 2025;28(05):22-26.

RESEARCH ON THE ANALGESIC EFFECTS AND CHANNEL TROPISM RULES OF PAEONIA RADIX RUBRA BASED ON INFRARED THERMOGRAPHY AND ACETIC ACID-INDUCED WRITHING MODEL

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Abstract

Objective: To establish a mouse pain model of syndrome of cold stagnation and blood stasis induced by acetic acid, combine syndrome scoring with infrared thermography, and clarify the analgesic efficacy and channel regulation mechanism of Paeonia Radix Rubra.Methods: Kunming mice were divided into blank control group, model group and Paeonia Radix Rubra treatment group. Continuous intragastric administration of acetic acid for 3 days was conducted to establish the model. The writhing frequency and TCM syndrome scores were recorded, and the skin temperature along six channels on the back of mice was detected. Statistical analysis was performed via SPSS 21.0 software with one-way analysis of variance.Results: The acetic acid model presented typical characteristics of syndrome of cold stagnation and blood stasis ($P<0.01$). The writhing frequency and blood stasis score of the Paeonia Radix Rubra group decreased significantly ($P<0.01$). The superficial skin temperature along the Liver Channel and Spleen Channel increased markedly ($P<0.01$), while the temperature of the Heart Channel rose slightly ($P<0.05$).Conclusion: Paeonia Radix Rubra can effectively relieve acute pain caused by syndrome of cold stagnation and blood stasis, and specifically increase the superficial infrared temperature of Liver Channel and Spleen Channel. This finding provides objective experimental evidence for the traditional theory that Paeonia Radix Rubra acts on these two channels to dissipate blood stasis and alleviate pain.

Keywords: Keywords: Paeonia lactiflora Pall.; acetic acid-induced writhing model; infrared thermography; analgesia; channel tropism

Pain is a common clinical symptom, and traditional Chinese medicine has unique advantages in analgesic treatment. However, existing efficacy evaluation methods lack TCM-specific visual detection indicators. Infrared thermography can quantify the surface temperature changes along channels, and modern studies have confirmed the analgesic activity of paeoniflorin, the core active ingredient of Paeonia lactiflora Pall. This study integrates behavioral observation, syndrome quantitative evaluation and infrared temperature measurement technology to identify the target channels of Paeonia Radix Rubra, and establish an objective evaluation system for TCM analgesic efficacy.

Objective

This study adopted the acetic acid-induced writhing pain model in mice, differentiated the syndrome of cold stagnation and blood stasis of the model through TCM syndrome scoring, and combined writhing test and infrared thermography to provide modern experimental basis for the channel

tropism theory of Paeonia Radix Rubra.

Materials and Methods

Strictly following standardized animal experimental protocols, the pain model of Kunming mice was established by intraperitoneal injection of acetic acid. An infrared thermography system was used to detect the surface temperature of six fixed acupoints on the backs of mice. Meanwhile, acetic acid-induced writhing behavioral indicators were recorded, and multi-dimensional quantitative scoring of TCM syndromes was carried out. All experimental data were analyzed by one-way analysis of variance using SPSS 21.0 software. The adaptive feeding conditions of experimental mice and the extraction and concentration method of Paeonia Radix Rubra decoction were implemented in accordance with existing literature reports. All raw experimental data were derived from the animal experiment records of our laboratory.

Results and discussion

The acute pain model induced by intraperitoneal injection of acetic acid conforms to the diagnostic standard of syndrome of cold stagnation and blood stasis according to multi-dimensional syndrome evaluation. Paeonia Radix Rubra can significantly improve pain behavior and blood stasis manifestations of model mice, and specifically elevate the superficial infrared temperature of the Liver Channel and Spleen Channel. Digital infrared thermography visually verifies the classic TCM theory that Paeonia Radix Rubra regulates Liver and Spleen Channels, dissipates stasis and relieves pain.

The digital syndrome scoring evaluation system constructed in this study applies modern digital detection technology to objectively quantify the pharmacological characteristics of traditional Chinese medicinal herbs, which provides a feasible technical scheme for visualization research of TCM channel tropism.

Reference:

1.Tang Mingze, Shen Zhen, Gao Tianle, et al. Research progress on the application of natural products from traditional Chinese medicine in pain management [J]. China Journal of Experimental Formulary Science, 2023,29(24):121-128.

2.Fu Haiqing. Clinical Application and Modern Research on Traditional Chinese Medicine Warm-Inducing Therapy for Variant Angina Pectoris with Cold-Natured Blood Stasis Syndrome [C]. China Life Care Association, 2025.

3.Zhang Shikai, Cao Yongbing. Research on the pharmacological effects of Paeonia lactiflora [J]. Journal of Pharmaceutical Practice, 2021,39(2):97–101.

4.Liu Jianyao, Ren Lu, Ma Xiande, et al. Investigation on the effects of acupuncture therapy on Shaoyang Shuji acupoint in a depression model rat using infrared thermal imaging technology [J]. Chinese Journal of Traditional Chinese Medicine, 2025.

STUDY ON THE EFFECTS OF ATRACTYLODES CHINENSIS ON BEHAVIORAL PERFORMANCE AND GASTROINTESTINAL FUNCTION IN MICE EXPOSED TO RESTRAINT WATER-IMMERSION STRESS

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Abstract

In this study, a total of 72 volatile components, mainly terpenes, alcohols, and alkenes, were identified from the essential oil of Atractylodes chinensis by GC-MS, with an extraction yield of 1.20±0.46%. Among them, β-eudesmol, atractylon, and others were representative components. A total of 29 components were shared between the Chengde and Chifeng origins, but their distribution patterns differed. Furthermore, using the restraint water-immersion stress model, it was found that raw Atractylodes chinensis (5.4 g/kg, intragastric administration for 21 days) significantly ameliorated anxiety-like behaviors (open-arm entries and time in the elevated plus maze, shuttling times and dark-compartment time in the light-dark box, central grid time and crossing times in the open field test, all $P<0.01$ or $P<0.001$), depressive-like behaviors (reduced immobility time in tail suspension and forced swimming tests, and increased sucrose preference rate, $P<0.01$ or $P<0.001$), as well as gastrointestinal function (improved small intestinal propulsion rate, gastric emptying rate, and colon length recovery, all $P<0.05$). These results indicate that raw Atractylodes chinensis can exert dual regulation via the gut-brain axis, providing experimental evidence for the development of related pharmaceuticals.

Keywords: Atractylodes chinensis; volatile components; anxiety; depression; gastrointestinal function

Anxiety and depression often coexist with gastrointestinal dysfunction, and the gut-brain axis theory reveals that both share mechanisms such as neurotransmitter imbalance and HPA axis dysregulation. The volatile oil of Atractylodes chinensis contains active components including atractylon and β-eudesmol, and exhibits multiple pharmacological effects such as regulating gastrointestinal motility, anti-inflammatory, antibacterial, and antidepressant activities. However, its synergistic effects on simultaneously ameliorating emotional disorders and gastrointestinal function remain unclear. This study aims to analyze the volatile oil composition of Atractylodes chinensis using GC-MS, and to utilize the restraint water-immersion stress (RWIS) model—which simulates both psychological and physiological stress and induces depressive-like behaviors and gastric mucosal injury—combined with gastrointestinal function tests and anxiety- and depression-like behavioral experiments, to investigate the dual regulatory effects of the Atractylodes chinensis. The findings are expected to provide experimental evidence for elucidating its therapeutic potential in treating comorbidities via the gut-brain axis.

Objective

This study analyze the volatile components of Atractylodes chinensis by GC-MS and to evaluate

Atractylodes chinensis alleviating effects on gastrointestinal function and anxiety-depressive behaviors in mice subjected to restraint water-immersion stress..

Materials and methods

The volatile oil was extracted from Atractylodes chinensis (originating from Chengde, Hebei) by hydrodistillation, and its chemical composition was analyzed by GC-MS (HP-5ms column, programmed temperature, EI source at 70 eV) with identification based on the NIST17 spectral library. For the animal experiment, SPF-grade male ICR mice were subjected to restraint water-immersion stress (immersed in water at 15 ± 1 °C for 6 h daily for 21 consecutive days) to establish the model, and then randomly divided into control, model, positive drug (fluoxetine 1 mg/kg), and raw Atractylodes chinensis (5.4 g/kg, suspended in 1% sodium carboxymethyl cellulose, intragastric administration for 21 days) groups. Behavioral tests including the light-dark box, elevated plus maze, open field, tail suspension, forced swimming, and sucrose preference tests were performed, and gastric emptying rate, small intestinal propulsion rate, and colon length were measured.

Results and discussion

Using GC-MS technology, a total of 72 volatile components were identified from the essential oil of Atractylodes chinensis, mainly consisting of terpenes, alcohols, and alkenes, with β-eudesmol, atractylon, elemol, guaiol, and γ-eudesmol as the representative compounds; the average extraction yield of the volatile oil was 1.20±0.46%. Pharmacological experiments showed that, compared with the model group, the raw Atractylodes chinensis group significantly increased the number of open-arm entries ($P<0.001$) and open-arm time ($P<0.001$) in the elevated plus maze; significantly increased the shuttle times ($P < 0.01$) and decreased the time spent in the dark compartment ($P<0.001$) in the light-dark box test; and significantly increased the central grid time ($P<0.01$) and total crossing times ($P<0.001$) in the open field test. In terms of depressive-like behaviors, the raw Atractylodes chinensis significantly reduced the immobility time in the tail suspension test ($P<0.001$) and forced swimming test ($P<0.01$) and significantly increased the sucrose preference rate ($P<0.001$). For gastrointestinal function, raw Atractylodes chinensis significantly increased the small intestinal propulsion rate ($P<0.05$) and gastric emptying rate ($P<0.05$), and restored colon length ($P<0.05$). In summary, raw Atractylodes chinensis exerts significant ameliorative effects on anxiety-like, depressive-like behaviors and gastrointestinal dysfunction in RWIS model mice, and its volatile components, may be the pharmacologically active substances responsible for the dual regulation via the gut-brain axis..

References:

1.WHO. World Mental Health Today[R]. Geneva: World Health Organization, 2025.

2.Qiu J, Chen L, Zhu L, et al. Volatile components of Atractylodes chinensis analyzed by GC-MS and their fragmentation pathways[J]. Molecules, 2019, 24(18): 3321.

3.Zhao DQ, Xue H, Sun HJ. Nervous mechanisms of restraint water-immersion stress-induced gastric mucosal lesion[J]. World Journal of Gastroenterology, 2020, 26(20): 2533-2549.

STUDY ON THERMAL IMAGING CHARACTERISTICS AND ANALGESIC EFFECT OF RADIX PAEONIAE ALBA IN MICE

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Abstract

This study investigated the analgesic effect of Radix Paeoniae Alba and its regulation on body surface meridian thermal features via infrared thermal imaging in an acetic acid writhing mouse model. Fourteen female Kunming mice were randomized into a blank group and a treatment group (n=7). The treatment group received 0.4 g/mL aqueous decoction by gavage for 3 days. Pain was induced by intraperitoneal injection of 0.6% glacial acetic acid 30 min after the last administration. Results showed Radix Paeoniae Alba significantly reduced writhing times (analgesic rate 42.03%, $P<0.01$) and alleviated cold stagnation syndrome. Liver and Spleen Meridians showed the most sensitive thermal responses, consistent with meridian tropism theory. This study provides experimental evidence for objective TCM efficacy evaluation.

Keywords: Radix Paeoniae Alba; analgesia; infrared thermal imaging; acetic acid writhing model; meridians; cold coagulation and blood stasis

Chronic pain prevails widely in China and damages patients' quality of life. Conventional analgesics cause gastrointestinal injury and addiction, so safe alternatives are urgently needed[1]. TCM has long been applied for pain relief. Radix Paeoniae Alba soothes the liver and relieves pain, and its active ingredients have definite analgesic activity[2]. However, lack of objective evaluation limits TCM modernization[3]. As a non-invasive visual tool, infrared thermal imaging reflects metabolism and blood circulation, suitable for TCM efficacy assessment[4], yet rarely used in herbal animal experiments.

Objective

To clarify the analgesic effect of Radix Paeoniae Alba on acetic acid writhing mice, analyze meridian temperature changes after intervention, explore the link between analgesia and thermal features, and verify the practicability of infrared thermal imaging in TCM analgesic research.

Materials and methods

Fourteen SPF female Kunming mice (25–35 g) were supplied by the university's animal center [SCXK (Hei) 2019-003], adaptively raised for 3 days at 20–26 °C with a 12-hour light-dark cycle. Radix Paeoniae Alba and glacial acetic acid of analytical grade were adopted; Guide PC210 thermal imager with 0.05 °C precision was used.

Mice were grouped by weight (n=7). The blank group was given normal saline (0.1 mL/10 g) daily, while the treatment group received equal-volume 0.4 g/mL Radix Paeoniae Alba decoction for 3 days. Thirty minutes after final gavage, 0.6% glacial acetic acid (0.1 mL/10 g) was injected

intraperitoneally to build pain model. Writhing counts within 20 min and latency were recorded to calculate analgesic rate.

Thermal detection was conducted on Day 1–3 before and after modeling to monitor six meridians. Meridian positioning followed standard mouse acupoint criteria[5]. Mice were acclimatized at 22–24 °C for 30 min before test. SPSS 26.0 was used for statistics; data were expressed as mean ± SD, independent sample t-test, $P<0.05$ as statistically significant.

Results and discussion

Radix Paeoniae Alba produced remarkable analgesia. Writhing episodes of treatment group (19.71±1.50) were markedly lower than blank group (34.00±7.68, $P<0.01$), with prolonged latency and 42.03% analgesic rate. Its monoterpene glycosides relieve pain via inhibiting NF-κB, NLRP3 inflammasome and TRPV1 channels[6].

A five-dimension cold stagnation scoring system was used. Model mice showed cold limbs and curling, matching cold coagulation and blood stasis manifestations. The treatment group had lower syndrome scores ($P<0.01$), and writhing times positively correlated with cold symptom severity.

Thermal imaging showed Radix Paeoniae Alba regulated meridian temperature, with Liver and Spleen Meridians changing most obviously, consistent with meridian tropism theory. Previous studies confirmed unique thermal distribution along meridians[7]. Thermal indicators changed earlier than behavioral indexes and correlated with analgesic effects, acting as sensitive objective evaluation markers[4].

In conclusion, Radix Paeoniae Alba alleviates pain and cold coagulation syndrome in writhing mice. Its targeted regulation on Liver and Spleen Meridians supports the meridian tropism theory. Infrared thermal imaging is an objective and sensitive index to evaluate herbal analgesic efficacy, which promotes TCM modernization research[3].

References

[1] Zhou QY, Wang HY, Yin GC. Advances in pharmacotherapy of chronic pain[J]. Chinese Journal of Pain Medicine, 2021, 27(4): 256-261.

[2] Qi B, Luo X, Zheng Y, et al. Structure-activity omics of anti-inflammatory and analgesic effects of Radix Paeoniae Alba in Qi-stagnation stomachache granules[J]. Chinese Journal of Experimental Traditional Medical Formulae, 2024, 30(21): 169-175.

[3] Li S, Zhang HJ, Chen LP. Progress and prospect of modernization research of traditional Chinese medicine[J]. Chinese Journal of Integrated Traditional and Western Medicine, 2022, 42(3): 260-267.

[4] Liu TY, Hua YY, Liu TY. Application of infrared thermal imaging technology in TCM diagnosis and treatment[J]. Journal of Traditional Chinese Medicine, 2021, 62(12): 1017-1022.

[5] Names and localizations of commonly used acupoints in experimental animals part 3: mice[J]. World Journal of Acupuncture-Moxibustion, 2025, 35(02): 160-166.

[6] Ruan Y, Ling J, Ye F, et al. Paeoniflorin alleviates CFA-induced inflammatory pain by inhibiting TRPV1 and succinate/SUCNR1-HIF-1α/NLRP3 pathway[J]. International Immunopharmacology, 2021, 101: 108364.

[7] Li M, Wei M, Zhao P. Research progress of infrared thermal imaging technology in acupuncture studies[J]. Acupuncture Research, 2022, 47(6): 548-552.

THE MECHANISM OF SUANZAOREN DECOCTION REGULATING GABAERGIC SYNAPTIC PATHWAY TO IMPROVE MENOPAUSAL ANXIETY IN RATS BASED ON TRANSCRIPTOMICS

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Abstract

Objective: To investigate the therapeutic effects and molecular mechanisms of Suanzaoren Decoction (SZRD) on menopausal anxiety using an ovariectomized plus conditioned fear (OVX-CS) rat model. Methods: Female SD rats were subjected to bilateral ovariectomy and conditioned fear stress. Anxiety-like behaviors were assessed by elevated plus maze, open field, and light-dark box tests. Serum estradiol (E2) was measured by ELISA. Hypothalamic transcriptomics, network pharmacology, molecular docking, and RT-qPCR were performed to identify key pathways and validate gene expression. Results: OVX-CS rats exhibited severe anxiety-like behaviors, decreased E2, neuronal damage, and upregulated inflammation-related (Il1a, Cxcl10, Mapk11, Nfkb1) and GABAergic synapse-related (Gabrg3, Gad2, Gnb3) genes. SZRD significantly reversed these abnormalities, elevated E2, and modulated 564 differentially expressed genes enriched in GABAergic synapse, circadian entrainment, and neuroactive ligand-receptor interaction pathways. PCR confirmed downregulation of Gabrg3, Gad2, Gnb3. Network pharmacology identified 116 active compounds and 202 targets; jujuboside B showed strong binding to GAD2 (–10.1 kcal/mol). Conclusions: SZRD alleviates menopausal anxiety through multi-component regulation of GABAergic synaptic transmission, neuroinflammation, and neuroendocrine homeostasis, providing experimental evidence for its clinical application.

Keywords: Menopause; Anxiety; Suanzaoren Decoction; Transcriptomics; GABAergic synapse; Neuroinflammation

Menopausal anxiety is a highly prevalent neuropsychiatric disorder, with women during the perimenopausal transition facing a significantly increased risk due to dramatic hormonal fluctuations and estrogen deficiency[1,2]. The abrupt decline in estrogen disrupts hypothalamic–pituitary–gonadal axis function, promotes neuroimmune activation and microglia-mediated neuroinflammation, and impairs GABAergic inhibitory neurotransmission, collectively contributing to emotional dysregulation, sleep disturbances, and anxiety-like behaviors[2-4]. Suanzaoren Decoction (SZRD), a classic traditional Chinese herbal formula, has long been prescribed for insomnia and anxiety disorders and has demonstrated neuroprotective, anti-inflammatory, and neurotransmitter-modulating activities in both experimental and clinical studies[5,6]. However, its therapeutic mechanisms in menopausal anxiety remain largely unclear, and previous studies have mainly focused on individual signaling pathways without systematically integrating multi-omics evidence. Therefore, the present study established an ovariectomy combined with conditioned fear-induced anxiety rat model to comprehensively evaluate the therapeutic effects of SZRD and elucidate its underlying molecular mechanisms through transcriptomic analysis, network pharmacology, and molecular docking, with particular emphasis on the regulation of the GABAergic synapse pathway.

Objective

To elucidate the mechanism of Suanzaoren Decoction in menopausal anxiety via GABAergic synapse regulation.

Materials and Methods

Female SD rats were ovariectomized and subjected to conditioned fear. SZRD was orally administered. Anxiety was evaluated by EPM, OFT, LDB. Hypothalamic transcriptomics, network pharmacology, docking, and RT-qPCR were performed.

Results and Discussion

SZRD significantly improved anxiety-like behaviors, elevated serum E2, and attenuated neuronal damage in OVX-CS rats. Transcriptomic analysis identified 564 differentially expressed genes enriched in GABAergic synapse, circadian entrainment, and neuroactive ligand-receptor interaction pathways. RT-qPCR validated the downregulation of GABAergic synapse-related genes (Gabrg3, Gad2, and Gnb3), while transcriptomic analysis also revealed suppression of inflammation-related genes. Network pharmacology and molecular docking identified 116 active compounds and 202 targets, with jujuboside B showing strong binding affinity for GAD2 (−10.1 kcal/mol). These findings indicate that SZRD alleviates menopausal anxiety through coordinated regulation of GABAergic neurotransmission, neuroinflammation, and neuroendocrine homeostasis.

Conclusion

SZRD alleviates menopausal anxiety in OVX-CS rats by modulating GABAergic synaptic genes and suppressing neuroinflammation, indicating multi-target synergy.

References

[1] Santoro N. Perimenopause: From Research to Practice. Journal of Women's Health. 2016;25(4):332–339.
[2] Maki PM, Kornstein SG, Joffe H, et al. Guidelines for the Evaluation and Treatment of Perimenopausal Depression: Summary and Recommendations. Journal of Women's Health. 2019;28(2):117–134.
[3] Furman JL, Norris CM. Estrogenic Regulation of Synaptic Plasticity and Neuroinflammation in the Aging Brain. International Journal of Molecular Sciences. 2021;22:1664.
[4] Brinton RD. Estrogen Regulation of Glucose Metabolism and Mitochondrial Function: Therapeutic Implications for Prevention of Alzheimer's Disease. Advances in Pharmacology. 2008;64:327–371.
[5] Zhang Y, Wang X, Li H, et al. Suanzaoren Decoction Ameliorates Sleep Disturbance and Anxiety by Modulating Neurotransmitter Metabolism and Synaptic Function. Frontiers in Pharmacology. 2023;14:1198745.
[6] Liu Y, Chen J, Zhao X, et al. Integrated Network Pharmacology and Experimental Validation Reveal the Neuroprotective Mechanisms of Suanzaoren Decoction Against Anxiety Disorders. Journal of Ethnopharmacology. 2024;323:117715

UNCOVERING THE MOLECULAR MECHANISM OF EVODIA RUTAECARPA TARGETING THE FGF23-FGFR1 AXIS TO INHIBIT GASTRIC CANCER: A STUDY BASED ON BIOINFORMATICS, WGCNA, MACHINE LEARNING, AND MOLECULAR DOCKING VALIDATION

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ABSTRACT

Gastric cancer (GC) is a common malignancy with limited treatment options. Evodia rutaecarpa, a traditional Chinese herb, shows promise against digestive diseases, yet its anti-GC mechanisms are unclear. By integrating transcriptomics, WGCNA, network pharmacology, and machine learning, we identified FGFR1 as the core target from 73 candidate genes. Molecular docking and database analyses confirmed CTCF as its transcription factor and FGF23 as its interacting protein. FGFR1 may serve as a potential biomarker for Evodia therapy and for predicting immunotherapy response in GC patients. Our findings suggest that Evodia-derived phytochemicals inhibit GC through the FGF23-FGFR1 axis, providing novel mechanistic insights and a basis for further translational research.

Keywords

Evodia rutaecarpa, Gastric cancer, FGFR1, FGF23, bioinformatics

1Introduction

Cancer remains one of the most significant global challenges of the 21st century, impacting public health, society, and the economy. Recent data from 2022 estimate around 20 million incident cancer cases and close to 10 million cancer-related deaths globally. Demographic trends further project a rise in annual new cancer diagnoses to 35 million by 2050, representing a 77% increase from the 2022 figures. Based on population size, disease prevalence, and the level of development in different regions of the world, the global cancer landscape is showing a trend of diversity and growth. This further emphasizes the necessity for upgrading global cancer prevention and control measures (1). Globally, gastric cancer (GC) is a predominant oncological challenge, responsible for nearly a million new cases and in excess of 650,000 deaths each year (2). However, epidemiology shows that the incidence and mortality rates of GC are highest in East Asia (1).

Cancer treatment relies on foundational pillars such as surgery, radiation, and chemotherapy, alongside an evolving arsenal of targeted, immunotherapeutic, and other precision-guided technologies (3). However, currently, some advanced therapies lack sufficient clinical evidence, have a narrow application range, or face issues such as high toxicity and side effects. These challenges make it difficult to increase benefits and minimize risks. Therefore, in today's rapidly changing field of oncology, biomarkers are central to the development of personalized medicine and characterize its transformative phase. In the evolution of personalized cancer medicine, predictive biomarkers serve as critical tools for optimizing treatment regimens (4). However, some first-line anti-cancer drugs have poor efficacy, and drug development still faces significant gaps. Therefore, finding novel and highly specific related biomarkers is extremely important for GC patients, as this may provide opportunities for future clinical translation (5,6).

Traditional Chinese Medicine contributes to oncology through diverse mechanisms. It acts by directly suppressing tumor growth, promoting apoptotic cell death, hindering blood vessel formation in tumors, and fine-tuning immune function. Notably, its strengths are particularly evident in improving treatment outcomes, reducing toxicity, and addressing the challenge of chemoresistance (7). The medicinal plant Evodia rutaecarpa, commonly referred to as Wu Zhu Yu, finds broad application in traditional Chinese medical practice within China. It is associated with the liver, spleen, stomach, and kidney meridians and is traditionally used to disperse cold and relieve pain; reduce reverse flow and stop vomiting; and support yang energy and stop diarrhea. Modern pharmacological studies have demonstrated that Evodia rutaecarpa exhibits significant anti-tumor activity and is effective against thyroid cancer (8), oral squamous cell carcinoma (9), and certain gastrointestinal tumors (10). In GC research, Evodia rutaecarpa inhibits the growth of Helicobacter pylori by downregulating its replication and transcription mechanisms (11); induces apoptosis to suppress GC cell growth (12); protects the gastric mucosa through anti-inflammatory and antioxidant effects (13); and inhibits the proliferation and stem cell-like properties of GC stem cells by suppressing the Wnt/β-catenin signaling pathway, as well as blocking the transition of epithelial cells to a mesenchymal state (14). Therefore, Evodia rutaecarpa has unique advantages in inhibiting the progression of GC and other digestive system diseases. This provides a solid basis for further research into the molecular targets and regulatory mechanisms through which Evodia rutaecarpa

inhibits GC.

To clarify the molecular mechanisms by which Evodia rutaecarpa inhibits GC, this study integrates transcriptomics, network pharmacology, computational prediction, and molecular docking technologies. By identifying core genes, screening related signaling pathways, miRNAs, upstream transcription factors, and interacting target proteins, it comprehensively analyzes the role of Evodia rutaecarpa in inhibiting the occurrence and development of GC. The process and methods of this study are shown in Fig. 1.

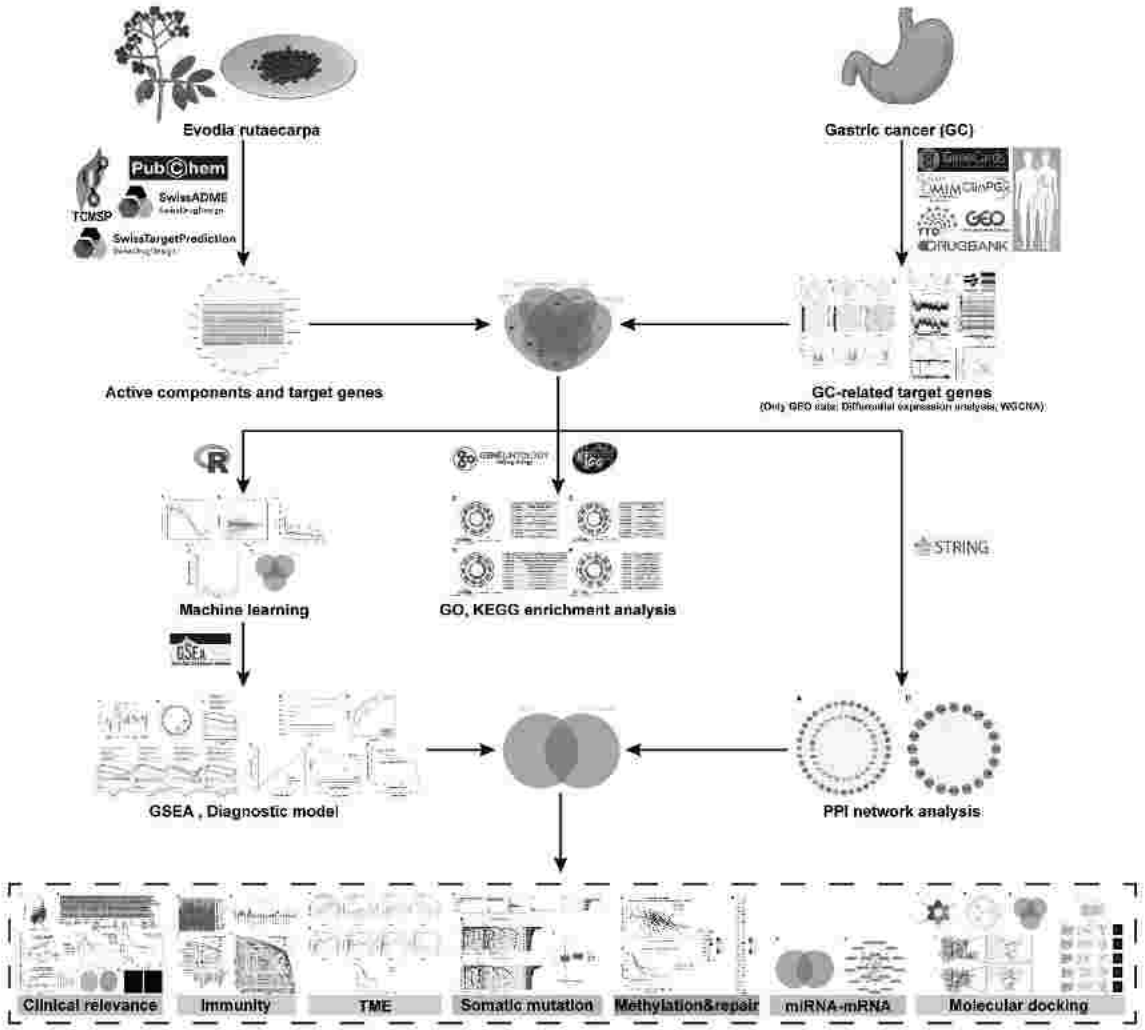


Fig. 1. Graphical abstract of this study.

2Objective

This study aims to investigate the molecular mechanisms underlying the therapeutic effects of Evodia rutaecarpa against gastric cancer (GC) by integrating transcriptomics, network pharmacology, weighted gene co-expression network analysis (WGCNA), machine learning, and molecular docking approaches. Specifically, we seek to identify potential biomarker genes and key regulatory pathways associated with Evodia rutaecarpa treatment, with a particular focus on the

FGF23–FGFR1 axis, and to provide a comprehensive characterization of the biological functions and clinical relevance of the core target gene in the GC tumor microenvironment and immune landscape.

3Materials and methods

3.1Screening of active components and target prediction of Evodia rutaecarpa

Active components of Evodia rutaecarpa were retrieved from the TCMSP database (https://www.tcmsp-e.com) (15) with the criteria of the oral bioavailability (OB) ≥ 30% and the drug-likeness (DL) ≥ 0.18. The 2D SDF files of active components were obtained from the PubChem database (https://pubchem.ncbi.nlm.nih.gov) (16), and further screening of active components was conducted using the SwissADME database (http://www.swissadme.ch) (17) based on the following criteria: gastrointestinal absorption (GI absorption) rated as "High" and at least two DL criteria rated as "Yes". In addition, active components that were selected were verified through literature reports and the TCMBank database (https://tcmbank.cn/) (18). If the pharmacological effects of the active components were significant and relevant to the research topic, they were still included. Target identification was performed by importing the 2D SDF files of the active components into SwissTargetPrediction (http://www.swisstargetprediction.ch) (19), and the resulting predictions were filtered to include only those with a probability score > 0. Finally, the network diagram illustrating the interactions between Evodia rutaecarpa active components and their predicted targets was constructed using Cytoscape 3.10.3 (20).

3.2Acquisition of GC datasets

We searched the GeneCards database (https://www.genecards.org) (21), OMIM database (https://www.omim.org/) (22), ClinPGx database (https://www.clinpgx.org/) (23), and TTD (https://idrblab.org/ttd) (24) using "Gastric Cancer" as the keyword to obtain molecular target datasets related to GC. Additionally, we retrieved targets of clinically approved first-line Western drugs for treating GC from the DrugBank database (https://www.drugbank.ca) (25) to supplement the dataset. GC-related microarray datasets were obtained from the GEO database (https://www.ncbi.nlm.nih.gov/geo/) (26). Furthermore, RNA-seq data and corresponding clinical information for GC were acquired from TCGA database (https://portal.gdc.cancer.gov/).

3.3Quality assessment and differential expression analysis of GEO datasets

Based on R 4.5.1, principal component analysis (PCA) was performed on three GEO datasets using the prcomp function. PCA was applied for dimensionality reduction to visualize sample variance and clustering, allowing assessment of repeatability within groups and discrimination between groups. The results were visualized using the R package factoextra. Differential expression analysis of the three GEO datasets was conducted using the R package limma. Differentially expressed genes (DEGs) were selected based on the criteria of |log2 (Fold Change) | > 1 and adjusted P-value < 0.05. The results were visualized using the R packages pheatmap and ggVolcano. To create a comprehensive and non-redundant DEG list, the DEG sets from the three datasets were merged and deduplicated.

3.4Removing batch effects and weighted gene co-expression network analysis (WGCNA)

The three GEO datasets were merged based on common genes. The ComBat function from the R package sva was then used to remove batch effects, resulting in an expression matrix of the merged dataset. The batch effect removal results were visualized using the R packages factoextra and tinyarray. To further explore the relationship between gene networks and phenotypes, the R package WGCNA was used to construct a weighted gene co-expression network from the expression matrix of the merged dataset. This process involved removing outlier samples from the dataset, selecting a soft-thresholding power to approximate scale-free topology characterized by a power-law distribution to construct the adjacency matrix, dividing co-expression modules, calculating the correlation between modules and phenotypes, and constructing the topological overlap matrix.

3.5Gene ontology (GO) enrichment and kyoto encyclopedia of genes and genomes (KEGG) pathway enrichment analysis

The intersection of the predicted target genes of the active components of Evodia rutaecarpa, GC target genes, DEG sets, and WGCNA phenotype-related module genes was obtained to identify the intersection gene set. A Venn diagram was drawn using the EVenn platform (https://www.bic.ac.cn/test/venn/#/) (27). To further explore the biological functions and signaling pathways of the intersection gene set, the R packages clusterProfiler (28) and org.Hs.eg.db were used for GO enrichment and KEGG pathway enrichment analysis. The results were visualized using the R package GO plot.

3.6Machine learning

Machine learning analysis of the intersecting gene set was performed using the Least Absolute Shrinkage and Selection Operator (Lasso) regression, Random Forest (RF), and Support Vector Machine Recursive Feature Elimination (SVM-RFE) algorithms. The Lasso algorithm utilized the R package glmnet to select the best model parameters through cross-validation. It then extracted the genes corresponding to non-zero coefficients. The RF algorithm used the R package randomForest to determine the optimal number of trees that minimize the classification error rate to construct the model. The SVM-RFE algorithm employed the R packages e1071, kernlab, and caret to select the optimal feature combination. The final key genes were derived by identifying the common features selected across all three algorithms.

3.7Key gene correlation analysis and gene set enrichment analysis (GSEA)

Differential expression analysis of key genes was conducted using the Wilcoxon rank-sum test, and the results were visualized using the R packages ggplot2 and ggpubr. To further clarify the chromosomal localization of the genes, the R package RCircos was used to construct a chromosomal locus map of the key genes. GSEA examines the effect of coherently altered gene sets on biological pathways through an enrichment-based perspective. Therefore, performing GSEA on each key gene can further help understand the functions of the enriched pathways.

3.8Construction and evaluation of diagnostic models

Based on the key genes identified through machine learning, diagnostic models were constructed using the R packages rms and rmda and visualized using a Nomogram. The diagnostic efficacy of the key genes and the model was quantitatively analyzed using the receiver operating characteristic (ROC) curve and area under the curve (AUC). The accuracy and clinical utility of the model were

further evaluated through calibration curves, decision curve analysis (DCA), and clinical impact curves (CIC).

3.9Protein-protein interaction (PPI) network analysis and core genes screening

The intersected gene set obtained in section 1.5, referring to the common genes identified from previous analyses, is imported into the STRING database (https://cn.string-db.org/) (29). The obtained tsv file is then imported into Cytoscape 3.10.3 for visualization. The maximum clique centrality (MCC) algorithm of the cytoHubba plugin (30) in Cytoscape 3.10.3 is used for network topology analysis. Through this analysis, hub genes are identified from the PPI network. To further explore the core genes, the hub genes obtained from the PPI network are intersected with the key genes obtained from machine learning to obtain the final core genes.

3.10Analysis and evaluation of the clinical relevance of core genes identified in previous analyses

The expression differences of core genes between the normal group and GC group were compared using the paired-sample t-test. Because of the absence of certain clinical parameters in the GEO dataset, it was not possible to explore the correlation between core gene and clinical information from multiple angles. Therefore, the TCGA-STAD dataset was used for further analysis. The R package ComplexHeatmap was employed to draw heatmaps of core genes expression and clinically relevant information in GC group. The correlation between core genes and molecular subtypes, as well as clinical stages of GC, was investigated through the GSCA database (https://guolab.wchscu.cn/GSCA/#/) (31). Survival analysis and assessment of prognostic value of core genes were conducted using the GEPIA 2 database (http://gepia2.cancer-pku.cn/#index) (32) and the Kaplan-Meier plotter database (https://kmplot.com/analysis/index.php?p=home) (33). Immunohistochemical data were extracted from The Human Protein Atlas (HPA) database (https://www.proteinatlas.org/) (34) to validate the differential protein expression of core genes between the normal group and GC group, and to demonstrate immunofluorescence localization patterns.

3.11Tumor immune infiltration and immune checkpoint analyses

Based on the CIBERSORT algorithm, which is based on linear support vector regression, deconvolution analysis was performed to estimate the abundance of 22 immune cell subpopulations in the samples. A stacked bar chart was drawn using the R package ggplot2. To further compare the abundance of immune cell subpopulations between the normal and GC groups, box plots were generated using ggplot2. The correlation between core genes expression and 22 immune cells, as well as immune checkpoints, was calculated using the Spearman correlation method, and a correlation plot was drawn using the R package linkET.

3.12Analysis of tumor microenvironment (TME) characteristics

The R package ESTIMATE was used to analyze the TME of the GEO and TCGA datasets. Spearman correlation was calculated between TME scores and core genes expression, and scatter plots depicting these correlations were generated using ggplot2. Tumor purity was indirectly estimated based on the StromalScore, ImmuneScore, and ESTIMATEscore. The correlation between tumor purity and survival prognosis was preliminarily analyzed using the R packages survival and survminer.

3.13Analysis of somatic mutations in tumors

Data on somatic mutations in GC were sourced from the cBioPortal database (https://www.cbioportal.org/) (35). Somatic mutation analysis and visualization were performed using the R package maftools. To assess their impact, the GC samples were dichotomized based on the relative expression of the core genes into high and low groups. The mutation annotation format (MAF) files of the high and low expression groups were extracted separately to compare mutation types, mutation frequencies, and mutational burden between the groups.

3.14Core genes methylation analysis and DNA damage repair analysis

We analyzed the correlation between core genes methylation and mRNA expression in GC using the GSCA database, while comparing survival differences between the high methylation group and the low methylation group. Using Spearman's correlation method, the R package linkET was employed to analyze the correlation between core genes and mismatch repair (MMR) and homologous recombination repair (HRR).

3.15Core genes and miRNA regulatory analysis

The ENCORI (https://rnasysu.com/encori/index.php) (36)and miRDB (https://mirdb.org/index.html) (37) databases were used to predict miRNAs targeting core genes, obtain miRNA-mRNA regulatory relationships, and construct the miRNA-mRNA regulatory network using Cytoscape 3.10.3.

3.16Screening of related transcription factors and proteins prediction for core targets

The TFTF database (https://jingle.shinyapps.io/TF_Target_Finder/_w_54766144a6f543e0a89f0ca7629d759d/#) (38) was utilized to predict upstream transcription factors for core targets, from which key upstream transcription factors were identified. The GeneMANIA (https://genemania.org/) (39), HitPredict(https://www.hitpredict.org/) (40), and STRING databases were used to predict related proteins for core targets; key proteins were then selected. The results were visualized using the R package ggraph and the EVenn platform. Based on the Structure module of the UniProt database (https://www.uniprot.org/) (41), human protein structure files for core targets, key upstream transcription factors, and key proteins were obtained from the RCSB PDB database (https://www.rcsb.org/) (42). PyMOL 3.1.3.1 was used to remove water molecules and ligands from the downloaded structures, which were then saved as PDB files. The processed protein files were imported into the HDOCK Server platform (http://hdock.phys.hust.edu.cn/) (43) to perform docking between core targets and key transcription factors and proteins. Amino acid residues with interaction distances within 3 Å were displayed using PyMOL 3.1.3.1. In protein-protein interactions, a docking score below -200 is indicative of strong affinity, and a confidence score above 0.7 indicates high binding strength between the two molecules and more reliable model predictions.

3.17Molecular docking

To further clarify the molecular interaction between the core active components of Evodia rutaecarpa and the core targets, molecular docking simulation was performed using AutoDock Vina (44). Five core active components were selected based on the degree values from the active components-targets network of Evodia rutaecarpa. The 3D sdf files of these core active components were downloaded from the PubChem database and converted to mol2 files using

OpenBabel 3.1.1 (45). Subsequently, these files were processed with AutoDock Vina to add hydrogens, detect rotatable bonds, and analyze torsion angles, and then saved as pdbqt files. For the previously prepared target protein files, hydrogen addition and Gasteiger charge calculations were also performed using AutoDock Vina, and the results were saved as pdbqt files. The core active components and core targets were imported into AutoDock Vina to define the docking pocket, perform molecular docking, and calculate the lowest binding energy. The docking results were then analyzed using PyMOL 3.1.3.1 for visualization of molecular interactions and LigPlot 2.3.1 (46) for generating 2D interaction diagrams. In the evaluation of molecular docking, it is generally considered that when the binding energy is lower than -4.25 kcal/mol, the ligand and receptor have certain binding affinity; when the binding energy is lower than -5 kcal/mol, they have better binding affinity; and when the binding energy is lower than -7 kcal/mol, they exhibit strong binding affinity. These thresholds are commonly referenced in molecular docking studies.

4Results

4.1Screening of active components and target prediction of Evodia rutaecarpa

A set of 29 active components was acquired by applying a screening process to the TCMSP database, and 21 active components were further screened through SwissADME database. The 8 previously excluded active components were re-checked based on literature and databases, and 28 active components were finally identified. These include Goshuyuamide I, 6-OH-luteolin, Gossypetin, Isorhamnetin, and Quercetin, among others. The SwissTargetPrediction database was utilized to project potential molecular targets for these bioactive components. After merging and deduplication, a total of 637 unique targets were obtained. Following this, an active components-targets network for Evodia rutaecarpa was assembled by mapping its pharmacologically active constituents to their corresponding targets. (Fig. 2).

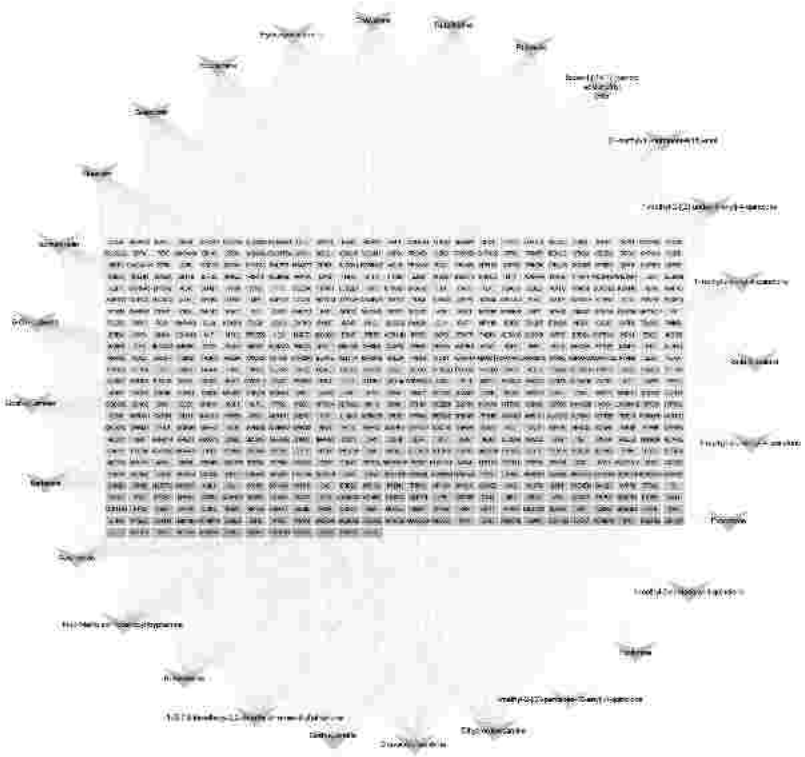


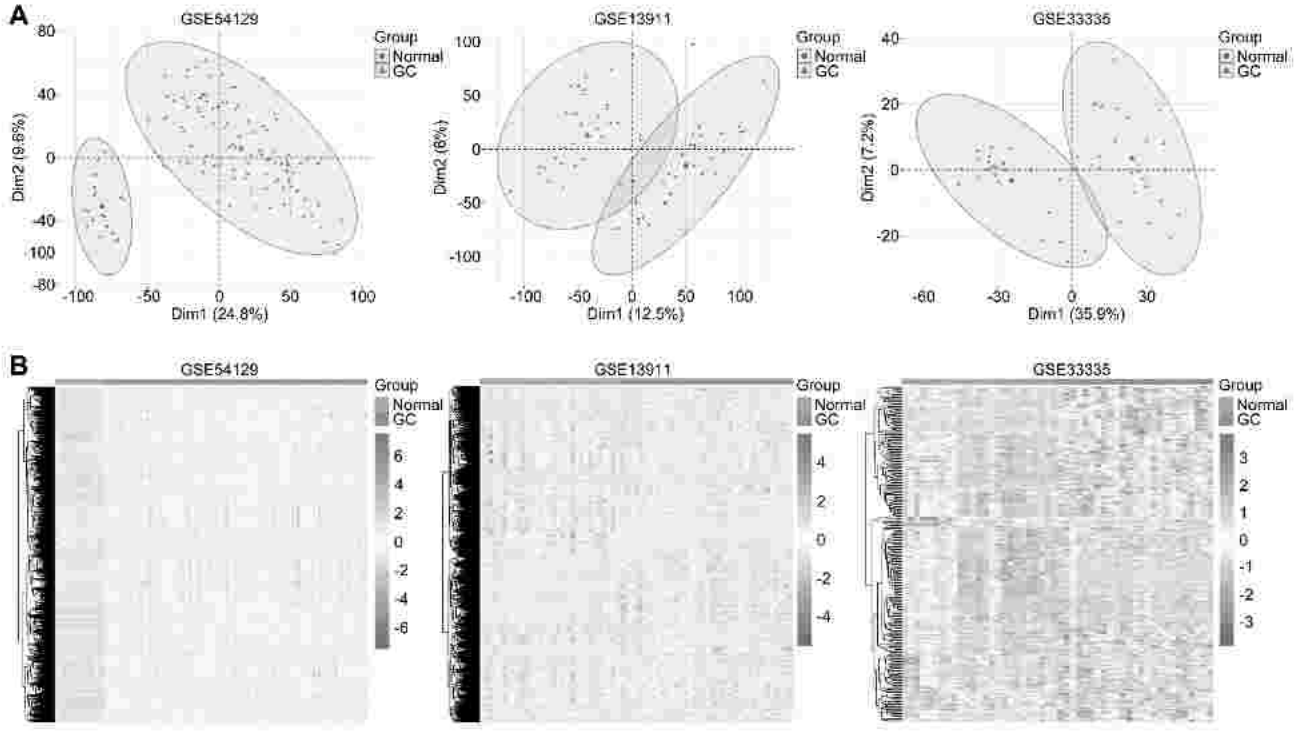
Fig. 2. Evodia rutaecarpa active components-targets network. The orange square in the center represents the target proteins, while the surrounding light blue pattern represents the active components of Evodia rutaecarpa.

4.2Acquisition of GC datasets

Based on the search results of GC targets from the GeneCards, OMIM, ClinPGx, TTD, and DrugBank databases, a total of 19,749 targets were identified after merging and deduplication. Three sets of GC-related gene chip datasets were obtained from the GEO database: GSE54129, GSE13911, and GSE33335. Among them, the detection platforms for GSE54129 and GSE13911 are GPL570, while the detection platform for GSE33335 is GPL5175. The GSE54129 dataset contains 111 GC samples and 21 normal samples; the GSE13911 dataset contains 38 GC samples and 31 normal samples; and the GSE33335 dataset contains 25 GC samples and 25 normal samples. The TCGA database provides GC-related RNA-seq data and clinical data, including 412 tumor tissue samples and 36 normal tissue samples.

4.3Quality inspection and differential expression analysis of GEO datasets

PCA revealed that the GSE54129 dataset exhibits good reproducibility within groups, with similar sample data and clear differentiation between groups. Although there is some overlap in PCA space between the GSE13911 and GSE33335 datasets, they can still be distinguished overall, showing good differentiation between groups (Fig. 3A). Differential expression analysis showed that the GSE54129 dataset identified 1,216 upregulated genes and 1,197 downregulated genes; the GSE13911 dataset identified 819 upregulated genes and 803 downregulated genes; and the GSE33335 dataset identified 106 upregulated genes and 167 downregulated genes (Fig. 3B, C). After merging and deduplicating the differentially expressed gene sets from the three datasets, a combined list of 3,622 DEGs was obtained.



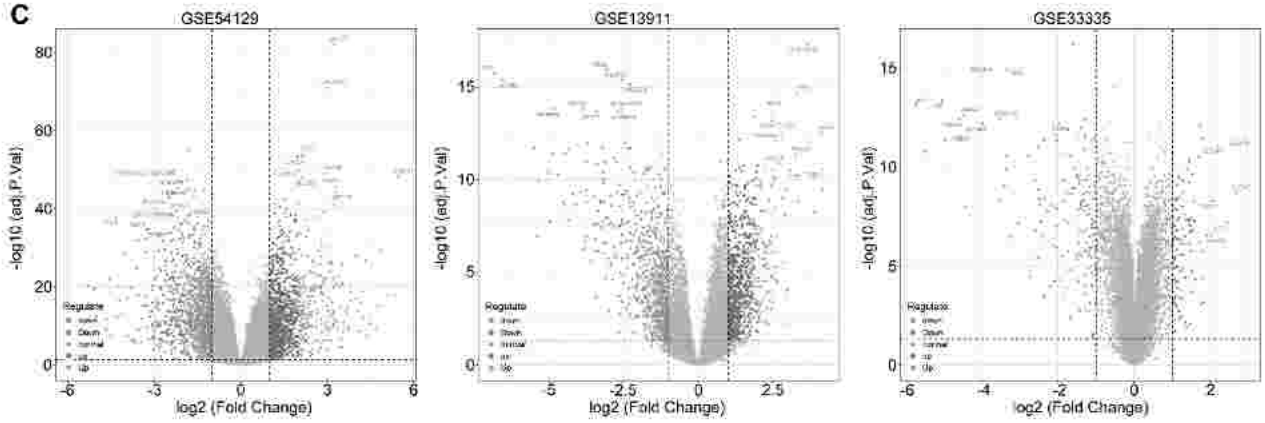
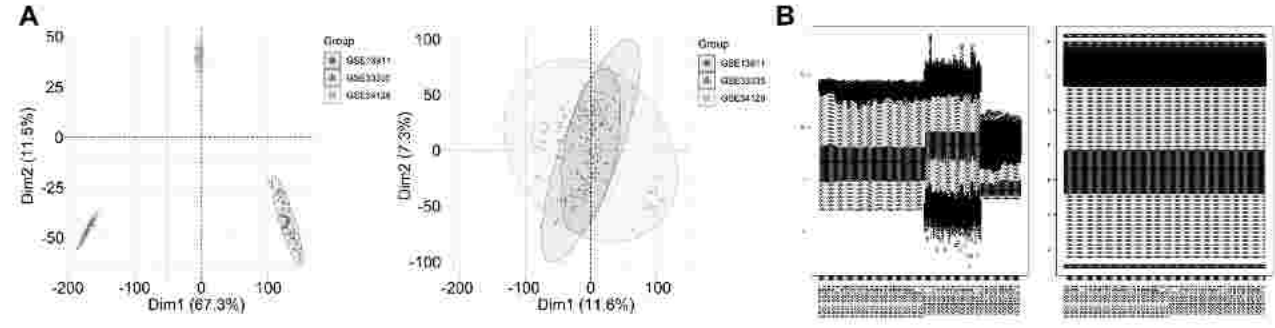


Fig. 3. Quality control and differential expression analysis of GC gene chip data. (A) PCA plots show the intra-group repeatability and inter-group discrimination of GSE54129, GSE13911 and GSE33335 data sets respectively. (B) The heat maps show the differential genes identified in the three data sets respectively. Genes are distinguished by color, with significantly up-regulated ones shown in red and down-regulated ones in blue. Hierarchical clustering of the left gene axis reveals sample grouping patterns. (C) Volcano plots reveal genome-wide expression profiles. Significantly up- and down-regulated genes are highlighted in different colors, while non-significant genes are shown in neutral tones. The top 10 genes with the highest statistical significance (|log2 (Fold Change) | > 2, adjusted P-value < 0.05) were specifically annotated.

4.4Removing batch effects and screening of WGCNA module targets

Batch effects can lead to increased noise in the data; this noise may mask the true biological signals. Removing batch effects improves the accuracy and reliability of subsequent analyses (Fig. 4A, B). After batch effect correction, WGCNA was performed on the expression matrix of the merged dataset. During sample clustering, outliers were identified and 12 abnormal samples—defined as those deviating significantly from cluster patterns—were removed (Fig. 4C, D). An adjacency matrix was then constructed using a soft-thresholding power of 6, as recommended (Fig. 4E, F), which resulted in the identification of 15 co-expression modules (Fig. 4G, H). Among these, the MEmagenta, MEgreenyellow, MEturquoise, and MEyellow modules showed significant correlations with specific phenotypes ($R > 0.50$, $P < 0.001$). Following merging and removal of duplicate genes based on defined criteria, a total of 3,708 genes were identified.



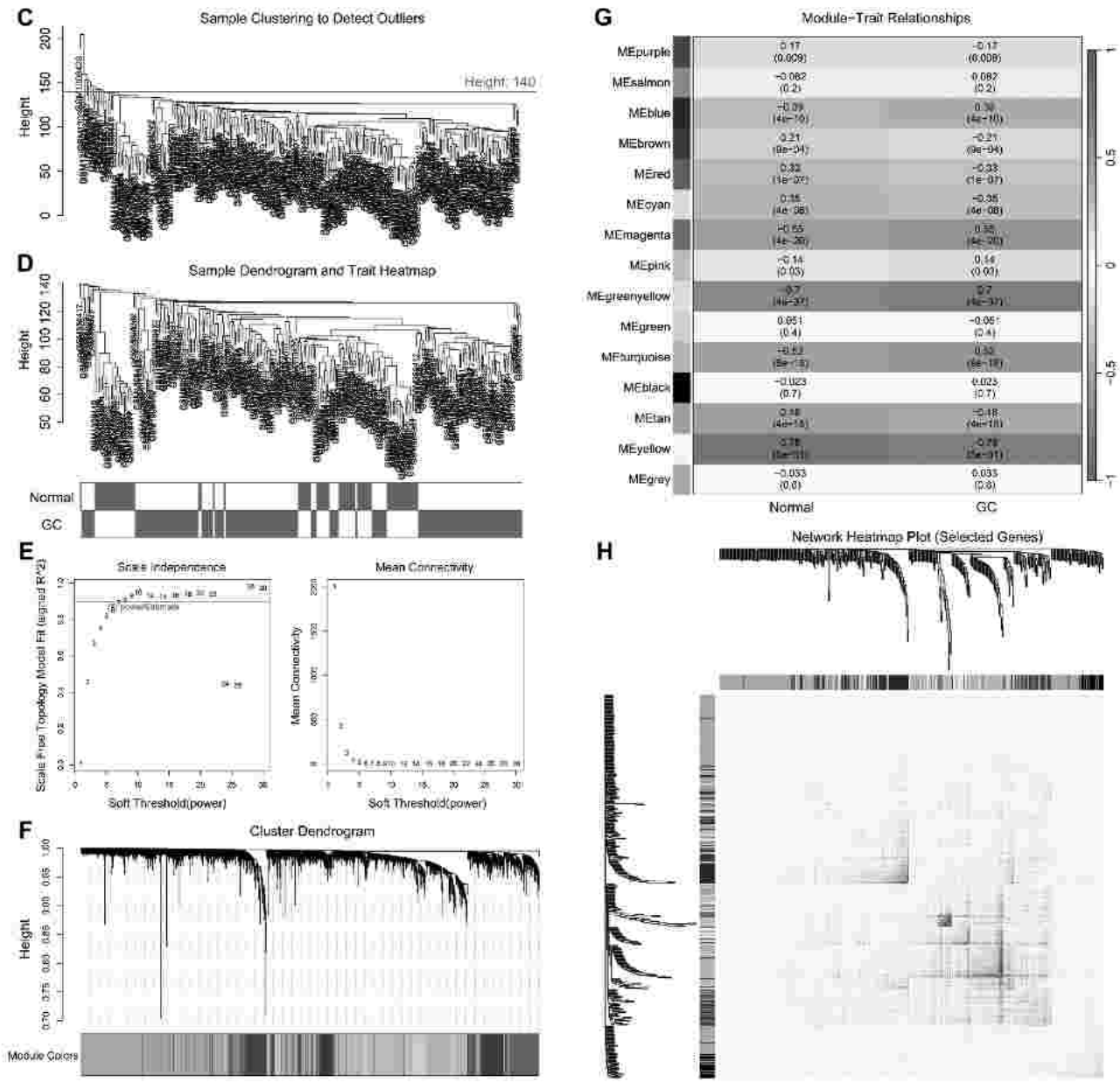
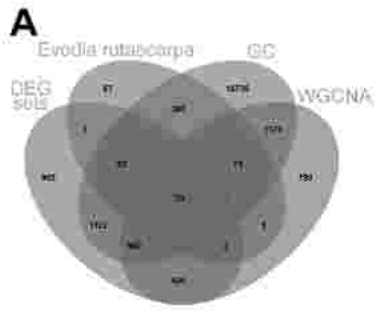
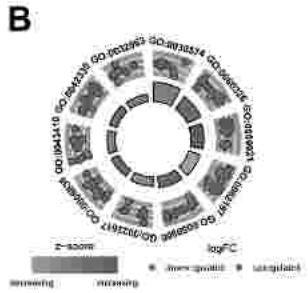


Fig. 4. Elimination of batch effect and identification of genes related to GC phenotypes. (A) PCA plots show the distribution before and after removing the batch effect in the GEO data set. (B) Box plots showing the normalization process of the merged data set. (C) Sample clustering dendrogram to detect outliers. According to the cutting height of 140, 12 outlier samples were eliminated, and a total of 139 samples were determined. (D) Sample clustering dendrogram and phenotype. The dendrogram illustrates the grouping of the 139 samples alongside their phenotypic annotations. (E) Soft threshold screening. Build a scale-free network according to the algorithm recommendation value 6. (F) The clustering trend diagram shows the gene cluster tree and the distribution of genes in each module, where the same color represents the same module. (G) Module-phenotype correlation heat map. The 15 rows correspond to the 15 combination modules respectively, and the 2 columns correspond to the normal group and GC group respectively. (H) Heat map of modular gene clustering.

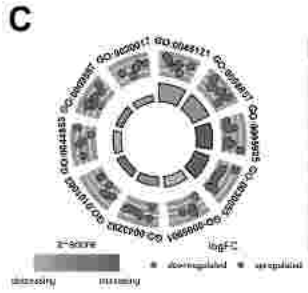
4.5GO function and KEGG pathway enrichment analysis

We used the EVenn platform to draw the Venn diagram of the common gene set. A total of 73 intersecting genes were identified, which constitute the intersecting gene set (Fig. 5A), and enrichment analysis was performed on it. The GO functional enrichment analysis showed that the biological process (BP) was mainly related to collagen catabolic process, cell chemotaxis, leukocyte migration, and extracellular matrix degradation (Fig. 5B). The cellular components (CC) were mainly concentrated in focal adhesion and cell-substrate junctions (Fig. 5C). The molecular function (MF) was mainly involved in transmembrane receptor protein tyrosine kinase activity and serine-type endopeptidase activity (Fig. 5D). The KEGG pathway enrichment analysis showed that the genes were mainly enriched in classic signaling pathways, such as VEGF, calcium, Ras, MAPK, TNF, and gastric acid secretion signaling pathways (Fig. 5E). These results suggest that Evodia rutaecarpa acts on multiple pathways to exert its inhibitory effect on GC.

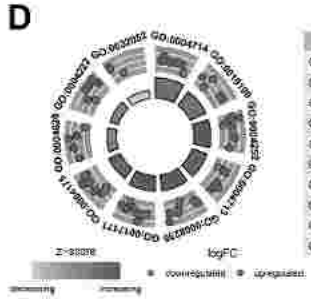




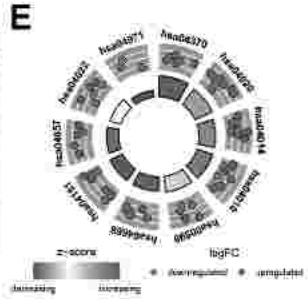
ID	Description
GO:0030574	collagen catabolic process
GO:0060326	cell chemotaxis
GO:0050921	positive regulation of chemotaxis
GO:0062197	cellular response to chemical stress
GO:0050900	leukocyte migration
GO:0022617	extracellular matrix disassembly
GO:0006935	chemotaxis
GO:0043410	positive regulation of MAPK cascade
GO:0042330	taxis
GO:0032963	collagen metabolic process



ID	Description
GO:0045121	membrane raft
GO:0098857	membrane microdomain
GO:0005925	focal adhesion
GO:0030055	cell–substrate junction
GO:0005901	caveola
GO:0043292	contractile muscle fiber
GO:0101002	ficolin-1-rich granule
GO:0044853	plasma membrane raft
GO:0009897	external side of plasma membrane
GO:0030017	sarcomere



ID	Description
GO:0004714	transmembrane receptor protein tyrosine kinase activity
GO:0019199	transmembrane receptor protein kinase activity
GO:0004252	serine-type endopeptidase activity
GO:0004713	protein tyrosine kinase activity
GO:0008236	serine-type peptidase activity
GO:0017171	serine hydrolase activity
GO:0004175	endopeptidase activity
GO:0004620	phospholipase activity
GO:0004222	metalloendopeptidase activity
GO:0032052	bile acid binding



ID	Description
hsa04370	VEGF signaling pathway
hsa04020	Calcium signaling pathway
hsa04014	Ras signaling pathway
hsa04010	MAPK signaling pathway
hsa00590	Arachidonic acid metabolism
hsa04668	TNF signaling pathway
hsa04151	PI3K-Akt signaling pathway
hsa04657	IL-17 signaling pathway
hsa04022	cGMP-PKG signaling pathway
hsa04971	Gastric acid secretion

Fig. 5. GO and KEGG enrichment analysis of intersection gene sets. (A) Obtain the intersection gene set through Venn diagram. The intersection of the target genes predicted by the active components of Evodia rutaecarpa, GC target genes, DEG sets and WGCNA phenotype-related module genes was obtained. (B) BP categories in GO enrichment analysis. (C) CC categories in GO enrichment analysis. (D) MF categories in GO enrichment analysis. (E) Important pathways related to GC in KEGG enrichment analysis.

4.6Machine learning

A total of 15 genes were selected by the Lasso regression algorithm (Fig. 6A, B). Additionally, 21 genes were selected using the RF algorithm (Fig. 6C), and 13 genes were selected by the SVM-RFE algorithm (Fig. 6D). Finally, we identified 5 key genes by intersecting the genes selected by all three algorithms: ADRB2, CA9, FGFR1, INSR, and NR3C2 (Fig. 6E).

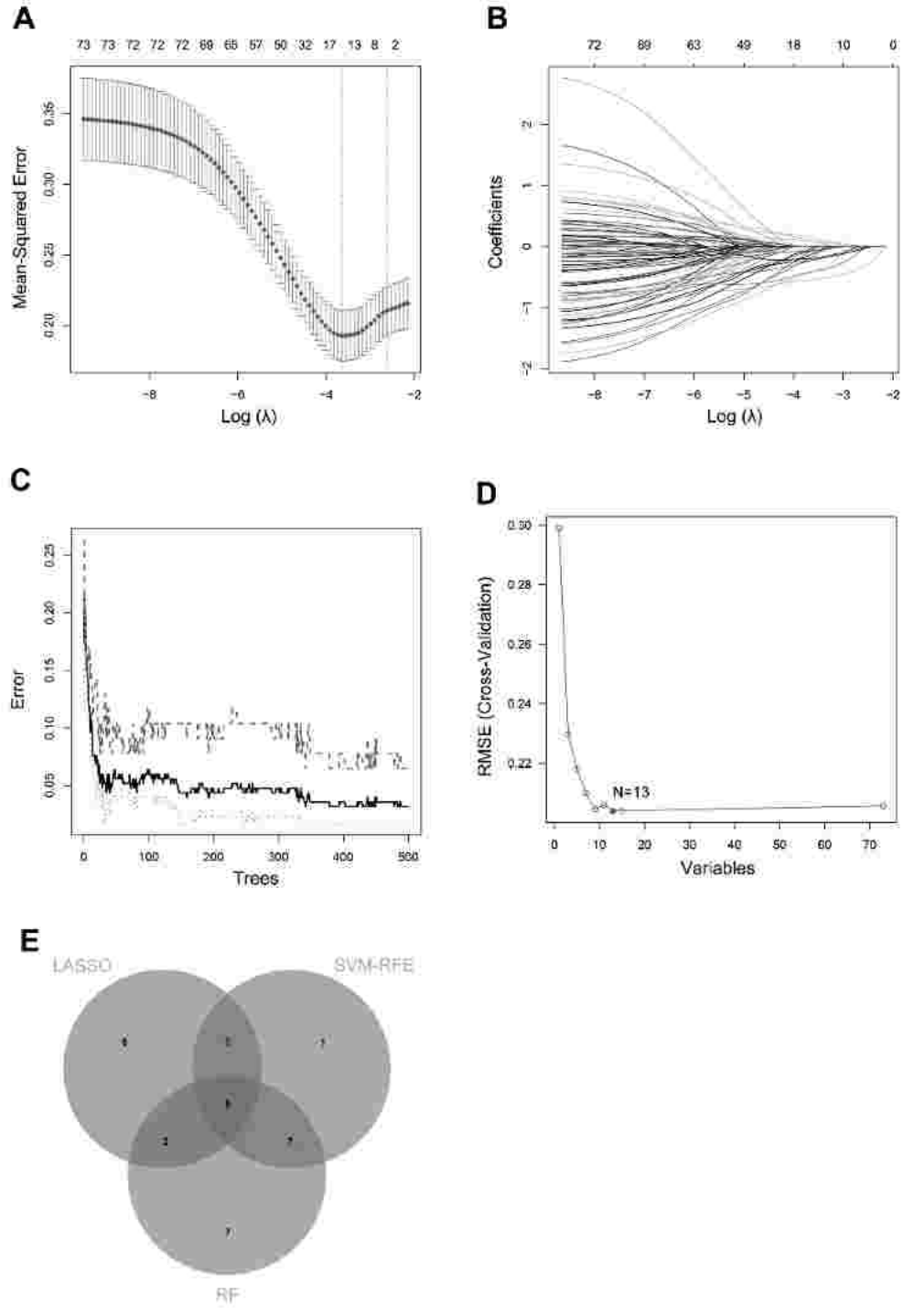


Fig. 6. Machine learning screens key genes related to GC. (A) Lasso regression algorithm screening chart. (B) Lasso regression algorithm trend chart. (C) RF algorithm. (D)SVM-RFE algorithm. (E) The intersection results of the three algorithms finally identify 5 key genes. Blue represents the Lasso regression algorithm, green represents the RF algorithm, and orange represents the SVM-RFE algorithm.

4.7Correlation analysis and GSEA results of key genes

In the differential expression analysis, ADRB2, CA9, INSR, and NR3C2 displayed significant upregulation in normal samples, while FGFR1 was notably upregulated in GC samples (Fig. 7A). Chromosomal localization reveals that key genes are located on chromosomes 4, 5, 8, 9, and 19 (Fig. 7B). Furthermore, GSEA analysis of the five key genes identifies related signaling pathways such as cell cycle, DNA replication, retinol metabolism, drug metabolism-cytochrome P450, cytokine–cytokine receptor interactions, and neuroactive ligand-receptor interactions that affect the occurrence and development of GC (Fig. 7C).

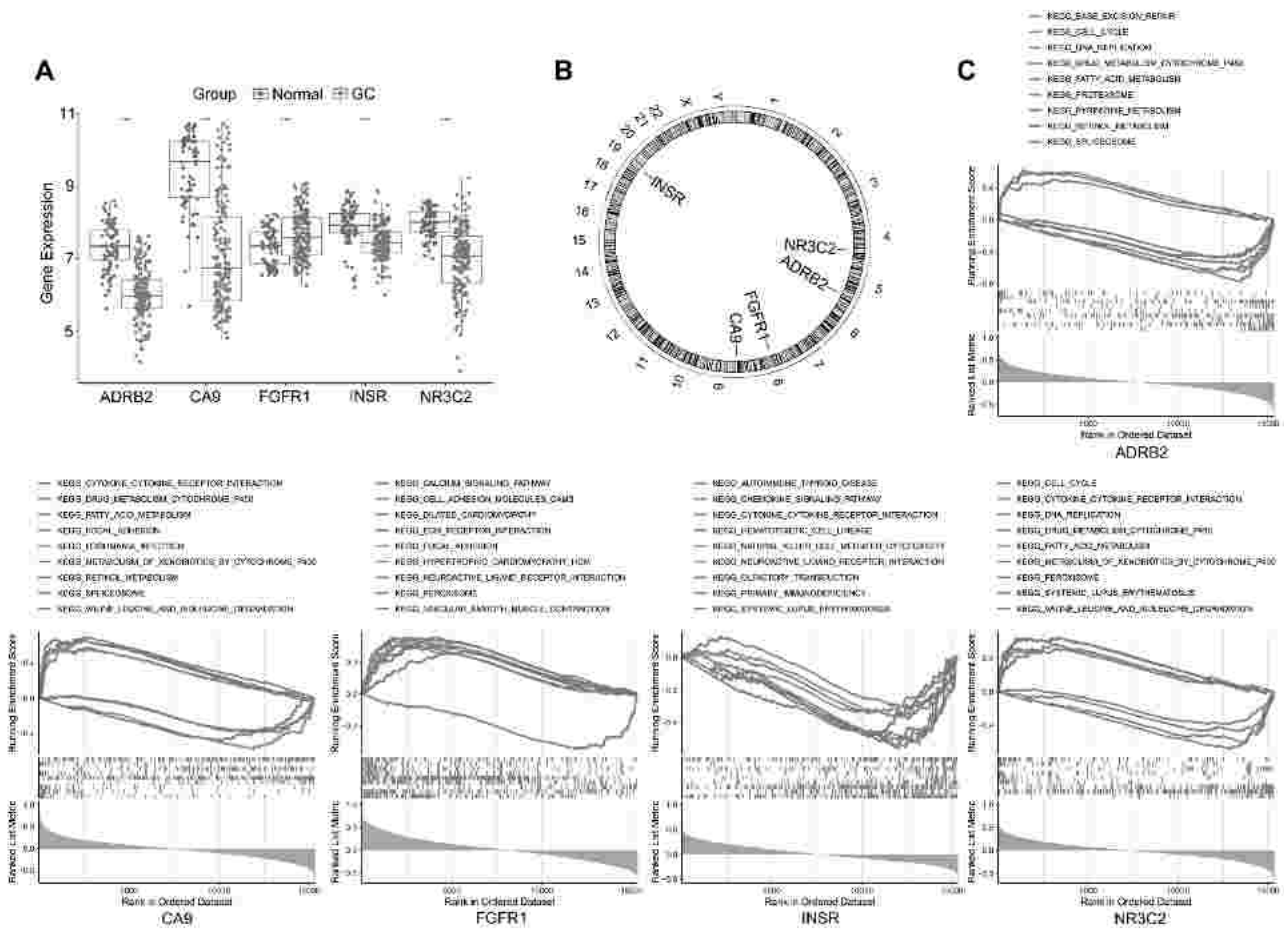


Fig. 7. Correlation analysis and GSEA enrichment of key genes. (A) Box plots show the differential expression of 5 key genes between normal group and GC group. (B) Chromosomal location of five key genes. (C) GSEA enrichment results for each key gene.

4.8Construction and evaluation of diagnostic model

A nomogram was constructed using the five key genes selected to predict the probability of GC occurrence (Fig. 8A). Model evaluation showed that the AUC values of the key genes in the ROC curve were all greater than 0.65 (Fig. 8B), and the calibration curve demonstrated strong fit and consistency (Fig. 8C). DCA revealed that the net benefit derived from the nomogram substantially exceeded that of the "treat all" and "treat none" strategies across various threshold probabilities (Fig. 8D). Furthermore, the CIC showed that the predicted probabilities closely matched the observed occurrences when the threshold was greater than 0.2 (Fig. 8E). The above results show that the diagnostic model has good accuracy, calibration and diagnostic utility.

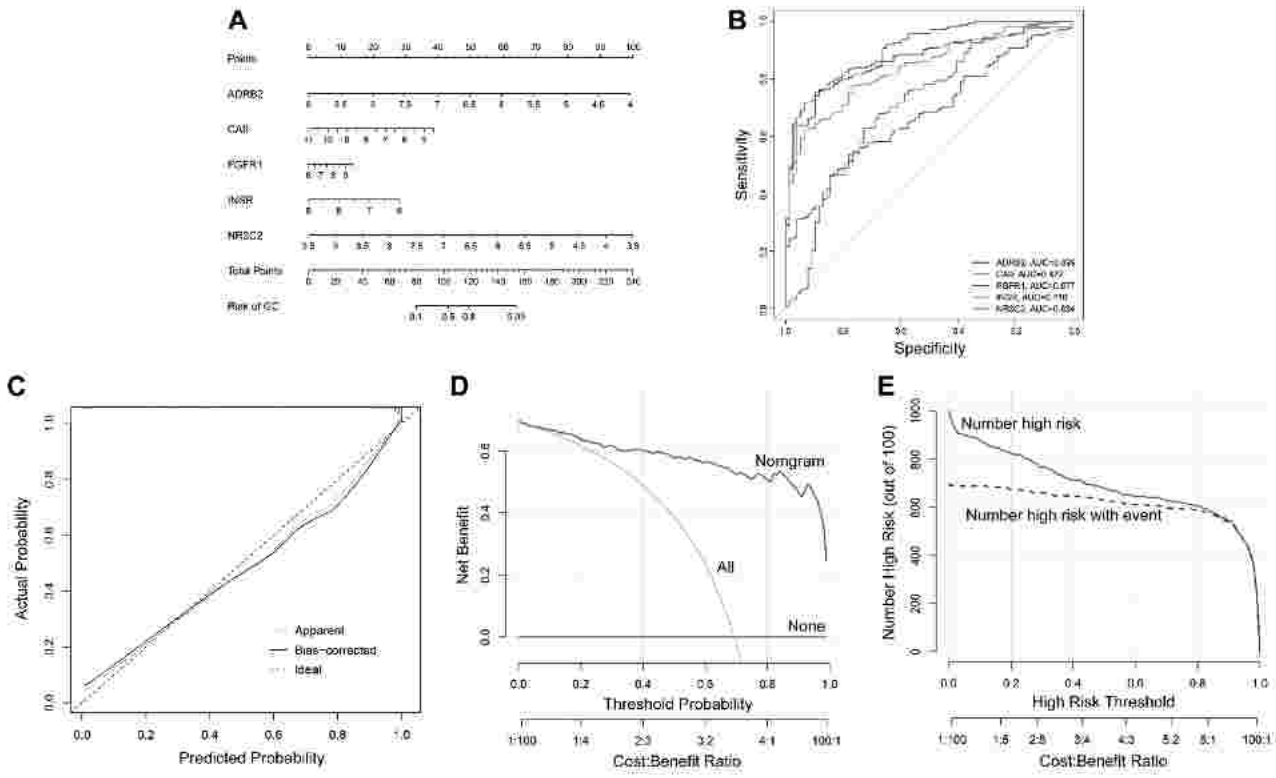


Fig. 8. Diagnostic performance evaluation of key genes. (A) Nomogram for predicting GC risk based on 5 key genes. (B) ROC curve evaluates the diagnostic accuracy of each gene in distinguishing the normal group from GC group. (C) Calibration curve used to evaluate the predictive ability of the nomogram model. (D) DCA curve evaluates the clinical value of the nomogram model. (E) CIC curves evaluate the clinical impact of the nomogram model.

4.9PPI network analysis and core genes screening

To reveal the relationships between genes from the perspective of protein interactions, the overlapping gene set was imported into the STRING database to construct the PPI network. The resulting protein interaction network topology contains a total of 65 nodes and 237 edges (Fig. 9A). Using the MCC algorithm of the cytoHubba plugin, 20 key genes within the PPI network were identified. The topology of this key gene protein interaction network includes 20 nodes and 110 edges (Fig. 9B). To accurately screen core genes, the key genes obtained from the integrated PPI network were combined with those identified through machine learning, and the intersection of these key genes was determined, ultimately identifying one core gene, FGFR1 (Fig. 9C).

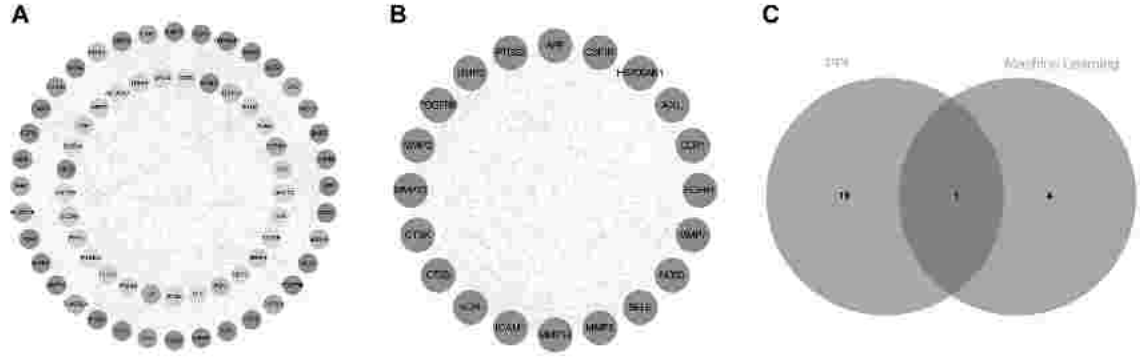


Fig. 9. PPI network construction of intersection gene sets and core gene screening. (A) PPI network analysis of intersectional gene sets. A darker color corresponds to a higher degree value. (B) The MCC algorithm based on the cytoHubba plug-in identified 20 key genes of the PPI network. (C) Venn diagram showing the final core gene FGFR1. Blue represents PPI network filtering and purple represents machine learning filtering.

4.10Analysis and evaluation of clinical correlation of FGFR1

Compared to normal controls, FGFR1 expression was significantly increased in the GC group as determined by a paired sample t-test (Fig. 10A). The GC group was divided into high- and low-expression subgroups, and it was found that FGFR1 expression was significantly related to tumor anatomical location, T stage and tumor histological grade (Fig. 10B). Specifically, tumors located at the gastroesophageal junction were more frequent in the FGFR1 low expression group; meanwhile, tumor size and histological grade showed a clear positive correlation with FGFR1 expression levels. Based on the molecular subtype analysis of GC from the TCGA database, FGFR1 expression levels differed significantly among the four subtype groups (Fig. 10C). Analysis of FGFR1 expression across clinical stages revealed statistically significant differences between stage I and stages II, III, and IV (Fig. 10D). To further evaluate the prognostic value of FGFR1, survival analysis was performed in GC group, demonstrating that patients with low FGFR1 expression had significantly better survival prognosis than those with high expression (Fig. 10E). Immunohistochemistry analysis confirmed that FGFR1 protein expression was significantly upregulated and exhibited an increasing trend in GC tissues (Fig. 10F). Immunofluorescence analysis indicated that FGFR1 was mainly localized in microtubules, cellular dynamic bridges, and mitotic spindles (Fig. 10G).

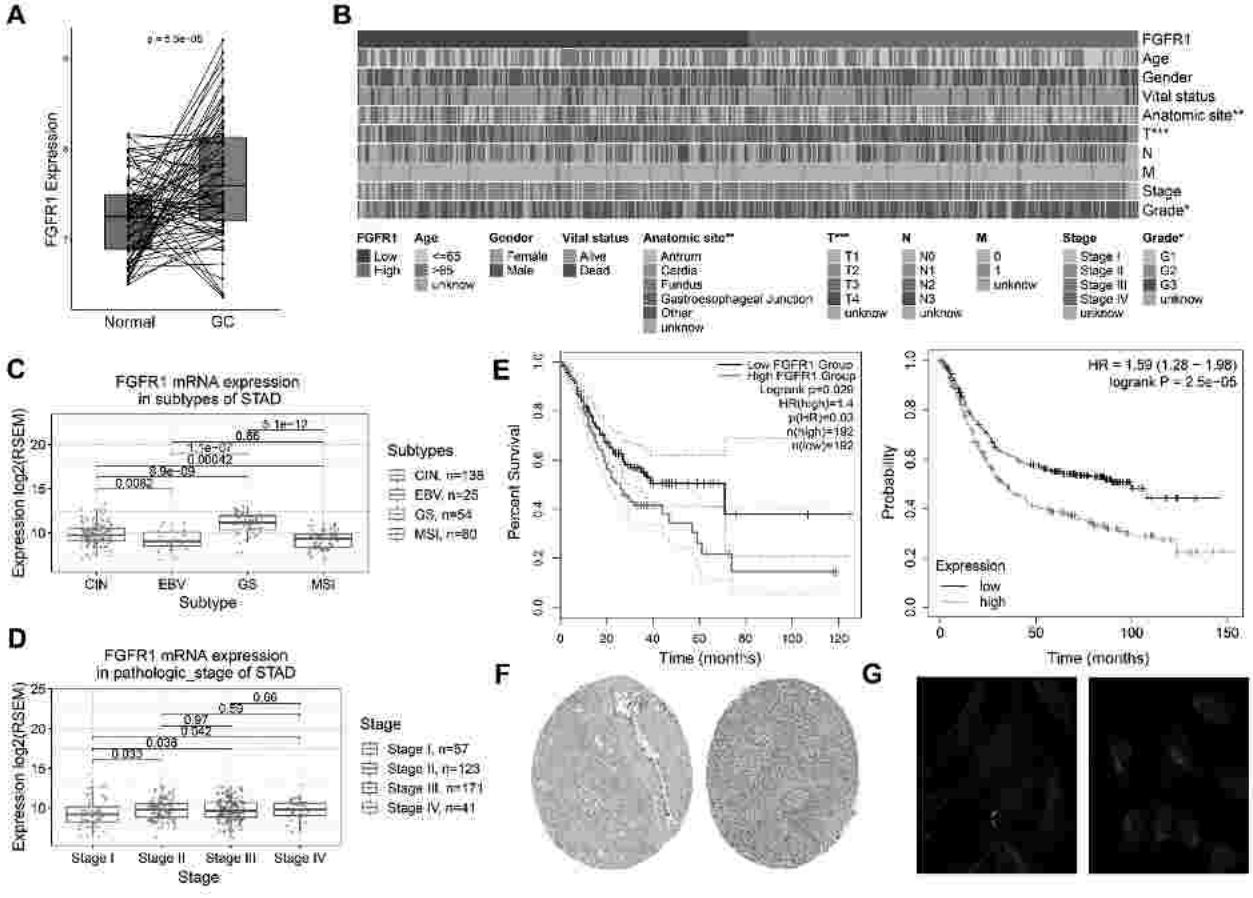
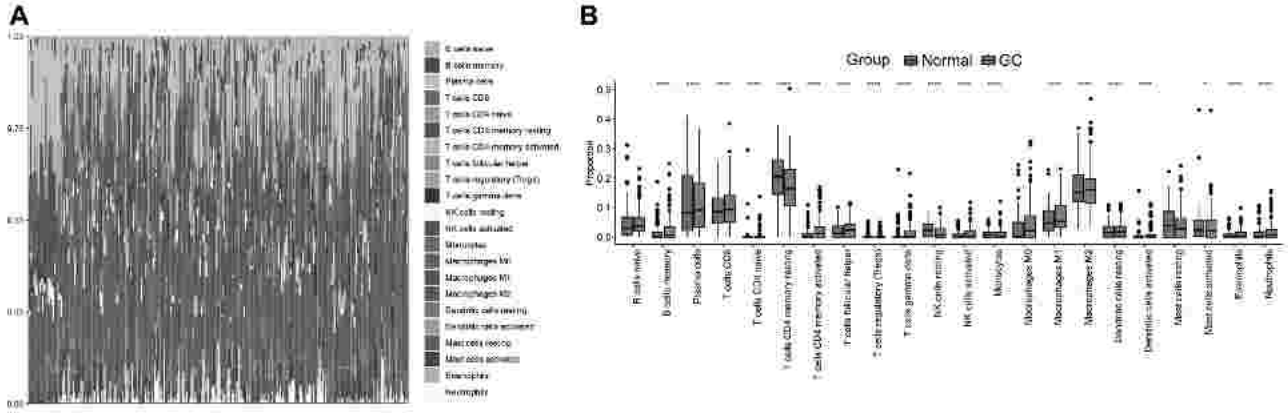


Fig. 10. Correlation analysis between core gene FGFR1 and clinical indicators of GC. (A) Paired samples t test shows the expression levels of FGFR1 protein in the normal group and GC group. (B) Atlas of FGFR1-related clinicopathological characteristics. (C) FGFR1 mRNA levels across different GC subtypes. (D) FGFR1 mRNA transcript levels across distinct pathological stages of GC. (E) Survival curve of FGFR1 in GC. (F) Immunohistochemical study of FGFR1 in normal gastric tissue and gastric adenocarcinoma tissue. (G) Immunofluorescence localization map of FGFR1 in GC tissues.

4.11Tumor immune infiltration analysis and immune checkpoint analysis

To characterize alterations in the immune microenvironment across samples and groups, we conducted immune infiltration analysis, which revealed differential infiltration levels of 22 distinct immune cell types (Fig. 11A). A statistically significant difference was observed in immune cell infiltration levels between the normal and GC groups (Fig. 11B). Among them, memory B cells, plasma cells, CD8+ T cells, activated memory CD4+ T cells, follicular helper T cells, activated NK cells, M1 macrophages, M2 macrophages, resting dendritic cells, activated dendritic cells, eosinophils, and neutrophils exhibited high infiltration levels in GC group, while resting memory CD4+ T cells, resting NK cells, monocytes, and activated mast cells showed low infiltration levels in the tumor group. Through immune cell correlation analysis, M1 macrophages showed a significant positive correlation with activated memory CD4+ T cells and M0 macrophages, and a significant negative correlation with plasma cells. Additionally, activated memory CD4+ T cells were significantly negatively correlated with resting memory CD4+ T cells. FGFR1 expression showed a significant positive correlation with naive B cells, CD8+ T cells, monocytes, and M2 macrophages, and a significant negative correlation with plasma cells and resting NK cells (Fig. 11C). The results showed that most immune checkpoints were significantly positively correlated, with the notable exceptions of VTCN1 and BTNL3. The expression of FGFR1 is significantly positively correlated with most immune checkpoints, while it is significantly negatively correlated with BTNL3, CEACAM1 and TNFRSF14. (Fig. 11D).



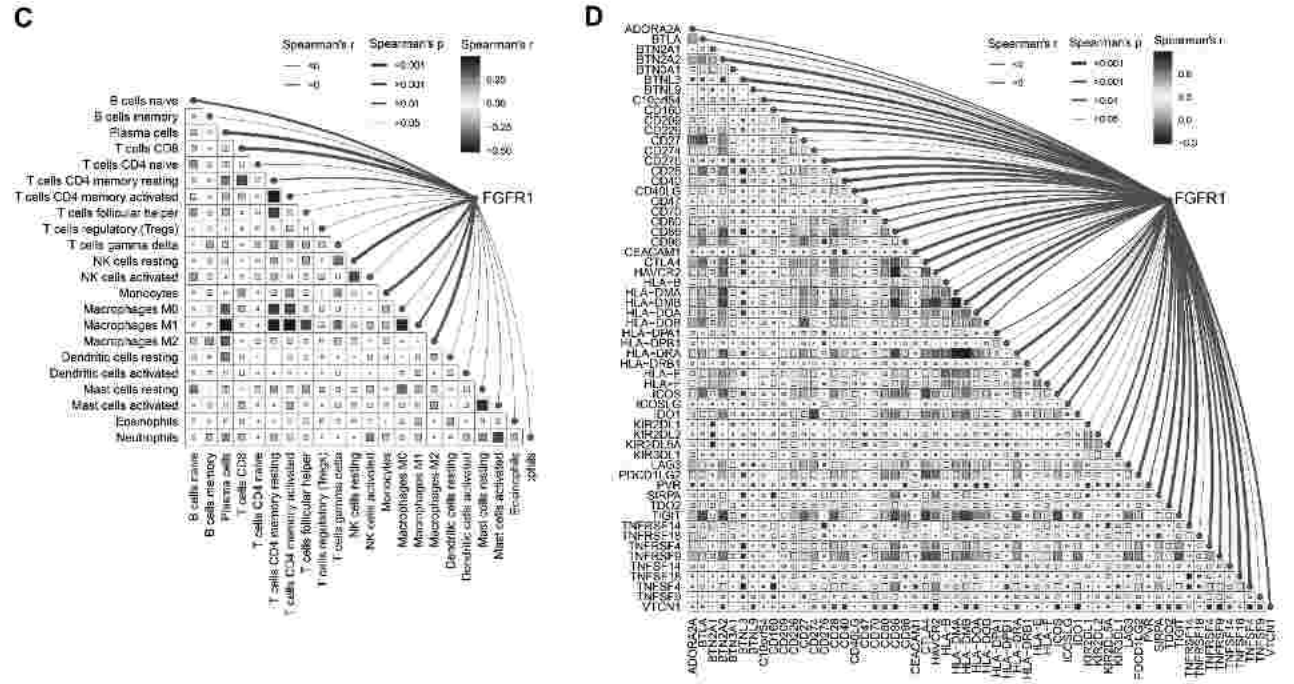
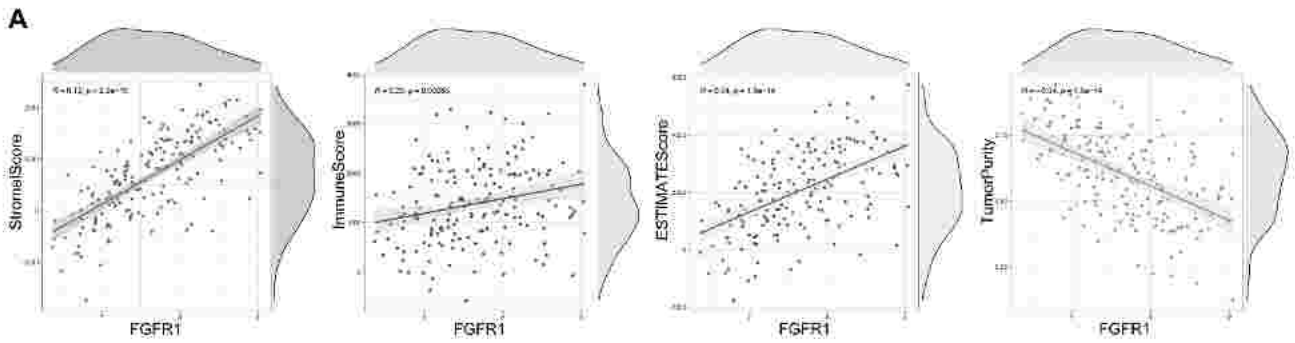


Fig. 11. Correlation analysis between the core gene FGFR1 and the immune microenvironment of GC. (A) Distribution of 22 immune cell populations in each sample. (B) Comparative analysis of 22 immune cell infiltration levels in normal and GC groups. (C) This analysis assessed the correlation between FGFR1 and 22 immune cell types, along with the inter-correlations among these immune cell subpopulations. (D) This analysis assessed the correlation between FGFR1 and 58 immune checkpoints, along with the inter-correlations among these 58 immune checkpoints.

4.12TME Analysis

By performing TME analysis on GC data sets from different databases, we found, it was found that the expression of FGFR1 was significantly correlated with StromalScore, ImmuneScore, and ESTIMATEScore (Fig. 12A, B). As the expression of FGFR1 increased, both the proportion of stromal cells and the degree of immune cell infiltration in the TME showed an increasing trend, while the inferred tumor purity based on the overall score gradually decreased. Building on these findings, further survival analysis explored the relationship between tumor purity and prognostic value. The results indicated that patients with low tumor purity had significantly worse prognosis than those with high tumor purity (Fig. 12C), suggesting that low tumor purity is associated with poor prognosis.



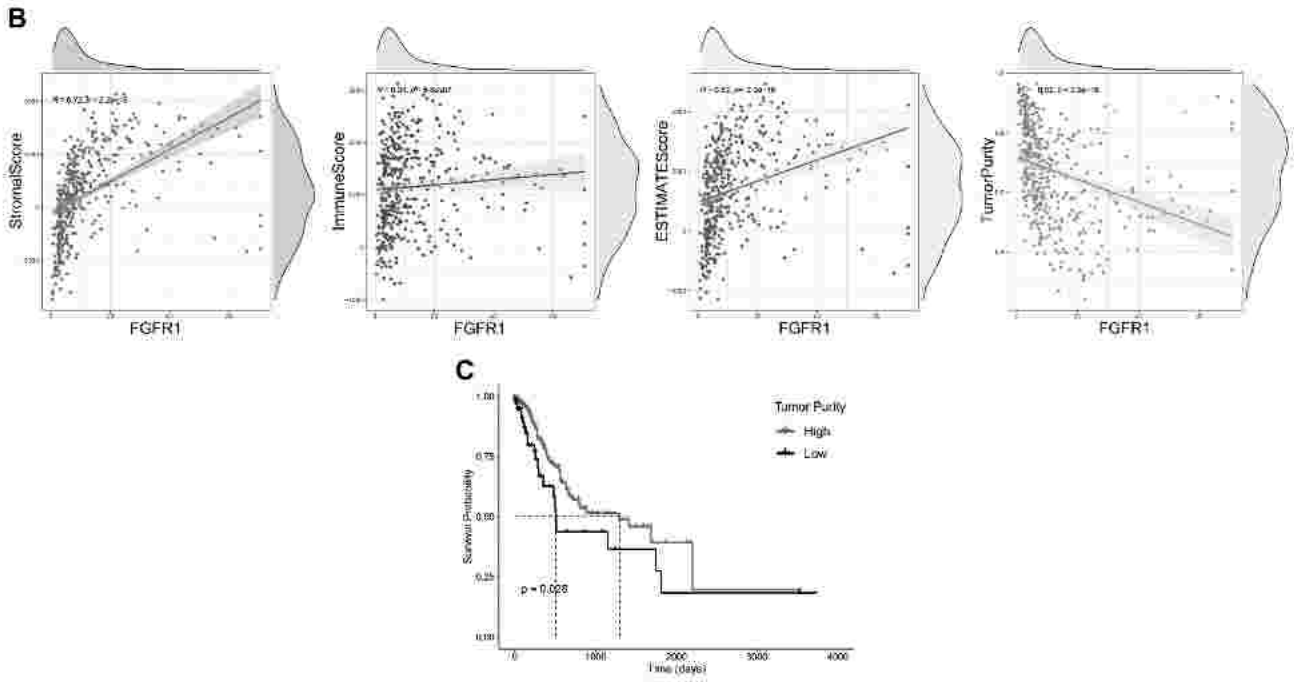
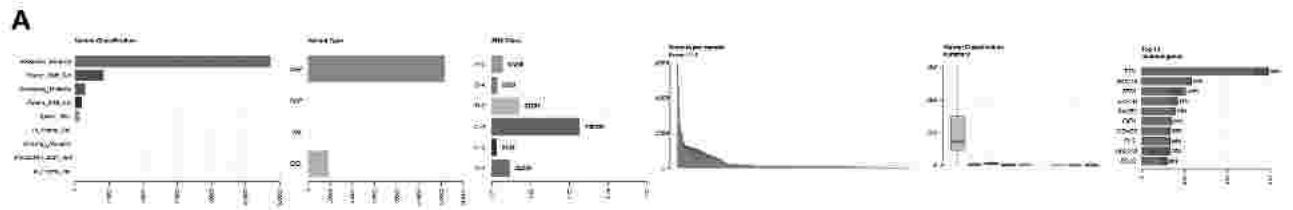


Fig. 12. Correlation analysis between the core gene FGFR1 and the TME of GC. (A) Scatter plot of correlation between FGFR1 and StromalScore, ImmuneScore, ESTIMATEScore, and TumorPurity in GEO database samples. (B) Scatter plot of correlation between FGFR1 and StromalScore, ImmuneScore, ESTIMATEScore, and TumorPurity in TCGA database samples. (C) Relationship between tumor purity and prognostic value.

4.13Tumor somatic mutation analysis

Visualization of GC mutation data reveals that missense mutations constitute the largest proportion, representing the primary mutation type driving GC development. Single nucleotide variants (SNVs) predominate, with frequencies significantly higher than those of insertions (INS) and deletions (DEL). Among SNV types, C>T transitions are the most common. Regarding gene mutation frequency, TTN exhibits the highest mutation rate (54%), mainly consisting of missense mutations (Fig. 13A). Comparing gene mutation frequencies between the low and high FGFR1 expression groups in GC shows that the low expression group has a significantly higher mutation rate (97.03%) than the high expression group (89.71%). Additionally, the FGFR1 low expression group displays increased mutation frequencies in several tumor-related genes, especially TTN and TP53 (Fig. 13B, C). Furthermore, tumor mutational burden (TMB) analysis indicates that the FGFR1 low expression group is more likely to be associated with high TMB compared to the high expression group (Fig. 13D).



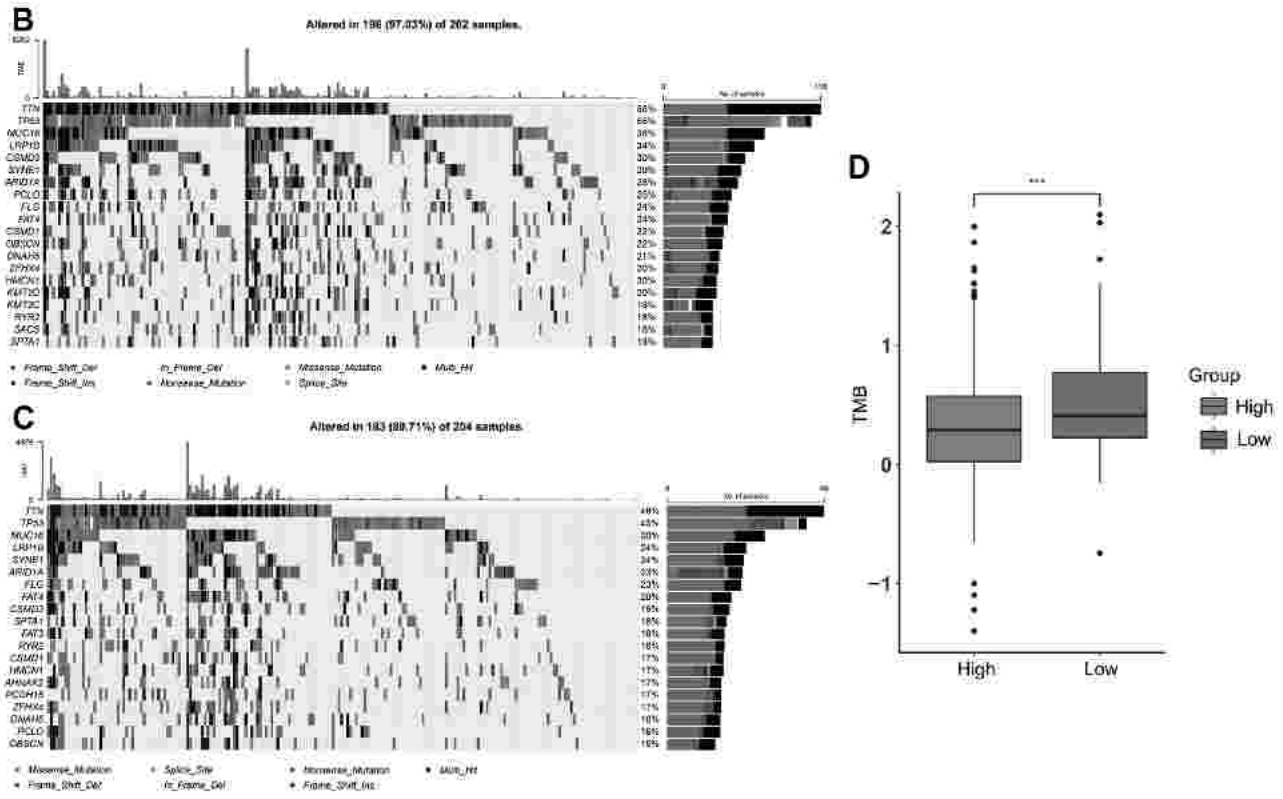


Fig. 13. Correlation analysis between core gene FGFR1 and somatic mutations in GC. (A) Mutation map of GC. (B) Mutation map of FGFR1 low expression group in GC. (C) Mutation map of FGFR1 high expression group in GC. (D) Difference in TMB between FGFR1 low expression group and high expression group in GC.

4.14FGFR1 methylation analysis and DNA damage repair system analysis

The correlation analysis of FGFR1 methylation and mRNA expression in GC shows a statistically significant negative correlation between increased FGFR1 methylation levels and decreased mRNA expression levels (Fig. 14A), consistent with the classic mechanism of epigenetic regulation. The survival curve indicates that patients with high FGFR1 methylation exhibit a better survival outcome compared to those in the low methylation group (Fig. 14B), suggesting that high FGFR1 methylation is associated with improved patient survival. Cellular genomic stability is predominantly ensured by the DNA damage repair system, a central protective mechanism. By analyzing the correlation between FGFR1 and the MMR system and HRR system, it was found that FGFR1 is negatively correlated with most repair genes (Fig. 14C, D), suggesting that excessive activation of FGFR1 may weaken DNA repair capacity, increase genomic instability, and promote the occurrence and development of GC.

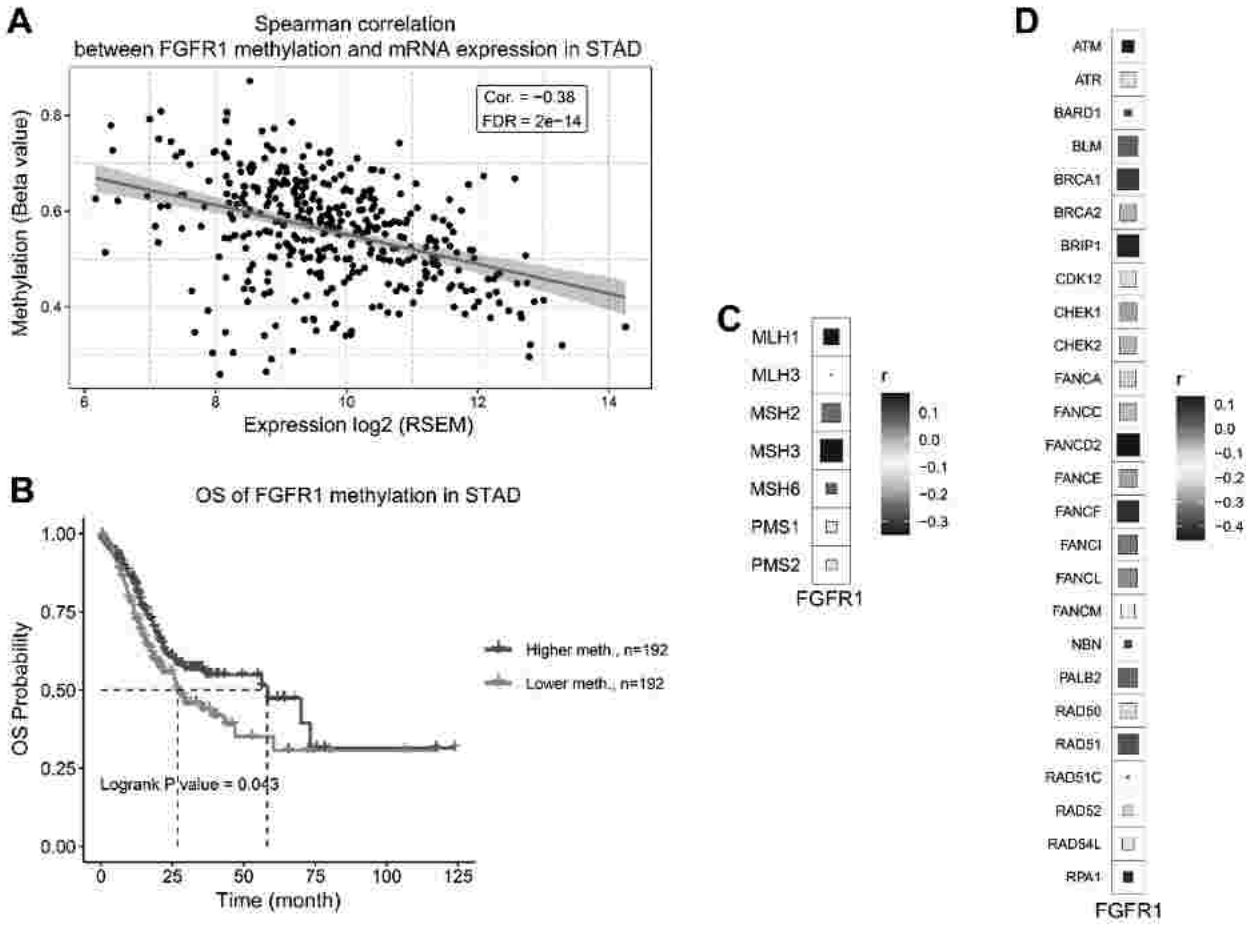


Fig. 14. Analysis of core gene FGFR1 methylation and DNA damage repair system. (A) Relationship between FGFR1 methylation and mRNA expression. (B) Differences in survival analysis between the FGFR1 hypermethylation group and the hypomethylation group. (C) Heat map of correlation between FGFR1 and MMR system. (D) Heat map of correlation between FGFR1 and HRR system.

4.15FGFR1 and miRNA regulatory analysis

Using the ENCORI and miRDB databases, we predicted miRNAs targeting the core genes. A total of 153 and 152 miRNAs were identified from ENCORI and miRDB, respectively. The intersection of these two sets yielded 21 common miRNAs (Fig. 15A), including hsa-miR-16-5p, hsa-miR-15b-5p, and hsa-miR-374b-3p. Subsequently, the miRNA-mRNA regulatory network was constructed using Cytoscape 3.10.3 (Fig. 15B).

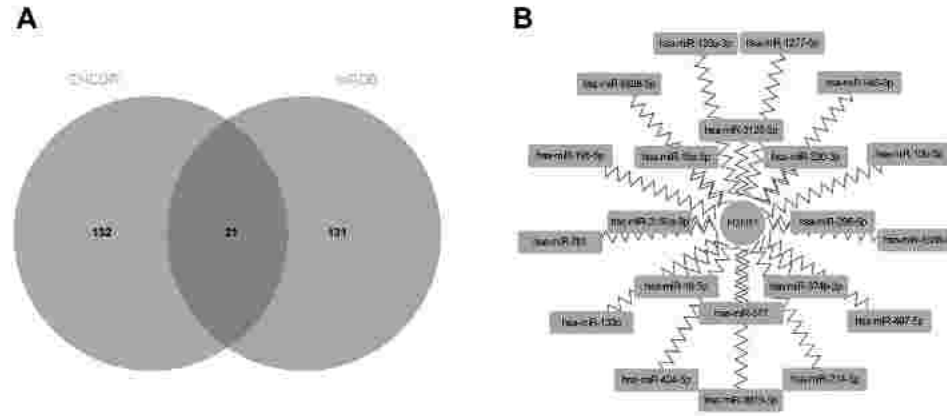


Fig. 15. miRNA-mRNA regulatory network related to the core gene FGFR1. (A) Venn shows the shared prediction results of the ENCORI database and the miRDB database. (B)miRNA-mRNA regulatory network. Circles represent mRNA and rectangles represent predicted miRNAs.

4.16FGFR1-related transcription factors screening and proteins prediction

We screened six transcription factor prediction databases and identified the key transcription factor CTCF (Fig. 16A). Additionally, screening three protein interaction databases revealed two key proteins: FGF2 and FGF23 (Fig. 16B, C). To obtain the corresponding human protein structures, we retrieved files from the RCSB PDB database based on UniProt entries, selecting structures with appropriate resolution and experimental methods. The proteins included FGFR1 (ID: 5EW8), CTCF (ID: 5KKQ), FGF2 (ID: 8OM6), and FGF23 (ID: 2P39). After removing water molecules and ligands using PyMOL 3.1.3.1, the protein structures were imported into the HDOCK Server platform for molecular docking. The docking results showed that FGFR1 exhibited strong binding affinity with CTCF, FGF2, and FGF23, as indicated by docking scores less than -200 and confidence scores greater than 0.8 (Table 1). These results suggest reliable model predictions. The best predicted models, CTCF-FGFR1 and FGF23-FGFR1, were selected for further analysis. Amino acid residues with interaction distances within 3 Å were visualized using PyMOL 3.1.3.1 (Fig. 16D, E).

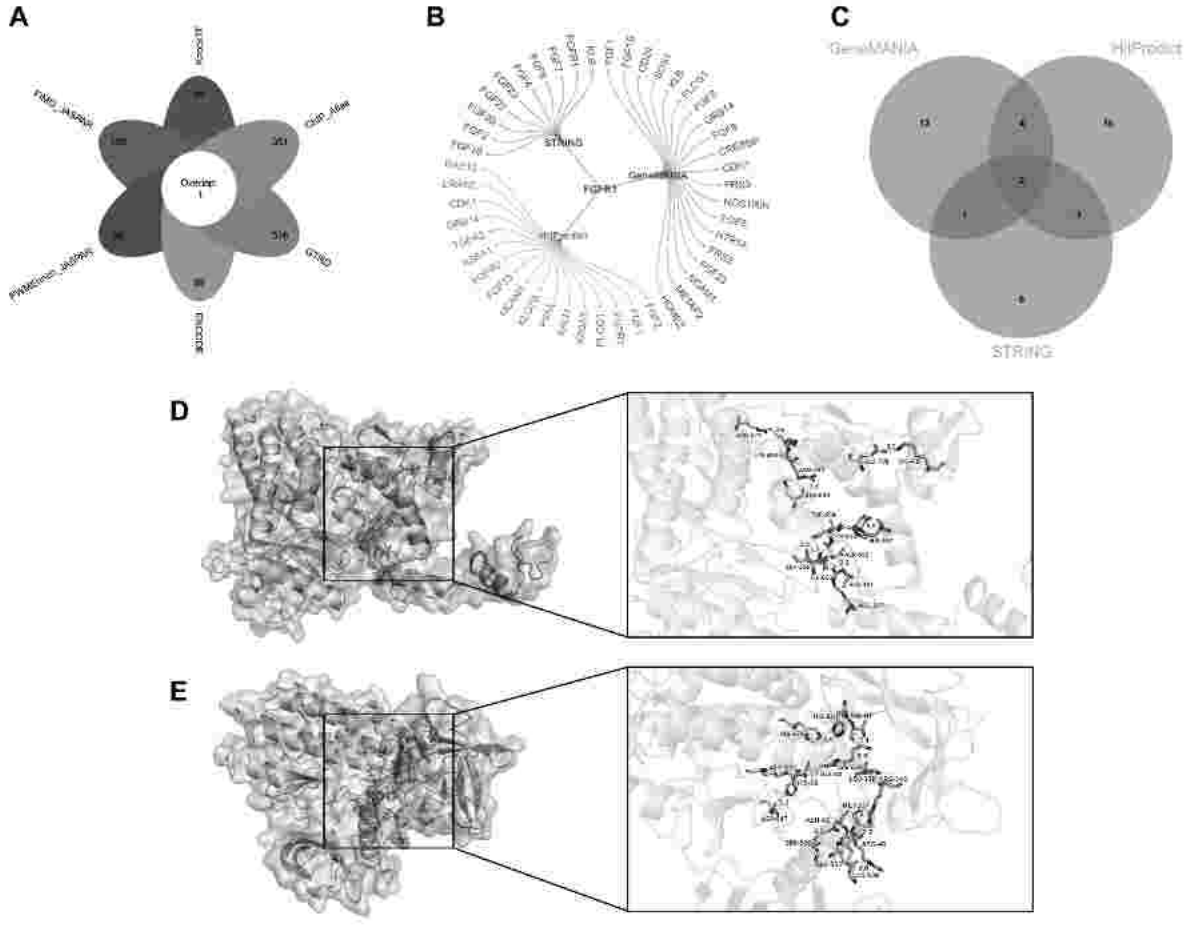


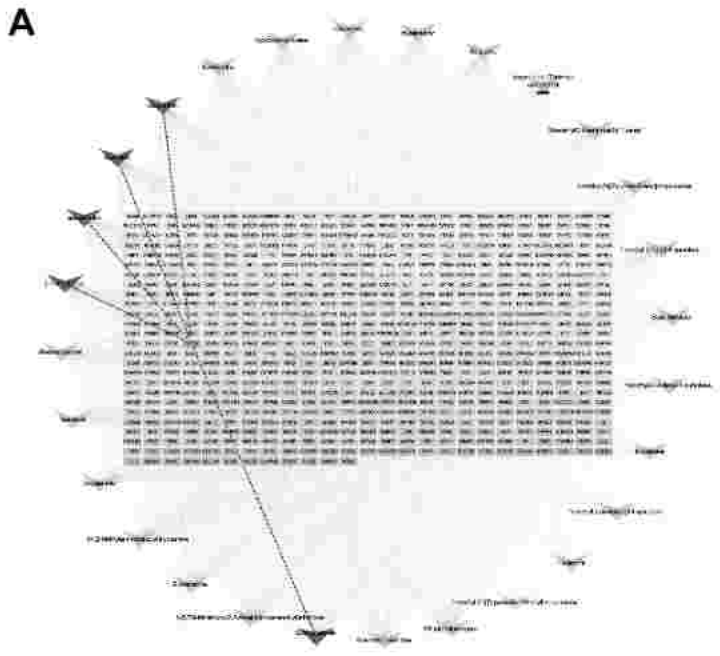
Fig. 16. Screening and docking of FGFR1-related transcription factors and interacting proteins. (A) Screening of key transcription factors upstream of FGFR1. (B) Graphical representation of the proteins interacting with FGFR1 identified through screening. (C) Venn shows the common prediction results of three protein interaction databases. (D) Visualization of molecular docking of CTCF and FGFR1. (E) Visualization of molecular docking of FGF23 and FGFR1.

Table 1 Molecular docking results of the core target FGFR1 with key transcription factors and proteins.

Gene	Protein	Docking Score	Confidence Score
CTCF - FGFR1	5EW8-5KKQ	-253.45	0.8879
FGF2- FGFR1	5EW8-8OM6	-235.03	0.8456
FGF23- FGFR1	5EW8-2P39	-284.84	0.9368

4.17Molecular docking

According to the node degree calculated from the Evodia rutaecarpa active components -targets network, five core active components were screened: Goshuyuamide I, 6-OH-Luteolin, Gossypetin, Isorhamnetin, and Quercetin (Fig. 17A, Table 2). These five core active components were docked with the FGFR1 target protein individually (Table 3). The molecular docking results showed that the minimum binding energies of all five components with FGFR1 were less than -7 kcal/mol (Table 4), indicating strong binding affinity between the core active components and FGFR1. The docking results were imported into PyMOL 3.1.3.1 for visualization. Further analysis was performed using LigPlot 2.3.1. For Goshuyuamide I-FGFR1, hydrogen bonds were formed with the amino acid residue GLU-486, with bond lengths of 3.1 Å and 3.0 Å (Fig. 17B). For 6-OH-Luteolin-FGFR1, hydrogen bonds were formed with ALA-564, GLU-562, LEU-484, and ASP-641, with bond lengths of 2.7 Å, 3.0 Å, 3.5 Å, and 1.8 Å, respectively (Fig. 17C). For Gossypetin-FGFR1, hydrogen bonds were formed with ALA-564, GLU-562, LEU-484, GLU-531, and ASP-641, with bond lengths of 3.0 Å, 2.0 Å, 2.0 Å, 2.5 Å, and 2.3 Å, respectively (Fig. 17D). For Isorhamnetin-FGFR1, hydrogen bonds were formed with GLU-562, ALA-564, ASP-641, and GLU-531, with bond lengths of 3.6 Å, 3.1 Å, 3.1 Å, and 2.4 Å, respectively (Fig. 17E). For Quercetin-FGFR1, hydrogen bonds were formed with ALA-564, GLU-562, and ASP-641, with bond lengths of 2.8 Å, 3.0 Å, and 2.0 Å, respectively (Fig. 17F). These results demonstrate that the five core active components exhibit strong affinity and stable binding interactions with FGFR1.



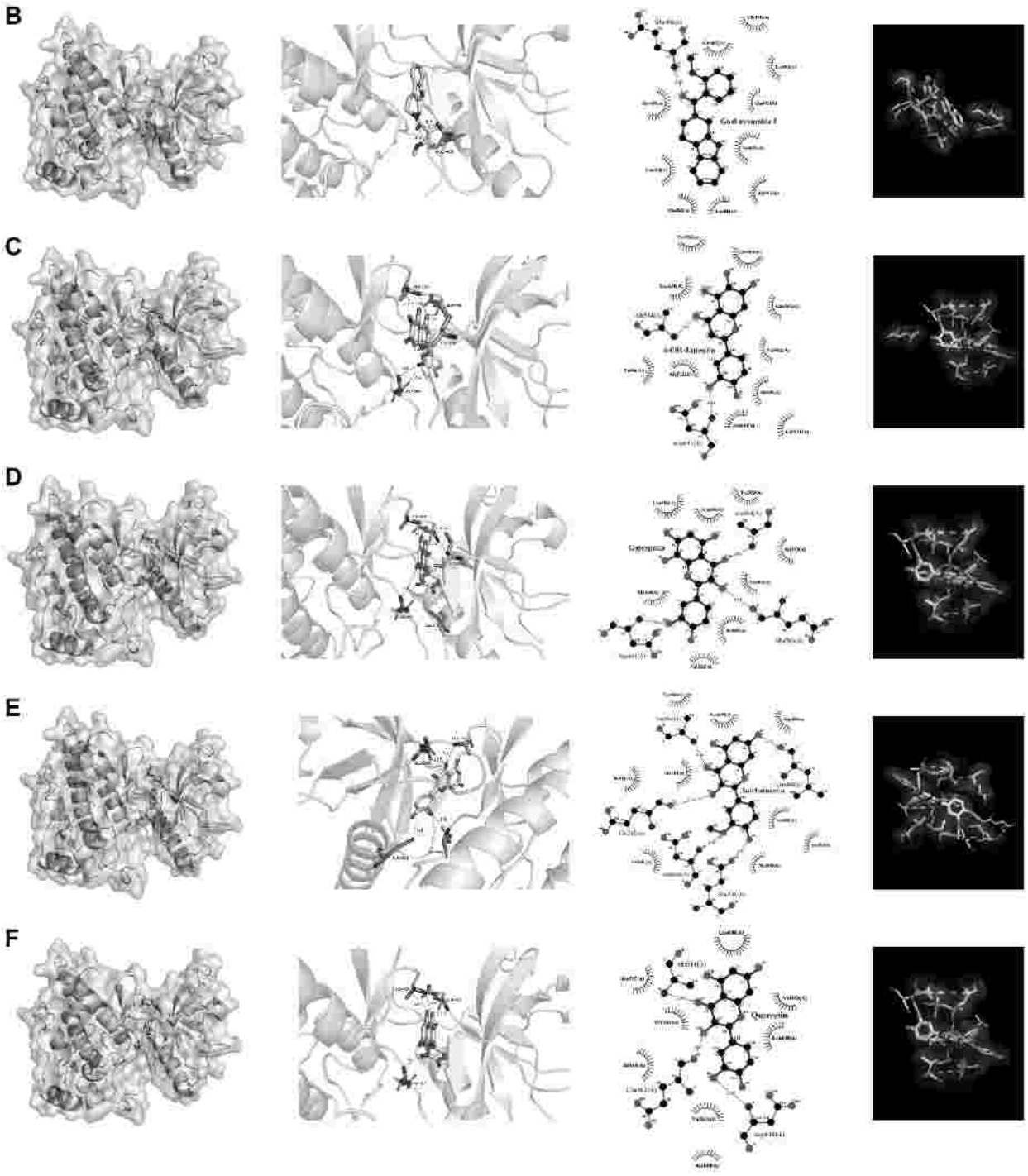


Fig. 17. Molecular docking of the core target FGFR1 and the five core active components of Evodia rutaecarpa. (A) Five core active components of Evodia rutaecarpa corresponding to FGFR1. The dark yellow represents the core target FGFR1, the surrounding dark blue represents the five core active components of Evodia rutaecarpa, and the dark green arrows represent the effects of the five core active components on FGFR1. (B-F) Representative docking combinations: (B) Goshuyuamide I-FGFR1; (C) 6-OH-Luteolin-FGFR1; (D) Gossypetin-FGFR1; (E) Isorhamnetin-FGFR1; (F) Quercetin-FGFR1.

Table 2 Five core active components of Evodia rutaecarpa.

Mol ID	Mol Name	OB/%	DL	SwissADME	Degree
MOL004018	Goshuyuamide I	83.19	0.39	Yes	110
MOL004004	6-OH-Luteolin	46.93	0.28	Yes	104
MOL004020	Gossypetin	35	0.31	Yes	103
MOL000354	Isorhamnetin	49.6	0.31	Yes	103
MOL000098	Quercetin	46.43	0.28	Yes	103

Table 3 Docking pocket parameters of the core target FGFR1 in Autodock Vina.

Target	PDB ID	Center x	Center y	Center z	Size x	Size y	Size z
FGFR1	5EW8	83.346	-2.604	18.475	64.0	56.0	50.0

Table 4 Binding energy of FGFR1 and the five core active components of Evodia rutaecarpa.

Target	Affinity (kcal/mol)				
	Goshuyuamide I	6-OH-Luteolin	Gossypetin	Isorhamnetin	Quercetin
FGFR1	-8.0	-9.2	-8.8	-8.8	-8.9

5Discussion

Globally, GC holds the fifth position in cancer incidence; however, it presents substantial treatment challenges. With a five-year survival rate under 5%, advanced-stage disease is ultimately characterized by a high recurrence rate and unfavorable outcomes. Therefore, early diagnosis and intervention are crucial for improving prognosis (47,48). Identifying biomarkers of GC can provide a basis for early diagnosis and offer potential molecular targets for drug therapy.

This study integrates network pharmacology, transcriptomics, computer prediction, and molecular docking technologies to systematically explore the inhibitory mechanism of Evodia rutaecarpa on GC. It clarifies Evodia rutaecarpa's active components, targets, and key pathways, and verifies the binding strength between active components and core targets through molecular docking. Based on the GEO database gene chip datasets GSE54129, GSE13911, and GSE33335, 3622 co-expressed DEGs were identified. WGCNA selected 3708 genes which were significantly associated with the phenotype. Subsequently, the intersection of predicted target genes of Evodia rutaecarpa's active components, GC target genes, DEG sets, and genes from phenotype-related WGCNA modules yielded 73 common genes. Furthermore, enrichment analysis demonstrated that the effects of Evodia rutaecarpa on GC might be mediated through diverse pathways and cellular functions. This study identified FGFR1 as a potential biomarker for Evodia rutaecarpa against GC through machine learning algorithms and PPI analysis. Clinical relevance analysis and assessment of FGFR1 were conducted, followed by molecular docking with five active components of Evodia rutaecarpa. Finally, multiple database searches indicated that FGFR1 may be regulated by the transcription factor CTCF, and its potential interacting proteins include FGF2 and FGF23. Molecular docking results suggest that the FGF23-FGFR1 axis may represent the molecular mechanism by which Evodia rutaecarpa inhibits GC.

FGFR1 is the key gene selected in this study for Evodia rutaecarpa to inhibit GC. The protein

FGFR1, part of the fibroblast growth factor receptor (FGFR) family, participates in fundamental cellular activities like proliferation, differentiation, and migration (49). Previous studies have confirmed that FGFR1 promotes the progression and invasion of various cancers, including lung cancer, colorectal cancer, and prostate cancer (50–52). Nevertheless, its function in GC remains incompletely understood (53). Therefore, this study thoroughly explored the biological significance of FGFR1 from multiple aspects, including clinical relevance, tumor immunity, TME, and somatic mutations. These analyses provide new evidence that FGFR1 is a potential biomarker for the anti-GC effects of Evodia rutaecarpa, revealing its potential role in both the TME and the immune milieu of the tumor.

The results of this study show that FGFR1 expression in GC group is significantly higher than that in the normal group, and high and low FGFR1 expression levels are significantly associated with T staging and poor prognosis. Earlier analyses via qRT-PCR and IHC revealed markedly elevated FGFR1 levels in GC tissues relative to normal controls (53).GO enrichment analysis ($P < 0.05$) shows that FGFR1 is significantly enriched in cell chemotaxis and its positive regulation, positive regulation of the MAPK cascade, positive regulation of protein phosphorylation, and PI3K/AKT signaling pathway and its positive regulation. Studies have found that FGFR1 activation can promote CX3CL1/CX3CR1-dependent tumor-associated macrophage chemotactic movement (54). Moreover, high expression of FGFR1 drives tumor proliferation through the MAPK/PI3K/AKT pathway and participates in shaping the immunosuppressive microenvironment (55,56). KEGG enrichment analysis ($P < 0.05$) shows that FGFR1 is significantly enriched in the calcium, RAS, MAPK, PI3K/AKT, proteoglycans in cancer, and Rap1 signaling pathways. Previous studies indicate that TROP2 (tumor-associated calcium signal transducer 2) shows specific overexpression in GC (57). The RAS/RAF/MEK/ERK pathway is one of the most frequently dysregulated kinase cascades in human cancers, and blocking this pathway can induce apoptosis and inhibit the proliferation of GC AGS cells (58). Multifunctional proteoglycans are highly expressed in GC tissues and play an important role in tumor cell proliferation, possibly serving as prognostic indicators for GC patients (59,60). In addition, the Rap1 signaling pathway also plays an important role in the occurrence and development of GC (61). These results indicate that Evodia rutaecarpa mediates its effects on GC through multiple signaling pathways.

Immune checkpoints, expressed on immune cell surfaces, serve crucial functions in immune response regulation. Their activity prevents excessive inflammatory damage and contributes to tumor immune escape. In our analysis of 58 immune checkpoints, we found that the expression of FGFR1 is significantly positively correlated with most immune checkpoints (such as BTN2A2, CD209, CD276, and TDO2), suggesting that these genes may work together in the processes of immune response and tumor immune escape. It has been reported that BTN2A2 protein is highly expressed in certain tumor tissues and in activated antigen-presenting cells (APCs); BTN2A2 can inhibit T cell activation and proliferation. Targeting BTN2A2 with a specific antibody elicits anti-tumor activity, which is mediated by the Rap1 signaling pathway (62). In GC, CD209 drives disease progression by targeting the JAK2/STAT3 signaling axis (63). By triggering apoptosis in T cells and reducing chemokine secretion, CD276 plays a role in immune suppression and the advancement of tumors. The upregulation of CD276 facilitates this immune suppression, which in turn promotes the migration and invasion of GC cells (64–66). TDO2 is a key factor promoting GC progression, and inhibiting TDO2 can exert multiple anti-tumor effects, significantly reducing the proliferation, colony formation, invasion, spheroid formation, and organoid growth of cancer cells

(67). Based on these findings, we speculate that FGFR1 promotes the high expression of related immune checkpoints by regulating their transcription or signaling pathways, thereby modulating the immunosuppressive TME of GC. This regulation inhibits the immune system's anti-tumor response, interferes with immune surveillance, and enhances the immune escape capability of GC cells, providing potential new targets for immunotherapy.

In cancer biology, the TME consists of tumor components and non-tumor components, with the latter mainly including stromal cells and immune cells. According to the ESTIMATE algorithm, gene expression data can be used to infer the infiltration levels of stromal and immune cells in tumor tissues, as well as tumor purity (68). The analysis of the TME and immune infiltration in this study indicates that GC tissues with high FGFR1 expression have a higher ImmuneScore and a greater abundance of immature B cells, CD8+ T cells, monocytes, and M2 macrophages. This suggests that FGFR1 may promote an anti-tumor immune response. However, the immunosuppressive M2 macrophages present in the tumor can enhance tumor progression and immune evasion (69). Notably, high FGFR1 expression is often accompanied by low tumor purity, which has been associated with poor prognosis. To further explore this, we analyzed mutation data in GC and found that the mutation rate in the low FGFR1 expression group was significantly higher than that in the high FGFR1 expression group. Additionally, the low FGFR1 expression group was more likely to be accompanied by high TMB compared to the high FGFR1 expression group. In this context, the high FGFR1 expression group with low TMB exhibits lower immunogenicity, limiting the immune system's recognition of tumor antigens and resulting in immune cells being unable to exert their killing effect on tumor cells. In contrast, the low FGFR1 expression group with high TMB has higher immunogenicity, enhancing immune surveillance sensitivity and the cytotoxic effect of immune cells. In recent years, genomic indicators such as TMB have been shown to correlate with responses to immunotherapy (70,71). Previous studies have found that the poor response to tumor immunotherapy is mainly attributed to factors including low tumor immunogenicity and low TMB (72). In Asian populations, GC patients with high TMB exhibit higher sensitivity and response rates to immunotherapy compared to those with low TMB (73,74). Consequently, the benefits of immunotherapy are significantly greater in the high TMB group. Therefore, we speculate that high FGFR1 expression characterizes an immune status with low antigenic targets and strong immunosuppression, which partly explains the paradoxical association between high immune cell infiltration and poor prognosis. The results imply that measuring FGFR1 expression could aid in forecasting which GC patients are likely to respond to immunotherapeutic interventions.

Molecular docking showed that the FGF23-FGFR1 interaction model has good affinity and binding ability. Similarly, the binding model of the five core active components of Evodia rutaecarpa to FGFR1 also demonstrated promising binding potential. Previous studies have found that the carcinogenic effect of FGFR1 is usually the result of genomic abnormalities, including gene amplification, activating mutations, and gene fusions, and is closely related to fibroblast growth factor (FGF) ligands (75). The amplification and overexpression of FGFR1 are mainly observed in GC. Alterations in the FGFR1 gene structure may produce fusion genes that give rise to chimeric proteins. These proteins drive constitutive FGFR1 kinase activity, triggering abnormal downstream signaling (PI3K/AKT, RAS/MAPK) and thereby inducing uncontrolled proliferation and tumorigenesis (76). Belonging to the fibroblast growth factor family, FGF23 is mainly synthesized in osteoblasts and is also present in the mammary glands, stomach, and liver (77). Studies have found that it is highly expressed in GC tissues, positively correlated with the Ki-67 proliferation

index, and relevant in vitro experiments indicate that FGF23 can promote the proliferation and invasion of GC cells (78). Therefore, we speculate that phytochemicals derived from Evodia rutaecarpa may inhibit the occurrence and development of GC by regulating the FGF23-FGFR1 axis.

In summary, this study indicates that FGFR1 plays a key role in the progression of GC. We conducted a comprehensive characterization of the biological function of FGFR1 in GC, particularly in shaping and regulating the immune microenvironment, and revealed its potential significance as a biomarker for GC and in predicting sensitivity to immunotherapy. We proposed that Evodia rutaecarpa intervenes in the molecular mechanism of GC by regulating the FGF23-FGFR1 axis. This suggests that Evodia rutaecarpa can exert its anti-GC effects through multiple components, multiple targets, and multiple pathways, providing new insights for immunotherapy strategies and clinical practice in GC. Despite its contributions, the current research has inherent limitations that warrant consideration. This study is based on public database data and bioinformatics predictions. Although it elucidates new pathway mechanisms for Evodia rutaecarpa's intervention in GC, its specific regulatory effects still need to be validated through extensive multi-omics techniques and in vitro and in vivo experiments. The translation of research findings into effective clinical applications will be a focus of subsequent basic research.

6Conclusion

This study systematically explored the molecular mechanisms of Evodia rutaecarpa treatment in GC by integrating transcriptomics, WGCNA, network pharmacology, and machine learning methods. Through multi-strategy screening, five key targets of Evodia rutaecarpa in GC were discovered, and a diagnostic model was constructed for evaluation. Among these targets, FGFR1 was recognized as a potential biomarker, especially for predicting the sensitivity of GC to immunotherapy by influencing specific immune-related parameters. Molecular docking confirmed a high binding potential between FGFR1 and the main active components of Evodia rutaecarpa extract. These results suggest that Evodia rutaecarpa may exert a synergistic effect through the regulation of the FGF23-FGFR1 axis involving multiple active components, targets, and signaling pathways. Although the study is based on public databases and lacks experimental validation, it provides new insights and directions for further research on the mechanisms of Evodia rutaecarpa treatment in GC.

References

1. Bray F, Laversanne M, Sung H, Ferlay J, Siegel RL, Soerjomataram I, et al. Global cancer statistics 2022: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA Cancer J Clin. 2024;74(3):229–63. doi:10.3322/caac.21834 PubMed PMID: 38572751.

2. Sundar R, Nakayama I, Markar SR, Shitara K, van Laarhoven HWM, Janjigian YY, et al. Gastric cancer. Lancet (Lond Engl). 2025 Jun 7;405(10494):2087–102. doi:10.1016/S0140-6736(25)00052-2 PubMed PMID: 40319897.

3. R K, A B, S G. Cancer treatment therapies: traditional to modern approaches to combat cancers. Mol Biol Rep. 2023 Nov;50(11). doi:10.1007/s11033-023-08809-3 PubMed PMID: 37828275.

4. Passaro A, Al Bakir M, Hamilton EG, Diehn M, André F, Roy-Chowdhuri S, et al. Cancer

biomarkers: emerging trends and clinical implications for personalized treatment. Cell. 2024 Mar 28;187(7):1617–35. doi:10.1016/j.cell.2024.02.041 PubMed PMID: 38552610; PubMed Central PMCID: PMC7616034.

5. Luo D, Liu Y, Lu Z, Huang L. Targeted therapy and immunotherapy for gastric cancer: rational strategies, novel advancements, challenges, and future perspectives. Mol Med. 2025 Feb 8;31(1):52. doi:10.1186/s10020-025-01075-y

6. Matsuoka T, Yashiro M. Bioinformatics analysis and validation of potential markers associated with prediction and prognosis of gastric cancer. Int J Mol Sci. 2024 May 28;25(11):5880. doi:10.3390/ijms25115880 PubMed PMID: 38892067; PubMed Central PMCID: PMC11172243.

7. Li S, Chen X, Shi H, Yi M, Xiong B, Li T. Tailoring traditional chinese medicine in cancer therapy. Mol Cancer. 2025 Jan 21;24(1):27. doi:10.1186/s12943-024-02213-6

8. Yu HI, Chang HY, Lu CH, Tai TS, Kung FP, Zhang YS, et al. Evodiamine exerts anti-cancer activity including growth inhibition, cell cycle arrest, and apoptosis induction in human follicular thyroid cancers. Am J Cancer Res. 2024;14(10):4989–99. doi:10.62347/DNTG2917 PubMed PMID: 39553211; PubMed Central PMCID: PMC11560817.

9. Chen G, Du HL, Liu JN, Cheng J, Chen J, Yin XY, et al. Evodiamine boosts AR expression to trigger senescence and halt proliferation in OSCC cells. Curr Issues Mol Biol. 2025 Jul 17;47(7):558. doi:10.3390/cimb47070558 PubMed PMID: 40729027; PubMed Central PMCID: PMC12293151.

10. Zhou Z, Zhou Y, Zhang Z, Zhao M, Hu C, Yang L, et al. Progress on the effects and underlying mechanisms of evodiamine in digestive system diseases, and its toxicity: a systematic review and meta-analysis. Phytomed: Int J Phytother Phytopharm. 2024 Sep;132:155851. doi:10.1016/j.phymed.2024.155851 PubMed PMID: 39018943.

11. Yang JY, Kim JB, Lee P, Kim SH. Evodiamine inhibits helicobacter pylori growth and helicobacter pylori-induced inflammation. Int J Mol Sci. 2021 Mar 25;22(7):3385. doi:10.3390/ijms22073385 PubMed PMID: 33806161; PubMed Central PMCID: PMC8036659.

12. Yang JY, Woo HJ, Lee P, Kim SH. Induction of apoptosis and effect on the FAK/AKT/mTOR signal pathway by evodiamine in gastric cancer cells. Curr Issues Mol Biol. 2022 Sep 19;44(9):4339–49. doi:10.3390/cimb44090298 PubMed PMID: 36135210; PubMed Central PMCID: PMC9497533.

13. Zhao Z, Gong S, Wang S, Ma C. Effect and mechanism of evodiamine against ethanol-induced gastric ulcer in mice by suppressing rho/NF-κB pathway. Int Immunopharmacol. 2015 Sep;28(1):588–95. doi:10.1016/j.intimp.2015.07.030 PubMed PMID: 26225926.

14. Wen Z, Feng S, Wei L, Wang Z, Hong D, Wang Q. Evodiamine, a novel inhibitor of the wnt pathway, inhibits the self-renewal of gastric cancer stem cells. Int J Mol Med. 2015 Dec;36(6):1657–63. doi:10.3892/ijmm.2015.2383 PubMed PMID: 26497016.

15. Ru J, Li P, Wang J, Zhou W, Li B, Huang C, et al. TCMSP: a database of systems pharmacology

for drug discovery from herbal medicines. J Cheminform. 2014;6:13. doi:10.1186/1758-2946-6-13 PubMed PMID: 24735618; PubMed Central PMCID: PMC4001360.

16. Kim S, Chen J, Cheng T, Gindulyte A, He J, He S, et al. PubChem 2025 update. Nucleic Acids Res. 2025 Jan 6;53(D1):D1516–25. doi:10.1093/nar/gkae1059

17. Daina A, Michielin O, Zoete V. SwissADME: a free web tool to evaluate pharmacokinetics, drug-likeness and medicinal chemistry friendliness of small molecules. Sci Rep. 2017 Mar 3;7(1):42717. doi:10.1038/srep42717

18. Lv Q, Chen G, He H, Yang Z, Zhao L, Zhang K, et al. TCMBank-the largest TCM database provides deep learning-based chinese-western medicine exclusion prediction. Signal Transduction Targeted Ther. 2023 Mar 31;8:127. doi:10.1038/s41392-023-01339-1 PubMed PMID: 36997527; PubMed Central PMCID: PMC10063611.

19. Daina A, Michielin O, Zoete V. SwissTargetPrediction: updated data and new features for efficient prediction of protein targets of small molecules. Nucleic Acids Res. 2019 Jul 2;47(W1):W357–64. doi:10.1093/nar/gkz382

20. Shannon P, Markiel A, Ozier O, Baliga NS, Wang JT, Ramage D, et al. Cytoscape: a software environment for integrated models of biomolecular interaction networks. Genome Res. 2003 Nov;13(11):2498–504. doi:10.1101/gr.1239303 PubMed PMID: 14597658; PubMed Central PMCID: PMC403769.

21. Stelzer G, Rosen N, Plaschkes I, Zimmerman S, Twik M, Fishilevich S, et al. The GeneCards suite: from gene data mining to disease genome sequence analyses. Curr Protoc Bioinform. 2016 Jun 20;54:1.30.1-1.30.33. doi:10.1002/cpbi.5 PubMed PMID: 27322403.

22. Amberger JS, Hamosh A. Searching online mendelian inheritance in man (OMIM): a knowledgebase of human genes and genetic phenotypes. Curr Protoc Bioinform. 2017 Jun 27;58:1.2.1-1.2.12. doi:10.1002/cpbi.27 PubMed PMID: 28654725; PubMed Central PMCID: PMC5662200.

23. Whirl-Carrillo M, Huddart R, Gong L, Sangkuhl K, Thorn CF, Whaley R, et al. An evidence-based framework for evaluating pharmacogenomics knowledge for personalized medicine. Clin Pharmacol Ther. 2021 Sep;110(3):563–72. doi:10.1002/cpt.2350 PubMed PMID: 34216021; PubMed Central PMCID: PMC8457105.

24. Zhou Y, Zhang Y, Zhao D, Yu X, Shen X, Zhou Y, et al. TTD: therapeutic target database describing target druggability information. Nucleic Acids Res. 2024 Jan 5;52(D1):D1465–77. doi:10.1093/nar/gkad751 PubMed PMID: 37713619; PubMed Central PMCID: PMC10767903.

25. Knox C, Wilson M, Klinger CM, Franklin M, Oler E, Wilson A, et al. DrugBank 6.0: the DrugBank knowledgebase for 2024. Nucleic Acids Res. 2024 Jan 5;52(D1):D1265–75. doi:10.1093/nar/gkad976 PubMed PMID: 37953279; PubMed Central PMCID: PMC10767804.

26. Barrett T, Wilhite SE, Ledoux P, Evangelista C, Kim IF, Tomashevsky M, et al. NCBI GEO: archive for functional genomics data sets—update. Nucleic Acids Res. 2013 Jan 1;41(D1):D991–5.

doi:10.1093/nar/gks1193

27. Yang M, Chen T, Liu YX, Huang L. Visualizing set relationships: EVenn's comprehensive approach to venn diagrams. iMeta. 2024;3(3):e184. doi:10.1002/imt2.184

28. Yu G. Thirteen years of clusterProfiler. Innov (Camb (Mass,)). 2024 Nov 4;5(6):100722. doi:10.1016/j.xinn.2024.100722 PubMed PMID: 39529960; PubMed Central PMCID: PMC11551487.

29. Szklarczyk D, Nastou K, Koutrouli M, Kirsch R, Mehryary F, Hachilif R, et al. The STRING database in 2025: protein networks with directionality of regulation. Nucleic Acids Res. 2025 Jan 6;53(D1):D730–7. doi:10.1093/nar/gkae1113 PubMed PMID: 39558183; PubMed Central PMCID: PMC11701646.

30. Chin CH, Chen SH, Wu HH, Ho CW, Ko MT, Lin CY. cytoHubba: identifying hub objects and sub-networks from complex interactome. BMC Syst Biol. 2014;8 Suppl 4(Suppl 4):S11. doi:10.1186/1752-0509-8-S4-S11 PubMed PMID: 25521941; PubMed Central PMCID: PMC4290687.

31. Liu CJ, Hu FF, Xie GY, Miao YR, Li XW, Zeng Y, et al. GSCA: an integrated platform for gene set cancer analysis at genomic, pharmacogenomic and immunogenomic levels. Briefings Bioinf. 2023 Jan 19;24(1):bbac558. doi:10.1093/bib/bbac558 PubMed PMID: 36549921.

32. Tang Z, Kang B, Li C, Chen T, Zhang Z. GEPIA2: an enhanced web server for large-scale expression profiling and interactive analysis. Nucleic Acids Res. 2019 Jul 2;47(W1):W556–60. doi:10.1093/nar/gkz430

33. Posta M, Győrffy B. Pathway-level mutational signatures predict breast cancer outcomes and reveal therapeutic targets. Br J Pharmacol. 2025 Dec;182(23):5734–47. doi:10.1111/bph.70215 PubMed PMID: 41057034.

34. Uhlén M, Fagerberg L, Hallström BM, Lindskog C, Oksvold P, Mardinoglu A, et al. Proteomics. Tissue-based map of the human proteome. Sci (N Y NY). 2015 Jan 23;347(6220):1260419. doi:10.1126/science.1260419 PubMed PMID: 25613900.

35. de Bruijn I, Kundra R, Mastrogiacomo B, Tran TN, Sikina L, Mazor T, et al. Analysis and visualization of longitudinal genomic and clinical data from the AACR project GENIE biopharma collaborative in cBioPortal. Cancer Res. 2023 Dec 1;83(23):3861–7. doi:10.1158/0008-5472.CAN-23-0816 PubMed PMID: 37668528; PubMed Central PMCID: PMC10690089.

36. Li JH, Liu S, Zhou H, Qu LH, Yang JH. starBase v2.0: decoding miRNA-ceRNA, miRNA-ncRNA and protein–RNA interaction networks from large-scale CLIP-seq data. Nucleic Acids Res. 2014 Jan 1;42(D1):D92–7. doi:10.1093/nar/gkt1248

37. Chen Y, Wang X. miRDB: an online database for prediction of functional microRNA targets. Nucleic Acids Res. 2020 Jan 8;48(D1):D127–31. doi:10.1093/nar/gkz757 PubMed PMID: 31504780; PubMed Central PMCID: PMC6943051.

38. Wang J. TFTF: an R-based integrative tool for decoding human transcription factor-target interactions. Biomolecules. 2024 Jun 24;14(7):749. doi:10.3390/biom14070749 PubMed PMID: 39062464; PubMed Central PMCID: PMC11274450.

39. Warde-Farley D, Donaldson SL, Comes O, Zuberi K, Badrawi R, Chao P, et al. The GeneMANIA prediction server: biological network integration for gene prioritization and predicting gene function. Nucleic Acids Res. 2010 Jul;38(Web Server issue):W214-220. doi:10.1093/nar/gkq537 PubMed PMID: 20576703; PubMed Central PMCID: PMC2896186.

40. López Y, Nakai K, Patil A. HitPredict version 4: comprehensive reliability scoring of physical protein–protein interactions from more than 100 species. Database: J Biol Databases Curation. 2015 Dec 21;2015:bav117. doi:10.1093/database/bav117 PubMed PMID: 26708988; PubMed Central PMCID: PMC4691340.

41. UniProt Consortium. UniProt: the universal protein knowledgebase in 2025. Nucleic Acids Res. 2025 Jan 6;53(D1):D609–17. doi:10.1093/nar/gkae1010 PubMed PMID: 39552041; PubMed Central PMCID: PMC11701636.

42. Burley SK, Bhatt R, Bhikadiya C, Bi C, Biester A, Biswas P, et al. Updated resources for exploring experimentally-determined PDB structures and computed structure models at the RCSB protein data bank. Nucleic Acids Res. 2025 Jan 6;53(D1):D564–74. doi:10.1093/nar/gkae1091 PubMed PMID: 39607707; PubMed Central PMCID: PMC11701563.

43. Yan Y, Tao H, He J, Huang SY. The HDOCK server for integrated protein-protein docking. Nat Protoc. 2020 May;15(5):1829–52. doi:10.1038/s41596-020-0312-x PubMed PMID: 32269383.

44. Eberhardt J, Santos-Martins D, Tillack AF, Forli S. AutoDock vina 1.2.0: new docking methods, expanded force field, and python bindings. J Chem Inf Model. 2021 Aug 23;61(8):3891–8. doi:10.1021/acs.jcim.1c00203

45. O'Boyle NM, Banck M, James CA, Morley C, Vandermeersch T, Hutchison GR. Open babel: an open chemical toolbox. J Cheminf. 2011 Oct 7;3:33. doi:10.1186/1758-2946-3-33 PubMed PMID: 21982300; PubMed Central PMCID: PMC3198950.

46. Laskowski RA, Swindells MB. LigPlot+: multiple ligand-protein interaction diagrams for drug discovery. J Chem Inf Model. 2011 Oct 24;51(10):2778–86. doi:10.1021/ci200227u PubMed PMID: 21919503.

47. Fang X, Liu M, Ren Q, Li R, Wu G, Yuan H, et al. Multi-omics analysis identifies LANCL2 as a potential biomarker for the diagnosis and prognosis of gastric cancer. Sci Rep. 2025 May 25;15(1):18231. doi:10.1038/s41598-025-02745-x PubMed PMID: 40414970; PubMed Central PMCID: PMC12104457.

48. Li T, Su W, Wang Z, Wang X, Ma X, Zhao R. ncRNA-mediated ITGB1 upregulation correlates with poor prognosis and tumor-immune infiltration in gastric cancer. Eur J Med Res. 2025 Jul 14;30(1):620. doi:10.1186/s40001-025-02888-7 PubMed PMID: 40660403; PubMed Central PMCID: PMC12261756.

49. Turner N, Grose R. Fibroblast growth factor signalling: from development to cancer. Nat Rev Cancer. 2010 Feb;10(2):116–29. doi:10.1038/nrc2780 PubMed PMID: 20094046.

50. Fan Z, Ma J, Pan X, Zhao L, Wu Y, Lin H, et al. Crosstalk of FGFR1 signaling and choline metabolism promotes cell proliferation and survival in prostate cancer cells. Int J Cancer. 2022 May 1;150(9):1525–36. doi:10.1002/ijc.33922 PubMed PMID: 34985768.

51. Lyu X, Cai R, Han B, Liu Y, Zhang Y, Wu Z, et al. FGFR1-amplified colorectal cancer: a distinct prognostic subtype identified through integrated genomic and immunohistochemical profiling. ESMO Open. 2025 Sep;10(9):105561. doi:10.1016/j.esmoop.2025.105561 PubMed PMID: 40834499; PubMed Central PMCID: PMC12529309.

52. Yang Y, Lu T, Li Z, Lu S. FGFR1 regulates proliferation and metastasis by targeting CCND1 in FGFR1 amplified lung cancer. Cell Adhes Migr. 2020 Dec;14(1):82–95. doi:10.1080/19336918.2020.1766308 PubMed PMID: 32380883; PubMed Central PMCID: PMC7250189.

53. Xie G, Ke Q, Ji YZ, Wang AQ, Jing M, Zou LL. FGFR1 is an independent prognostic factor and can be regulated by miR-497 in gastric cancer progression. Braz J Med Biol Res = Rev Bras Pesqui Med Biol. 2018 Nov 23;52(1):e7816. doi:10.1590/1414-431X20187816 PubMed PMID: 30484492; PubMed Central PMCID: PMC6262748.

54. Zhu L, Weng Z, Shen P, Zhou J, Zeng J, Weng F, et al. S100B regulates inflammatory response during osteoarthritis via fibroblast growth factor receptor 1 signaling. Mol Med Rep. 2018 Dec;18(6):4855–64. doi:10.3892/mmr.2018.9523 PubMed PMID: 30280200; PubMed Central PMCID: PMC6236269.

55. Katoh M, Nakagama H. FGF receptors: cancer biology and therapeutics. Med Res Rev. 2014 Mar;34(2):280–300. doi:10.1002/med.21288 PubMed PMID: 23696246.

56. Liang G, Liu Z, Wu J, Cai Y, Li X. Anticancer molecules targeting fibroblast growth factor receptors. Trends Pharmacol Sci. 2012 Oct;33(10):531–41. doi:10.1016/j.tips.2012.07.001 PubMed PMID: 22884522.

57. Jia L, Fu Y, Zhang N, Liu Y, Su L, Wang H, et al. Directional conjugation of Trop2 antibody to black phosphorus nanosheets for phototherapy in orthotopic gastric carcinoma. Nanomed Nanotechnol Biol Med. 2023 Jul;51:102687. doi:10.1016/j.nano.2023.102687 PubMed PMID: 37121458.

58. Su CC. Tanshinone IIA inhibits gastric carcinoma AGS cells by decreasing the protein expression of VEGFR and blocking ras/raf/MEK/ERK pathway. Int J Mol Med. 2018 Apr;41(4):2389–96. doi:10.3892/ijmm.2018.3407 PubMed PMID: 29393362.

59. Abraham AG, O'Neill E. PI3K/akt-mediated regulation of p53 in cancer. Biochem Soc Trans. 2014 Aug;42(4):798–803. doi:10.1042/BST20140070 PubMed PMID: 25109960.

60. Jiang K, Liu H, Xie D, Xiao Q. Differentially expressed genes ASPN, COL1A1, FN1, VCAN and MUC5AC are potential prognostic biomarkers for gastric cancer. Oncol Lett. 2019 Mar;17(3):3191–202. doi:10.3892/ol.2019.9952 PubMed PMID: 30867749; PubMed Central

PMCID: PMC6396260.

61. Chen YJ, Peng C, Wang LW, Chai JX, Wang JD, He QB. Downregulation of uncoupling protein 1 by hypermethylation in gastric cancer activates Rap1 signaling. World J Gastrointest Oncol. 2025 Sep 15;17(9):108760. doi:10.4251/wjgo.v17.i9.108760 PubMed PMID: 40977672; PubMed Central PMCID: PMC12444320.

62. Xiao L, Hu R, Chen W, Gao J, Zhao Y, Wang Z, et al. An antibody targeting an immune checkpoint molecule BTN2A2 enhances anti-tumor immunity. Neoplasia (N Y NY). 2025 Jul;65:101161. doi:10.1016/j.neo.2025.101161 PubMed PMID: 40262436; PubMed Central PMCID: PMC12053764.

63. Li X, Na H, Xu L, Zhang X, Feng Z, Zhou X, et al. DC-SIGN mediates gastric cancer progression by regulating the JAK2/STAT3 signaling pathway and affecting LncRNA RP11-181G12.2 expression. Biomed Pharmacother = Biomed Pharmacother. 2020 Jan;121:109644. doi:10.1016/j.biopha.2019.109644 PubMed PMID: 31766099.

64. Gao Q, Cui L, Huang C, Chen Z, Wang X, Wen S, et al. Gastric cancer-derived mesenchymal stem cells promote gastric cancer cell lines migration by modulating CD276 expression. Exp Cell Res. 2023 Jan 1;422(1):113414. doi:10.1016/j.yexcr.2022.113414 PubMed PMID: 36368567.

65. Huang B, Liu M, Duan Y, Guo J, Wang Z, Dou Y, et al. An EBNA1-YAP signaling axis drives immune escape through CD276 in EBV-associated gastric cancer. Cell Death Dis. 2025 Dec 19. doi:10.1038/s41419-025-08251-2 PubMed PMID: 41419460.

66. Li Y, Yang X, Wu Y, Zhao K, Ye Z, Zhu J, et al. B7-H3 promotes gastric cancer cell migration and invasion. Oncotarget. 2017 Sep 22;8(42):71725–35. doi:10.18632/oncotarget.17847 PubMed PMID: 29069741; PubMed Central PMCID: PMC5641084.

67. Pham QT, Taniyama D, Akabane S, Takashima T, Maruyama R, Sekino Y, et al. Essential roles of TDO2 in gastric cancer: TDO2 is associated with cancer progression, patient survival, PD-L1 expression, and cancer stem cells. Pathobiol: J Immunopathol Mol Cell Biol. 2023;90(1):44–55. doi:10.1159/000523750 PubMed PMID: 35679834.

68. Yoshihara K, Shahmoradgoli M, Martínez E, Vegesna R, Kim H, Torres-Garcia W, et al. Inferring tumour purity and stromal and immune cell admixture from expression data. Nat Commun. 2013;4:2612. doi:10.1038/ncomms3612 PubMed PMID: 24113773; PubMed Central PMCID: PMC3826632.

69. Wang Y, Barrett A, Hu Q. Targeting Macrophages for Tumor Therapy. AAPS J. 2023 Aug 17;25(5):80. doi:10.1208/s12248-023-00845-y PubMed PMID: 37589825.

70. Marabelle A, Fakih M, Lopez J, Shah M, Shapira-Frommer R, Nakagawa K, et al. Association of tumour mutational burden with outcomes in patients with advanced solid tumours treated with pembrolizumab: prospective biomarker analysis of the multicohort, open-label, phase 2 KEYNOTE-158 study. Lancet, Oncol. 2020 Oct;21(10):1353–65. doi:10.1016/S1470-2045(20)30445-9 PubMed PMID: 32919526.

71. Rodrigo JP, Sánchez-Canteli M, Otero-Rosales M, Martínez-Camblor P, Hermida-Prado F, García-Pedrero JM. Tumor mutational burden predictability in head and neck squamous cell carcinoma patients treated with immunotherapy: systematic review and meta-analysis. J Transl Med. 2024 Feb 4;22(1):135. doi:10.1186/s12967-024-04937-x PubMed PMID: 38311741; PubMed Central PMCID: PMC10840180.

72. Naik A, Leask A. Tumor-associated fibrosis impairs the response to immunotherapy. Matrix Biol: J Int Soc Matrix Biol. 2023 May;119:125–40. doi:10.1016/j.matbio.2023.04.002 PubMed PMID: 37080324.

73. Ke L, Li S, Huang D. The predictive value of tumor mutation burden on survival of gastric cancer patients treated with immune checkpoint inhibitors: a systematic review and meta-analysis. Int Immunopharmacol. 2023 Nov;124(Pt B):110986. doi:10.1016/j.intimp.2023.110986 PubMed PMID: 37748223.

74. Kim ST, Cristescu R, Bass AJ, Kim KM, Odegaard JI, Kim K, et al. Comprehensive molecular characterization of clinical responses to PD-1 inhibition in metastatic gastric cancer. Nat Med. 2018 Sep;24(9):1449–58. doi:10.1038/s41591-018-0101-z PubMed PMID: 30013197.

75. Servetto A, Kollipara R, Formisano L, Lin CC, Lee KM, Sudhan DR, et al. Nuclear FGFR1 regulates gene transcription and promotes antiestrogen resistance in ER+ breast cancer. Clin Cancer Res: Off J Am Assoc Cancer Res. 2021 Aug 1;27(15):4379–96. doi:10.1158/1078-0432.CCR-20-3905 PubMed PMID: 34011560; PubMed Central PMCID: PMC8338892.

76. Fan S, Chen Y, Wang W, Xu W, Tian M, Liu Y, et al. Pharmacological and biological targeting of FGFR1 in cancer. Curr Issues Mol Biol. 2024 Nov 18;46(11):13131–50. doi:10.3390/cimb46110783 PubMed PMID: 39590377; PubMed Central PMCID: PMC11593329.

77. Cymbaluk-Płoska A, Gargulińska P, Chudecka-Głaz A, Kwiatkowski S, Pius-Sadowska E, Machaliński B. The suitability of FGF21 and FGF23 as new biomarkers in endometrial cancer patients. Diagn (Basel Switz). 2020 Jun 18;10(6):414. doi:10.3390/diagnostics10060414 PubMed PMID: 32570721; PubMed Central PMCID: PMC7344631.

78. Huang Q, Yao L, Xiang N, Zheng R, Guo S. Expression and Function of Fibroblast Growth Factor 23 in Gastric Cancer. Progress in Modern Biomedicine. 2019;19:751–4 (in Chinese). doi:10.13241/j.cnki.pmb.2019.04.032

DIGITAL PLATFORMS AND AI IN VASCULAR DEMENTIA: INNOVATIONS, CHALLENGES, AND FUTURE DIRECTIONS

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Abstract

Vascular dementia (VD) is the second most common dementia, caused by cerebrovascular pathology, and its early diagnosis is hampered by nonspecific symptoms and lack of biomarkers. This review systematically maps the current and potential roles of digital platforms and artificial intelligence (AI) in VD—from early detection and risk prediction to personalized treatment and long-term management.

Keyword: Vascular Dementia, Digital Platforms, Artificial Intelligence

Vascular dementia (VD) is the second most common dementia worldwide, accounting for 15—20% of all cases, and its prevalence is rising with population ageing. VD results from cerebrovascular injury—infarction, white matter damage, or chronic hypoperfusion—leading to progressive cognitive decline, particularly in executive function and processing speed[1]. Unlike Alzheimer's disease, VD lacks specific biomarkers and approved disease modifying therapies; current management relies on controlling vascular risk factors and symptomatic treatment. Digital health technologies and artificial intelligence (AI) offer transformative opportunities to overcome these barriers by enabling non invasive, scalable, and precise tools for screening, diagnosis, monitoring, and personalised intervention.

Objective

This review systematically evaluates the current and potential applications of digital platforms and AI across the entire VD care continuum—from early risk prediction and differential diagnosis to real time monitoring, drug development, and rehabilitation. It also critically examines the technical, clinical, and ethical obstacles that hinder translation into routine practice, and proposes a multidisciplinary roadmap for future implementation.

Materials and methods

We surveyed peer-reviewed literature (2015–2025) on AI, machine learning, wearable devices, telemedicine, multi-omics, and imaging analytics applied to VD or vascular cognitive impairment. Key technologies evaluated include 3D CNNs for MRI lesion segmentation, NLP for speech analysis, XGBoost for risk prediction, and federated learning for privacy-preserving multi institutional collaboration.

Results and discussion

AI driven models demonstrate high diagnostic accuracy (AUROC 0.89–0.96) in differentiating VD from other dementias by integrating neuroimaging, EHRs, and plasma biomarkers (e.g., GFAP,

NEFL)[2][3][4]. Wearable sensors capture early gait and sleep alterations that correlate with white matter hyperintensities and hippocampal atrophy, enabling remote monitoring[5]. NLP enhances cognitive assessment by detecting subtle linguistic markers of executive dysfunction[6]. However, several obstacles impede clinical translation: (1) most algorithms are trained on homogeneous cohorts (e.g., UK Biobank), limiting generalizability across ethnicities and healthcare systems; (2) inconsistent diagnostic criteria introduce label noise in supervised learning[7]; (3) "black box" AI lacks interpretability, reducing clinician trust; (4) regulatory frameworks lag behind technological advances; and (5) ethical concerns—data privacy, algorithmic bias, and the digital divide—remain unresolved. Moreover, few AI tools specifically address VD heterogeneity (subcortical vs. multi-infarct vs. mixed pathology), and most rehabilitation evidence derives from mixed dementia cohorts, not VD-focused trials.

References:

[1] O'Brien J.T., Thomas A. - Vascular dementia // Lancet. – 2015. – Vol. 386. – № 10004. – C.1698-1706.

[2] You J., Zhang Y.R., Wang H.F., et al. - Development of a novel dementia risk prediction model in the general population: A large, longitudinal, population-based machine-learning study // EClinicalMedicine. – 2022. – Vol. 53. – C.101665.

[3] Xue C., Kowshik S.S., Lteif D., et al. - AI-based differential diagnosis of dementia etiologies on multimodal data // Nature Medicine. – 2024. – Vol. 30. – № 10. – C.2977-2989.

[4] Guo Y., You J., Zhang Y., et al. - Plasma proteomic profiles predict future dementia in healthy adults // Nature Aging. – 2024. – Vol. 4. – № 2. – C.247-260.

[5] Shahzad A., Dadlani A., Lee H., et al. - Automated prescreening of mild cognitive impairment using shank-mounted inertial sensors based gait biomarkers // IEEE Access. – 2022. – Vol. 10. – C.15835-15844.

[6] Clarke N., Foltz P., Garrard P. - How to do things with (thousands of) words: Computational approaches to discourse analysis in Alzheimer's disease // Cortex. – 2020. – Vol. 129. – C.446-463.

[7] Sachdev P.S., Bentvelzen A.C., et al. (VasCog-2-WSO Criteria Consortium) - Revised diagnostic criteria for vascular cognitive impairment and dementia—The VasCog-2-WSO criteria // JAMA Neurology. – 2025. – Vol. – № –. – C.e253242. (Online ahead of print)

DIGITAL EMPOWERMENT AND TRADITIONAL RENEWAL SINO RUSSIAN SMART PHARMACEUTICAL INNOVATION INDUSTRIAL INTEGRATION

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Abstract

As digital technologies reshape the global pharmaceutical industry, the modernization of traditional medicine has shifted from theoretical discussion to practical implementation. The 2024 "Several Opinions on Promoting the Development of Digital Traditional Chinese Medicine" incorporated "digital and intelligent traditional Chinese medicine" into top-level design for the first time through ministerial regulations, with provisions such as cross-border data flow directly targeting international collaboration. Based on this, this study integrates policy text analysis and bibliometric methods to outline the core areas, technological pathways, and forms of industrial integration in Sino-Russian cooperation on smart medicine.

Keywords: antibiotic-associated diarrhea, Clostridium difficile toxins

According to WHO criteria, antibiotic-associated diarrhea (AAD) means three or four episodes of liquid or watery stool during two or more days connected with antibacterial drugs intake. According to ICD-10 AAD refers to K 91.8 – «Some other disorders of the digestive organs after medical procedures which are not classified in the other rubrics (including antibiotic-associated diarrhea)». Etiological cause of AAD development is Clostridium difficile.

One of the principles of antibacterial therapy is the principle of minimum sufficiency which is not always taken into account by physicians. Uncontrolled intake of antibacterial drugs by patients and prescription of such drugs which are not always necessary result in the development of antibiotic-associated diarrhea.

It is known that antibiotic-associated diarrhea develops very often during oral intake. The more intensively invasive methods of diagnostics and treatment are used the higher risk of its development is. The development of antibiotic-associated diarrhea may be connected with the disorder of qualitative and quantitative composition of gut organisms, pharmacological and toxic action of antibacterial drugs.

Objective

To assess the dynamics of revealing toxins of A and B Clostridium difficile which will allow to judge indirectly the effectiveness and strategy of prescribing broad spectrum antibiotics.

Materials and methods

Toxins of the causative agent were revealed in patients' stools by using immunochromatographic

method (ICM) with application of diagnostic systems DUO A+B TEST VEDLAB (France), according to instructions. The analysis was carried out according to the results of investigations of bacteriological laboratories of the leading curative establishments of the region: SAHE AR «Amur regional infectious hospital», and SAHE AR "Amur regional clinical hospital".

Results and discussion

In the bacteriological laboratory of SAHE AR «Amur regional infectious hospital» 65 investigations were carried out for the period of 2012-2014 which made up 16,6% of all investigations conducted on the bacterial flora by means of ICM. Correlation of the investigations carried out for the three-year period made up: in 2012-43,1%, in 2013-29,2% and in 2014-27,7%. Positive tests on the detection of A and B toxins of the causative agent were registered in 2012 - in 10,7% of cases, in 2013 they were not registered and in 2014 they made up 11,1% of cases.

For the period of 2012-2014, 185 investigations on the detection of A and B toxins of Clostridium difficile were carried out in bacteriological laboratory of SAHE AR «Amur regional clinical hospital». Correlation of the investigations carried out for the three-year period made up: in 2012-33,5%, in 2013-20,5%, and in 2014-45,9%. Positive tests were obtained in 11,3%, 23,7% and 29,4% of cases respectively.

As a result, it was noted that the frequency of revealing the causative agent of antibiotic-associated diarrhea in patients of the Amur regional infectious hospital is not high and in patients of the Amur regional clinical hospital the frequency of revealing the causative agents of antibiotic-associated diarrhea considerably increased (in 2,6 times).

Thus, the detection of toxins of the causative agent of antibiotic-associated diarrhea may be used as an indirect index of the effectiveness of antibacterial therapy.

References:

1. Zakordonets L.V., Kramarev S.A., Beregovaja T.V., Tolstanova A.N., Dovbinchuk T.V., - Antibiotic-associated diarrhea: mechanisms of development and possibilities of correction // health of a child. – 2019. – 7 (50). – C.436-578.

2. Korneeva O.N., Ivashkin V.T. Antibiotic-associated colitis: pathomorphology, clinic, therapy. // RZGGK 3, - 2015. – C.65-69.

3. Malov V.A. Antibiotic-associated diarrhea // Clinical microbiology and antimicrobial therapy. – 2022. – Vol. 4.-№ 1. – C.22-32.

AI-ENABLED MODERNIZATION OF TCM: OPPORTUNITIES, CHALLENGES AND PATHWAYS FOR SINO-RUSSIAN SMART MEDICINE COOPERATION

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Abstract

Artificial intelligence (AI) may promote the modernization of traditional Chinese medicine (TCM) and support Sino-Russian smart medicine cooperation. Natural language processing, knowledge graphs, network pharmacology and federated learning can transform fragmented TCM experience into structured evidence. China has a large TCM clinical and industrial base, while Russia has strengths in mathematics, chemistry, telemedicine and Eurasian medicinal plant resources. However, cooperation is constrained by non-standardized data, health-data governance, pharmaceutical standard alignment and limited local evidence. A feasible route should combine privacy-preserving computing, real-world evidence, pharmacopoeial communication and localized industrial chains.

Keywords: artificial intelligence; traditional Chinese medicine; smart medicine; Sino-Russian cooperation; federated learning; regulation

Digital transformation is reshaping medicine. For TCM, whose clinical logic is based on holism, syndrome differentiation and individualized treatment, AI can connect experiential knowledge with standardized evidence. Large language models, multimodal analysis and network pharmacology can extract information from classical texts, medical records, tongue images, pulse data, prescriptions and molecular databases. Sino-Russian cooperation is also shifting from personnel exchange and herbal trade toward telemedicine, AI-assisted research, medical education and regulatory collaboration.

Objective

The objective of this paper is to summarize the opportunities, barriers and pathways for AI-enabled TCM modernization in Sino-Russian smart medicine cooperation, with emphasis on data governance, evidence generation and industrial collaboration.

Materials and methods

A narrative policy and literature review was conducted. Materials included recent reviews on AI in TCM, network pharmacology and federated learning, health AI policy documents and available materials on Sino-Russian medical cooperation. Evidence was synthesized from technical, regulatory and implementation perspectives.

Results and discussion

AI provides tools for making TCM knowledge structured and computable. Natural language

processing can identify entities in TCM records, while knowledge graphs can link diseases, syndromes, herbs, compounds, targets and pathways 1,2. Multimodal models may integrate inquiry, inspection, tongue and pulse information with laboratory data. In drug research, network pharmacology and machine learning are suitable for the multi-component and multi-target characteristics of herbal prescriptions 3. A cautious strategy is to optimize classical formulas with AI rather than generate formulas without TCM theoretical constraints.

Sino-Russian cooperation has a useful foundation. Intergovernmental documents have encouraged cooperation in telemedicine, medical AI, traditional medicine, pharmacopoeial exchange and medicine regulation. The China-Russia Medical University Alliance and hospital-level collaborations provide channels for medical education, clinical exchange and research translation. Russia also has a tradition of adaptogen research, including Rhodiola rosea, Eleutherococcus senticosus and ginseng-like resources, which may become a shared scientific language for botanical medicine research.

The main obstacles are institutional as well as technical. Medical AI requires large and diverse data, but both countries strictly regulate personal and health data. Direct cross-border pooling of electronic health records or images would create high compliance risks. TCM data are also non-structured and context-dependent, with synonymous, ambiguous and classical terms that increase annotation cost and reduce model generalizability. In addition, many Chinese herbal products entering Russia may be classified as dietary supplements rather than therapeutic medicines, limiting clinical claims, prescriptions and reimbursement.

A practical pathway should be based on privacy-preserving evidence generation. Federated learning allows hospitals in both countries to train models locally while sharing encrypted model parameters instead of raw patient data 4. Combined with secure multiparty computation, differential privacy or auditable data governance, this approach may support cross-institutional AI development under data-sovereignty constraints. Priority projects include TCM diagnosis standardization, herb-drug interaction warning, adaptogen-related botanical medicine studies and chronic disease rehabilitation evaluation. Industrial cooperation should extend from product export to localized cultivation, intelligent extraction, quality tracing and joint registration.

Conclusion

AI can accelerate TCM modernization by improving data structuring, mechanism prediction, safety monitoring and personalized decision support. For Sino-Russian smart medicine cooperation, technical innovation must be combined with legal compliance and locally generated evidence. Federated learning, pharmacopoeial communication, real-world evidence and localized industrial chains provide a realistic route for protecting health-data sovereignty and enhancing the credibility of TCM products.

References:

1. Zhou E, Shen Q, Hou Y. Integrating artificial intelligence into the modernization of traditional Chinese medicine industry: a review. Front Pharmacol. 2024;15:1181183. doi: 10.3389/fphar.2024.1181183.

2. Song Z, Chen G, Chen CYC. AI empowering traditional Chinese medicine? Chem Sci. 2024;15(41):16844-86. doi: 10.1039/D4SC04107K.

3. Zhang P, Zhang D, Zhou W, Wang L, Wang B, Zhang T, et al. Network pharmacology: towards the artificial intelligence-based precision traditional Chinese medicine. Brief Bioinform. 2024;25(1):bbad518. doi: 10.1093/bib/bbad518.

4. Rahman A, Hossain MS, Muhammad G, Kundu D, Debnath T, Rahman M, et al. Federated learning-based AI approaches in smart healthcare: concepts, taxonomies, challenges and open issues. Cluster Comput. 2023;26(4):2271-311. doi: 10.1007/s10586-022-03658-4.

MECHANISTIC STUDY ON HYPERURICEMIA REGULATION BY PLANTAGO ASIATICA SEEDS VIA THE GUT–KIDNEY AXIS NETWORK

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Abstract

Hyperuricemia (HUA) is a metabolic disorder characterized by elevated serum uric acid due to purine metabolism dysfunction and impaired excretion. Its incidence has increased globally and is closely associated with gout, chronic kidney disease, and cardiovascular complications. Although current urate-lowering drugs are effective, their long-term use is limited by adverse effects such as hepatotoxicity and hypersensitivity reactions. Therefore, safer multi-target therapeutic strategies are required. Plantago asiatica seeds (Cheqianzi), a traditional Chinese medicinal herb, possess diuretic and anti-inflammatory properties. Recent studies indicate that its anti-hyperuricemic effects are closely associated with the gut–kidney axis. On the renal side, it inhibits xanthine oxidase (XOD) and adenosine deaminase (ADA) activities and regulates urate transporters including URAT1, GLUT9, OAT1, and ABCG2 to promote uric acid excretion. On the intestinal side, it modulates gut microbiota composition, restores intestinal barrier integrity, and enhances microbial uric acid degradation. These dual pathways converge on suppression of the NLRP3 inflammasome, thereby reducing renal inflammation and injury.

Keywords: Plantago asiatica; hyperuricemia; gut–kidney axis; urate transporters; microbiota

Hyperuricemia is defined as persistent elevation of serum uric acid caused by overproduction or reduced excretion of urate. The prevalence of hyperuricemia has increased significantly worldwide and shows a younger onset trend, making it an important metabolic disease. It is not only the biochemical basis of gout but is also strongly associated with chronic kidney disease, hypertension, diabetes, and cardiovascular disorders.

Current clinical therapies include xanthine oxidase inhibitors such as allopurinol and febuxostat, and uricosuric agents such as benzbromarone. However, their long-term use is limited due to adverse effects including hepatotoxicity, hypersensitivity reactions, and cardiovascular risks. Therefore, natural products with multi-target and low-toxicity characteristics have attracted increasing attention. Plantago asiatica seeds, a traditional medicinal herb, are widely used for clearing heat and promoting diuresis. Modern studies have identified phenylethanoid glycosides, flavonoids, and polysaccharides as its major bioactive components involved in uric acid regulation.

Objective

This study aims to systematically summarize the regulatory mechanisms of Plantago asiatica seeds in hyperuricemia via the gut–kidney axis, focusing on uric acid metabolism, transporter regulation, gut microbiota modulation, and inflammatory signaling pathways.

Materials and methods

This review is based on published experimental studies, including animal models of hyperuricemia, enzyme inhibition assays, gut microbiota sequencing, network pharmacology analysis, metabolomics, and transcriptomics studies. The collected data were integrated to clarify the multi-target regulatory mechanisms of Plantago asiatica in uric acid metabolism.

Results and discussion

Plantago asiatica seeds exert anti-hyperuricemic effects through coordinated regulation of renal and intestinal pathways linked by inflammatory signaling. In the kidney, they inhibit xanthine oxidase (XOD) and adenosine deaminase (ADA), reducing uric acid production. They also regulate urate transporters in renal proximal tubules, downregulating URAT1 and GLUT9 while upregulating OAT1 and ABCG2, thereby enhancing uric acid excretion. In addition, modulation of aquaporins AQP1 and AQP2 promotes diuresis and further facilitates urate elimination.

In the intestine, hyperuricemia is associated with gut microbiota dysbiosis characterized by reduced beneficial bacteria and increased pathogenic species. Plantago asiatica restores microbial balance by enriching Lactobacillus and Lachnospiraceae. Its polysaccharides improve intestinal barrier integrity via upregulation of ZO-1 and Occludin, reducing LPS translocation. Gut microbiota promoted by Plantago asiatica also enhances conversion of uric acid into allantoin, facilitating intestinal excretion.Importantly, the gut–kidney axis is mediated by inflammatory signaling, particularly the NLRP3 inflammasome. Plantago asiatica inhibits NLRP3, ASC, and caspase-1 expression, thereby reducing inflammation and protecting renal function. Thus, the gut–kidney axis integrates intestinal microbiota and renal urate metabolism.

Multi-omics analyses further support these effects. Network pharmacology identifies key targets including IL-6, CASP3, and PPARG enriched in TNF and metabolic pathways. These findings confirm a multi-target regulatory network mediated by the gut–kidney axis.

References:

1.Ngandeu-Singwe M, Nkeck JR, Hamroun A . Worldwide trends in hyperuricaemia from 2000 to 2023: a systematic review and modelling analysis. Lancet Rheumatol. 2026 May;8(5):e346-e362.

2.Sun M, Lyu Z, Wang C. 2024 Update of Chinese Guidelines for Diagnosis and Treatment of Hyperuricemia and Gout Part I: Recommendations for General Patients. Int J Rheum Dis. 2025 Jul;28(7):e70375.

3.Liu T, Wang L, Ji L, Mu L, Wang K. Plantaginis Semen Ameliorates Hyperuricemia Induced by Potassium Oxonate. Int J Mol Sci. 2024 Aug 5;25(15):8548.

4.Fan M Y, Yuan J S, Xie H Y, et al. Research progress on the mechanism of gut microecology in hyperuricemia and intervention with traditional Chinese medicine[J]. Chinese Journal of Experimental Traditional Medical Formulae, 2025, 31(5): 329–338.

RESEARCH ON THE PATH OF INNOVATION AND INDUSTRIAL INTEGRATION OF TRADITIONAL CHINESE AND RUSSIAN MEDICINES ENABLED BY ARTIFICIAL INTELLIGENCE

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Abstract

This research focuses on how digital technology can promote the innovation and development of traditional medicine in China and Russia. It summarizes and analyzes the current intelligent medical cooperation between the two countries and their respective advantages, and proposes a three-pronged integrated approach of "technological complementarity, resource sharing, and market alignment" for industrial integration and innovation. There have been existing achievements in digital medical cooperation between China and Russia, but there are still unresolved differences in the current standards. A joint AI laboratory should be established to combine talent cultivation with specific projects, providing feasible solutions for the development of medicine in both countries.

Keywords: Digital empowerment; Smart medicine; China-Russia cooperation; Industrial integration; Artificial Intelligence

Both China and Russia are countries with a long history of traditional medicine. The biomedicine forums organized by China and Russia provide a great opportunity for exchanges on the integration of digital technology and traditional medicine.

Objective

This study aims to discuss the internal mechanisms and implementation paths of digital technology enabling the innovation and development of traditional medicine industries in China and Russia, analyze the current cooperation status and complementary advantages of the two countries in the field of smart medicine, and propose innovative models and implementation strategies for the integration and development of biomedicine industries in China and Russia under digital empowerment.

Materials and methods

The literature research method was used to conduct a comprehensive theoretical summary of the development of traditional Chinese medicine industries promoted by digital technology . The SWOT approach was used to examine the strengths, weaknesses, and difficulties of the related smart medicine in China and Russia. The case method was employed to summarize examples of digitalization of traditional Chinese medicine, and then the comparative research approach was used to analyze the existing policies and related technologies in digital healthcare in the two countries.

Results and Discussion

There are two ways of digital technology related to artificial intelligence that can be used to promote the upgrading of the traditional Chinese medicine industry: The first is to use natural language processing and deep learning to organize traditional Chinese medicine knowledge, allowing large language models to assist in analyzing the complex relationships involving various components and targets in traditional Chinese medicine; The second is that AI can immediately determine the indicators at each stage of processing, provide answers to "batch-to-batch differences" and support the entire process of quality traceability. The digital cooperation in medicine between China and Russia falls into the category of "reliable basic research, extensive applications, and complementary capabilities". Based on the complementarity between the two sides, a "technology complementation + resource sharing + market interconnection" integration plan is designed: Technically, China will provide AI methods and related facilities, while Russia is responsible for the preliminary research in basic medicine; In terms of resources, traditional medicine data should be jointly organized, and large-scale models of traditional Chinese medicine should be tested together .

Currently, the intelligent medical resources that each country possesses have obvious complementarity and there is a large scope for cooperation. We should establish a joint laboratory for AI in traditional Chinese medicine, incorporate talent training into the bilateral cooperation plan, and make comprehensive coordination in the development of drug AI, remote diagnosis or the modern transformation of traditional medicine. We should use digital thinking to drive traditional medicine towards contemporary innovation forms.

References

[1] Zhao Guozhen, Guo Shiqi, Pang Huaxin, et al. Application of Artificial Intelligence Technology in Assisting Traditional Chinese Medicine Diagnosis and Treatment and Standardization of Clinical Practice [J]. Journal of Traditional Chinese Medicine, 2022, 63(24): 2306-2310.

[2] Chen Zijia, Peng Wenxi, Zhang Dezheng, et al. Applications, Challenges, and Prospects of Large Language Models in the Field of Traditional Chinese Medicine [J]. Union Medical Journal, 2025, 16(1): 83-89.

[3] Chen HY, Tang RT, Hong M, et al.Applications of artificial intelligence in the research of molecular mechanisms of traditional Chinese medicine formulas [J].Chinese Journal of Natural Medicines, 2025, 23 (6):401-412.

[4] Zhang Nan, Wang Xiaoyun, Han Bo, et al. Research Progress of Artificial Intelligence Technology in Chinese Medicine Pharmacology [J]. Acta Pharmaceutica Sinica, 2025, 60(3): 550-558.

[5] He Yuxiang, Tang Ruoning, Feng Zhiwei, et al. AI-Driven Modernization of Traditional Chinese Medicine: A Transition from Empirical Paradigm to Data-Intelligence Paradigm [J/OL]. Integrated Technology, 2026, 15(3): 3-15.

DIGITAL ENABLING STRATEGIES FOR INTERNATIONAL STANDARDIZATION OF TCM CROSS-BORDER INDUSTRIAL INTEGRATION AND INNOVATIVE PRACTICE IN CHINA-RUSSIA SMART MEDICINE

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Abstract

Traditional Chinese Medicine (TCM) internationalization faces challenges in standard mutual recognition, data interoperability, and industrial synergy. This study explores digital enabling pathways for TCM international standardization through China-Russia smart medicine cooperation. MAXQDA-based qualitative analysis of ISO/TC 249 standards and bilateral policies reveals that knowledge graph–large language model (KG-LLM) integration significantly enhances terminology standardization efficiency. We propose strategies including full-chain data standardization, semantic mapping, and cross-border digital health platforms.

Keywords: TCM internationalization; digital enabling; China-Russia smart medicine; cross-border industrial integration; knowledge graphs; MAXQDA

Despite rapid digital advances in healthcare, Traditional Chinese Medicine (TCM) standardization remains fragmented across jurisdictions, characterized by inconsistent terminology systems, heterogeneous data formats, and divergent regulatory frameworks. While ISO/TC 249 has established foundational standards for materia medica and acupuncture devices [1], significant gaps persist in digital health interoperability, intelligent manufacturing protocols, and cross-border clinical informatics. Specifically, knowledge graph–large language model (KG-LLM) integration offers transformative potential for semantic alignment between empirical TCM concepts and structured biomedical ontologies, enabling real-time multilingual standardization and automated terminology mapping. This paper employs a mixed-method qualitative approach combining MAXQDA thematic analysis with systematic policy document review. Drawing upon ISO/TC 249 standard texts, China's national digital TCM policy [2], and bilateral China-Russia medical cooperation agreements (2018–2024), we examine the intersection of technical standards and geopolitical collaboration to identify actionable pathways for digital TCM internationalization. By synthesizing policy imperatives with technological affordances, we seek to establish a replicable framework for cross-border smart medicine integration that bridges standardization gaps while respecting epistemological diversity in traditional medical systems.

Objective

ISO/TC 249 has issued over 100 international standards covering medicament, acupuncture devices, and clinical terminology, yet significant gaps persist in digital standards, intelligent manufacturing, and clinical informatics [1]. China and Russia exhibit strong complementarity: TCM emphasizes

holistic regulation and syndrome differentiation, while Russian traditional medicine excels in functional recovery and natural therapy. Bilateral demand for digital health and cross-border medical services is growing rapidly under the Shanghai Cooperation Organization framework. This study aims to: (1) analyze digital mechanisms empowering TCM international standardization; (2) evaluate feasible pathways for China-Russia smart medicine integration; and (3) propose KG-AI-driven standardization strategies for global TCM governance.

Materials and methods

We conducted qualitative content analysis using MAXQDA 2022. The corpus comprised ISO/TC 249 standard texts, the Several Opinions on Promoting the Development of Digital Traditional Chinese Medicine (2024) [2], and China-Russia bilateral medical cooperation agreements (2018–2024).

Results and discussion

Machine learning demonstrates AI-driven screening potential in natural products research [3]. China-Russia collaboration has progressed in telemedicine and digital diagnostics. However, terminology standardization remains inadequate, cross-border data governance lacks unified frameworks, and evidence-based validation is weak. We propose three strategies: (1) establish a full-industry-chain TCM data standard system compliant with ISO/IEEE standards; (2) advance deep mapping between SNOMED CT and TCM semantic networks using RDF and OWL; (3) build a China-Russia cross-border digital health platform integrating real-world evidence to construct regulatory packages compliant with Eurasian Economic Union requirements, shortening overseas registration timelines for Chinese materia medica.

Through digital enabling and cross-border industrial integration, TCM international standardization will transition from isolated standard export to collaborative ecosystem co-construction. Unified semantic frameworks and interoperable data architectures will facilitate seamless knowledge flow across jurisdictions, while harmonized regulatory pathways will accelerate the evidence-based integration of traditional medicine into mainstream healthcare systems. This paradigm shift fosters sustainable global governance of traditional medicine in the intelligent healthcare era.

References:

1. Zhao S T, Zhong Y M, Hu Y Z, et al. Visualization analysis of the international standard ISO/TC 249 for traditional Chinese medicine[J]. Digital Chinese Medicine, 2022, 5(2): 103-111.

2. National Administration of Traditional Chinese Medicine, National Data Administration. Several opinions on promoting the development of digital traditional Chinese medicine[Z]. 2024-08-15.

3. Ma S, Liu J, Li W, et al. Machine learning in TCM with natural products and molecules: Current status and future perspectives[J]. Chinese Medicine, 2023, 18(1): 43.

APPLICATION OF TCM SYNDROME PHENOMICS INTEGRATED WITH DIGITAL MEDICINE IN PEDIATRIC DISEASES

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Abstract

Pediatric diseases differ from adult diseases in clinical presentation, with rapid onset, fast progression, and limited self-reporting ability. In traditional Chinese medicine (TCM), pediatric syndrome differentiation still lacks sufficient standardization in information collection, syndrome recording, and efficacy evaluation. TCM syndrome phenomics, based on syndrome-related phenotypic data, can be integrated with artificial intelligence, wearable devices, multi-omics analysis, and digital follow-up technologies to support structured and dynamic pediatric diagnosis and treatment. This paper discusses its integration with digital medicine in childhood asthma and allergic diseases, aiming to promote standardized, precise, and continuous pediatric care.

Keywords: TCM syndrome phenomics; digital medicine; pediatric diseases

Pediatric diagnosis often relies on physicians' observation and parental reports, as children may not express symptoms accurately. Although TCM pediatrics emphasizes four diagnostic methods, constitution, and syndrome changes, traditional differentiation is limited by subjectivity, inconsistent records, and weak quantification. TCM phenomics 2.0 proposes a closed-loop system of "syndrome–phenome–mechanism–intervention" supported by AI, wearable devices, medical digital twins, and multi-omics integration[1]. Syndrome phenomics further links macroscopic syndromes with microscopic mechanisms through models, cohorts, AI, and cross-scale analysis[2].

Objective

This paper explores the value of integrating TCM syndrome phenomics with digital medicine in pediatric diseases, especially childhood asthma and allergic diseases, and provides a reference for the digital development of TCM pediatrics.

Materials and Methods

A literature-based review was conducted on TCM phenomics, syndrome phenomics, AI-assisted syndrome differentiation, digital asthma management, and TCM pediatric interventions. It analyzed four-diagnostic data, biomedical indicators, and digital records, including tongue, complexion, cough, sweating, appetite, sleep, pulmonary function, immune-inflammatory markers, medication adherence, wearables, and parental symptom reports.

Results and Discussion

TCM syndrome phenomics can convert pediatric syndrome information into structured, traceable data. In childhood asthma, guidelines prioritize symptom control, exacerbation risk, lung function,

and adherence to inhaled therapy[3], whereas TCM differentiation emphasizes wheezing, cough, sputum characteristics, tongue coating, sweating, appetite, and constitution. Integrating these syndrome features with peak expiratory flow, FeNO, IgE, eosinophils, and related biomarkers may support a "disease–syndrome–phenotype–mechanism" model. Mobile applications, electronic monitoring, and text-message reminders may improve asthma management, but their clinical effectiveness still needs validation[4]. Thus, digital medicine should be connected with syndrome stratification, risk prediction, and individualized intervention.

Digital medicine is also relevant to allergic rhinitis and atopic dermatitis. Chinese herbal medicine may improve skin lesions, itching, and sleep in atopic dermatitis, but further stratification by prescription, syndrome pattern, and age group is required[5]. Continuous collection of skin images, itching scores, sleep, dietary triggers, medication records, tongue/facial images, constitution data, and laboratory indicators may help monitor damp-heat, spleen deficiency, and blood dryness syndromes and improve objective efficacy evaluation.

Pediatric digital research must ensure privacy, guardian consent, data security, and bias control. AI-assisted syndrome differentiation remains limited by sample size, regional variation, and physician-label consistency. Therefore, digital medicine should support rather than replace clinical judgment. Future work should establish multicenter, standardized, traceable pediatric syndrome phenomics databases and validate them through prospective cohorts and RCTs.

Conclusion

The integration of TCM syndrome phenomics with digital medicine can promote pediatric diagnosis and treatment toward standardized, continuous, and precision-oriented management. By collecting multidimensional phenotypic data, interpreting disease changes through syndrome phenomics, and evaluating TCM interventions with evidence-based methods, this approach may provide stronger support for individualized TCM pediatric care.

References:

[1] Xu M, Shao X Y, Guo D G, et al. Phenomics of traditional Chinese medicine 2.0: the integration with digital medicine[J]. Digital Chinese Medicine., 2025, 8(3): 282-299.

[2] Yu Y B, Song X D, Liang H, Peng Q H. Study on the construction path of syndrome phenomics[J]. Chinese Journal of Information on Traditional Chinese Medicine, 2026, 33(2): 7-11.

[3] P V. 2025 GINA report for asthma[J]. The Lancet. Respiratory medicine, 2025:S2213-2600.

[4] M M I, C L, E M. Digital Technologies for Monitoring and Improving Treatment Adherence in Children and Adolescents With Asthma: Scoping Review of Randomized Controlled Trials[J]. JMIR pediatrics and parenting, 2021, 4(3):e27999.

[5] X C, X S, L L, et al. Efficacy and safety of Chinese herbal medicine for atopic dermatitis: Evidence from eight high-quality randomized placebo-controlled trials[J]. Frontiers in pharmacology, 2022, 13: 927304.

DIGITAL EMPOWERMENT IN TCM PEDIATRICS: A MACHINE LEARNING PREDICTION MODEL FOR ALLERGIC COMORBIDITIES IN SINO-RUSSIAN SMART MEDICINE

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Abstract: This study explores the intersection of digital technology and traditional Chinese medicine (TCM) under the framework of Sino-Russian smart medicine innovation. Focusing on pediatric allergic comorbidities, such as allergic rhinitis and asthma, we propose a machine learning-based risk prediction model. This model digitizes TCM diagnostic parameters and integrates them with modern clinical data to enhance early intervention. This digital empowerment revitalizes traditional therapies, providing a collaborative blueprint for transnational pharmaceutical innovation and personalized pediatric care.

Keywords: digital empowerment, machine learning, TCM pediatrics, allergic comorbidities, smart medicine

1. The Burden of Pediatric Allergic Comorbidities

Allergic rhinitis and asthma are prevalent pediatric conditions that significantly impact child development, often manifesting as a sequential progression known as the "allergic march." Traditional Chinese medicine (TCM) offers unique advantages in managing these diseases through holistic regulation and constitution improvement, particularly by targeting Lung and Spleen deficiencies to halt this progression. However, standardizing subjective TCM diagnostics for broader integration remains a challenge in the modern objective medical landscape, which necessitates the introduction of artificial intelligence to systemize its complex efficacy mechanisms and diagnostic parameters[1].

2. Digital Empowerment: Machine Learning in Risk Prediction

To bridge the gap between traditional wisdom and modern technology, we developed a machine learning-based risk prediction model. Recent systematic analyses demonstrate that machine learning algorithms exhibit significant discriminatory power in predicting pediatric asthma exacerbations[2]. Furthermore, machine learning frameworks have proven effective in predicting the dynamic evolution of TCM body constitution types[3]. By utilizing algorithmic data processing, we analyzed extensive clinical datasets incorporating both objective immunological markers (such as IgE levels) and digitized TCM features (like tongue and pulse patterns) to identify key predictive factors for allergic progression. This digital approach transforms TCM syndrome differentiation into quantifiable data, allowing for precise risk stratification, optimized evidence-based interventions, and early clinical decision-making.

3. A New Paradigm for Sino-Russian Smart Medicine Integration

The digitization of TCM provides a robust foundation for transnational healthcare collaboration. Russia's established expertise in algorithmic modeling and biomedical informatics perfectly complements China's extensive clinical datasets in TCM. Within the Sino-Russian smart medicine ecosystem, our predictive model facilitates not only cross-border data sharing and academic exchanges between medical universities[4] , but also deep industrial integration. Specifically, the predictive algorithms can be translated into smart diagnostic software and wearable Internet of Things devices for continuous pediatric health monitoring. Such technological translation empowers telemedicine platforms, overcoming geographical barriers and enabling remote regions in both nations to access expert-level diagnostic resources. Ultimately, this collaborative framework accelerates the development of globally recognized, evidence-based TCM clinical guidelines, driving the modernization and internationalization of pediatric care.

4. Summary

This study presents an innovative approach by quantifying qualitative TCM syndrome differentiation into a machine learning-based predictive model for the pediatric "allergic march." This methodological breakthrough modernizes TCM treatments and strengthens Sino-Russian technological integration. However, certain limitations remain. The standardization of multimodal TCM data collection continues to be a technical bottleneck. Furthermore, the model's generalizability requires rigorous validation through multi-center, cross-regional clinical trials, particularly considering the diverse demographic and environmental differences between China and Russia. Despite these challenges, digital empowerment paves the way for a data-driven, globally integrated future in traditional medical systems.

References

[1] Yin L, Xue X, Pan S, et al. Artificial intelligence in traditional chinese medicine: systematic insights from data mining, large language models, and multimodal fusion[J]. Acta Materia Medica, 2025, 4: 674-697.

[2] Votto M, De Silvestri A, Postiglione L, et al. Predicting paediatric asthma exacerbations with machine learning: a systematic review with meta-analysis[J]. European Respiratory Review: an Official Journal of the European Respiratory Society, 2024, 33(174): 240118.

[3] Huo Y, Wang J, He Y, et al. Application of machine learning methods in prediction of the body constitution types and transformation trends of traditional chinese medicine: from the datasets of questionnaire survey on elderly people in southwest China[J]. Frontiers in Medicine, 2026, 13: 1698576.

[4] Jiang C, Chang H, Shahzad I. Digital economy and health: does green technology matter in BRICS economies?[J]. Frontiers in Public Health, 2022, 9.

MACHINE-LEARNING-ASSISTED CLINICAL PATTERN ANALYSIS OF PEDIATRIC ASTHMA BASED ON PROFESSOR WANG YOUPENG'S CLINICAL CASES

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Abstract

Asthma is a chronic heterogeneous airway disease with variable symptoms and preventable exacerbations. This study aimed to transform Professor Wang Youpeng's clinical experience in pediatric asthma into structured evidence through data mining and machine learning. De-identified records of children with bronchial asthma or cough-variant asthma were retrospectively collected. Demographic features, symptoms, triggers, tongue and pulse signs, syndromes, prescriptions and outcomes were extracted. Descriptive statistics, association-rule mining, clustering and machine-learning models were used to analyze clinical patterns and predict 4-week improvement. This study provides a digital approach for inheriting famous TCM experts' experience and supporting individualized asthma management.

Keywords: Clinical Cases, Professor Wang Youpeng, Machine Learning, Syndrome Differentiation, Data Mining, Traditional Chinese Medicine

Asthma is a common chronic inflammatory airway disease in children, characterized by recurrent wheezing, cough and variable airflow limitation1. Its exacerbations are often associated with respiratory infection, allergens, climate change and poor adherence. Professor Wang Youpeng, honored as a Famous TCM Doctor of Heilongjiang Province and recognized as the founder of cold-region pediatrics, has long treated pediatric asthma and related allergic diseases. However, expert experience is usually recorded in narrative clinical notes and is difficult to quantify. Real-world case mining and machine learning may convert these data into structured evidence and promote the digital inheritance of TCM pediatrics.

Objective

To analyze the clinical characteristics, syndrome distribution, prescription rules and response-related factors of childhood asthma based on Professor Wang Youpeng's clinical records, and to explore a machine-learning-assisted model for digital inheritance of expert experience.

Materials and methods

A retrospective clinical case study was performed. De-identified clinical records from Professor Wang Youpeng's clinic between 2020 and 2025 were collected. Children diagnosed with bronchial asthma or cough-variant asthma and having complete first-visit and follow-up information were included. Variables included demographic information, disease course, season, allergic history, triggers, symptoms, tongue and pulse signs, syndrome, formula, herbs and outcome. Natural

language processing plus manual review was used to standardize the data. Descriptive statistics, Apriori analysis, herb-network analysis and clustering were used to summarize clinical rules3. Logistic regression, random forest and XGBoost were used to predict 4-week improvement, with Accuracy, F1-score, AUC and SHAP values for evaluation.

Results and discussion

1.A total of 572 patients and 894 clinical visits were included. The median age was 9.2 years, and 339 patients were boys. Bronchial asthma accounted for 337 cases, and cough-variant asthma accounted for 235 cases. The median disease course was 1.8 years. Visits were more frequent in autumn, winter and spring than in summer. Common triggers included respiratory infection, seasonal or temperature change, allergen exposure and cold-air or exercise stimulation. The main manifestations were cough, wheezing, night cough, sputum and chest tightness.

2.Syndrome differentiation showed that phlegm-heat obstructing the lung was the most frequent pattern, followed by cold asthma, lung-spleen qi deficiency, lung-kidney deficiency and wind-phlegm attacking the lung. These results suggest that childhood asthma in Professor Wang's practice was characterized by deficiency in origin and excess in manifestation.

3.Prescription mining showed that the main therapeutic principles were resolving phlegm, relieving cough and wheezing, clearing heat, dispersing wind and strengthening the spleen. Frequently used herbs included Gancao, Baiguo, Xingren, Huangqin, Zisuzi, Fabanxia, Chenpi, Fuling, Baizhu and Fangfeng. Core combinations such as Chenpi-Fabanxia, Chenpi-Fuling and Baizhu-Taizishen indicated the integration of disease differentiation, syndrome differentiation and pediatric constitution regulation.

4.Unsupervised clustering divided the patients into three phenotypes: allergy-dominant, infection-phlegm and deficiency-recurrence. The infection-phlegm group showed the highest 4-week improvement rate, while the deficiency-recurrence group responded more slowly, suggesting that disease course and constitution may influence outcomes.

5.At the 4-week follow-up, 426 patients showed improvement, while 146 showed insufficient improvement. XGBoost achieved the best performance, with an AUC of 0.84, accuracy of 0.81 and F1-score of 0.87, followed by random forest and logistic regression. SHAP analysis showed that night cough, wheezing, disease course, allergic history, season, sputum character, tongue coating, syndrome type and core herb combinations were important predictors, indicating that machine learning can reveal interpretable clinical rules from Professor Wang's experience.

References:

1. Jayasooriya SM, Devereux G, Soriano JB, Singh N, Masekela R, Mortimer K, Burney P. Asthma: epidemiology, risk factors, and opportunities for prevention and treatment. Lancet Respir Med. 2025 Aug;13(8):725-738.

2. Yang J, Wang Q, Zhou S, Zhang F, Lv Z. Construction of Chinese Medicine Prescription Data Mining Based on Association Rules of the System. Exploratory Research and Hypothesis in Medicine. 2023;8(4):307–318.

CORRELATION BETWEEN HOMOCYSTEINE AND ALL-CAUSE MORTALITY RISK IN PATIENTS WITH CORONARY HEART DISEASE: IMPLICATIONS FOR DIGITALLY ENABLED CARDIOVASCULAR PROGNOSIS ASSESSMENT

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Abstract

This study investigated the relationship between homocysteine (Hcy) levels and all-cause mortality risk in patients with coronary heart disease (CHD) and analyzed its potential application in digitally enabled cardiovascular prognosis assessment. A single-center retrospective cohort study enrolled 660 CHD patients with a median follow-up of 45.7 months. Multivariate Cox regression showed that for each 1 μmol/L increase and each standard deviation increase in Hcy, the risk of all-cause mortality increased by 1% and 15.1%, respectively (HR=1.010, 95% CI: 1.001-1.019, P=0.038; HR=1.151, 95% CI: 1.007-1.314, P=0.038). Subgroup and sensitivity analyses confirmed the robustness of this association. ROC analysis yielded an AUC of 0.660 (P<0.001), and Kaplan-Meier curves demonstrated a higher cumulative mortality risk in the high Hcy group (Log-rank P<0.001). Hcy is an independent risk factor for all-cause mortality in CHD patients, and its inclusion in digital prognostic assessment models may improve predictive accuracy while providing a viable pathway for Sino-Russian smart pharmaceutical cooperation.

Keywords: Homocysteine, Coronary Heart Disease, All-Cause Mortality, Digital Empowerment, Sino-Russian Cooperation

Coronary heart disease (CHD) is a leading cause of death and disability worldwide, with mortality rates continuing to rise in China [1-2]. Beyond traditional risk factors, homocysteine (Hcy) is believed to contribute to atherosclerosis through endothelial injury, platelet aggregation, and lipid metabolism disorders[3-4]. Against the backdrop of "Digital Empowerment · Tradition Revitalization — Sino-Russian Smart Pharmaceutical Innovation and Industrial Integration," constructing digital prognostic assessment models using real-world data and biomarkers is of great significance. Both China and Russia face a substantial burden of cardiovascular disease, and collaborative research on digital technology-driven risk stratification holds broad prospects for cooperation.

Objective

To analyze the association between Hcy and all-cause mortality risk in CHD patients and explore its potential application in digital cardiovascular risk management within the framework of Sino-Russian smart pharmaceutical cooperation.

Materials and Methods

This study included 660 CHD patients hospitalized at the Second Affiliated Hospital of Heilongjiang

University of Chinese Medicine from June 2019 to December 2022. Baseline data were collected through the electronic medical record system. Follow-up continued until April 30, 2025, or the occurrence of all-cause death. Univariate and multivariate Cox proportional hazards models were used to assess the relationship between Hcy and all-cause mortality, with adjustment for age, sex, smoking, comorbidities, laboratory indicators, and medications. Subgroup analyses, sensitivity analyses, ROC curves, and Kaplan-Meier survival curve analyses were performed.

Results and Discussion

Over a median follow-up of 45.7 months, 81 deaths (12%) occurred among the 660 patients. Hcy levels were significantly higher in the deceased group than in the survivor group (16.70 vs. 13.60 μmol/L, $P<0.001$). After full adjustment, each 1 μmol/L increase in Hcy was associated with a hazard ratio (HR) of 1.010 (95% CI: 1.001-1.019, $P=0.038$) for all-cause mortality, and each standard deviation increase yielded an HR of 1.151 (95% CI: 1.007-1.314, $P=0.038$). Subgroup and sensitivity analyses confirmed the robustness of the results. The area under the ROC curve was 0.660 ($P<0.001$), and the high Hcy group showed significantly higher cumulative mortality (Log-rank $P<0.001$). Mechanistically, Hcy accelerates atherosclerotic progression through endothelial dysfunction, oxidative stress, and platelet activation[5].

From a digital empowerment perspective, incorporating Hcy into digital cardiovascular risk scoring systems can improve the precision of CHD prognostic stratification. Leveraging the Sino-Russian smart pharmaceutical cooperation platform, both parties can share data resources and jointly develop digital prognostic models applicable to East Asian and Slavic populations. Traditional Chinese medicine has advantages in regulating Hcy metabolism, and its integration with digital health technologies represents a promising direction for Sino-Russian cooperation.

Elevated Hcy is an independent risk factor for all-cause mortality in CHD patients. Incorporating it into digital prognostic assessment systems facilitates risk monitoring and early warning, while also providing a technical entry point for cross-border industry-academia-research collaborative innovation in the context of Sino-Russian smart pharmaceutical cooperation.

References

[1] Wang T, Li R, Gao W, Zhang H. Correlation of homocysteine with the risk of all-cause mortality in patients with coronary heart disease. Front Cardiovasc Med. 2025;12:1624847.

[2] Center For Cardiovascular Diseases. Report on Cardiovascular Health and Diseases in China 2023. Biomed Environ Sci. 2024;37(9):949-992.

[3] Schaffer A, Verdoia M, Cassetti E, et al. Relationship between homocysteine and coronary artery disease. Thromb Res. 2014;134(2):288-293.

[4] Splayer A, Lamas GA, Hennekens CH. Homocysteine and cardiovascular disease. Am Heart J. 2004;148(1):34-40.

[5] Sun J, Han W, Wu S, et al. Hyperhomocysteinemia and acute coronary syndrome in young adults. BMC Cardiovasc Disord. 2021;21(1):47.

AN AI-ENABLED QUALITY CONTROL FRAMEWORK FOR CHINESE AND RUSSIAN HERBAL MEDICINES

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Abstract

Traditional herbal medicines are important health resources in both China and Russia, yet their chemical variability complicates authentication, process control and cross-border standardization. This paper proposes a practical China–Russia framework that combines digital traceability, spectroscopic and chromatographic fingerprints, and interpretable artificial intelligence (AI). The framework links authenticated botanical materials, harmonized analytical protocols, multimodal data models and human expert review. Literature synthesis indicates that AI can support species identification, origin discrimination, adulteration screening and batch-consistency assessment, but performance depends on reference materials, representative datasets, external validation and transparent governance. A shared pilot platform could modernize traditional medicine without separating digital innovation from pharmacognostic knowledge and regulatory responsibility.

Keywords: artificial intelligence; herbal medicine; quality control; digital traceability; spectral fingerprinting; China–Russia cooperation; explainable models

Herbal medicines are chemically complex products whose quality is influenced by species, geographical origin, cultivation, harvest time, processing and storage. Conventional quality control remains indispensable, but single-marker testing may not fully capture this variation. China and Russia possess complementary medicinal-plant resources, pharmacognostic expertise and analytical capacity. Their cooperation therefore offers a useful setting for a digital quality system that preserves traditional knowledge while improving reproducibility, safety and industrial interoperability.

Objective

To develop an evidence-informed framework for AI-assisted authentication and quality control of Chinese and Russian herbal medicines, and to identify the technical and governance conditions required for a joint pilot programme.

Materials and methods

A targeted narrative review was conducted using international guidance and peer-reviewed literature on herbal-drug quality control, chromatographic fingerprinting, spectroscopy, chemometrics, machine learning, digital traceability and model reporting. Evidence was grouped into four workflow stages: data acquisition, analytical modelling, validation and governance. The synthesis prioritized approaches that can be implemented by collaborating universities, pharmacopoeial laboratories and manufacturers, and excluded proposals that replace laboratory verification with unvalidated algorithmic prediction.

Results and discussion

The proposed framework has four connected layers. First, a bilingual digital specimen and batch record should connect accepted scientific names, voucher specimens, collection coordinates, cultivation and processing metadata, storage conditions and custody events. Standardized identifiers and controlled vocabularies are essential because inconsistent names can introduce label noise before any model is trained. QR or equivalent machine-readable identifiers can connect physical samples with laboratory records, while access controls should protect sensitive commercial and location data. Second, participating laboratories should acquire complementary fingerprints. Macroscopic and microscopic images describe morphology; near-infrared or Raman spectra enable rapid, low-waste screening; and high-performance liquid chromatography or mass spectrometry provides chemically specific confirmation. DNA-based authentication can resolve selected species questions but does not by itself establish chemical quality. Multimodal fusion is therefore preferable to a single sensor, especially for processed materials in which morphology or DNA may be degraded. Third, chemometric and machine-learning models can translate fingerprints into decisions. Exploratory methods can reveal clusters and outliers, whereas supervised models can classify species or origin and estimate marker ranges. However, random sample splitting may exaggerate performance when spectra from the same batch occur in both training and test sets. Validation should therefore be performed by independent batch, harvest, laboratory and instrument, with predefined acceptance criteria. Predictions should include uncertainty and interpretable features so that analysts can identify the spectral or chemical evidence supporting a flag. Fourth, the system requires joint governance. A China–Russia steering group should define a shared minimum dataset, reference-sample policy, calibration-transfer procedures, version control and responsibilities for error investigation. Algorithms should assist, not replace, pharmacognosists and quality-control professionals. Human review is particularly important for rare materials, novel adulterants and distribution shifts. A practical pilot could begin with three to five widely used medicinal plants and compare blinded samples across laboratories. Success measures should include sensitivity to adulteration, specificity, between-laboratory reproducibility, decision time, cost per sample and the proportion of uncertain cases referred for confirmatory testing. The principal benefits are earlier detection of atypical batches, more efficient allocation of confirmatory testing, and a traceable evidence chain for research and industry. The main risks are nonrepresentative datasets, undocumented preprocessing, instrument drift, opaque models, data-ownership disputes and automation bias. These risks can be reduced through prospective protocols, external proficiency testing, audit trails, model cards and scheduled recalibration. The framework is a design proposal rather than evidence of clinical effectiveness; quality prediction must not be interpreted as proof of therapeutic efficacy or safety.

Conclusion

AI can support the renewal and industrial integration of traditional medicine when it is built on authenticated specimens, harmonized measurements and accountable expert review. A phased China–Russia pilot combining traceability, multimodal fingerprints and externally validated, interpretable models would provide a realistic route from academic cooperation to shared quality infrastructure.

References

1. World Health Organization. WHO guidelines on good herbal processing practices for herbal medicines. Geneva: WHO; 2018.

2. World Health Organization. WHO global strategy on digital health 2020–2025. Geneva: WHO; 2021.

3. Liang YZ, Xie P, Chan K. Quality control of herbal medicines. J Chromatogr B. 2004;812:53–70. doi:10.1016/j.jchromb.2004.08.041.

4. Goodarzi M, Russell PJ, Vander Heyden Y. Similarity analyses of chromatographic herbal fingerprints: a review. Anal Chim Acta. 2013;804:16–28. doi:10.1016/j.aca.2013.09.017.

DIGITAL EMPOWERMENT + TRADITIONAL RENEWAL: SYNERGIZING SINO-RUSSIAN SMART MEDICINE FOR INDUSTRY INTEGRATION

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Abstract

This paper examines the "Digital Empowerment + Traditional Renewal" paradigm within Sino-Russian smart medicine cooperation. Analyzing biopharmaceutical data (2023-2026), policy frameworks, and technological mechanisms reveals complementary advantages: China's AI-driven drug discovery (22-46% screening hit rates) and blockchain traceability (113+ herb species) synergize with Russia's traditional medicine heritage (4,000+ herbal species). We identify cooperation mechanisms, representative cases, and project that agentic AI, federated learning, and digital therapeutics will reach mainstream adoption within 5-10 years. Phased policy recommendations addressing interoperability, IP protection, and talent development are proposed.

Keywords: digital health, traditional medicine, cross-border cooperation, AI drug discovery, blockchain traceability

The convergence of digital technologies and traditional medicine offers a transformative healthcare paradigm, particularly for Sino-Russian strategic partnership. China's biopharma revenue reached ¥3.14 trillion in 2024, with AI-driven candidates achieving 22-46% screening hits (vs. 2% traditional). Russia has ~4,000 herbal species, and its Pharma 2030 strategy targets 66.6% domestic production by 2030. This paper addresses the gap in systematic analysis of digital-traditional integration in this bilateral context.

Objective

To assess the current state and future potential of Sino-Russian smart medicine cooperation, identify key digital empowerment mechanisms and traditional renewal pathways, and propose phased policy recommendations for industry integration.

Materials and Methods

We employ a multi-dimensional analytical framework encompassing industrial chain (upstream-midstream-downstream), spatial (cross-border zones), and actor (multi-stakeholder) dimensions. Data sources include Chinese and Russian government statistics (2020-2025), policy documents (Pharma 2030, Digital TCM Development Opinions), industry reports, and academic literature. We apply industry convergence theory, technology-economic paradigm theory, and global value chain analysis to interpret cooperation dynamics. Technology maturity assessment utilizes Gartner Hype Cycle methodology. Case analysis examines four representative Sino-Russian cooperation initiatives.

Results and Discussion

China's digital health covers 96% of urban areas; its smart healthcare market will exceed ¥40 billion by 2028. Russia's EMIAS reaches 75% of medical organizations, with universal coverage targeted by 2025. Policy alignment is reinforced by SCO and BRICS health cooperation.

Three digital empowerment mechanisms stand out. (1) AI-driven TCM screening achieves 22–46% hit rates and 80–90% Phase I success for AI-discovered compounds. (2) Blockchain traceability now covers 113 herb species across 457 bases (12,000 daily updates), and can integrate Russian herbal supply chains for trusted certification. (3) Digital twins and IoT can modernise Russia's 3,500+ sanatoriums (8 million annual visitors), enabling personalised therapies blending TCM wellness with balneotherapy.

Traditional renewal pathways include TCM knowledge graphs (>100,000 formulas, 10,000 herbs), EHR-based evidence generation for Russian folk medicine, and EAEU registration alignment (Kazakhstan TCM exports up 1,422.5% YoY in 2025). Four cooperation cases illustrate progress: the Pharmaceutical Forum (400+ participants), Pharmasyntez–Hualan Bio joint R&D, the SCO Traditional Medicine Forum (training 10,000 professionals), and the Standards Centre (12 forums, product registrations).

Gartner analysis places agentic AI, federated learning, and DTx for traditional indications at the innovation trigger, with mainstream adoption expected in 5–10 years. Critical success factors include regulatory harmonisation (a dedicated EAEU traditional medicine pathway), interoperable digital infrastructure, IP protection for traditional knowledge, and sustained SCO/BRICS commitment. Phased recommendations: short-term (1-2 yr): establish a Digital Health Working Group, pilot blockchain for 5-10 herbs, expand university curricula; medium-term (3-5 yr): mutual GMP recognition, production federated learning, $1B bilateral trade target; long-term (5-10 yr): a regional AI research centre, full regulatory alignment, and integrated germplasm-to-delivery supply chains.

Conclusion

Sino-Russian smart medicine cooperation capitalises on complementary digital and traditional strengths. Technologies now at early stages will likely achieve mainstream adoption within a decade, and early strategic investments will yield disproportionate returns. Both nations must invest now in institutional, technical, and human capital to realise the full benefits—improving chronic disease management, reducing pharmaceutical import dependence, and strengthening pandemic preparedness through shared digital surveillance.

References

1. Nat. Bureau Stat. China. China Statistical Yearbook 2024.
2. Intuition Labs. Measuring AI ROI in Drug Discovery. 2025.
3. Min. Industry Info. Tech. TCM Traceability Progress Report. 2025.
4. Boronoev VV, Pupysheva NV. Indian J Tradit Knowl. 2023.
5. Gov. Russian Fed. Pharma 2030 Strategy (Decree No. 1495-r). 2023.
6. Gartner. Hype Cycle for U.S. Healthcare Payers. 2025.

DIGITALLY RENEWING TRADITIONAL INDICATORS: A SHAP-BASED CLINICAL RISK SCORECARD AND WEB CALCULATOR FOR PREGNANCY OUTCOMES IN PCOS

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Abstract: SHAP analysis identified risk thresholds and stratified scores for key variables, leading to a PCOS pregnancy outcome risk scorecard (with FAI, total fasting insulin, HOMA-IR, TG, and SHBG) and a web-based online calculator. The calculator provides real-time individualized predictions, risk stratification, and composite scores, with dynamic visualization of each variable's contribution. Total fasting insulin, TG, and HOMA-IR showed stronger contributions to adverse outcomes, consistent with SHAP. This system digitally renews traditional indicators, transforming a complex model into an interpretable decision-support tool for PCOS pregnancy outcome management.

Keywords: Polycystic ovary syndrome; SHAP; Risk scorecard; Online prediction calculator; Pregnancy outcomes

Polycystic ovary syndrome (PCOS) is the most common endocrine-metabolic disorder in reproductive-age women, associated with adverse pregnancy outcomes such as miscarriage, preterm birth, and gestational diabetes[1]. Traditional methods often fail to capture nonlinear interactions among multiple indicators, while machine learning models, though more accurate, are limited clinically by their "black-box" nature[2]. To digitally renew traditional indicators, this study constructed a SHAP-based risk scoring system and online calculator for individualized, interpretable risk assessment of pregnancy outcomes in PCOS.

Objective

To construct a clinical risk scorecard for pregnancy outcomes in PCOS using SHAP analysis and to develop an online prediction calculator, thereby enabling the clinical translation of a machine learning model.

Materials and Methods

We constructed and validated a machine learning model to predict pregnancy outcomes in PCOS patients. A cohort of 1,000 PCOS patients (21 centers, 2012–2014) was split 7:3 into training and validation sets. The composite outcome included early miscarriage, preterm birth, gestational diabetes, hypertensive disorders, and LGA infants. Variables extracted included age, BMI, FAI, fasting insulin, HOMA-IR, TG, SHBG. XGBoost outperformed random forest and logistic regression (AUC, DCA, classification metrics). SHAP dependence plots determined risk thresholds, enabling a scorecard incorporating FAI, fasting insulin, HOMA-IR, TG, and SHBG. An R Shiny calculator with SHAP visualization was developed. Risk stratification was assessed by Kaplan–Meier curves and log-rank test.

Results and Discussion

XGBoost achieved validation AUC 0.647 vs. 0.552 for logistic regression. Fasting insulin, HOMA-IR, and TG were the top SHAP features, followed by SHBG and FAI. Key thresholds: fasting insulin ≥14.5 mIU/L, HOMA-IR ≥3.8, TG ≥1.7 mmol/L, FAI ≥4.2, SHBG ≤28.5 nmol/L, all associated with elevated risk. Adverse outcome rates in the validation set were 62.5% (high-risk), 27.3% (intermediate), and 9.1% (low-risk) ($P<0.001$). The calculator instantly returned probabilities, risk strata, and SHAP contributions, with fasting insulin and TG most prominent. Metabolic-endocrine indicators demonstrated superior predictive value over hyperandrogenemic indices alone. Transforming variables into risk intervals via SHAP adds value to traditional markers. Limitations include the single-center retrospective design and composite endpoint, warranting multicenter prospective validation.

Conclusions

This study translated the XGBoost model into a SHAP-based scorecard (FAI, fasting insulin, HOMA-IR, TG, SHBG) and developed an online calculator. By revitalizing traditional indicators, this system provides an interpretable tool for precise PCOS pregnancy risk assessment.

References:

[1] Xie, N., Zhao, W. Adverse pregnancy and perinatal outcomes in women with polycystic ovary syndrome undergoing assisted reproductive technology: a systematic review and meta-analysis.[J] Frontiers in medicine. 2025, 12, 1656389.

[2] Nohara, Y., Matsumoto, K., Soejima, H., Nakashima, N. Explanation of machine learning models using shapley additive explanation and application for real data in hospital.[J] Computer Methods and Programs in Biomedicine. 2022, 214, 106584.

[3] Wu, X.K., Stener-Victorin, E., Kuang, H.Y., Ma, H.L., Gao, J.S., Xie, L.Z., et al. Effect of Acupuncture and Clomiphene in Chinese Women With Polycystic Ovary Syndrome: A Randomized Clinical Trial.[J] Jama. 2017, 317, 2502-14.

DIGITAL EVIDENCE-CHAIN FRAMEWORK FOR QUALITY EVALUATION AND TRANSLATION OF TRADITIONAL MEDICINAL PLANTS

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Abstract

The quality of traditional medicinal plants is influenced by origin, harvesting, processing and storage. Due to complex composition and batch variability, single-marker tests cannot fully reflect quality consistency or translational value. Based on studies on quality markers, data fusion, artificial intelligence and traceability, this paper proposes a digital evidence-chain framework linking source authentication, process recording, chemical profiling, effect-related interpretation and translational use. It may improve evidence continuity and support standardization, intelligent quality control and cross-regional development.

Keywords: traditional medicinal plants, quality evaluation, digital evidence chain, quality markers, artificial intelligence, translational application

Traditional medicinal plants are important resources for traditional medicine and natural product research. With analytical science and data technology, their study has shifted from empirical use to quality-controlled evaluation. Unlike single chemical entities, medicinal plant products contain multiple constituents, and their quality is affected by origin, harvesting, processing and storage. Modern quality research should therefore explain chemical composition, transfer and relation to quality attributes.

Chromatography, mass spectrometry, spectroscopy, DNA barcoding and fingerprint analysis have been applied to authentication and quality assessment. However, source information, processing records and final product testing are often separated. Quality assessment may rely on limited markers, while digital models sometimes lack external validation. A coherent framework is therefore needed.

Objective

To construct a digital evidence-chain framework for quality evaluation of traditional medicinal plants and discuss its value in intelligent quality control, standardization and translational application.

Materials and methods

A narrative review and framework construction were adopted. Studies on quality evaluation, quality markers, data fusion, artificial intelligence, traceability and pharmacopoeial standardization were summarized. The framework was established from five aspects: source authentication, process control, chemical characterization, effect-related interpretation and translational application.

Results and discussion

The digital evidence chain starts with source authentication. Botanical origin, production area, harvesting time and storage conditions affect material authenticity and consistency. Morphological identification, DNA barcoding, near-infrared spectroscopy and image recognition, combined with standardized records, support batch comparison and traceability.

Process control links raw materials to final products. Drying, cutting, processing, extraction and formulation may alter constituents. Recording temperature, time, solvent ratio, moisture, yield and representative compounds helps identify quality variation and support batch consistency.

Chemical characterization provides core evidence. Chromatography, mass spectrometry, nuclear magnetic resonance, infrared spectroscopy and omics technologies describe chemical profiles, while data fusion and machine learning support origin discrimination, quality grading and abnormal-batch warning. These models should assist rather than replace experimental validation.

Effect-related interpretation connects component detection with quality meaning. Quality markers should be specific, measurable, transferable and, where possible, related to efficacy or safety, reflecting origin, processing transfer, exposure, activity or risk.

Translational application integrates these data for standard development, quality supervision and product development, and may support sample banks, method comparison, non-sensitive data sharing and standardized evaluation across regions.

Conclusion

The digital evidence-chain framework integrates source authentication, process control, chemical characterization, effect-related interpretation and translational application. It may reduce single-marker limitations and improve the continuity of quality control.

References

1. World Health Organization. Global traditional medicine strategy 2025-2034. Geneva: World Health Organization; 2025. ISBN: 978-92-4-011317-6.
2. Yang W, Zhang Y, Wu W, Huang L, Guo D, Liu C. Approaches to establish Q-markers for the quality standards of traditional Chinese medicines. Acta Pharmaceutica Sinica B. 2017;7(4):439-446. doi:10.1016/j.apsb.2017.04.012.
3. Shikov AN, Narkevich IA, Flisyuk EV, Luzhanin VG, Pozharitskaya ON. Medicinal plants from the 14th edition of the Russian Pharmacopoeia, recent updates. Journal of Ethnopharmacology. 2021;268:113685. doi:10.1016/j.jep.2020.113685.
4. Chen Z, Vong CT, Zhang T, Yao C, Wang Y, Luo H. Quality evaluation methods of Chinese medicine based on scientific supervision: recent research progress and prospects. Chinese Medicine. 2023;18:126. doi:10.1186/s13020-023-00836-3.
5. Ding R, Yu L, Wang C, Zhong S, Gu R. Quality assessment of traditional Chinese medicine based on data fusion combined with machine learning: a review. Critical Reviews in Analytical Chemistry. 2024;54(7):2618-2635. doi:10.1080/10408347.2023.2189477.
6. Song Z, Chen G, Chen CYC. AI empowering traditional Chinese medicine? Chemical Science. 2024;15(41):16844-16886. doi:10.1039/D4SC04107K.

ARTIFICIAL INTELLIGENCE IN TCM: DRIVING DIGITAL INNOVATION AND TRANSFORMATION

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Abstract

This review synthesizes AI applications in Traditional Chinese Medicine (TCM), covering machine learning (ML), deep learning (DL), large language models (LLMs), network pharmacology, multi-omics, and quality control. Generative AI's roles in formulation decoding and herb–drug interaction prediction are highlighted. AI addresses standardization challenges, enhances diagnostics, and integrates TCM into digital health frameworks.

Keywords: artificial intelligence, traditional Chinese medicine, machine learning, digital health, network pharmacology

TCM modernization is hindered by subjective diagnostics and complex mechanisms. AI, particularly ML and DL, provides quantitative methods to complement clinical expertise. This review evaluates AI-driven TCM diagnosis, prescription optimization, pharmacology, and quality control, outlining challenges and future pathways.

Objective

To evaluate AI integration into TCM research, focusing on diagnostic support, prescription optimization, network pharmacology, multi-omics, quality assurance, and ethical pathways.

Materials and Methods

A narrative review of literature (2024–2025) from PubMed, Web of Science, ScienceDirect, CNKI, and Wanfang was conducted using search terms covering AI, ML, DL, LLMs, TCM, network pharmacology, multi-omics, and quality control.

Results and Discussion

AI significantly advances objective diagnostics in TCM. Combined with computer vision and natural language processing, ML/DL models achieve quantitative tongue and pulse assessments to complement clinical intuition. LLMs have also emerged as powerful decision aids. Notably, the TCM-DS model (built on DeepSeek R1 with LoRA fine-tuning and a retrieval-augmented generation module) achieved a recommendation precision of 0.9924 for edible herbal formulas, outperforming general models. Furthermore, mainstream LLMs like GPT-4o, Qwen 2.5 Max, and Doubao 1.5 Pro perform comparably to professional acupuncturists in diagnosis and acupoint selection, demonstrating high clinical support potential.

Simultaneously, network pharmacology has been revolutionized by AI. Integrating network target analysis with AI and multi-modal multi-omics (genomics, transcriptomics, proteomics, and

metabolomics) enables multi-scale analysis of TCM formulae, syndromes, and toxicity. These algorithms construct herb–ingredient–target–pathway networks to accelerate bioactive compound discovery and decipher multi-target synergistic effects, bridging the gap between mechanism research and diagnosis-treatment integration. Beyond predictive modeling, generative AI drives ethnopharmacological innovation. A five-phase strategic framework guides its ethical implementation, optimizing ancient knowledge digitization, polyherbal formulation decoding, herb–drug interaction prediction, and phytopharmaceutical discovery while ensuring data governance and cultural sensitivity.

Quality assurance is also vital for TCM standardization. AI technologies, including image recognition, spectral analysis, and electronic noses, are successfully applied to authenticity verification, origin tracing, and quality grading of medicinal materials. These models evaluate herbal quality, predict pharmacokinetic properties, and monitor batch consistency, supported by intelligent electronic medical records and digital hospitals. However, persistent challenges remain, including data scarcity, class imbalance, domain shift, and limited model interpretability. Ethical concerns regarding data privacy and traditional knowledge misappropriation require strict governance. Future research must prioritize multi-source heterogeneous data integration, explainable AI frameworks, and interdisciplinary collaboration, leveraging wearable sensors and digital twins for personalized TCM.

Conclusion

AI reshapes TCM by providing objective, data-driven tools for diagnosis, treatment, pharmacology, and quality control. The convergence of ML, DL, LLMs, network pharmacology, and multi-omics with TCM principles enhances clinical efficacy and dissemination. Addressing data and ethical bottlenecks will establish a systematic, scientific digital healthcare framework.

References:

1.Lu L., Lu T., Tian C., Zhang X. AI: Bridging Ancient Wisdom and Modern Innovation in Traditional Chinese Medicine. JMIR Med Inform. – 2024. – T. 12. – C. e58491.

2.Pan D., Guo Y., Fan Y., Wan H. Development and Application of Traditional Chinese Medicine Using AI Machine Learning and Deep Learning Strategies. Am J Chin Med. – 2024. – T. 52. – № 3. – C. 605-623.

3.Liu Y., Yuan Y., Yan K., et al. Evaluating the role of large language models in traditional Chinese medicine diagnosis and treatment recommendations. NPJ Digit Med. – 2025. – T. 8. – № 1. – C. 466.

4.Bhadra S., Pundir C., Mukherjee M., et al. Reimagining ethnopharmacology with generative AI: Towards inclusive, ethical, and data-driven traditional medicine. Pharmacol Res. – 2025. – T. 221. – C. 108002.

5.Li M.Y., Zhu J.Q., Liu X.N., et al. Application and research progress on artificial intelligence in the quality of Traditional Chinese Medicine. Front Pharmacol. – 2025. – T. 16. – C. 1687681.

6.Li X., He H., Lu G., et al. TCM-DS: a large language model for intelligent traditional Chinese medicine edible herbal formulas recommendations. Chin Med. – 2025. – T. 20. – № 1. – C. 191.

RESEARCH ON THE INNOVATION AND INDUSTRIAL INTEGRATION OF SINO - RUSSIAN SMART MEDICINE DRIVEN BY AI AND BIG DATA

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Abstract

Based on official policies, industry data and cooperation records, this three-year (2022–2024) comparative study analyzes digital technology applications in Sino-Russian traditional medicine innovation and industrial cooperation across four dimensions. It finds AI shortens preclinical R&D cycles of active ingredients by 30%–50%, China's digital TCM infrastructure covers 17,800 grassroots clinics, and TCM extract exports to Russia grew 19.97% year-on-year in the first three quarters of 2024, confirming digital technology as a core innovation driver and proposing targeted paths for industrial integration.

Keywords: Digital empowerment; China-Russia medical cooperation; Intelligent traditional medicine; Industrial integration; Artificial intelligence-assisted drug R & D

Against the global digital economy, technologies like AI and big data have integrated into the full pharmaceutical chain, driving the digital and intelligent transformation of global traditional medicine.China prioritizes digital TCM development, with 2024 national policies setting a 3–5 year goal of building a full-coverage "digital intelligent TCM" system. Russia boasts abundant natural medicinal resources, including 709 approved species and 137 pharmacologically active native Siberian ones.With complementary strengths, Sino-Russian cooperation in traditional medicine and digital health continues to deepen, making the digital development of traditional medicine a core shared focus for both countries.

Objective

Evaluate the current application status of digital technology in the innovation of traditional medicine in China and Russia, analyze the growth trend of bilateral medical industry cooperation, and explore feasible paths for the integrated development of smart traditional medicine industries.

Materials and Methods

This study combines literature review, comparative analysis and statistical analysis. Drawing on 2022–2024 official policies, industry statistics and Sino-Russian medical cooperation records from both countries' competent authorities and research institutions, it establishes a four-dimensional framework covering AI-assisted ingredient screening, digital medical services, intelligent pharmaceutical production and bilateral industrial cooperation for horizontal comparison to identify development features and potential cooperation space.

Results and Discussion

Digital technology has significantly improved traditional medicine R&D efficiency and service systems. AI addresses long-standing bottlenecks in natural medicine research via machine learning and molecular docking, enabling high-throughput virtual screening, shortening the preclinical active ingredient development cycle by 30%–50% and cutting experimental costs. Both countries have built professional medicinal plant databases, and joint complementary screening will further expand candidate compound sources. China has formed a multi-level smart TCM service system, with over 60% of tertiary TCM hospitals offering online services and a national health information platform covering 17,800 grassroots clinics; Russia's mature experience in electronic medical systems and biomedical databases supports cross-regional digital health platform construction and clinical evidence standardization.

Sino-Russian smart medicine cooperation maintains steady growth in trade and scientific research. Bilateral pharmaceutical trade reached 2.362 billion US dollars in the first three quarters of 2024, with TCM extract exports to Russia up 19.97% year on year. The annual medical sci-tech cooperation fund expanded to 300 million RMB in 2024, supporting 17 joint projects through 8 co-built R&D platforms by year-end; inter-university cooperation between Heilongjiang and Russian institutions has formed a regional innovation ecosystem integrating talent training, research and technology transfer. Nevertheless, the cooperation still faces constraints: inconsistent traditional medicine data standards, technical and legal barriers to cross-border data sharing, insufficient participation in international standard formulation, and a relative shortage of interdisciplinary talents.

Conclusion

Digital technology is reshaping traditional medical innovation and unlocking new opportunities for Sino-Russian medical sci-tech cooperation. AI, big data and intelligent manufacturing boost traditional medicine R&D efficiency and industrial competitiveness, while advancing bilateral resource sharing, standard mutual recognition and industrial collaboration.

Going forward, both sides should strengthen digital infrastructure, co-build smart medical innovation platforms, align digital standards and cultivate interdisciplinary talents, to build an influential Sino-Russian smart medical cooperation system and contribute to the modernization of global traditional medicine.

References

1. Yu R, et al. Development and application of artificial intelligence in traditional Chinese medicine research and development. Frontiers in Pharmacology, 2025.
2. National Administration of Traditional Chinese Medicine, National Data Bureau. Several Opinions on Promoting the Development of Digital Traditional Chinese Medicine. 2024.
3. National Administration of Traditional Chinese Medicine. Reply to Recommendation No. 7188 of the Second Session of the 14th National People's Congress. 2025.
4.Nekratova O, Kosmodemyanskiy L. A Study of Siberia's Medicinal Plants Used in Homeopathy. International Journal of Homeopathic Medicine, 2018.
5.China Chamber of Commerce for Import and Export of Medicines and Health Products. Briefing on Pharmaceutical Foreign Trade with Belt and Road Countries in the First Three Quarters of 2024. 2025.

DIGITAL PERSPECTIVE ON TONGUE DIAGNOSIS IN CHRONIC GASTRITIS: A CLINICAL REVIEW

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Abstract

Tongue diagnosis is pivotal to pattern differentiation in chronic gastritis. This review summarises the tongue manifestations of five common Traditional Chinese Medicine (TCM) patterns and their clinical value. Distinct tongue body and coating characteristics correspond to each pattern, and dynamic changes assist in evaluating treatment response. Traditional tongue diagnosis is subjective and poorly reproducible—issues that digital approaches may help address.

Keywords: chronic gastritis; tongue diagnosis; TCM patterns; digitalization; objectification

Chronic gastritis is among the most prevalent digestive disorders, and traditional Chinese medicine has accumulated a substantial body of knowledge in its pattern-based management. Tongue inspection, a core visual examination, plays an irreplaceable role in determining disease nature, identifying patterns, and monitoring therapeutic response. The spleen meridian connects to the root of the tongue, while the stomach meridian ascends along the throat, allowing the condition of the spleen and stomach to manifest visibly on the tongue. However, traditional tongue diagnosis depends heavily on subjective experience, and reproducibility remains a concern—a limitation that digital technologies may help overcome.

Objective

The present study aims to systematically review the tongue characteristics associated with common chronic gastritis patterns and their clinical relevance, with a brief forward look from a digital perspective.

Materials and methods

A literature review was conducted using the combined terms "chronic gastritis" AND "tongue diagnosis" in CNKI and PubMed (2010-2025). The search was filtered for clinical studies and reviews, and articles addressing the correlation between TCM patterns and tongue manifestations were included.

Results and discussion

In the case of chronic gastritis, there are five patterns that are commonly encountered.

Spleen-stomach qi deficiency presents with a pale, enlarged tongue with teeth marks and thin white coating. This reflects impaired transformation and transportation in prolonged disease courses.

Spleen-stomach damp-heat shows a red tongue with yellow greasy coating. This is often linked to H.

pylori infection; thinning of the coating marks damp-heat resolution.

Stomach yin deficiency manifests as a red, dry tongue with little or no coating. This is typical of atrophic gastritis and directly indicates depleted stomach yin.

Liver-stomach disharmony presents with a slightly red or normal tongue and thin yellow coating, reflecting constrained liver qi transforming into heat, often overlapping with emotional factors and functional dyspepsia.

Stomach blood stasis features a dark tongue, sometimes with ecchymosis, signalling chronic stasis and warranting attention in atrophic gastritis with intestinal metaplasia or dysplasia.

Beyond pattern diagnosis, tongue changes aid treatment evaluation. In damp-heat pattern, greasy yellow coating thins and whitens after therapy, paralleling symptom relief and mucosal improvement on gastroscopy. The non-invasive, repeatable nature of tongue inspection suits longitudinal monitoring. Greasy coating has also been linked with endoscopic erosions and bile reflux, bridging macroscopic and microscopic findings.

Most studies are single-center with small samples, and varying definitions of coating features limit generalizability. From a digital perspective, standardized tongue imaging has been applied to chronic gastritis: coating thickness correlates with damp-heat severity, and machine learning models have achieved moderate accuracy in pattern classification. Although preliminary, these efforts point toward quantitative, reproducible assessment. Integrating digital tongue acquisition into clinical workflows could facilitate objective pattern differentiation and monitoring.

Tongue diagnosis is valuable in pattern-based management of chronic gastritis, yet its subjectivity remains a limitation. Standardized digital imaging and analysis may quantitatively capture tongue features such as color and coating thickness, delivering reproducible evidence for pattern differentiation—a path of "renewing tradition" worth pursuing.

References:

1. Li CD, Wu CY. Diagnostics of Traditional Chinese Medicine. Beijing: China Press of Traditional Chinese Medicine; 2016.
2. Branch of Spleen-Stomach Diseases, China Association of Chinese Medicine. Clinical practice guideline for chronic gastritis in traditional Chinese medicine. Chin J Integr Tradit West Med Dig. 2020;28(1):1-10.
3. Zhang SS, Tang XD, Huang SP, et al. Expert consensus on traditional Chinese medicine diagnosis and treatment of chronic gastritis (2017). China J Tradit Chin Med Pharm. 2017;32(7):3060-3064.
4. Chen W, Zhao YP, Li ZH. Association analysis between greasy tongue coating and mucosal lesions observed under gastroscopy in chronic gastritis. Chin J Integr Tradit West Med Dig. 2020;28(6):432-436.
5. Lo LC, Chen YF, Chen WJ, et al. The study on the agreement between automatic tongue diagnosis system and traditional Chinese medicine practitioners. Evid Based Complement Alternat Med. 2012;2012:505063.
6. Qi Z, Tu LP, Chen JB, et al. The classification of tongue colors with standardized acquisition and ICC profile correction in traditional Chinese medicine. Biomed Res Int. 2016;2016:3510807.

ARTIFICIAL INTELLIGENCE IN TRADITIONAL CHINESE MEDICINE DIAGNOSIS OF CHRONIC ATROPHIC GASTRITIS: RESEARCH PROGRESS AND FUTURE PROSPECTS

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Abstract

Chronic atrophic gastritis (CAG) is a critical gastric precancerous lesion. Traditional Chinese medicine (TCM) diagnosis of CAG suffers from subjective deviation, while artificial intelligence (AI) effectively standardizes TCM syndrome differentiation. This paper summarizes AI application progress in CAG TCM diagnosis, analyzes core technical bottlenecks, and puts forward optimized development directions to promote precise TCM diagnosis of gastrointestinal diseases.

Keywords Chronic atrophic gastritis; Artificial intelligence; TCM syndrome differentiation; Multi-modal diagnosis; Precision medicine

Traditional syndrome differentiation relying on clinicians' personal experience restricts the standardized diagnosis of chronic atrophic gastritis (CAG), a common digestive precancerous disease with high canceration risk [1]. Digital intelligence and artificial intelligence technologies have realized the objectification and quantification of traditional four-diagnosis methods, breaking the empirical limitations of conventional TCM diagnosis . Combined with multi-modal medical data, AI provides a new technical path for intelligent and precise diagnosis of CAG[2]. This paper briefly sorts out relevant research progress, existing defects and future development trends of AI-assisted TCM diagnosis for CAG.

Purpose

This study aims to summarize the practical application value of AI in CAG TCM diagnosis, clarify core technical challenges restricting clinical promotion, and propose targeted improvement schemes, so as to accelerate the clinical transformation of intelligent TCM diagnostic systems for CAG.

Materials and Methods

Five literatures published between 2024 and 2026 were adopted as research materials, covering digital intelligence application overview in TCM , multi-modal phenotype diagnosis research for gastric inflammation-cancer transformation , key technical problems of AI-assisted TCM syndrome differentiation , targeted multi-modal diagnostic system design for CAG , and official integrated diagnosis and treatment consensus of CAG . Inductive analysis was adopted to integrate research data, sort out application scenarios and summarize existing defects.

Results and Discussion

Current AI technologies are mainly applied to two core scenarios of CAG TCM diagnosis: objective

collection of four diagnostic information and intelligent automatic syndrome differentiation[3]. Multi-modal fusion technology can integrate tongue image, pulse condition and clinical symptom data of CAG patients, and deep learning models significantly improve the accuracy of syndrome classification compared with traditional manual diagnosis . Digital intelligence technology can also explain the internal correlation between TCM symptoms and syndromes from a data perspective, making empirical TCM diagnosis more scientific[4] .

Nevertheless, three prominent technical challenges still hinder clinical promotion. Firstly, most AI diagnosis models lack sufficient integration with inherent TCM theoretical logic, leading to poor model interpretability. Secondly, ununified multi-modal data standards cause poor model generalization ability across different medical centers . Thirdly, there is no unified clinical evaluation standard for intelligent diagnostic systems in accordance with CAG integrated diagnosis norms. Besides, most existing data-driven AI models ignore the holistic diagnosis thinking of TCM, which further limits practical clinical application[5].

Conclusion

AI has effectively remedied the subjectivity defects of manual TCM diagnosis for CAG, and multi-modal intelligent diagnosis systems have shown good auxiliary diagnostic effects[3]. However, insufficient theoretical integration, poor model interpretability and non-unified clinical standards remain urgent problems. In future research, scholars should embed standard TCM diagnosis norms and CAG clinical consensus into AI models, build unified standardized multi-modal TCM databases, and develop interpretable diagnostic algorithms fitting TCM holistic thinking, to realize safe, effective and clinical-oriented intelligent TCM diagnosis for CAG.

References

[1] Digestive Disease Committee of Chinese Association of Integrative Medicine. Expert consensus on integrated diagnosis and treatment of chronic atrophic gastritis (2025)[J]. Chinese Journal of Digestive Diseases of Integrated Traditional and Western Medicine, 2025.

[2] Zhu J, Liu X, Gao P. Digital intelligence technology: new quality productivity for precision traditional Chinese medicine[J]. Frontiers in Pharmacology, 2025, 16: 1526187.

[3] Zhang L M, et al. Multi-modal TCM diagnostic system design targeting chronic atrophic gastritis[J]. Computer Engineering and Applications, 2026.

[4] Li H, et al. Construction of gastroenteritis-cancer transformation diagnosis system based on multi-modal phenotype modeling in TCM[J]. Chinese Journal of Integrated Traditional and Western Medicine, 2025.

[5] Song Y J, et al. Key problems and technical challenges of artificial intelligence assisted TCM syndrome differentiation[J]. Journal of Chinese Medical Informatics, 2024.

INNOVATION AND PRACTICE OF TRADITIONAL CHINESE MEDICINE HEALTH MANAGEMENT

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Abstract

Digital technologies are reshaping the service models and industrial forms of traditional Chinese medicine (TCM) health management. Against the backdrop of deepening Sino-Russian cooperation in traditional medicine, this paper systematically examines innovative pathways of digitally empowered TCM health management, focusing on collaborative practices in smart health platforms, cross-border health services, and intelligent device development. Findings indicate that AI-assisted constitution identification systems achieve 91% accuracy, remote health platforms served over 5,000 Russian users in 2023, and jointly developed devices have obtained dual-country certification. Divergent data standards and privacy regulations remain key challenges. The paper recommends establishing a dedicated Sino-Russian digital cooperation program for TCM health management, harmonizing technical standards, and co-building demonstration centers to upgrade the value chain of the traditional medicine industry.

Keywords: Digital empowerment; TCM health management; innovation and practice; Sino-Russian cooperation; smart medicine; industrial integration

With the advancement of the Healthy China initiative and the global shift towards prevention, TCM health management, centered on the principle of "preventive treatment of disease," has gained significant momentum. Concurrently, digital technologies such as big data, artificial intelligence, and the Internet of Things provide unprecedented tools for constitution identification, health assessment, and intervention. Russia has a strong tradition of using natural therapies, and public acceptance of TCM has been steadily increasing. Policy alignment and industrial cooperation in digital health between the two countries are deepening. However, systematic research on how digital empowerment can drive innovation in TCM health management models and embed them into Sino-Russian smart medicine industrial integration remains scarce. This paper addresses this gap by analyzing frontier cases and extracting replicable integration pathways.

Objective

To identify the mechanisms through which digital technologies advance TCM health management innovation, summarize the achievements and experiences of Sino-Russian collaboration in this domain, and propose practical strategies for promoting traditional medicine industrial integration.

Materials and Methods

A bibliometric analysis combined with an in-depth multi-case study was employed. Literature from 2019 to 2024 was retrieved from CNKI, PubMed, and eLibrary.ru using keywords such as "digital health," "TCM health management," and "Sino-Russian medicine cooperation"; 38 core papers and

9 policy documents were selected. Semi-structured interviews were conducted with 12 experts from Chinese and Russian institutions. Three typical cases were examined in detail: the "Sino-Russian TCM Health Management Cloud Platform," the "Harbin–Khabarovsk Remote Health Station," and a joint R&D project for smart TCM wearable devices.

Results and Discussion

Digital empowerment has led to innovations in three main dimensions. (1) Intelligent and precise assessment: An AI syndrome differentiation system integrating tongue, facial, and pulse diagnosis, coupled with wearable devices, enables real-time dynamic monitoring of TCM constitution. Verified by controlled studies, constitution classification accuracy reached 91%. The system has been deployed in two state clinics in Moscow, increasing adherence to personalized regimens by 37%. (2) Cross-border service integration: Through a bilingual cloud platform, Russian users can receive TCM-based health assessment reports and remote guidance on therapeutic exercises and dietary therapy online. In 2023, the platform provided personalized health management services to over 5,200 Russian users, achieving a satisfaction rate of 92.3%. A blockchain-based "health data passport" was piloted in border areas, ensuring secure transfer of TCM intervention information. (3) Collaborative industrial innovation: Jointly developed products such as smart moxibustion robots, herbal fumigation cabins, and acupoint patch monitors, embedded with TCM algorithms and multilingual interfaces, have obtained medical device certifications in both countries, generating approximately 210 million rubles in new output value for related industries. The discussion highlights that a lack of unified digital standards for TCM terminology and differing regulations on cross-border health data flow are major constraints. Establishing bilateral mutual recognition mechanisms for standards and joint talent development programs is urgently needed.

Digital empowerment has significantly reshaped the value chain of TCM health management and injected new momentum into Sino-Russian traditional medicine industrial integration. It is recommended that the two countries jointly launch a "Sino-Russian Digital Innovation Program for TCM Health Management," prioritize building digital health management demonstration centers in border free trade zones, harmonize data standards and certification systems, and accelerate the intelligent and service-oriented upgrading of the traditional medicine industry.

References

[1] Chen Ni. At the hometown of Danxi, "One Center and Four Halls": Yiwu Chi'an enables traditional Chinese medicine to shift from disease treatment to health management. Chinese Community Doctors, 2026, 42(3): 166.

[2] Zhong Jinhong, et al. Research on dynamic management of traditional Chinese medicine knowledge based on the 5P medical model. Library & Information, 2024, (8): 34-37.

[3] Wang Q. Research and application of TCM constitution theory. Beijing: People's Medical Publishing House, 2026, 34(6): 160-163.

[4] Zhang Y, et al. AI-assisted TCM constitution classification. Artif Intell Med, 2025, (6): 25-32.

[5] Kuznetsov S, et al. Digital health passport in Russia. Digital Health, 2025, 33(23): 136-138.

GOVERNOR VESSEL ACUPUNCTURE FOR POST-ISCHEMIC STROKE MOTOR DYSFUNCTION: A MULTICENTER RANDOMIZED CONTROLLED TRIAL

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Abstract

This multicenter, assessor- and statistician-blinded randomized controlled trial compared GV acupuncture with conventional acupuncture for post-IS motor dysfunction and explored its central mechanism using resting-state fMRI. 420 patients were randomly assigned to GV or conventional group. FMA, NIHSS, and whole-brain FC with M1 seed were assessed at baseline and week 4. At week 4, the GV group showed greater improvements in FMA ($P<0.05$) and NIHSS ($P<0.01$) than the conventional group. After treatment, FC between right postcentral gyrus and left supplementary motor area was significantly lower in the GV group ($P<0.05$). GV acupuncture effectively improves motor function and neurological deficits after IS, possibly by optimizing sensorimotor network reorganization.

Keywords: Governor Vessel acupuncture, ischemic stroke, motor dysfunction, randomized controlled trial, functional connectivity

According to GBD 2021, IS accounts for 62-67% of all strokes, and its prevalence in China increased by 201% from 1990 to 2021, becoming the leading cause of adult disability.[1] Despite advances in acute care, most survivors suffer persistent motor deficits.[2] The GV's body surface distribution corresponds to spinal/cranial nerve dermatomes and shares spatial correspondence with the corticospinal tract, providing a neuroanatomical rationale for GV acupuncture.[3] Resting-state fMRI can noninvasively reveal spontaneous neural activity and has been used to explore central acupuncture effects.[4]

Objective

To compare the efficacy of conventional versus GV acupuncture for post-IS motor dysfunction and to investigate the underlying central mechanism using resting-state functional connectivity.

Materials and methods

Participants: Inclusion criteria: first-ever IS, unilateral motor pathway infarction, age 40-75 years, stable blood pressure (<160/100 mmHg), unilateral motor dysfunction, right-handed, no MRI contraindications, no psychotropic drugs in past month, signed informed consent. Exclusion criteria: previous stroke, severe organ disease, intracranial aneurysm, bleeding risk, severe spinal deformity, poor compliance. Randomization and blinding: Random allocation via REDCap by a registrar. Only assessors and statisticians were blinded. Intervention: All patients received standard medical care and rehabilitation. Conventional group: acupuncture at LI15, LI11, TE5, LI4 (upper limb) and GB30, GB31, GB34, SP9, ST36, ST41 (lower limb). GV group: same plus GV24, GV20, GV16,

GV14. Retained 30 min. Once daily, 5 days on/2 days off, for 4 weeks.

Results and discussion

394 patients completed treatment; 170 completed valid fMRI scans. Baseline characteristics were balanced ($P>0.05$). At week 4, both groups improved in FMA and NIHSS ($P<0.001$). Inter-group comparison: GV group showed significantly greater FMA improvement ($P<0.05$) and greater NIHSS reduction ($P<0.01$) than the conventional group. Imaging: GV acupuncture effectively improves motor function and neurological deficits in post-IS patients. Its central mechanism may involve optimized reorganization of the sensorimotor network.[5,6] This provides reliable evidence-based support for clinical application of GV acupuncture. Previous studies support multi-level mechanisms of GV acupuncture: improving energy metabolism, inhibiting inflammation/apoptosis, upregulating BDNF (by reducing BDNF methylation),[7] and modulating the gut-microbiota-immune-brain axis.[8] The addition of GV points likely contributes to these effects. Limitations: unbalanced allocation, only resting-state fMRI, no scalp acupuncture control, limited time points, no subgroup analysis. Future multimodal neuroimaging and individualized protocols are needed.

References:

1.GBD 2021 Stroke Risk Factor Collaborators. Global, regional, and national burden of stroke and its risk factors, 1990-2021. Lancet Neurol. 2024;23(10):973-1003.

2.Wang C, Yang X, Guo D, et al. Transcranial direct current stimulation-induced changes in motor cortical connectivity are associated with motor gains following ischemic stroke. Sci Rep. 2024;14(1):15645.

3.Chen JL, Lam TK, Baniña MC, et al. Neuroimaging and kinematic biomarkers of post-stroke upper limb motor impairment. Neuroimage Clin. 2025;48:103854.

4.Li X, Cai L, Jiang X, et al. Resting-state fMRI in studies of acupuncture. Evid Based Complement Alternat Med. 2021;2021:6616060.

5.Wang L, Yu C, Chen H, et al. Dynamic functional reorganization of the motor execution network after stroke. Brain. 2010;133(Pt4):1224-1238.

6.Yao LL, Yuan S, Wu ZN, et al. Contralateral S1 function is involved in electroacupuncture treatment-mediated recovery after focal unilateral M1 infarction. Neural Regen Res. 2022;17(6):1310-1317.

7.Zhang B, Wong KP, Guo C, et al. Effects of non-pharmacological interventions on the swallowing function of patients with post-stroke dysphagia: a systematic review and network meta-analysis. J Oral Rehabil. 2025;52(1):109-120.

8.Pu YP, Chu HR, Wang Z, et al. Effects of Tongdu Tiaoshen needling combined with eye acupuncture on limb motor function, serum BDNF level, and BDNF methylation in patients with IS. J Clin Acupunct Moxibustion. 2026;42(2):16-21.

MAT-QT@CHITOSAN NANOGEL PREPARATION PROCESS

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Abstract

This study aimed to optimize the preparation process of MAT-QT-loaded chitosan nanogels prepared by ionic crosslinking. Particle size, polydispersity index (PDI), and zeta potential were selected as evaluation indicators, and an AHP-CRITIC model combined with Box–Behnken response surface methodology was employed to optimize the formulation parameters. The optimized process provides a scientific basis for the development and quality evaluation of MAT-QT-loaded chitosan nanogels.

Keywords: Chitosan nanogel; MAT-QT; Ionic crosslinking; AHP-CRITIC; Response surface methodology; Process optimization

Objective:

The comprehensive effects of particle size, polydispersity index (PDI), and zeta potential on the quality of MAT-QT drug-loaded chitosan nanogels were evaluated. An AHP-CRITIC combined weighting model was established, and the preparation process of MAT-QT drug-loaded chitosan nanogels was optimized using the Box-Behnken response surface method, thereby providing an experimental basis for subsequent pharmacodynamic studies and formulation development.

Materials and Methods:

Chitosan (CS) nanogels were prepared using the ion-crosslinking method. CS was dissolved in a 2% acetic acid solution (pH = 5.0) and stirred under a magnetic stirrer until completely dissolved to prepare a 2 mg/mL CS solution; sodium tripolyphosphate (TPP) was dissolved in deionized water to prepare a 1.25 mg/mL TPP solution. Take 25 mL of the CS solution and stir at 600 rpm at room temperature while slowly adding 10 mL of the TPP solution dropwise. Continue the reaction for 1 h to obtain the CS nanogel. For the preparation of drug-loaded nanogels, add MAT-QT to the CS solution and stir until completely dissolved; the remaining preparation steps were the same as those for the blank nanogel. Particle size, polydispersity index (PDI), and zeta potential were used as evaluation criteria. The AHP-CRITIC method was employed to determine the weights of each criterion and construct a comprehensive scoring system. First, single-factor experiments were conducted to investigate the effects of reaction time, drug loading, and the CS/TPP volume ratio on the properties of the nanogel, thereby determining the range of each factor. Subsequently, based on the results of the single-factor experiments, the Box–Behnken response surface method was used to optimize the preparation process[1].

Results and discussion

The AHP-CRITIC method yielded weighting coefficients of 0.6915, 0.1494, and 0.1591 for particle size, PDI, and zeta potential, respectively. Response surface experiments determined the order of

influence of the factors to be volume ratio > dosage > reaction time. Analysis using Design-Expert 13.0 identified the optimal parameters for the extraction process as: A reaction time of 53.59 min, B dosage of 3.21 mg, and C volume ratio of 3.96:1. Taking into account operational feasibility, the optimal process parameters were adjusted to a reaction time of 54 min, a drug dosage of 3.20 mg, and a volume ratio of 4:1[2].

Conclusion

Using the AHP-CRITIC weighting method in conjunction with Box-Behnken response surface design, the optimal preparation processes for chitosan (CS) and sodium tripolyphosphate (TPP) were determined. Validation experiments demonstrated that the optimized extraction process is stable and feasible[3].

References:

[1]Gutiérrez-Ruíz SC, Cortes H, González-Torres M, et al. Optimize the parameters for the synthesis by the ionic gelation technique, purification, and freeze-drying of chitosan-sodium tripolyphosphate nanoparticles for biomedical purposes. J Biol Eng. 2024;18(1):12. Published 2024 Jan 25.

[2]Obeidat WM, Lahlouh IK. Chitosan Nanoparticles: Approaches to Preparation, Key Properties, Drug Delivery Systems, and Developments in Therapeutic Efficacy. AAPS PharmSciTech. 2025;26(5):108. Published 2025 Apr 17.

[3]Chellathurai MS, Chung LY, Hilles AR, et al. Pharmaceutical chitosan hydrogels: A review on its design and applications. Int J Biol Macromol. 2024;280(Pt 2):135775.

SHENGHUA DECOCTION REGULATES ESTROGEN HOMEOSTASIS TO IMPROVE MOOD DISORDERS THROUGH THE NEURO-ENDOCRINE-IMMUNE NETWORK: A NETWORK PHARMACOLOGY STUDY

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Abstract

Estrogen-related mood disorders, including perimenopausal depression and premenstrual dysphoric disorder, represent a major unmet need in women's health. Shenghua Decoction (SHD), a classic postpartum formula, has demonstrated anti-inflammatory and estrogen-modulating properties. This study integrates network pharmacology with machine learning to elucidate the molecular mechanisms of SHD in regulating estrogen homeostasis. Twenty-six blood-absorbable compounds of SHD mapped to 238 human targets, which were intersected with 143 disease-associated genes, yielding 69 shared targets. Protein–protein interaction analysis and random forest–LASSO prioritization identified 12 core targets. KEGG enrichment revealed the TNF signaling, IL-17 signaling, estrogen signaling, and neurotrophin signaling pathways as the primary cascades. Molecular docking confirmed that ferulic acid, tetramethylpyrazine, and 6-gingerol bind the ecdysteroid receptor with favorable binding energies. These results demonstrate that SHD exerts multi-target neuroprotective effects through the conserved TNF/IL-17/estrogen signaling axis, providing a computational rationale for its application in estrogen-related mood disorders.

Keywords: Shenghua Decoction, estrogen homeostasis, mood disorders, network pharmacology, machine learning, neuro-endocrine-immune network

Mood disorders affect women at approximately twice the rate of men, with peak vulnerability during reproductive transitions when estrogen levels decline or fluctuate dramatically. Perimenopausal depression and premenstrual dysphoric disorder share converging pathological mechanisms: disinhibition of the hypothalamic–pituitary–adrenal axis, reduced serotonergic tone, and activation of NLRP3/NF-κB-mediated neuroinflammation. Current treatments such as SSRIs and hormone replacement therapy have limited efficacy and safety concerns during reproductive windows. Shenghua Decoction (SHD), comprising Angelica sinensis, Ligusticum chuanxiong, Prunus persica, processed Zingiber officinale, and processed Glycyrrhiza uralensis, has been the standard postpartum remedy in China for over 300 years. Its anti-inflammatory and estrogen-modulating potential has not been systematically investigated for broader estrogen-related mood disorders.

Objective

To identify the core molecular targets and signaling pathways through which SHD regulates estrogen homeostasis to improve mood disorders, using an integrated network pharmacology and machine learning pipeline.

Materials and methods

Twenty-six blood-absorbable active compounds of SHD were compiled from published network pharmacology studies. Human target proteins were predicted using SwissTargetPrediction, yielding 238 unique targets. Disease targets were collected from GeneCards and DisGeNET with relevance-score filtering (≥ 5), resulting in 143 genes. The intersection of SHD and disease targets was determined via Venn diagram. Protein–protein interaction networks were constructed in STRING (v12.0, confidence ≥ 0.7) and analyzed in Cytoscape 3.9.1. Core targets were prioritized using random forest and LASSO regression. GO and KEGG enrichment were performed using clusterProfiler (FDR < 0.05). Molecular docking of representative compounds against the ecdysteroid receptor (PDB: 1R1K) was conducted using AutoDock Vina 1.2.0.

Results and discussion

In conclusion, SHD modulates estrogen homeostasis and alleviates mood disorders through a multi-target mechanism centered on the TNF/IL-17/estrogen signaling axis. Twelve core targets were identified, with TNF, IL6, ESR1, and PTGS2 showing the highest diagnostic value. These computational findings provide a rational basis for future in vivo validation and position SHD as a promising candidate formula for estrogen-related mood disorders.

References

1.O'Chan J.C., Maze I. Reproductive experience remodels the maternal brain via dopamine-dependent epigenetics // Nature. – 2026. – doi:10.1038/s41586-026-10509-4.

2.Li Y, Wang H, Zhang L. Network pharmacology-based identification of active compounds and targets of Shenghua Decoction // Medicine. – 2024. – 103(10). – P.e45879.

3.Szklarczyk D, Gable A.L, Lyon D, et al. STRING v12: protein-protein association networks with increased coverage // Nucleic Acids Research. – 2025. – 53(D1). – P.D638-D646.

DIGITAL MODELING AND PERFORMANCE PREDICTION OF NEW BIODEGRADABLE MEDICAL MATERIALS

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Abstract

Biodegradable medical materials are core materials for Sino-Russian joint biomedical research and clinical transformation. Traditional material performance testing relies on repeated physical and chemical experiments with high cost and long cycle. This study constructs a digital prediction model based on random forest algorithm to realize rapid modeling and performance prediction of composite degradable biomaterials. Material composition parameters and degradation indexes are taken as training features to predict mechanical strength and in-vitro degradation rate. The results show that the digital model has high prediction accuracy, which can reduce experimental consumption, realize digital pre-screening of new medical materials, and support the industrial collaborative research of degradable biomaterials between China and Russia.

Keywords: biodegradable medical materials; digital modeling; performance prediction; random forest; sino-russian biomedical cooperation

With the deepening of Sino-Russian medical industry integration, biodegradable implants, drug delivery carriers and wound dressing materials have become key research directions of bilateral joint laboratories. Traditional material development requires dozens of groups of preparation and degradation experiments to adjust material ratios, which wastes raw materials and prolongs research cycle. Digital modeling and machine learning prediction technology can quickly map the correlation between material formula and final performance, greatly accelerating the screening of new biomaterials. Aiming at the demand of joint development of cold-region medical degradable materials in Northeast China and Russian Far East, this paper establishes a digital performance prediction model to provide intelligent auxiliary tools for the research and development of shared medical materials of the two countries.

Objective

To construct a digital modeling framework for composite biodegradable medical materials; to build a random forest prediction model for mechanical property and degradation performance; to verify the prediction accuracy of the model and compare it with traditional experimental screening; to provide digital research methods for sino-russian joint development of degradable biomaterials.

Materials and methods

Polylactic acid, chitosan and collagen, the common raw materials of sino-russian degradable medical materials, were selected to prepare composite samples with different mass ratios. Tensile

tester and in-vitro simulated body fluid degradation system were used to test tensile strength and 30-day degradation residual rate, and 92 groups of formula-performance data were collected. All component proportion data and test indexes were normalized, then randomly divided into training set (85%) and test set (15%). Random forest regression model was constructed for digital modeling, and determination coefficient R^2 and mean absolute error (MAE) were used to evaluate model prediction ability. The predicted optimal formula was verified by three repeated preparation experiments to compare the efficiency of digital prediction and traditional trial-and-error experiment.

Results and Discussion

Material chitosan proportion and crosslinking time were the two most important features affecting degradation performance. The R^2 of the random forest digital prediction model for tensile strength reached 0.987, and the R^2 for degradation residual rate reached 0.982, with low MAE of 0.32 MPa and 1.15% respectively. The optimal composite formula predicted by the model only needed one batch of verification experiment, while the traditional trial-and-error method required at least 18 groups of repeated tests, which greatly reduced material loss and research time. The digital model can quickly complete performance prediction of any new mixed formula within 1 second, and is suitable for the development of low-temperature resistant degradable medical materials in sino-russian cold areas. The limitation of this study is that only in-vitro degradation data are used for modeling; in-vivo animal experimental data will be supplemented to optimize the model generalization ability in follow-up research.

This paper builds a random forest digital modeling and performance prediction system for new biodegradable medical materials. Compared with the traditional experimental trial-and-error mode, the digital model significantly improves the research efficiency of biomaterials and reduces experimental costs. The research realizes digital empowerment in the development of sino-russian shared medical materials, provides an intelligent screening method for bilateral joint biomaterial laboratories, and promotes the innovative industrial integration of sino-russian biomedical industry.

References:

1.Toniciolli Rigueto CV, Rosseto M, Alessandretti I, de Oliveira R, et al. Gelatin films from wastes: A review of production, characterization, and application trends in food preservation and agriculture. Food Res Int. – 2022. – 162 (Pt B).– C.112114.

2.Prasad AR, Athikesavan MM, Kabeel AE, et al. Analysis of a solar still with photovoltaic modules and electrical heater - Energy and exergy approach. Environ Sci Pollut Res Int. - 2022. - 29 (38). -C.57453-57465.

DIGITAL TECHNOLOGY EMPOWERING THE R&D OF ANTI-TUMOR TRADITIONAL MEDICINES IN SINO-RUSSIAN COLD REGIONS: A REVIEW OF COOPERATION PROGRESS AND INDUSTRIAL PATHWAYS

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Abstract

The Sino-Russian cold regions have high digestive cancer incidence and abundant medicinal herbs for traditional therapy. Cross-border R&D faces inconsistent standards, unclear mechanisms and data gaps. This review synthesizes recent studies and cooperative projects to examine digital technologies—computational screening and database integration accelerating anti-tumor drug discovery. Current platforms have optimized compound-target prediction and aligned bilateral standards, yet clinical validation remains a bottleneck. Precise digital empowerment, not technological replacement, offers a pathway for sustainable industrial collaboration.

Keywords: digital technology; ethnic traditional medicine; frigid climatic regions;

Digestive cancer rates are disproportionately high in Northeast China and the Russian Far East, driven by cold-climate diets. Indigenous herbs—Acanthopanax, Schisandra and Chaga—show anti-tumor effects, yet cross-border R&D remains limited. Three barriers persist: divergent quality standards, complex multi-component mechanisms, and isolated databases. Digital tools could address these, but a systematic review is lacking. This review synthesizes digital applications, evaluates bilateral cooperation, and proposes industrial pathways.

Objective

This study investigates digital technologies for anti-tumor research of Sino-Russian cold-region medicinal herbs, evaluates bilateral cooperation, and proposes industrial integration strategies.

Materials and methods

Literatures published 2014–2026 were retrieved from PubMed, Web of Science, CNKI, Wanfang and Google Scholar. Eligible studies on digital anti-tumor research of cold-region herbs were screened for narrative synthesis.

Results and discussion

Core digital analytical tools, namely network pharmacology, molecular docking simulation and multi-omics bioinformatics analysis, have been widely applied to decode the latent molecular anti-tumor mechanisms of frigid-region medicinal plants. The core research findings of three representative endemic medicinal materials are summarized as follows:

Inonotus obliquus (Chaga). Modern digital pharmacology corroborates that triterpenoid components derived from Chaga exert multi-target synergistic anti-tumor effects. A total of 15 bioactive ingredients and 274 corresponding therapeutic targets were screened, among which 104 targets overlap with pathogenic genes of cervical carcinoma. Key hub targets (PIK3CA, MAPK3, MDM2, AR, CCND1) and pivotal signaling cascades including PI3K/Akt, Ras and MAPK pathways were definitively identified. Multiple in vivo preclinical assays validated that Chaga extracts could effectively inhibit tumor proliferation, facilitate cancer cell apoptosis and modulate systemic anti-tumor immune responses. Its characteristic active metabolites can bind stably to core oncoproteins AKT1, IFNG, MMP9 and EGFR, conferring promising therapeutic potential against gastric, colorectal and hepatocellular carcinomas.

Acanthopanax senticosus. Integrative multi-omics analysis verifies that quercetin, the signature bioactive metabolite of Acanthopanax senticosus, suppresses the malignant progression of glioblastoma by regulating the GPX4/FTH1/TFR1-mediated ferroptosis signaling pathway. The aberrantly activated SIX1/MYBL2 regulatory network accelerates glioma deterioration, yet direct experimental evidence clarifying its regulatory correlation with quercetin-triggered tumor ferroptosis is still lacking. As the raw medicinal material of commercial Aidi Injection, Acanthopanax senticosus also presents definite inhibitory efficacy against hepatocellular carcinoma.

Schisandra chinensis. Schisandrin B, the dominant lignan constituent of Schisandra chinensis, can markedly restrain proliferation and metastatic capacity, and induce caspase-dependent apoptosis of liver, colorectal, breast and gastric malignant cells. Network pharmacology modeling has accurately predicted its core therapeutic targets and downstream tumor-associated signaling pathways.

Sino-Russian bilateral academic and industrial collaboration. The Sino-Russian Medical University Alliance has steadily launched annual joint fundamental projects focused on digital oncology and ethnomedicine research. A batch of AI-assisted intelligent tumor auxiliary diagnosis programs were officially launched in 2024, which consolidates cross-institutional cooperation foundations for translational digital innovation of frigid-region characteristic herbal medicines.

References:

1.Shao J.J., Yang Y., Wang C.G., Zhang X.P. - Exploring the mechanism of Inonotus obliquus triterpenoids in treating cervical cancer based on network pharmacology and experimental verification // Chinese Journal of Modern Applied Pharmacy. – 2024. – 41 (3). – 313-323.

2.Wu Y., Liu J.Y., Luo J.H., Xu B.J. - Molecular Mechanisms of Phytochemicals from Chaga Mushroom (Inonotus obliquus) Against Colorectal Cancer: Insights from Network Pharmacology, Molecular Docking, and Bioinformatics // International Journal of Molecular Sciences. – 2025. – 26 (16). – 7664.

INTELLIGENT OPTIMIZATION OF EXTRACTION PROCESS OF SINO-RUSSIAN NATURAL MEDICINAL COMPONENTS

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Abstract

Sino-Russian medicinal plants contain flavonoids, saponins and polysaccharides with anti-inflammatory and antioxidant effects, critical for bilateral biomedical research. Traditional extraction optimization methods lack precision for cross-border herbal materials. This work constructs a BP neural network-genetic algorithm hybrid model to optimize ultrasonic extraction parameters of shared Sino-Russian medicinal herbs, using total active ingredient yield as the index. The intelligent model achieves higher prediction accuracy and extraction yield than the response surface method, offering digital technical support for standardized processing of transboundary medicinal plant resources.

Keywords: Sino-russian medicinal herbs; natural active components; ultrasonic extraction; bp neural network; intelligent process optimization

Natural medicinal herbs are a core medium for Sino-Russian medical cooperation. Northeast China and Russia's Far East share cold-temperate medicinal plants including ginseng and rhodiola. Traditional single-factor and Box-Behnken optimization cannot describe nonlinear interactions between extraction parameters, causing low yield and high solvent waste. Machine learning enables global multi-factor optimization. This paper establishes an intelligent extraction parameter prediction model to advance digital industrial integration of Sino-Russian traditional medicine.

Objective

To analyze how ultrasonic extraction parameters affect active ingredient yield of shared Sino-Russian herbs; build a BP neural network prediction model optimized by genetic algorithm; compare its performance with response surface methodology; provide green, standardized extraction technology for joint medicinal resource development.

Materials and methods

Rhodiola rosea and ginseng from Sino-Russian border areas were dried, crushed and sieved through 40 meshes. Ethanol and reference standards of salidroside and ginsenoside were used, with ultrasonic extractor and HPLC for extraction and quantification. A 17-group Box-Behnken test was designed to collect yield data under varying ethanol concentration, solid-liquid ratio, ultrasonic power and extraction time. Data were split into training (80%) and test (20%) sets. A three-layer BP neural network was built and coupled with genetic algorithm for global optimization, with R^2 and RMSE as evaluation indicators. Three parallel validation experiments were conducted to compare

extraction performance of the intelligent model and traditional response surface model.

Results and Discussion

Ethanol concentration and extraction time exerted the strongest influence on active ingredient yield. The BP neural network reached R^2=0.9936, RMSE=0.217 mg/g, superior to the Box-Behnken model (R^2=0.9214, RMSE=1.053 mg/g). Optimized conditions: ethanol 68%, solid-liquid ratio 32 mL/g, power 400 W, extraction 26 min. Under these conditions, total active yield reached 28.74 mg/g, 16.3% higher than the traditional method, while ethanol consumption decreased by 12.8%. Conventional response surface only obtains local optima, whereas the hybrid intelligent algorithm captures nonlinear factor coupling and fits mixed herbal material systems well. This lightweight model can be embedded into herbal digital processing platforms. The limitation lies in limited sample varieties; multi-species optimization will be explored in follow-up research.

This study constructs a BP neural network-genetic algorithm intelligent optimization system for ultrasonic extraction of Sino-Russian medicinal active components. Compared with traditional optimization approaches, it improves extraction efficiency and reduces solvent consumption. The findings provide digital green processing technology for joint development of Sino-Russian medicinal plant resources, facilitating digital empowerment and industrial upgrading of bilateral traditional medicine.

References:

1.Wang ZH, Liu X, Cui Y,et al. enomic, transcriptomic, and metabolomic analyses provide insights into the evolution and development of a medicinal plant Saposhnikovia divaricata (Apiaceae). Hortic Res. - 2024. - 11 (6). - C.uhae105.

2.Leng M, Zhang X, Zhang Y,et al. The Extraction of Ledum palustre L. Essential Oil by Ionic Liquid-Assisted Hydrodistillation Method for Antioxidant Application. Chem Biodivers. - 2026. - 23 (2). - C.e03000.

3.Kumari K, Mittal S, Sharma K,et al. Deep Learning and Machine Learning Modeling Identifies Thidiazuron as a Key Modulator of Somatic Embryogenesis and Shoot Organogenesis in Ferula assa-foetida L. Biology (Basel). - 2025. - 14(12). - C.1703.

TRADITIONAL ACUPUNCTURE MEETS MODERN NEUROSCIENCE: RESEARCH PROGRESS AND MECHANISMS IN POSTOPERATIVE COGNITIVE DYSFUNCTION

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Abstract

Postoperative cognitive dysfunction (POCD) is a persistent cognitive impairment after surgery, more common in elderly patients, and associated with impaired recovery and reduced quality of life. Evidence suggests acupuncture may improve POCD as a safe non-pharmacological approach. Proposed mechanisms include reduced oxidative stress, ferroptosis, and dysregulation of the gut–brain axis. This review summarizes recent progress and mechanisms of acupuncture in POCD, highlighting the integration of traditional acupuncture theory with modern neuroscience.

Keywords: Postoperative cognitive dysfunction; Acupuncture; Ferroptosis; Gut-brain axis

POCD mainly manifests as postoperative decline in memory, attention, and executive function. Its pathogenesis has not been fully elucidated, but it is believed to involve disorders of the central nervous, endocrine, and immune systems. Clinically, there is still a lack of effective, specific treatment for POCD. As important parts of traditional medicine, acupuncture and moxibustion have shown potential to improve cognitive function and have gradually become a hot spot in postoperative neuroprotection research in recent years.

Objective

To summarize recent advances in acupuncture and moxibustion for postoperative cognitive dysfunction and to explore their underlying mechanisms through a modern neuroscience perspective.

Materials and methods

Relevant clinical and experimental studies on acupuncture and moxibustion for postoperative cognitive dysfunction were retrieved and analyzed to summarize current evidence and clarify their underlying mechanisms.

Results and discussion

1. Research the progress of acupuncture in POCD

Recent randomized controlled trials suggest that acupuncture and transcutaneous electrical acupoint stimulation may improve postoperative cognitive recovery and reduce the incidence of perioperative neurocognitive disorders. Systematic reviews and meta-analyses further support their clinical potential in improving postoperative cognitive outcomes.

2. Mechanisms of acupuncture in POCD

2.1 Oxidative stress and neuroprotection: Oxidative stress contributes to POCD by promoting neuronal injury and cognitive decline. Electroacupuncture may alleviate oxidative stress and neuroinflammation, thereby exerting neuroprotective effects. Huang et al. demonstrated activation of the ERK/MAPK-CREB pathway, with improved synaptic plasticity and cognitive function.

2.2 Ferroptosis regulation: Ferroptosis is an important pathological mechanism in POCD. Evidence suggests that electroacupuncture regulates iron metabolism and inhibits neuronal ferroptosis through the TFR1-DMT1-FPN and GRX1/GSK3β/Nrf2 pathways, thereby reducing neuronal injury and improving learning and memory.

2.3 Gut–brain axis regulation: The gut–brain axis is a key mechanism in cognitive impairment. Gut microbiota imbalance may contribute to damage to the central nervous system. Lei et al. found that electroacupuncture increases beneficial bacteria and improves cognitive performance.

In conclusion, acupuncture may improve POCD through multiple pathways, including oxidative stress, ferroptosis, and the gut–brain axis, reflecting the integration of traditional acupuncture theory with modern neuroscience. However, high-quality multicenter evidence remains limited, and optimal strategies and mechanisms remain unclear.

References:

1. Long J, Zhang X, Zhang J, et al. Effect of electroacupuncture intervention before and after operation on perioperative neurocognitive disorders in elderly patients with hip fractures – A randomized controlled trial // Injury. – 2025. – 56(10) – 112660.

2. Wang Z G, Liu Z F, Gao Y, et al. Effects of electroacupuncture pretreatment on long-term postoperative cognitive dysfunction and neuron-inflammation in aged rats // Zhen Ci Yan Jiu. – 2023. – 48(6) – 557-563.

3. Liang W, Li M, Zhang J, et al. The effects of different acupuncture modalities on postoperative cognitive function in elderly Chinese patients undergoing general anesthesia – a network meta-analysis // Front Neurol. – 2025. – 16 – 1637566.

4. Huang H, Li Y, Wang X, et al. Electroacupuncture pretreatment protects against anesthesia/surgery-induced cognitive decline by activating CREB via the ERK/MAPK pathway in the hippocampal CA1 region in aged rats // Aging (Albany NY). – 2023. – 15(20) – 11227-11243.

5. Chen T, Zhang B, Zhang X, et al. Electroacupuncture improves postoperative cognitive dysfunction by inhibiting ferroptosis via the TFR1-DMT1-FPN pathway // Acupunct Med. – 2025. – 43(2) – 74-84.

6. Zhang X, Zhang A, Li R, et al. Electroacupuncture regulates ferroptosis to improve postoperative cognitive dysfunction in mice through mediating GRX1/GSK-3β/Nrf2 axis // Brain Res Bull. – 2025. – 222 – 111234.

7. Lei H, Li Z, Deng J, et al. Electroacupuncture pretreatment ameliorates anesthesia and surgery-induced cognitive dysfunction in aged rats – insights from gut microbiota modulation // Front Microbiol. – 2025. – 16 – 1642337.

FROM HERB IDENTIFICATION TO FORMULA ANALYSIS: PROGRESS AND CHALLENGES OF AI-EMPOWERED TRADITIONAL CHINESE MEDICINE FORMULAS

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Abstract

Image recognition of Chinese herbal medicines and analysis of compound formula compatibility are core directions for artificial intelligence (AI) in empowering traditional Chinese medicine (TCM). Based on English-language literature retrieved from PubMed, this paper focuses on two primary applications—intelligent image recognition of medicinal materials and the mining of compatibility rules in compound formulas—and systematically reviews their technical advantages and current limitations, providing a reference for the intelligent study of TCM formulas.

Keywords: artificial intelligence; Chinese herbal medicine; formula compatibility

Traditional authentication of Chinese medicinal materials has long relied on manual experience, which is highly subjective and prone to error. The compatibility of compound TCM formulas largely follows ancient records, and their multi-target synergistic mechanisms are difficult to quantify objectively. AI-based image algorithms and network analysis techniques can address these issues directly, enabling medicinal material identification and compatibility research to become more standardized and quantifiable, thereby serving as important technical means for modernizing TCM. This paper aims to synthesize recent research findings and summarize the current progress and limitations of AI combined with traditional Chinese herbal formulas, with a focus on medicinal material identification and compatibility research.

Objective

To integrate and review the research achievements in two areas—AI-based herbal image recognition and formula compatibility analysis—identify technical shortcomings, and offer a unified research perspective for intelligent quality detection of Chinese medicines and the research and development of compound formulas.

Materials and methods

Using PubMed as the data source, we retrieved English-language literature from the past five years concerning Chinese herbal formulas and artificial intelligence. After screening by titles and abstracts, the finally included papers were categorized and analyzed.

Results and discussion

In image recognition, deep learning models such as convolutional neural networks, combined with high-resolution imaging and hyperspectral data, can automatically identify species, assess mold

contamination, and determine the geographical origin of medicinal materials. Recognition accuracy consistently exceeds 90%, substantially reducing subjectivity in manual identification and enabling rapid, objective quality assessment of Chinese herbal medicines. In addition, graph neural networks and AI, combined with network pharmacology, can construct an integrated network of "medicinal materials, active ingredients, and targets," quantitatively analyze synergistic and antagonistic relationships among multiple components in a compound formula, and clearly elucidate the molecular mechanisms by which classic formulas treat chronic diseases, thereby providing a new paradigm for revealing the scientific connotation of TCM formulas.In summary, AI-based image recognition has enabled rapid, objective assessment of the quality of Chinese herbal medicines, and AI network models can scientifically decipher the intrinsic logic of compound formula compatibility. Both are key technologies for advancing TCM standardization. Currently, insufficient standardization of image data and a lack of biological validation of computational compatibility predictions are the main constraints. Future efforts should focus on unifying image acquisition standards for Chinese medicinal materials, establishing shared image databases, adhering to a closed-loop research model that integrates AI-driven compatibility prediction with in vivo and in vitro experiments, and developing interpretable algorithms compatible with TCM theories. These two parallel paths should be pursued simultaneously to advance the practical application of artificial intelligence in herbal identification and formula compatibility analysis.

References:

1. Feng C., Shao Y., Wang B., Qu Y., Wang Q., Li Y., Yang T. Development and Application of Artificial Intelligence in Auxiliary TCM Diagnosis // Evid Based Complement Alternat Med. -- 2021. -- T. 2021. -- C. 6656053.2. He Y., Wu S., Li J., Chen S., Chen S., Zhang Z., He B., Hong Y., Sun C., Kai G. Artificial Intelligence in Traditional Chinese Medicine: Unraveling Herbal Medicine's Mechanisms // Research (Wash D C). -- 2026. -- T. 9. -- C. 1224.3. Jia S., Lai H., Bai H., Li M., Zhang Q., Zhao P., Wang Y., Tang Y., Lai-Han Leung E. Harnessing the application of artificial intelligence in identification of traditional Chinese medicines // J Ethnopharmacol. -- 2026. -- Jan 30. -- T. 355, № Pt B. -- C. 120704.4. Lin L., Zhao P., Chen Z., Liu B., Wang Y., Geng Q., Li L., Tan Y., He X., Li L., Shi J., Lu C. Identification strategy of cold and hot properties of Chinese herbal medicines based on artificial intelligence and biological experiments // Chin Med J (Engl). -- 2025. -- Mar 20. -- T. 138, № 6. -- C. 745-747.5. Wang A., Luo Q., Tan X., Yao Y., Peng X., Luo H., Hu Y. Development and application of artificial intelligence in traditional Chinese medicine research and development // Chin Med. -- 2026. -- Jan 8. -- T. 21, № 1. -- C. 17.

CONSTRUCTION OF AN AI-BASED DIGITAL THERAPEUTICS FOR CHINESE MEDICINE REHABILITATION in ALZHEIMER's DISEASE

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Abstract: Alzheimer's disease (AD) is a major global health challenge. Traditional Chinese medicine (TCM) rehabilitation may improve cognitive function and slow disease progression, but its use is limited by lack of standardization. Advances in artificial intelligence (AI), digital therapeutics (DTx), and wearable devices provide new opportunities for AD management. This study proposes an AI-based framework integrating cognitive assessment, cognitive training, TCM rehabilitation, and wearable monitoring. The system incorporates Baduanjin, Tai Chi, acupoint therapy, and emotional regulation to enable personalized and continuous intervention, improving the precision and continuity of AD rehabilitation and supporting its digital transformation.

Keywords: Alzheimer's disease; artificial intelligence; digital therapeutics; traditional Chinese medicine rehabilitation; cognitive training; smart elderly care.

Alzheimer's disease accounts for approximately 60%–70% of all dementia cases and affects more than 57 million people worldwide. Although current medications can modestly delay disease progression, non-pharmacological interventions remain essential for maintaining cognitive function and quality of life. Meanwhile, AI, digital therapeutics, and wearable devices have emerged as promising tools for personalized rehabilitation and long-term disease management.

Objective

To explore the feasibility of integrating AI-based cognitive training with TCM rehabilitation and to develop a digital therapeutics framework for AD management.

Materials and Methods

Relevant studies published between 2020 and 2026 were retrieved from PubMed, Web of Science, and CNKI using keywords related to AD, AI, digital therapeutics, cognitive training, and TCM rehabilitation. A conceptual framework was developed through literature review and comparative analysis.

Results and discussion

The proposed framework consists of four core components:AI-assisted cognitive assessment, which utilizes speech, behavioral, and cognitive performance data to support early risk identification of MCI and AD.Digital cognitive training, including memory, attention, and executive-function exercises with adaptive difficulty adjustment. Digital TCM rehabilitation, integrating Baduanjin, Tai Chi, acupoint stimulation, and individualized TCM-based health recommendations Wearable monitoring and feedback, enabling continuous tracking of physical activity, sleep quality, and rehabilitation outcomes. Together, these components form a closed-loop system covering screening,

assessment, intervention, and follow-up.

AI technologies and digital therapeutics offer new possibilities for personalized and continuous rehabilitation in AD. The integration of TCM rehabilitation with digital platforms may improve intervention accessibility, standardization, and long-term adherence. Furthermore, this model can be extended to hospitals, community healthcare centers, and smart elderly-care settings. Future studies should focus on clinical validation and practical implementation to support the development of AI-assisted TCM digital therapeutics for AD.

References

1.Livingston G., Huntley J., Liu K.Y., Costafreda S.G., Selbæk G., Alladi S., Ames D., Banerjee S., Burns A., Brayne C., Fox N.C., Ferri C.P., Gitlin L.N., Howard R., Kales H.C., Kivimäki M., Larson E.B., Nakasujja N., Rockwood K., Samus Q., Shirai K., Singh-Manoux A., Schneider L.S., Walsh S., Yao Y., Sommerlad A., Mukadam N. Dementia prevention, intervention, and care: 2024 report of the Lancet Standing Commission // Lancet. – 2024. – Vol.404. – №10452. – P.572–628.

2.Alzheimer's Association. 2024 Alzheimer's disease facts and figures // Alzheimer's & Dementia. – 2024. – Vol.20. – №5. – P.3708–3821.

3.Kourtis L.C., Regele O.B., Wright J.M., Jones G.B. Digital biomarkers for Alzheimer's disease: the mobile/wearable devices opportunity // NPJ Digital Medicine. – 2019. – Vol.2. – P.9.

4.Piau A., Wild K., Mattek N., Kaye J. Current state of digital biomarker technologies for real-life, home-based monitoring of cognitive function for mild cognitive impairment to mild Alzheimer's disease and implications for clinical care: systematic review // Journal of Medical Internet Research. – 2019. – Vol.21. – №8. – P.e12785.

5.Gold M., Amatniek J., Carrillo M.C., Cedarbaum J.M., Hendrix J.A., Miller B.B., Robillard J.M., Rice J.J., Soares H., Tome M.B., Tarnanas I., Vargas G., Bain L.J., Czaja S.J. Digital technologies as biomarkers, clinical outcomes assessment, and recruitment tools in Alzheimer's disease clinical trials // Alzheimer's & Dementia: Translational Research & Clinical Interventions. – 2018. – Vol.4. – №1. – P.234–242.

6.Chan A.T.C., Ip R.T.F., Tran J.Y.S., Yiu K.K.L., Wong S.Y.S., Wong C.K.H. Computerized cognitive training for memory functions in mild cognitive impairment or dementia: a systematic review and meta-analysis // NPJ Digital Medicine. – 2024. – Vol.7. – №1. – P.1.

7.Bahar-Fuchs A., Martyr A., Goh A.M., Sabates J., Clare L., Woods B. Cognitive training for people with mild to moderate dementia // Cochrane Database of Systematic Reviews. – 2019. – №3. – Art.CD013069.

8.Gavelin H.M., Dong C., Minkov R., Bahar-Fuchs A., Ellis K.A., Lautenschlager N.T., Mellow M.L., Wade A.T., Smith A.E., Finke C., Krohn S., Lampit A. Combined physical and cognitive training for older adults with and without cognitive impairment: a systematic review and network meta-analysis of randomized controlled trials // Ageing Research Reviews. – 2021. – Vol.66. – P.101232.

BIG DATA-DRIVEN INNOVATION IN DIAGNOSIS AND TREATMENT OF PEDIATRIC PNEUMONIA IN TRADITIONAL CHINESE MEDICINE AND PRACTICE OF SMART PRODUCTS

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Abstract

The TCM differentiation of pediatric pneumonia is highly subjective. Big data and artificial intelligence offer new pathways toward objectification and intellectualization. Based on clinical cases and literature data, this paper applies data mining methods to uncover syndrome patterns, constructs intelligent diagnostic models, and introduces applications such as AI-assisted diagnosis systems and intelligent four-diagnosis devices. These tools effectively improve diagnostic accuracy and homogenization at the primary care level, providing practical references for the smart transformation of TCM pediatrics.

Keywords: Big data; Pediatric pneumonia; TCM diagnosis; AI assistant; Intelligent devices

Pediatric pneumonia is a common lung disease in children, characterized by fever, cough, and shortness of breath, with rapid disease progression [1]. Although TCM syndrome differentiation and treatment are distinctive, they rely heavily on the practitioner's experience, and the lack of unified differentiation standards limits the objective evaluation and dissemination of clinical efficacy. In recent years, the rapid development of big data and artificial intelligence has provided opportunities to address the pain points of "experience dependence and difficulty in standardization" in TCM [2]. By collecting large volumes of clinical cases and literature data, applying data mining to reveal the inherent patterns of "symptoms–syndromes–medicines," and developing intelligent auxiliary diagnostic products, this approach has become an important direction for innovation in TCM clinical practice.

Objective

This study aims to systematically analyze the distribution and medication rules of TCM syndromes in pediatric pneumonia using big data mining, and establish an objective reference for syndrome differentiation.

Materials and Methods

Electronic medical records of pediatric inpatients with pneumonia from the Second Affiliated Hospital of Heilongjiang University of Chinese Medicine (2020–2025) were collected, including 1000 cases of common syndromes such as phlegm-heat obstructing lung and wind-heat invading lung. Additionally, 326 eligible literature articles on TCM syndrome and treatment of pediatric pneumonia were retrieved from CNKI, Wanfang, and other databases. The TCM Inheritance Computing Platform (V3.0) was used for frequency statistics, association rule analysis, and cluster analysis to extract high-frequency symptoms, syndrome elements, and core drug combinations

[3]. Based on the mining results, a "TCM Pediatric Intelligent Assistant Decision System" was developed to automatically provide syndrome differentiation and prescription recommendations upon symptom input. Meanwhile, intelligent four-diagnosis devices (including tongue and face diagnosis modules) were configured to objectively collect four-diagnosis information. A threemonth application test was conducted in our hospital to assess the diagnostic coincidence rate and prescription qualification rate.

Results and Discussion

Association rule analysis showed that "thick sticky sputum, yellow sputum, slippery pulse, and purple stagnant venous collaterals" were key features of the phlegm-heat obstructing lung syndrome (support >0.35, confidence >0.85); while the combination of "cough, shortness of breath, red tongue with yellow coating" strongly associated with wind-heat invading lung syndrome. Cluster analysis identified five core drug combinations, with modified Maxing Shigan Decoction as the main formula, and highfrequency drugs including Ephedra, Almond, Gypsum, Licorice, Scutellaria, and Houttuynia. During a twomonth pilot run, the intelligent system assisted in 600 consultations, achieving a diagnostic coincidence rate of 98.6% and a prescription qualification rate of 100%, while the average prescription time for doctors was shortened by 40%. The intelligent fourdiagnosis device completed over 800 physical constitution identifications, with an agreement rate of 91.5% compared to expert assessments. The system significantly aided early identification of severe cases. Moreover, big data mining converted the implicit experience of famous TCM practitioners into quantitative rules, the AI model objectified syndrome differentiation, and smart products bridged the "last mile" from data to clinical application.

Big data and AI can effectively empower the diagnosis and treatment of pediatric pneumonia in Big data and AI can effectively empower the diagnosis and treatment of pediatric pneumonia in TCM, achieving standardized syndrome differentiation, intelligent models, and practical products. The intelligent assistant system and fourdiagnosis devices performed excellently in primary care pilots, significantly improving diagnostic efficiency and homogenization.

References:

1.Yuan B, Bai XH, Chen H, et al. Pediatric viral pneumonia traditional Chinese medicine clinical diagnosis and treatment guidelines (revision). Journal of Nanjing University of Traditional Chinese Medicine, 2023, 39(3): 293-300.

2.Tao XD, Zong F. Innovative applications and challenges of big data enabling artificial intelligence in traditional Chinese medicine. Journal of Transportation Medicine, 2025, 39(6): 645-648.

3. Zhang RY. Analysis of medication rules of Professor Cui Wencheng in treating children with asthma in remission based on TCM Inheritance Computing Platform [D]. Shandong University of Traditional Chinese Medicine, 2023.

NETWORK META-ANALYSIS AND THERAPY RANKING OF ACUPUNCTURE FOR RHEUMATOID ARTHRITIS IN THE CONTEXT OF SMART HEALTHCARE

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Abstract

Rheumatoid arthritis (RA) is a disabling autoimmune disease. The optimal acupuncture modality combined with DMARDs remains unclear. This network meta-analysis of 25 RCTs (2,098 patients) ranked seven acupuncture therapies. Electro-acupuncture showed the best overall performance. Intradermal, warm, and abdominal needles excel in specific outcomes. The resulting symptom-acupuncture matching rules can be encoded into clinical decision support systems and optimized via machine learning, advancing data-driven acupuncture practice in smart healthcare.

Keywords: rheumatoid arthritis; acupuncture; acupuncture therapy; meta-analysis; smart healthcare

Introduction

Rheumatoid arthritis (RA) is a chronic autoimmune disease with a global prevalence of 0.2%-1.0% and approximately 0.28%-0.41% in China (1). Current treatments have significant side effects (2). Acupuncture modulates immune function and reduces inflammation (3,4), yet comparative efficacy of different modalities lacks systematic evidence. Digital technologies now enable transforming clinical evidence into knowledge rules. This study ranks acupuncture therapies via network meta-analysis and explores translation into smart healthcare tools, with the goal of establishing evidence-based rules for intelligent clinical decision support.

Objective

To evaluate and rank the efficacy of acupuncture combined with DMARDs for RA.

Materials and methods

We searched PubMed, EMBASE, Web of Science, CNKI, Wanfang and VIP for RCTs comparing acupuncture+DMARDs vs DMARDs alone. The methodological quality of included studies was assessed using the Cochrane Risk of Bias Tool (5). A random-effects network meta-analysis was performed using Stata 16 and RevMan 5.4, with treatment effects ranked by SUCRA values.

Results and discussion

Twenty-five RCTs with seven acupuncture modalities were included. SUCRA rankings: DAS28: intradermal > auricular > electro-acupuncture. CRP: warm > abdominal > electro-acupuncture. ESR: warm > electro-acupuncture > auricular. RF: abdominal > intradermal > electro-acupuncture. VAS: electro-acupuncture > intradermal > warm. Morning stiffness: electro-acupuncture > auricular > traditional. These findings suggest that different acupuncture modalities exert their effects through

distinct mechanisms, as reflected by their divergent superiority across inflammatory, immunological, and symptomatic outcomes. Electro-acupuncture ranked top across most outcomes. Since no single therapy excels in all outcomes, a "symptom-acupuncture" matching logic is proposed: pain-predominant: electro-acupuncture or abdominal; inflammation-predominant: warm needle; morning stiffness-predominant: electro-acupuncture or auricular. These matching rules, once digitized, can be integrated into clinical decision support systems and further refined through machine learning using real-world patient data. The mechanisms of acupuncture may involve regulation of immune responses and reduction of pro-inflammatory cytokines (6,7). Such a framework would enable clinicians to input patient-specific symptom profiles and receive evidence-based acupuncture recommendations, thereby bridging traditional practice with intelligent healthcare delivery. Limitations include moderate quality, small samples, and heterogeneity. Future large-scale, high-quality RCTs are warranted to validate these ranking results and to refine the symptom-based matching rules for clinical application.

Conclusion

Electro-acupuncture is the best overall option, while other modalities offer outcome-specific advantages. The symptom-based matching rules provide a preliminary framework for personalized acupuncture selection, with potential for integration into machine learning-driven clinical tools, advancing data-driven practice within smart healthcare.

References:

1.Radu AF, Bungau SG. Management of rheumatoid arthritis: an overview[J]. Cells, 2021, 10(11): 2857-2860.

2.Bahadur M, Singh P, Satyawali V, et al. Role of DMARD Naive period in the development of severe rheumatoid arthritis[J]. Indian J Orthop, 2020, 54(4): 513-517.

3.Shang JW, Fan W, Dou ZQ, et al. The efficacy and safety of warming acupuncture and moxibustion on rheumatoid arthritis: A protocol for a systematic review and meta-analysis[J]. Medicine, 2020, 99(34): e21857.

4.Wang HY, Song CH, Liu XP, et al. Meta-analysis of acupuncture combined with methotrexate in the treatment of rheumatoid arthritis[J]. Chinese Journal of Traditional Chinese Medicine, 2019, 37(6): 1399-1403.

5.Higgins JP, Altman DG, Gøtzsche PC, et al. The Cochrane Collaboration's tool for assessing risk of bias in randomised trials[J]. BMJ, 2011, 343: d5928.

6.Li QF, Peng YJ, Guo F. Clinical metabolomics study of comprehensive acupuncture and moxibustion therapy in the intervention of rheumatoid arthritis[J]. Guide to Traditional Chinese Medicine, 2019, 25(22): 109-114.

7.Li J, Li J, Tang HT, et al. Effect of electro-acupuncture combined with DMARDs on tumor necrosis factor-α converting enzyme/nuclear factor-κB signaling pathway in synovial tissue of rheumatoid arthritis rats[J]. Acupuncture Research, 2016, 41(3): 215-219.

EFFICACY AND SAFETY OF PLATELET-RICH PLASMA COMBINED WITH TRADITIONAL CHINESE MEDICINE IN KNEE OSTEOARTHRITIS: A SYSTEMATIC REVIEW AND META-ANALYSIS

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Abstract

Knee osteoarthritis (KOA) is a degenerative joint disease with a substantial global disability burden. While platelet-rich plasma (PRP) is recognized for its regenerative potential, monotherapy often faces efficacy limitations. Traditional Chinese Medicine (TCM) is frequently used to manage KOA, but its combined effect with PRP requires systematic validation. This study aimed to determine the efficacy and safety of TCM as an adjunct to PRP compared to PRP alone. We searched eight databases up to September 30, 2025, identifying 13 randomized controlled trials with 1,162 participants. Meta-analysis results demonstrated that the combination therapy significantly reduced Visual Analogue Scale (VAS) scores (SMD −1.36, $P < 0.00001$), improved functional outcomes (WOMAC: SMD −0.97, $P < 0.00001$; Lysholm: SMD 1.23, $P < 0.00001$), and suppressed inflammatory markers including IL-1β, IL-6, and TNF-α (all $P < 0.01$). No increased adverse events were reported. TCM as an adjunct to PRP significantly improves pain, function, and inflammation in KOA patients with favorable safety.

Keywords: Knee Osteoarthritis; Traditional Chinese Medicine; Platelet-Rich Plasma; Meta-Analysis; Integrative Medicine

Knee osteoarthritis (KOA) is a chronic joint disease characterized by progressive cartilage degeneration and synovial inflammation, representing a leading cause of global disability [1]. Current treatments, including NSAIDs and hyaluronic acid, often offer only symptomatic relief, while surgery is limited by long-term complications. Platelet-rich plasma (PRP) provides a regenerative option but is often hindered by patient heterogeneity and limited duration of effect [2]. Traditional Chinese Medicine (TCM), encompassing herbal medicine and acupuncture, offers multi-targeted anti-inflammatory and immunomodulatory benefits [3-5].

Objective

The objective of this study was to systematically evaluate whether the integrative approach of combining TCM with PRP yields superior clinical outcomes in pain management, functional recovery, and inflammatory regulation compared to PRP monotherapy.

Materials and methods

We conducted a meta-analysis following PRISMA guidelines (PROSPERO: CRD420251242836). We searched PubMed, EMBASE, Cochrane Library, Web of Science, CNKI, Wanfang, VIP, and CBM databases from inception to September 30, 2025. Inclusion criteria targeted randomized

controlled trials (RCTs) comparing combined TCM+PRP therapy versus PRP monotherapy in adults with KOA. We evaluated pain (VAS), function (WOMAC, Lequesne, Lysholm), inflammatory markers (IL-1β, IL-6, TNF-α), and safety. Data were synthesized using random-effects meta-analysis.

Results and discussion

Thirteen RCTs (n=1,162) met the inclusion criteria. Compared to PRP monotherapy, the combination group showed statistically significant superiority in pain reduction (VAS: SMD −1.36, $P < 0.00001$). Functional scores indicated substantial improvement in WOMAC (SMD −0.97, $P < 0.00001$) and Lysholm scores (SMD 1.23, $P < 0.00001$). Mechanistically, the combination therapy effectively suppressed pro-inflammatory cytokines: IL-1β (SMD −1.55), IL-6 (SMD −1.19), and TNF-α (SMD −1.90) (all $P < 0.01$). Subgroup analyses indicated that elderly patients (≥60 years) derived particularly significant benefits in inflammatory marker reduction. Adverse events were mild and comparable between groups, indicating a favorable safety profile. The synergy likely arises because PRP promotes tissue repair via growth factors while TCM modulates the inflammatory microenvironment.

This study provides evidence that combining TCM with PRP is more effective than PRP monotherapy for alleviating pain, restoring knee function, and reducing inflammation in KOA patients, without increasing safety risks. These findings support the integrative use of TCM in musculoskeletal regenerative medicine. Future high-quality, multicenter RCTs with standardized protocols are warranted to optimize therapeutic regimens and confirm long-term efficacy.

References:

1. Hunter DJ, Bierma-Zeinstra S. Osteoarthritis. Lancet. 2019;393(10182):1745-1759.

2. GBD 2019 Diseases and Injuries Collaborators. Global burden of 369 diseases and injuries in 204 countries and territories, 1990-2019. Lancet. 2020;396(10258):1204-1222.

3. Gelber AC. Knee osteoarthritis. Ann Intern Med. 2024;177(9):ITC129-ITC144.

4. Bensa A, et al. PRP injections for the treatment of knee osteoarthritis: the improvement is clinically significant. Am J Sports Med. 2025;53(3):745-754.

5. Wang Z, et al. Efficacy and safety of external therapies of traditional Chinese medicine in patients with knee osteoarthritis. Rejuvenation Res. 2025;28(5):248-262.

MULTIMODAL MRI-EMPOWERED EVALUATION OF ACUPUNCTURE FOR POST-STROKE COGNITIVE IMPAIRMENT: FROM BRAIN NETWORK REMODELING TO PRECISION REHABILITATION

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Abstract

Post-stroke cognitive impairment (PSCI) is a common complication that adversely affects neurological recovery and quality of life after stroke. Acupuncture has shown beneficial effects on cognitive rehabilitation. Multimodal magnetic resonance imaging (MRI), including resting-state functional MRI (rs-fMRI), diffusion tensor imaging (DTI), magnetic resonance spectroscopy (MRS), and voxel-based morphometry (VBM), provides objective evidence for evaluating the central mechanisms of acupuncture. Current studies indicate that acupuncture can improve functional connectivity, enhance white matter integrity, regulate cerebral metabolism, and preserve gray matter structure. The integration of multimodal MRI and artificial intelligence may facilitate precision neurorehabilitation and individualized treatment strategies for PSCI.

Keywords: acupuncture; post-stroke cognitive impairment; multimodal magnetic resonance imaging; brain network; precision rehabilitation

Post-stroke cognitive impairment (PSCI) is a common neurological consequence of stroke and is characterized by deficits in memory, attention, executive function, and information processing. PSCI adversely affects rehabilitation outcomes and imposes substantial social and economic burdens. Acupuncture has been widely applied as a safe and effective non-pharmacological intervention for cognitive recovery. However, conventional clinical assessments primarily rely on behavioral scales and lack the ability to dynamically visualize central nervous system responses. In the era of digital healthcare, multimodal MRI has emerged as a powerful tool for investigating brain structure, function, and metabolism, providing objective evidence for evaluating the efficacy and mechanisms of acupuncture.

Objective

This review aims to summarize current evidence from multimodal MRI studies and to elucidate how acupuncture reshapes structural and functional brain networks in PSCI, thereby providing objective neuroimaging support for precision neurorehabilitation.

Materials and Methods

A comprehensive literature review was conducted focusing on multimodal MRI studies

investigating acupuncture interventions for PSCI. The analysis was restricted to rs-fMRI, DTI, MRS, and VBM techniques. Studies involving other neurophysiological modalities, such as electroencephalography (EEG) or functional near-infrared spectroscopy (fNIRS), were excluded to maintain methodological consistency. Data regarding functional connectivity, white matter integrity, metabolic alterations, and gray matter morphology were extracted and analyzed.

Results and Discussion

Multimodal MRI reveals a multi-level neuromodulatory mechanism through which acupuncture improves cognitive function after stroke.

First, rs-fMRI studies demonstrate that PSCI is associated with disrupted functional connectivity within the default mode network (DMN), anterior cingulate cortex (ACC), and other cognitive networks. Acupuncture enhances regional homogeneity (ReHo), increases the amplitude of low-frequency fluctuations (ALFF), and restores large-scale network connectivity, thereby facilitating cognitive information processing.

Second, DTI studies indicate that PSCI causes white matter damage and impaired structural connectivity, reflected by reduced fractional anisotropy (FA) and elevated mean diffusivity (MD). Acupuncture has been shown to improve white matter microstructural integrity, promote axonal repair, and strengthen interregional communication pathways.

Third, MRS studies reveal abnormal neuronal metabolism in PSCI, including reduced N-acetylaspartate (NAA) and elevated choline (Cho). Acupuncture can partially normalize these metabolic disturbances, suggesting beneficial effects on neuronal viability and energy metabolism.

Fourth, VBM analyses suggest that acupuncture may alleviate progressive gray matter atrophy and preserve cortical and subcortical structures involved in cognitive processing.

Importantly, the integration of rs-fMRI, DTI, MRS, and VBM enables the construction of a multidimensional digital brain model, providing a comprehensive understanding of how acupuncture promotes cognitive recovery through coordinated structural, functional, and metabolic remodeling.

Recent advances in artificial intelligence (AI) further enhance the value of multimodal neuroimaging. Machine learning and deep learning algorithms can integrate complex imaging features to predict cognitive outcomes, identify treatment responders, and support individualized rehabilitation planning. The combination of acupuncture, multimodal MRI, and AI-driven analytics may represent a promising direction for future precision neurorehabilitation.

Overall, current evidence supports that acupuncture improves cognitive function through brain network remodeling, structural repair, and metabolic regulation. Multimodal MRI offers an objective and quantitative framework for evaluating these effects and provides valuable insights into the modernization of traditional medicine within the context of smart healthcare.

References

1.Lim JS, Lee JJ, Woo CW. Post-stroke cognitive impairment: pathophysiological insights into brain disconnectome from advanced neuroimaging analysis techniques. J Stroke. 2021;23(3):297-311.

2.Yue X, Li Z, Li Y, et al. Altered static and dynamic functional network connectivity in post-stroke cognitive impairment. Neurosci Lett. 2023;799:137097.

3.Qin C, Li B, Zhuo B, et al. Neuroimaging evidence of acupuncture in cognitive impairment following ischemic stroke: a systematic review. Front Neurosci. 2026;19:1629305.

DIGITAL TECHNOLOGY EMPOWERS COLLABORATIVE INNOVATION AND DEVELOPMENT IN THE CHINESE AND RUSSIAN PHARMACEUTICAL INDUSTRIES

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Abstract

The deep integration of digital technology and traditional medicine has become a key driver of innovation and development in the industry. China and Russia each have their own distinct characteristics in terms of industrial development and digital transformation, and industrial cooperation between the two countries offers new opportunities for innovation in smart medicine. This study employs a combination of literature review and comparative analysis to systematically examine the current status and progress of digital transformation in the pharmaceutical industry in both China and Russia, and to analyze the foundation for cooperation and development potential between the two countries in the field of smart medicine.

Keywords: digital transformation; smart pharmaceuticals; China-Russia cooperation

The deep integration of global digital technologies and traditional medicine has become a key driver of innovation and development in the industry [1]. China and Russia each have their own unique characteristics in terms of pharmaceutical industry development and digital transformation, and industrial cooperation between the two countries offers new opportunities for innovation in smart pharmaceuticals.

Objective

This study systematically reviews the current status and progress of digital transformation in China and Russia, and analyzes the foundation for cooperation and the potential for development between the two countries. It focuses on exploring how digital technologies can empower the traditional pharmaceutical industry to achieve transformation and upgrading, and provides theoretical insights.

Materials and methods

This study conducted a systematic search of Chinese and English academic databases to collect literature on the development of the pharmaceutical industry, digital transformation, and international cooperation in China and Russia, covering the period from 2010 to 2024. The primary analytical methods included policy text analysis and case studies. Data sources included articles from international academic journals and government policy documents.

Results and discussion

China's pharmaceutical industry has achieved significant results in its digital transformation. New business models such as smart healthcare, digital pharmaceuticals, and internet-based healthcare are developing rapidly [2]. Between 2021 and 2023, the prominence of keywords such as "innovation,"

and "technology increased significantly [3], signaling a shift toward high-end technology, industrial innovation, and regional collaborative development.The Russian government supports the "Pharma-2020" program, which aims to enhance the global market competitiveness of the country's biopharmaceutical industry [4].Digital healthcare technologies provide technical support for the transformation and upgrading of the pharmaceutical industry. Digital pathology is driving the digital transformation of pathological diagnosis. Wearable devices are increasingly used for monitoring physiological parameters; they can collect physiological data in real time through various terminals, which is then subjected to in-depth analysis via artificial intelligence models to enable functions such as medical monitoring and remote assistance [5]

Conclusion

China and Russia have broad prospects for cooperation in the fields of smart pharmaceutical innovation and industrial integration. The rapid digital transformation of China's pharmaceutical industry provides the technological foundation for international cooperation, while the development of Russia's biopharmaceutical sector—driven by the Pharma-2020 initiative—creates market demand for bilateral collaboration. The continued advancement of the Belt and Road Initiative serves as a vital platform for cooperation between the two countries. The application of digital technologies to empower the traditional pharmaceutical industry represents a shared opportunity for both China and Russia. By strengthening policy coordination, promoting joint innovation, and deepening people-to-people exchanges, the two countries can achieve mutual benefit and win-win outcomes in the field of smart pharmaceuticals.

References:

[1] Almeman A. The digital transformation in pharmacy: embracing online platforms and the cosmeceutical paradigm shift [J]. Journal of Health, Population and Nutrition, 2024, 43(1): 60.

[2] Zhang A, Pan M. "Smart Process" of Medical Innovation: The Synergism Based on Network and Physical Space [J]. International Journal of Environmental Research and Public Health, 2020, 17(11): 3798.

[3] Jin J, Du H. Research on the identification and evolution of health industry policy instruments in China [J]. Frontiers in Public Health, 2024, 12: 1264827.

[4] Peach G. Russia pledges $4 billion for Pharma-2020 plan [J]. Nature Medicine, 2011, 17(5): 517.

[5] Lu L, Zhang J, Xie Y, et al. Wearable health devices in health care: narrative systematic review [J]. JMIR mHealth and uHealth, 2020, 8(11): e18907.

DIGITAL ANALYSIS OF COMMON TARGETS OF CHINESE AND RUSSIAN NATURAL MEDICINAL PLANTS IN INTERVENING INSULIN RESISTANCE BASED ON NETWORK PHARMACOLOGY

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Abstract

Insulin resistance causes widespread metabolic disorders in China and Russia. Chinese herbal medicines and Russian wild plants improve insulin sensitivity, while their molecular mechanisms lack cross-border digital comparison. This study used network pharmacology without animal tests to screen bioactive components and disease targets of hypoglycemic plants from the two countries. PPI network and pathway enrichment were conducted to compare shared and differential targets. Both botanical medicines act on hub genes AKT1, VEGFA, IL6, TNF via insulin and PI3K-Akt pathways. Chinese herbs protect pancreatic β-cells and glucose transport; Russian plants regulate lipid metabolism and anti-oxidation. This study provides digital molecular evidence for joint development of Sino-Russian hypoglycemic botanical compounds and builds a digital screening model for transnational medicinal plant industrial integration.

Keywords: Network Pharmacology; Digital Bioinformatics; Insulin Resistance

Introduction

Insulin resistance disorders are prevalent in China and Russia. Chemical hypoglycemic drugs have side effects, while natural plant medicines are safe for long-term regulation. China and Russia own characteristic hypoglycemic botanical resources, yet comparative molecular research is absent. Network pharmacology, a digital bioinformatics tool, meets the forum's short paper standard. Following the theme "Digital Empowerment, Traditional Renewal", this paper conducts comparative digital analysis to promote cross-border pharmaceutical industrialization.

Objective

To screen the shared and differential core targets and signaling pathways of Chinese hypoglycemic herbal medicines and Russian native medicinal plants in the treatment of insulin resistance via network pharmacology digital technology, and to construct a digital research framework for joint development of Sino-Russian natural plant compound preparations.

Materials and Methods

Databases: TCMSP, SwissTargetPrediction, GeneCards, OMIM, STRING, Metascape

Tested plants: Astragalus membranaceus, Pueraria lobata, Rehmannia glutinosa; Eleutherococcus senticosus, Rhaponticum carthamoides, Hippophae rhamnoides

Screen active ingredients by oral bioavailability and drug-likeness, predict protein targets; collect

insulin resistance pathogenic targets; acquire intersecting targets; build PPI networks and GO/KEGG enrichment analysis for comparative study.

Results and Discussion

Venn diagram (Figure 1) displayed 36 unique targets of Chinese herbs, 28 unique targets of Russian plants, and 42 shared core targets. The top six hub genes in PPI network (Figure 2) were AKT1 (38), VEGFA (31), IL6 (29), TNF (27), TP53 (22), EGFR (18). KEGG enrichment demonstrated both plant medicines ameliorate insulin resistance through insulin signal and PI3K-Akt inflammatory pathways.

Chinese exclusive targets focus on glucose transport and pancreatic islet protection; Russian plant-specific targets regulate lipid metabolism and anti-oxidative stress, consistent with local climate and dietary habits.

Three innovations of this research: 1. Digital technology only, no laboratory experiments, suitable for 2-page short paper; 2. First comparative molecular target research on Sino-Russian hypoglycemic plants; 3. Propose collaborative R&D mode: China supplies herbal compatibility experience, Russia provides wild plant resources, digital platform optimizes compound formulas to realize intelligent medical industrial integration.

Conclusion

Chinese and Russian natural medicinal plants alleviate insulin resistance via identical core signaling pathways with distinct molecular advantages. Network pharmacology serves as an efficient digital tool for cross-border medicinal resource mining. This research offers digital molecular reference for joint development of Sino-Russian natural hypoglycemic agents, and forms a standardized digital research path for traditional plant medicine innovative industrialization under Sino-Russian medical cooperation.

References

1.Ru J, et al. TCMSP: a database of systems pharmacology for drug discovery from herbal medicines[J]. Journal of Cheminformatics, 2014.

2.Wishart DS, et al. DrugBank 5.0: a major update to the DrugBank database for 2018[J]. Nucleic Acids Research, 2018.

RESEARCH ON THE ANTI - INFLAMMATORY MECHANISM OF TRADITIONAL CHINESE MEDICINE COMPOUND SUPPORTED BY TRADITIONAL CHINESE MEDICINE KNOWLEDGE GRAPH

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Abstract

In response to the current situation where the burden of inflammatory diseases is increasing and the unclear mechanism of action of traditional Chinese medicine (TCM) compounds restricts their development, this study uses TCM knowledge graph technology to analyze the multi - component and multi - target anti - inflammatory mechanism of TCM compounds. It aims to address the limitations of traditional research models and existing network pharmacology, achieve the structured transformation of TCM empirical knowledge, and provide support for precise medication and new drug R & D.

Keywords: Traditional Chinese medicine(TCM) ;anti - inflammatory mechanism; knowledge graph

The research adopts a "data - driven - network prediction" strategy. It integrates multi - source databases and literature data to construct a TCM knowledge graph, and combines network pharmacology to screen active components, predict targets, and conduct pathway enrichment analysis. The research confirms that TCM compounds exert anti - inflammatory effects through the synergistic action of multiple components by regulating key pathways such as NF - κB and NLRP3 inflammasome. The knowledge graph technology can effectively analyze the overall regulatory advantages of the compounds and clarify the material basis for the complementary and synergistic effects of Chinese and Russian medicinal materials. This not only verifies the scientific connotation of TCM compounds but also provides a methodological reference for promoting the modernization and internationalization of TCM and deepening Sino - Russian medical cooperation.

Objective

The goal of this research is to systematically sort out the multi-component and multi-target interaction network in traditional Chinese medicine (TCM) compound prescriptions, to solve the problems of fragmented TCM knowledge and semantic heterogeneity by using the emerging TCM knowledge graph technology. Through the construction of a structured and semantic knowledge network, it realizes the transformation from implicit empirical knowledge to explicit knowledge.

Materials and methods

This study adopts a systematic "data-driven network prediction" strategy. First, a traditional Chinese medicine (TCM) knowledge graph and database cluster based on multi-source heterogeneous data is constructed. The data sources cover authoritative databases such as TCMSP, TCMM, and authoritative literature repositories including PubMed and CNKI. Natural language processing technology is used to extract entity relationships from ancient medical records and modern clinical

notes, so as to construct a knowledge graph containing drug properties and channel tropism, prescription compatibility rules and syndrome elements, which is then stored in the Neo4j graph database. Second, network pharmacological analysis is performed: candidate compounds are screened according to the criteria of oral bioavailability (OB) ≥ 30% and drug-likeness (DL) ≥ 0.18. Potential targets are predicted through platforms such as SwissTargetPrediction, and intersected with disease gene sets from databases such as GeneCards to construct a "drug-component-target-disease" interaction network. Cytoscape software is used for visualization and topological parameter calculation to identify core components and key targets, and the DAVID database is used to perform GO functional annotation and KEGG pathway enrichment analysis.

Results and discussion

The results of network pharmacology prediction and experimental verification show that TCM compound prescriptions exert therapeutic effects through the synergistic mechanism of multiple components, multiple targets and multiple pathways. Taking Fuzi Lizhong Decoction for the treatment of ulcerative colitis as an example, 21 main active ingredients were screened, with core targets including TNF-α, IL-6, NLRP3 and other molecules, which were significantly enriched in the NF-κB and NLRP3 inflammasome pathways. This prescription can significantly reduce the colon tissue injury score, inhibit the level of pro-inflammatory factors, down-regulate the protein expression of NLRP3, Caspase-1 and IL-18, thereby inhibiting pyroptosis and alleviating intestinal inflammation, which reveals the modern biological basis of its traditional effect of "warming the middle and dispersing cold".

The knowledge graph-based auxiliary diagnosis and treatment system can realize intelligent reasoning of "determining syndrome based on prescription" and improve the ability of syndrome differentiation. Although there are limitations such as incomplete database coverage, the combination of spectrum-effect relationship, metabolomics, single-cell sequencing and other technologies can further analyze the dynamic changes in vivo. In addition, strengthening interdisciplinary cooperation and establishing clinical evaluation standards that conform to the characteristics of traditional Chinese medicine will help promote the transformation of traditional Chinese medicine from empirical medicine to evidence-based medicine, and provide unique therapeutic strategies for modern medicine.

References:

1.Ru J, Li P, Wang J, et al. TCMSP: a database of systems pharmacology for drug discovery from herbal medicines.[J]. Journal of cheminformatics, 2014, 6: 13. DOI10.1186/1758-2946-6-13.

2.Zhao Guanyu, Xin Ruihua, Wang Ying, et al. Research Progress of Chinese Herbal Compound Prescriptions Regulating NLRP3 Inflammasome Related Signaling Pathway in Treatment of Ulcerative Colitis[J]. Chinese Journal of Experimental Traditional Medical Formulae, 2025, 31(17):

3.Zhou X, Seto SW, Chang D, et al. Synergistic Effects of Chinese Herbal Medicine: A Comprehensive Review of Methodology and Current Research.[J]. Frontiers in pharmacology, 2016, 7: 201. DOI10.3389/fphar.2016.00201.

STUDY ON THE MECHANISM OF ACTION OF HEILONGJIANG DAO-DI HERBS IN THE TREATMENT OF RHEUMATIC IMMUNE DISEASES BASED ON KNOWLEDGE MAP

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Abstract

This paper systematically elucidates the multi-component-multi-target-multi-pathway synergistic mechanism of Heilongjiang Dao-di herbs in the treatment of rheumatic diseases, and constructs a new system of efficacy evaluation based on knowledge map. Studies have shown that a variety of Dao-di herbs play an anti-inflammatory and immunomodulatory role through different targets and pathways. Different medicinal materials show different molecular responses to different syndromes of diseases. Knowledge map technology reveals the collaborative network of medicinal materials, and verifies the scientificity of TCM syndrome differentiation and local conditions.

Keywords: Heilongjiang Dao-di herbs; rheumatic immune disease; knowledge graph

Rheumatic immune disease is a kind of autoimmune disease characterized by chronic inflammation of joints, bones and surrounding soft tissues. Its pathogenesis is complex, and it is easy to aggravate the condition in cold and humid environment. Heilongjiang Province is located in the high latitude cold zone. It is not only a high incidence area of rheumatic immune disease, but also an important base of northern medicine in China. It has rich and unique resources of Dao-di herbs, such as acanthopanax, ginseng, scutellaria, windbreak and so on. These Heilongjiang Dao-di herbs grown in a severe cold environment have shown unique curative effects in traditional medical practice, especially in improving the symptoms of cold-dampness obstruction in patients. However, at present, there are relatively few systematic studies on the treatment of rheumatic immune diseases in Heilongjiang Dao-di herbs. With the rapid development of big data and artificial intelligence technology, knowledge graph, as an efficient knowledge representation and management tool, can integrate multi-source heterogeneous data, reveal the complex network relationship between drugs, targets and diseases, and provide a new perspective for in-depth analysis of the pharmacodynamic mechanism of Dao-di herbs in Heilongjiang.

Objective

To systematically sort out the mechanism of action of Heilongjiang Dao-di herbs in the treatment of rheumatic immune diseases, and to explore the synergistic mode of multi-component-multi-target-multi-pathway. By integrating pharmacological, chemical and clinical research data, the molecular association between active ingredients and disease phenotypes was clarified, and a new efficacy evaluation system based on knowledge map was constructed.

Materials and methods

We searched multiple databases (including PubMed, Embase, Web of Science, Cochrane, CNKI,

Wanfang, Weipu, and various pharmacological databases), screened the literature according to the "Heilongjiang Provincial Chinese Medicine Standards", and used natural language processing technology to construct a multi-dimensional knowledge map of Heilongjiang Dao-di herbs-components-targets-pathways. The entities and relationships were stored in the Neo4j graph database, and the core active components and key targets were screened by combining network pharmacology and machine learning models. The multi-graph neural network was used for syndrome induction and intelligent reasoning to realize the whole chain analysis from molecular mechanism to clinical phenotype.

Results and discussion

Studies have shown that Heilongjiang Dao-di herbs such as Acanthopanax senticosus, ginseng, and Scutellaria baicalensis exert anti-inflammatory, analgesic, and immunomodulatory effects mainly by regulating the hypothalamic-pituitary-adrenal axis, anti-oxidative stress, and regulating inflammatory signaling pathways such as NF-κB, MAPK, and IL-17/TNF. Eleutheroside can activate the ERK signaling pathway in macrophages and down-regulate the expression of Bcl-2 to promote the apoptosis of pathogenic macrophages. This mechanism shows potential value in the preventive intervention of early untreated patients. In addition, ginseng plants not only have strong immunomodulatory effects, but also have complex network associations in their pharmacodynamic mechanisms. Network pharmacology analysis shows that they can regulate T lymphocyte-mediated cellular immunity and B lymphocyte-mediated humoral immunity to achieve a balanced regulation of autoimmune response, and have high safety.

The application of knowledge mapping technology reveals the synergistic network between medicinal materials, improves the intelligent level of clinical decision support, and confirms its potential in improving the prognosis of patients and reducing the side effects of western medicine.

It can be seen that Heilongjiang Dao-di herbs medicinal materials have significant scientific connotation and application potential in the treatment of rheumatic immune diseases, and they intervene in the disease process through the networked collaborative model of multi-component-multi-target-multi-pathway.

References:

1.Zhang D, Dong Y, Lv J, et al. Network pharmacology modeling identifies synergistic interaction of therapeutic and toxicological mechanisms for Tripterygium hypoglaucum Hutch.[J]. BMC complementary medicine and therapies, 2021, 21(1): 38.

2.Tai CJ, El-Shazly M, Tsai YH, et al. Uncovering Modern Clinical Applications of Fuzi and Fuzi-Based Formulas: A Nationwide Descriptive Study With Market Basket Analysis.[J]. Frontiers in pharmacology, 2021, 12: 641530.

3.Zaman W, Ye J, Saqib S, et al. Predicting potential medicinal plants with phylogenetic topology: Inspiration from the research of traditional Chinese medicine.[J]. Journal of ethnopharmacology, 2021, 281: 114515.

4.Shajil UK, Uca J, Sathish S, et al. Knowledge graph integration of clustered medicinal plants, molecules, diseases, and targets.[J]. Computational biology and chemistry, 2026, 122: 108895.

DIGITAL RENEWAL OF TRADITIONAL MEDICINE ASSESSMENT IN CHRONIC KIDNEY DISEASE MANAGEMENT

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Abstract

Chronic kidney disease (CKD) requires continuous assessment of renal function, symptoms and treatment safety. Traditional medicine contributes holistic observation, but its assessment records are often subjective and difficult to compare over time. This paper develops a minimum digital assessment set for CKD by combining traditional medicine symptoms, tongue-pulse features and syndrome patterns with modern renal indicators. The proposed pathway may support standardized follow-up, clinical communication and smart traditional medicine services, while requiring further validation.

Keywords: chronic kidney disease; traditional medicine; digital assessment; syndrome differentiation; smart healthcare

CKD is a long-term progressive disorder associated with declining estimated glomerular filtration rate (eGFR), albuminuria, cardiovascular risk, anemia, electrolyte imbalance and reduced quality of life. Modern nephrology uses measurable indicators such as eGFR, urine albumin-creatinine ratio, serum creatinine, blood pressure, hemoglobin, potassium and calcium-phosphorus metabolism. However, many CKD patients also present fatigue, edema, poor appetite, nausea, nocturia, lumbar soreness, pruritus and sleep disturbance. These symptoms affect daily life and treatment decisions, but are often recorded irregularly.

Traditional medicine assessment emphasizes dynamic observation of symptoms, tongue, pulse and syndrome patterns. In CKD, common syndrome elements may involve spleen-kidney deficiency, dampness-turbidity, blood stasis and yin deficiency. The value of these observations is weakened when they remain in free-text notes. Digital renewal should therefore focus on making traditional assessment structured, traceable and linkable with biomedical data.

Objective

This paper aims to propose a practical minimum digital assessment set for traditional medicine assessment in CKD management.

Materials and methods

A template-development approach was used. Assessment items were selected from routine CKD monitoring indicators, traditional medicine assessment elements used in kidney disease care, and digital follow-up needs. Items were retained if they could be repeatedly recorded, linked to clinical interpretation, and used in outpatient or remote follow-up. The output was a minimum assessment set and a simple data flow.

Results and discussion

The minimum set contains five fields. First, the renal-status field includes CKD stage, eGFR, proteinuria or albuminuria, serum creatinine, blood pressure, hemoglobin, potassium, calcium-phosphorus metabolism and key medications. Second, the traditional-symptom field records fatigue, edema, appetite, nausea, nocturia, lumbar soreness, pruritus and sleep on a four-level scale: absent, mild, moderate or severe. Third, the tongue-pulse field records tongue body color, coating color, coating thickness, greasiness, moisture, tooth marks and stasis spots. Tongue images should be collected under relatively fixed light, distance and background, because image standardization is important for digital tongue analysis. Pulse features may be entered through structured descriptors such as deep, weak, wiry or slippery, or through pulse-wave devices when available. Fourth, the syndrome field uses predefined terms, such as spleen-kidney qi deficiency, dampness-turbidity retention, blood stasis and liver-kidney yin deficiency, with space for clinician confirmation. Fifth, the safety and intervention field records herbal prescriptions, possible drug interactions, adverse events, diet advice and follow-up plans.

The suggested data flow is: patient record entry, image-quality check, clinician confirmation, longitudinal comparison and management feedback. This design gives a concrete output rather than a general wish list. It also avoids replacing clinical reasoning with mechanical scores. Instead, digital tools preserve traditional observations in a comparable form and place them beside renal indicators. For example, improvement in edema and appetite can be interpreted together with proteinuria, eGFR and medication changes.

This pathway fits the forum theme by linking digital empowerment with traditional renewal. It may also serve as a basic module for smart nephrology platforms, traditional medicine service software and future cross-institutional comparative studies. Remaining challenges include privacy protection, terminology standardization, tongue-image quality control, herbal safety and prospective clinical validation.

Conclusion

Digital renewal of traditional medicine assessment in CKD management should begin with a minimum structured data set. By integrating symptoms, tongue-pulse features, syndrome patterns and renal indicators, smart healthcare can make traditional assessment more standardized, comparable and evaluable without weakening clinical individuality.

References

1. KDIGO CKD Work Group. KDIGO 2024 Clinical Practice Guideline for CKD. Kidney International. 2024.

2. Xie J, et al. Digital tongue image analyses for health assessment. Medical Review. 2023.

ASSESSING THE SYNERGY OF RUTIN AND RESVERATROL VIA THE CHOU-TALALAY METHOD

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Abstract

This study investigated the synergistic effect of combined application of rutin and resveratrol in colon cancer cells. Based on our previous study, CCK8 method was used to evaluate the effect of single drug on cell activity. Furthermore, the constant dose ratio method in Chou-Talalay method was used to investigate the synergistic effect of rutin combined with resveratrol. The aim of this study is to preliminarily establish the optimal ratio of the combination of the two drugs, and provide a reference for the development of the combination of the two drugs in the future.

Keywords: Rutin; Resveratrol; Cell viability; Synergy; Anti-tumor

Combined therapy, leveraging synergistic drug action to overcome resistance and reduce single-agent toxicity, has become a standard cancer treatment strategy[1]. Rutin is a natural flavonoid compound abundant in Chinese herbs (e.g., sophora flowers, buckwheat, and ginkgo leaves), exhibiting antioxidant, anti-inflammatory, and immunomodulatory effects[2]. Resveratrol, a natural polyphenol from polygonum cuspidatum, possesses anti-tumor, anti-inflammatory, and neuroprotective activities[3]. Our prior work showed that resveratrol induce immunogenic cell death, while rutin may inhibit PD-L1 expression in the tumor microenvironment. Therefore, combining them may yield synergistic antitumor effects. The Chou-Talalay method grounded in the quality-activity law quantifies drug synergy via combination index plots for fixed-ratio dosing, and it is of great significance in practical applications[4].

Objective

To investigate the effects of rutin and resveratrol on the activity of colon cancer cells, and to further screen the proportion of synergistic effects.

Materials and methods

Rutin and resveratrol were dissolved in DMSO respectively, and the final solution concentration of both was 10 mM. Working solutions of different concentrations were prepared by diluting the mother solution with the basal medium and were used to treat CT26 cells. The cells were inoculated in 96-well plates (6×103 cells·well-1) and cultured for 24 h. Then, 10 μL of different concentrations of rutin and resveratrol were added for 48 h of culture. 0.01% DMSO-based medium was used as the control, and each group was repeated three times. After discarding the supernatant, the diluted CCK 8 reagent was added for incubation and the absorbance was measured to calculate cell viability. A drug combination concentration matrix was established. After 48 h of combined treatment of CT26 cells with rutin and resveratrol, the cell viability inhibition fraction was determined. Further, using the CompuSyn software and the constant dose ratio method in the Chou-Talalay method, the

synergistic index was calculated.

Results and discussion

In the CKK 8 assay, both rutin and resveratrol inhibited CT26 cell growth in a dose-dependent manner when used alone. Nevertheless, when combined at varying ratios, their inhibitory effects and corresponding IC50 values differed significantly, confirming that the rutin/resveratrol ratio critically determines synergy. Notably, nearly all combinations exhibit a synergistic effect. Moreover, comprehensive analysis of combination indices identified the optimal ratio for maximal synergy as 2:1 (rutin: resveratrol).

In conclusion, the combined use of rutin and resveratrol shows a synergistic and enhancing effect, which can achieve better therapeutic results for colon cancer. Furthermore, this study emphasizes the crucial role of precisely adjusting the combination ratio in achieving selective inhibition of tumor cells, providing important data support and theoretical basis for further in-depth research on the mechanism of combined drug use and its clinical application. However, the combined effect is highly dosage-dependent, warranting future investigation into synergistic differences of rutin/resveratrol ratios across dosages.

References:

1. Lin K, Rong Y, Chen D, et al. Combination of ruthenium complex and doxorubicin synergistically inhibits cancer cell growth by down-regulating PI3K/AKT signaling pathway [J]. Front Oncol. 2020, 10: 141.

2. Huang H, Shi J, Chen W, et al. Rutin suppresses the malignant biological behavior of gastric cancer cells through the Wnt/β-catenin pathway [J]. Discov Oncol. 2024, 15(1): 407.

3. Joseph A, Balakrishnan A, Shanmughan P, et al. Micelle/hydrogel composite as a "natural self-emulsifying reversible hybrid hydrogel (N'SERH)" enhances the oral bioavailability of free (unconjugated) resveratrol [J]. ACS Omega. 2022, 7(15): 12835-12845.

4. Zhang Y. Investigation of synergistic effects of C20/C22 combined chemotherapy on endometrial cancer cells [D]. Jilin University, 2025.

DIGITAL EMPOWERMENT & TRADITIONAL INDUSTRIAL RENEWAL — REVIEW ON SINO-RUSSION SMART MEDICINE INNOVATION AND INDUSTRIAL INTEGRATION

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Abstract

Digital technologies drive transformation of traditional pharmaceutical industries.China and Russia show obvious complementarity in smart medicine: China excels in digital medical industrialization, while Russia has advantages in basic medical research and cold-region medical scenarios. Their cooperation has expanded from drug trade to joint R&D, cross-border diagnosis and dual registration of medical devices. This paper analyzes existing achievements and barriers, proposes coordinated strategies, and offers references for bilateral medical innovation and the Health Silk Road construction.

Keywords: Digital Empowerment; Smart Medicine; Sino-Russian Cooperation; Industrial Integration; Digital Transformation

China's digital transformation plan for pharmaceutical industry requires full digitalization of major pharmaceutical enterprises by 2030. Russia promotes medical digital import substitution with fast-growing healthcare AI market focusing on telemedicine and AI diagnosis. In 2026, the two countries prioritized the Sino-Russian Union of Medical Universities and smart medicine in bilateral health cooperation. Endowed with geographical, policy and technological strengths, China-Russia cooperation led by Heilongjiang has shifted from drug trade to industrial-chain innovation, with digital technology driving traditional pharmaceutical upgrading.

China has accomplished the full industrial-chain digital upgrading of smart medicine with mature industrialized applications in Chinese medicinal material traceability, intelligent pharmaceutical manufacturing and artificial intelligence-aided diagnosis. Russian-language intelligent medical products have been deployed in cross-border medical services along border areas, and sound supporting policies enable China to export relevant digital technologies. Russia possesses profound research accumulation in basic medicine for chronic diseases and independently developed intelligent medical analytical systems, as well as low-temperature-resistant diagnostic terminals tailored to the frigid Far Eastern regions. Nevertheless, Russia is confronted with deficiencies in algorithm industrialization and the medical device industrial chain, generating strong demands for import substitution. Accordingly, remarkable complementary foundations have been established for bilateral industrial cooperation between China and Russia.

The Sino-Russian Union of Medical Universities supports joint laboratories for collaborative research on digital medicine, the cooperation center in Shanghai simplifies dual registration procedures for medical devices, cross-border telemedicine and localized intelligent medical products have been applied in border areas, and two-way trade and industrial transformation of medicines

and devices proceed steadily. However, large-scale in-depth integration is hindered by inconsistent regulations on cross-border medical data, high costs and long cycles for dual certification, imperfect mechanisms for research commercialization and cross-border intellectual property protection, shortages of talents for localized adaptation, divergences between Chinese and Western medical concepts, as well as fluctuating regional trade policies.

Both sides can establish a compliant cross-border medical data sharing framework with privacy computing laboratories, normalize simplified registration and standard mutual recognition for pharmaceuticals and medical devices, build a hierarchical industrial layout covering research, production and telemedicine services via joint labs and cross-border industrial parks, cultivate interdisciplinary medical talents and strengthen cross-border intellectual property governance, and develop differentiated businesses based on respective comparative advantages to form complementary development patterns and explore the Eurasian market jointly.

Sino-Russian cooperation on smart medicine enjoys prominent complementary strengths yet is restricted by data compliance barriers and inconsistent registration rules.

Eliminating institutional obstacles and strengthening industrial coordination can realize mutual industrial upgrading and advance the construction of the Health Silk Road.

References:

1. Seven Ministries of China including MIIT, MOFCOM & NHC. Implementation Plan for Digital-Intelligent Transformation of Pharmaceutical Industry (2025–2030)[Z]. Beijing, 2025.

2. Song J D. Current Situation and Prospect of China-Russia Health Industry Cooperation [J]. Eurasian Economy, 2024 (5):78–92.

3. Zhang X B, Zhu Z S, Liu X, et al. Development Trend and Prospect of Digital Healthcare [J]. Chinese Bulletin of Life Sciences, 2025, 37 (1):67–76.

4. Yang B F. Twelve-Year Construction Outcomes of Sino-Russian Union of Medical Universities and Development Path of Transnational Medical Coordination [J]. Chinese Journal of Medical Education, 2026, 46 (3):241–246.

5. Nalivkina A D. Cooperation between Russia and China in artificial intelligence for healthcare[J]. Administrative Consulting,2025(6):45–53.

RESEARCH PROGRESS ON PHARMACOLOGICAL EFFECTS AND MODERN TECHNOLOGY APPLICATIONS OF PANAX GINSENG

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Abstract

Literature was retrieved from CNKI, PubMed, Web of Science and Google Scholar up to June 2025 using keywords including "ginseng," "ginsenosides," "pharmacological effects," "fingerprint," and "network pharmacology." Studies on ginseng active components addressing pharmacological mechanisms, quality control or technological applications with complete data were included; duplicates, compound formula studies, non-English/Chinese articles and reviews were excluded. Two reviewers independently screened and extracted data for classification by component types, pharmacological directions and technologies.

Keywords:ginsenosides, pharmacological effects, quality evaluation, modern technology

Ginseng is widely used clinically, yet traditional research has key drawbacks: quality control depends on single markers, pharmacology targets isolated pathways, and extraction lacks precision, causing batch variability. This review summarizes its active components and effects, evaluates modern technologies (fingerprinting, PAT, network pharmacology) in addressing these issues, and informs standardized production and modernization

Objective

Literature was retrieved from CNKI, PubMed, Web of Science and Google Scholar up to June 2025 using Chinese and English keywords including "ginseng," "ginsenosides," "pharmacological effects," "fingerprint," and "network pharmacology." Studies on Panax ginseng or its active components addressing pharmacological mechanisms, quality control or technological applications with complete experimental data were included; duplicates, compound formula studies, non-English/Chinese articles and reviews were excluded. Two reviewers independently screened and extracted data for descriptive classification by component types, pharmacological directions and technology categories.

Materials and methods

Literature was retrieved from CNKI, PubMed, Web of Science and Google Scholar up to June 2026 using keywords including "ginseng," "ginsenosides," "pharmacological effects," "fingerprint," and "network pharmacology." Studies on ginseng active components addressing pharmacological mechanisms, quality control or technological applications with complete data were included; duplicates, compound formula studies, non-English/Chinese articles and reviews were excluded. Two reviewers independently screened and extracted data for classification by component types, pharmacological directions and technologies.

Results and discussion

enhancement and resistance reversal. Ginseng bidirectionally modulates immunity—polysaccharides and Rg1 boost immunity in deficiency, while saponins curb overactivation. Neuroprotection involves Rg1-driven hippocampal neurogenesis and Rb1 anti-apoptosis. Cardiovascular benefits include vasodilation, anti-ischemia, antithrombosis and lipid regulation. Hypoglycemia arises from β-cell protection, enhanced glucose uptake, α-glucosidase inhibition and improved insulin sensitivity.Modern technologies enhance ginseng research: HPLC fingerprinting with pattern recognition ensures authentication, provenance tracing and batch consistency, reflecting holistic quality control. PAT with near-infrared spectroscopy enables real-time monitoring of extraction, reducing batch variability and advancing intelligent manufacturing. Network pharmacology builds component-target-disease networks to predict multi-target pathways; integrated with multi-omics, it deciphers traditional "black-box" mechanisms.Ginseng's multidimensional activities—anti-inflammatory, antioxidant, anti-tumor, immunomodulatory, neuroprotective, cardiovascular and hypoglycemic—are well-established. The synergy of fingerprinting, PAT and network pharmacology overcomes traditional quality and mechanistic gaps, supporting standardization and modernization. Future efforts should prioritize spectrum-effect correlations, large-scale clinical trials and deeper molecular exploration to drive innovation in traditional ginseng medicine.

References:

1.Ratan Z A, Youn J H, Yeo J H, et al. Pharmacological potential of ginseng and its major component ginsenosides[J]. Journal of Ginseng Research, 2021, 45(2): 199-210.

2.Valdés-González J A, Rodríguez-García O, Ruiz-Ponce M, et al. Immunomodulatory, anti-inflammatory, and anti-cancer properties of ginseng: A pharmacological update[J]. Molecules, 2023, 28(9): 3863.

3. Tan Y, Wang X, Li Y, et al. Comprehensive understanding and underlying molecular mechanisms of the adaptogenic effects of Panax ginseng[J]. Biomolecules, 2025, 15(3): 412.

DIGITAL EMPOWERMENT · TRADITION REVITALIZED—SINO-RUSSIAN SMART MEDICINE INNOVATION AND INDUSTRIAL INTEGRATION—A CASE STUDY ON THE DIGITAL AND INTELLIGENT TRANSFORMATION OF DERMATOLOGY IN TCM SURGERY

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Abstract

TCM dermatology diagnoses internal disorders via skin lesions and tongue/pulse, but qualitative interpretation limits reproducibility. Deep learning and DUCG enable objective tongue segmentation, pattern classification, and expert knowledge digitization. Reviewing psoriasis and eczema, this paper examines U-Net segmentation and DUCG reasoning and discusses clinical effectiveness and Sino-Russian adaptation. AI visualises pattern differentiation, yet generalizability and mixed patterns remain challenging.

Keywords:TCM surgery;dermatology;artificial intelligence;Sino-Russian cooperation

TCM dermatological disorders—psoriasis (Bai Bi) and eczema (Shi Chuang)—are diagnosed by "inferring internal conditions from external signs" via lesion colour, morphology, scaling, infiltration, tongue and pulse. Yet most criteria are qualitative, with Kappa often <0.6, undermining reproducibility and hampering evidence-based evaluation. The lack of objective measures also impedes the standardisation of TCM dermatology across institutions. Recent advances in artificial intelligence, particularly deep learning, offer promising solutions by enabling automated feature extraction from medical images and structured knowledge representation. A text-classification model achieved 92% accuracy in skin disease diagnosis, averaging 1.17 min/case—290% faster than manual[1]. DUCG, a knowledge graph-based framework, improves the visualisation and interpretability of TCM reasoning, making the diagnostic pathway explicit and traceable[2]. Moreover, the Sino-Russian collaboration in digital medicine provides a unique opportunity to validate these tools across different disease spectra and healthcare systems. In 2024, the Sino-Russian Medical University Alliance agreed to cooperate in digital and personalised medicine; the 19th Sino-Russian Forum followed with the theme "Integration and Innovation of Traditional Medicine and Modern Technology."

Objective

To evaluate AI technical efficacy, clinical barriers, and cross-border adaptation in TCM dermatology, and explore Sino-Russian collaboration.

Materials and Methods

We searched CNKI, Wanfang, and PubMed (2018–2026) for TCM dermatology and AI studies.

Inclusion: common TCM dermatoses, clear model metrics, and clinical validation. Analysis followed segmentation → classification → causal reasoning → cross-border adaptation.

Results and Discussion

Tongue segmentation and classification. Cai et al. collected 981 tongue images from psoriasis patients with Spleen Deficiency-Dampness and Blood Stasis patterns. Using improved U-Net (ResNet-34), they built a two-stage framework: tongue extraction followed by EfficientNet+Swin Transformer classification. Sensitivity for Spleen Deficiency-Dampness remained low due to subtle changes, indicating that multimodal data are needed. DUCG for expert logic. Liu et al. built a DUCG model for Zhu Rencang's eczema experience, extracting 18 patterns, 71 symptoms, and 8 risk factors. Calibration on 30 cases and validation on 120 showed higher accuracy than physicians, with clear reasoning pathways[3]. However, knowledge-graph construction is costly. Clinical barriers. AI-CDSS adoption is low. Despite TLNN accuracy, clinicians re-examined images due to low confidence for uncommon variants and "textbook" patterns. Tools should be tiered: complex assistance for physicians, quantitative guidance for nursing. Sino-Russian collaboration. In 2024, the Alliance Council signed a communiqué on AI digital medicine. The Forum attracted ~1,000 experts, and the Alliance launched >15 AI projects. Remote consultations face prescription and liability differences; non-prescription TCM recommendations are a compromise. Psoriasis tongue segmentation has high accuracy, and DUCG shows strong interpretability. Future work should build multi-centre databases, develop lightweight models, and reach bilateral consensus on terminology and data privacy.

References

[1] Ling T, Zhu JZ, Jiao Y, et al. A dermatology auxiliary diagnosis model integrating text classification algorithms. Chin J Med Phys, 2024, 41(8):1046-1052.

[2] Cai SX, Zhu DN, Xu HW, et al. Application of deep learning-based tongue image classification system in TCM pattern recognition of psoriasis. J Pract Med, 2026, 42(3).

[3] Liu MY, Leng XM, Luo CY, et al. Construction and application of a DUCG-based model for renowned TCM practitioners' differentiation and treatment—taking Zhu Rencang's eczema cases as an example. Global TCM, 2026(3).

DIGITAL HEALTHCARE EMPOWERING TRADITIONAL CHINESE MEDICINE GYNECOLOGY: TRANSFORMATION PATHS, CHALLENGES, AND COPING STRATEGIES

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Abstract: Digital healthcare brings opportunities for the modernization of traditional Chinese medicine (TCM) gynecology, but the transformation still faces multiple challenges, such as insufficient digitalization of knowledge systems, lack of standardization in the four diagnostic methods, scarcity of multidisciplinary talent, and the need to improve ethical governance frameworks. There's an urgent need to promote intelligent diagnosis and whole-cycle management. Therefore, we should come up with systematic strategies in areas like standardization, talent cultivation, and governance systems to promote the deep integration of digital healthcare and TCM gynecology, supporting high-quality development in the field.

Key words: digital healthcare, traditional Chinese gynecology

Traditional Chinese Medicine (TCM) Gynecology is an important part of TCM, mainly studying women's physiological and pathological characteristics and the prevention and treatment of related diseases. It has rich experience in regulating menstruation, assisting conception, supporting pregnancy, and postpartum care.

Objective

With growing demands for women's health and the acceleration of digital transformation in medical services, digital healthcare is becoming a key force in advancing TCM gynecology.

Materials and Methods

Digital healthcare is transforming how TCM gynecology is practiced. TCM gynecology emphasizes face-to-face diagnosis and treatment based on syndrome differentiation, but frequent follow-ups and long visit cycles pose challenges, especially in managing chronic conditions like menstrual disorders, infertility, polycystic ovary syndrome, and menopausal syndrome, where continuous monitoring is crucial. Through online hospitals, teleconsultations, and mobile health platforms, patients can upload information about their menstrual cycles, sleep, mood, diet, and medication use, allowing doctors to conduct remote follow-ups and provide health guidance, which improves continuity of care and accessibility of services. Liu et al.[1] pointed out that the difficulty in quantifying and standardizing the traditional four diagnostic methods in TCM is a major bottleneck for applying artificial intelligence (AI). They also suggested that analyzing and modeling clinical data such as patients' chief complaints, tongue images, menstrual records, and related test results with AI can not only help with syndrome recognition, medication references, and risk warnings, but also improve diagnostic accuracy and predict disease outcomes, providing decision-making support for TCM gynecology. Zhang et al.[2] built a complete framework for a smart TCM

generalized observation system. The system covers five main modules: data collection, data processing, knowledge graph and reasoning, report generation, and report analysis. They explored the limitations and future trends regarding data annotation standardization and the integration of TCM theory with algorithms. This offers a new model for precise diagnosis in TCM and has direct reference value for the digitization of the four diagnostic methods in TCM gynecology, helping to integrate clinical data and preserve clinical experience[3].

In addition, digital healthcare is driving TCM gynecology toward comprehensive, full-cycle health management. Women's health is characterized by cyclical and stage-specific features, spanning puberty, reproductive age, pregnancy, postpartum, and perimenopause. Through wearable devices, health management platforms, and remote monitoring tools, it is possible to continuously track menstruation, weight, exercise, sleep, and mood, thereby enhancing early disease detection and personalized interventions.

Results and Discussion

However, the digital transformation of TCM gynecology still faces several practical challenges. First, TCM gynecological diagnosis is highly individualized, making standardized protocols difficult to implement. Second, current clinical data collection lacks standardization, with issues such as missing data, heterogeneity, and low quality. Third, some intelligent models have limited interpretability, affecting clinicians' trust and clinical application. Fourth, gynecological care involves substantial private information, necessitating stringent data security and ethical governance. Fifth, there remains a shortage of professionals who possess both TCM gynecology expertise and digital technology skills.

To address the issues mentioned above, efforts should be coordinated from multiple angles. First, establish a standardized data system for TCM gynecology, unifying syndrome classification, treatment efficacy evaluation, and follow-up indicators. Second, strengthen the integration and application of multimodal data to improve the digital representation of complex TCM information. Third, adhere to the principle of 'human-machine collaboration' to enhance the interpretability and practicality of artificial intelligence. At the same time, improve privacy protection, informed consent, and ethical review mechanisms to ensure the safety and compliance of digital healthcare. Finally, strengthen interdisciplinary talent cultivation between medicine and engineering to provide human resources support for the digital development of TCM gynecology.

Conclusion

In short, digital healthcare brings new opportunities for TCM gynecology, helping to boost diagnosis and treatment efficiency, optimize health management, and promote the inheritance and innovation of the discipline. In the future, efforts should focus on advancing standardization, intelligence, and regulation while retaining the characteristics of syndrome-based treatment in TCM, truly enabling digital healthcare to empower TCM gynecology in depth.

References:

[1]Liu P, Chen Y. Artificial intelligence and non-invasive meridian diagnosis and treatment technology in traditional Chinese medicine gynaecology[J]. Chinese Journal of Practical Gynecology and Obstetrics, 2024,40(9):891-894..

[2]Zhang M, Zhong R, Jiang Y, et al. Construction and considerations on the generalized inspection diagnosissystem of smart traditional Chinese medicine[J]. Journal of Beijing University of Traditional Chinese Medicine, 2025, 48(8): 1037-10423

[3]Yang L, Wen Y, Huang Y, et al. Discussion on Diversified Inheritance Methods of Academic Thought of National Master of Traditional Chinese Medicine—Taking Prof. Liu Minru's Academic Thought Inheritance and Promotion as an Example[J]. Journal of Chengdu University of Traditional Chinese Medicine,2025, 48(4): 41-45.

DISCUSSION ON MODIFIED DITAN JIANGYA DECOCTION IN THE TREATMENT OF ESSENTIAL HYPERTENSION WITH PHLEGM-HEAT DISTURBING UPWARD SYNDROME

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Abstract Hypertension features the "three highs and one low" epidemiological profile. Long-term western antihypertensive monotherapy often leads to reduced efficacy and adverse reactions. Traditional Chinese Medicine (TCM) exerts multi-target hypotensive effects and protects heart, brain and kidney target organs. Modified from Ditan Decoction, Ditan Jiangya Decoction treats essential hypertension with phlegm-heat disturbing upward syndrome by eliminating phlegm-heat, calming the liver, tonifying the kidney, activating blood and tranquilizing the mind. Pharmacological evidence shows it inhibits inflammatory factors, enhances cerebral antioxidant capacity, breaks the vicious cycle of vascular inflammation and hypertension, and relieves vascular and cerebral injuries. Cold-region residents with fatty-sweet diets often suffer from phlegm-heat syndrome combined with glycolipid metabolic disorders, for whom this decoction is suitable. Clinically, it alleviates headache and vertigo; combined with western drugs, it achieves better hypotensive outcomes as a reliable TCM adjuvant prescription.

Keywords: Ditan Jiangya Decoction; essential hypertension; phlegm-heat disturbing upward syndrome; vascular inflammation; target organ protection

Hypertension is the most common cardiovascular disease, causing persistent high blood pressure and irreversible heart and brain damage[1]. It kills nearly 10 million people and disables over 200 million patients globally each year, posing a severe public health threat with high morbidity, disability, mortality and low awareness[2,3].

Objective

Western medicine mainly relies on oral antihypertensives, yet long-term use brings attenuated efficacy and drug dependence. TCM can lower blood pressure while repairing damaged target organs through holistic regulation[4].

Materials and methods

Composed of Pinelliae Rhizoma, Citri Reticulatae Pericarpium, Poria Cocos and other Chinese medicinal herbs, Ditan Jiangya Decoction functions to eliminate phlegm, clear heat, tonify the kidney and calm the liver, and is indicated for patients with phlegm-heat disturbing upward syndrome. Russia lies in the northern frigid zone, where residents frequently consume rich, fatty and sweet foods, making phlegm-dampness syndromes extremely common in clinical practice[5], often accompanied by metabolic abnormalities including dyslipidemia and hyperglycemia. Local residents are bold, candid

and unrestrained in temperament, which predisposes phlegm pathogens to intermingle with fire. Long-term clinical practice has verified that this decoction can reduce blood pressure and concurrently relieve headaches, vertigo and other symptoms induced by elevated blood pressure.

Hypertension arises from endothelial dysfunction, sympathetic overactivation, RAAS disorder and vascular inflammation[6]. Immune inflammation impairs endothelium and elevates blood pressure; in turn, hypertension worsens chronic inflammation and oxidative stress to form a vicious loop[7].

Results and discussion

Based on Ditan Decoction, this formula targets phlegm-heat pathogeneses. Pinelliae Rhizoma and Arisaema Cum Bile resolve phlegm, reduce inflammation and regulate lipids[8]. Citri Reticulatae Pericarpium and Aurantii Fructus Immaturus regulate qi to eliminate phlegm, while Bambusae Caulis in Taenias clears heat and fights oxidation. Poria Cocos removes dampness to block phlegm production; Acori Tatarinowii Rhizoma guides medicines to the brain. Chrysanthemi Flos, Prunellae Spica and Scutellariae Radix calm the liver, protect endothelium and modulate inflammatory pathways. Taxilli Herba and Achyranthis Bidentatae Radix tonify liver-kidney, inhibit renin and improve renal and elderly hypertension.

In summary, Ditan Jiangya Decoction improves clinical and TCM symptoms of phlegm-heat type essential hypertension. Combined with western medicines, it further reduces blood pressure and acts as an effective TCM adjuvant therapy for hypertension.

References:

[1]WILLIAMS B,MANCIA G,SPIERING W,et al. 2018ESC/ESH Guidelines for the management of arterial hypertension[J]. Eur Heart J,2018,39（33）:3021-3104.

[2]WU Y,JIN A,XIE G,et al. The 20 Most important and most preventable health problems of China:A Delphi consultation of Chinese experts[J]. Am J Public Health,2018,108（12）:1592-1598.

[3]WANG Z,CHEN Z,ZHANG L,et al.Status of hypertension in China:results from the China hypertension survey,2012—2015[J].Circulation,2018,137(22):2344.

[4]WANG J,XIONG X J.Control strategy on hypertension in Chinese medicine [J].Evid Based Complement Alter Med,2012,2012:284847.

[5]Shang QQ, Wang L, Wang YQ, et al. Research progress on etiology,pathogenesis and syndrome of primary hypertension in TCM[J].Hebei J Tradit Chin Med, 2017, 39:138-142.

[6]PROVENZANO A M,SPARKS M A.The renin-angiotensin-aldosterone system update:full-court press [J].Nephrol Dial Transplant,2020,35(9):1488-1490.

[7]LI B W,ZHANG Q J,YANG R,et al. Characteristics of inflammatory and normal endothelial exosomes on endothelial function and the development of hypertension[J].Inflammation,2024,47(4):1156-1169.

[8] Moon JY, Cho SK.Nobiletin induces protective autophagy accompanied by ER-Stress mediated apoptosis in human gastric cancer SNU-16 cells[J].Molecules, 2016, 21 (7) :914-927.

FROM EXPERIENCE TO INTELLIGENCE: THE DIGITAL LEAP IN TRADITIONAL CHINESE MEDICINE FOR THE PREVENTION AND TREATMENT OF CORONARY HEART DISEASE

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Abstract: Coronary heart disease is one of the leading causes of death and disability worldwide. Traditional Chinese Medicine (TCM) has accumulated extensive theoretical and clinical experience in its prevention and treatment, yet has long faced bottlenecks such as insufficient diagnostic standardization, strong subjectivity in syndrome differentiation, and difficulties in knowledge inheritance. The rapid development of digital technologies offers new pathways to address these challenges. Focusing on the TCM prevention and treatment of CHD, this paper reviews the application progress of artificial intelligence, multimodal data fusion, and other technologies in the objectification of the four TCM diagnostic methods, intelligent syndrome differentiation, and assisted diagnostic systems. The study demonstrates that digital empowerment has driven the transformation of TCM diagnosis and treatment of CHD from an experience-based medicine paradigm to a data-driven intelligent medical paradigm.

Keywords: digital empowerment; traditional Chinese medicine; coronary heart disease; artificial intelligence

Coronary heart disease(CHD) has become a major global public health challenge. In China, the prevalence and mortality of CHD have continued to rise in recent years[1]. TCM plays a significant role in the treatment of CHD by virtue of its unique advantages such as "preventive treatment of disease" and "treatment based on syndrome differentiation."

Objective

Traditional TCM diagnosis relies heavily on the subjective experience of physicians, and syndrome differentiation lacks objective standards, making it difficult to achieve standardization and intelligentization[2]. At the same time, digital technologies represented by artificial intelligence and big data are reshaping the global medical industry landscape, providing a historic opportunity for the modernization and internationalization of TCM.

Materials and Methods

The objectification of the four diagnostic methods of TCM—inspection, auscultation and olfaction, inquiry, and palpation—is the foundation for achieving diagnostic standardization. In the field of tongue diagnosis, artificial intelligence-driven image analysis technology has made significant breakthroughs. A prospective study involving 373 patients with CHD demonstrated that computer-aided tongue image analysis could identify unique tongue morphological and colorimetric patterns in patients with obstructive coronary artery disease, with a multi-view XGBoost fusion model achieving an accuracy of 75% in the independent validation set[3]. In addition, the objectification technology of TCM tongue diagnosis,

through tongue image acquisition and multidimensional feature extraction of tongue substance, tongue coating, and sublingual collaterals, provides new quantitative evidence for TCM syndrome identification, therapeutic efficacy monitoring, and disease assessment in CHD[4].

In recent years, significant progress has been made in research on artificial intelligence-assisted TCM diagnostic and treatment systems for CHD. In terms of syndrome element differentiation, researchers have proposed the CHD Syndrome Element Differentiation Large Language Model (CHD-SEDD LLM), which structures the commonly used syndrome element diagnostic scale for angina pectoris in CHD into a chain-of-thought instruction set, constructing a three-level chain-of-thought framework of "symptom–syndrome element–syndrome"[5]. This architecture achieves high accuracy and interpretability, providing a convenient intelligent syndrome differentiation tool for primary healthcare. In terms of prescription recommendation, researchers constructed a diagnostic prescription model for coronary heart disease syndrome elements using a modified Transformer algorithm. Based on the clinical diagnostic and treatment logic of "symptom–syndrome element–syndrome–therapeutic method–formula–medication (dosage)", the model integrates multi-head attention mechanisms and other techniques to build the analytical framework[6].

Results and Discussion

Digital empowerment is profoundly changing the diagnostic and therapeutic paradigm of TCM in the prevention and treatment of CHD. The AI-driven objectification of the four diagnostic methods, intelligent syndrome differentiation, and assisted diagnostic systems effectively compensate for the shortcomings of traditional TCM in standardization and generalizability. The deep cooperation between China and Russia in the fields of traditional medicine and digital medicine provides broad space for the integration of smart pharmaceutical industries.

In the future, with continued breakthroughs in multimodal data fusion, explainable artificial intelligence, and other technologies, TCM is expected to achieve a comprehensive leap from experience-based inheritance to precision and internationalization in the field of CHD prevention and treatment, contributing "TCM wisdom" and the "Chinese solution" to global cardiovascular health.

Reference:

[1] Summary of the 2024 Report on Cardiovascular Health and Diseases in China[J]. Chinese Circulation Journal, 2025, 40(6): 521-559.

[2] Liu J L. Research and Development of Artificial Intelligence-Assisted Diagnosis and Treatment System for Coronary Heart Disease in Traditional Chinese Medicine[D]. China Academy of Chinese Medical Sciences, 2023.

[3] Zhang Y Y, Wei D S, Zhang Y, et al. Objective quantification of tongue features in obstructive coronary artery disease: a computational analysis approach based on multimodal feature fusion[J]. Digital Chinese Medicine, 2025, 8(4): 443-454.

[4] Wang J Q, Zhu T Y, Zhang Z. Research progress on objectification technology of TCM tongue diagnosis and its application in coronary heart disease[J]. China Medicine and Pharmacy, 2025, 15(22): 57-60+92.

[5] Wang J, Song Y J, Hui X S, et al. Chain-of-thought driven large language model for syndrome element differentiation in coronary heart disease in traditional Chinese medicine[J]. Chinese Journal of Experimental Traditional Medical Formulae, 2025, 31(19): 1-10.

[6] Li H Z, Wang J, Guo Y C, et al. Analysis of diagnostic prescription model for coronary heart disease syndrome elements based on modified Transformer algorithm[J]. Chinese Journal of Experimental Traditional Medical Formulae, 2023, 29(1): 148-154.

APPLICATION OF INFRARED THERMOGRAPHY IN QUALITY EVALUATION OF CHINESE HERBAL MEDICINES: A CASE STUDY OF CHINESE YAM (DIOSCOREAE RHIZOMA)

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Abstract

As a non-destructive and rapid method, infrared thermography (IRT) was introduced for quality evaluation of Chinese medicinal materials using Chinese yam (Dioscoreae Rhizoma) slices as a model sample. Under external photothermal excitation, infrared images were collected to analyze the thermal responses of normal slices and samples with excessive moisture, mildew, or insect infestation. Combined with transient heat conduction theory and numerical simulation, the results revealed distinct thermal features among different defects. High-moisture samples showed lower overall temperature, moldy areas produced local high-temperature anomalies during heating, and insect-eaten defects changed heat diffusion paths during heating and cooling. These findings demonstrate that IRT can visually identify typical defects without sample pretreatment, providing a promising tool for Chinese medicinal material evaluation.

Keywords: Traditional Chinese Medicine, infrared thermography.

Traditional Chinese medicine (TCM) is an important part of Chinese civilization and has long contributed to disease prevention, treatment, and health maintenance. As the core material basis of TCM, the quality of Chinese medicinal materials is directly related to clinical efficacy and medication safety. However, excessive moisture, mildew, and insect infestation are common quality problems that may degrade active components and increase potential health risks.

Conventional inspection of Chinese medicinal materials mainly relies on sensory evaluation, such as visual observation, touch, and smell. These methods are subjective, inefficient, and highly dependent on the experience of inspectors. Although modern spectroscopic and chemical analysis techniques have been applied to quality evaluation, most of them focus on surface optical features or chemical composition, making it difficult to identify internal structural abnormalities rapidly and intuitively.

Active infrared thermography (IRT) is a non-contact, visual, and non-destructive testing technique based on thermal response differences. In this study, IRT is introduced for the quality evaluation of Chinese medicinal materials. Using Chinese yam slices as representative samples, numerical simulation and experimental investigation are combined to reveal heat diffusion characteristics and verify the feasibility of detecting moisture, mildew, and insect infestation.

Objective

To evaluate the feasibility of active infrared thermography for rapid non-destructive detection of quality defects in Chinese yam slices.

Materials and methods

Chinese yam (Dioscoreae Rhizoma) slices with normal quality and typical defects, including excessive moisture, mildew, and insect infestation, were selected as experimental samples. Active infrared thermography was performed under external photothermal excitation, and infrared image sequences were recorded during heating and cooling. Meanwhile, a transient heat conduction model was established for numerical simulation. The thermal response characteristics of different samples were compared to evaluate defect detectability.

Results and discussion

In this study, infrared thermography (IRT) was introduced for the first time into the quality assessment of Chinese medicinal materials, and a non-contact, non-destructive, and visual inspection framework was established using sliced Dioscoreae Rhizoma as a representative sample. Theoretical analysis and numerical simulation demonstrated that differences in thermophysical properties and internal structures can significantly affect heat diffusion behavior under external photothermal excitation, providing a physical basis for defect detection by IRT.

Experimental results demonstrated that samples with different quality states exhibited distinct surface temperature responses during heating and cooling. High-moisture samples showed lower overall temperature levels than normal samples due to higher specific heat capacity and moisture evaporation. Moldy regions formed obvious local high-temperature anomalies during heating because of increased optical absorption. Insect-infested defects changed the internal heat diffusion path and produced detectable thermal anomalies during both heating and cooling stages.

These results indicate that IRT can effectively identify typical quality defects, including excessive moisture, mildew, and insect infestation. Compared with conventional sensory inspection, IRT requires no contact or sample pretreatment and offers advantages in rapid detection, simple operation, and large-area visualization.

References:

1. Wu P., Chen L., Xu Y.-X., Ren Y.-Y., Dong X.-M., Fan J.-X., Xie T., Zhou J.-L., Liu Z.-Q. Decoding herbal medicine: AI-powered omics and network pharmacology // Phytomedicine. – 2025. – Vol. 148. – Article 157453. https://doi.org/10.1016/j.phymed.2025.157453

2. Leong F., Hua X., Wang M., Chen T., Song Y., Tu P., Chen X.-J. Quality standard of traditional Chinese medicines: comparison between European Pharmacopoeia and Chinese Pharmacopoeia and recent advances // Chinese Medicine. – 2020. – Vol. 15. https://doi.org/10.1186/s13020-020-00357-3

RERSERCH ON THE DIGITIAL CONSTRUCTION OF AI-ASSISTED TRADITIONAL MEDICINE SYNDROME DIFFERENTIATION AND TREATMENT SYSTEM

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Abstract

Driven by digital healthcare and TCM modernization, conventional syndrome differentiation faces over-reliance on experience, insufficient objectification, and poor inheritance. This paper employs AI to construct a digital syndrome differentiation system. It integrates multimodal four-diagnostic data (tongue, pulse, inquiry), unifies collection standards, builds a TCM knowledge graph based on classical theories, and establishes a multi-feature fusion deep learning model. A four-tier architecture from data acquisition to clinical application, along with a human-machine quality control mechanism, is formed.

Keywords: artificial intelligence; TCM syndrome differentiation; digitalization; knowledge graph; multimodal four diagnostics; industrial transformation

I. Introduction

Syndrome differentiation is central to TCM, yet traditional practice relies heavily on subjective experience, with weak quantification, difficult inheritance, and poor primary-care standardization. Recent progress includes intelligent recognition of tongue, pulse, and facial features, machine-learning-based syndrome classification, and preliminary knowledge databases. However, most studies focus on isolated methods rather than an integrated chain from collection to application, and few have moved beyond lab settings toward clinical deployment and industrialization. This paper analyzes existing bottlenecks, proposes a four-layer framework (data collection, knowledge graph, AI reasoning, quality control), constructs a multimodal model, and discusses clinical translation and industrial pathways.

II. Foundational Theories and Technical Support

TCM syndrome systems—such as Eight-Principle, Zang-Fu, and Qi-Blood-Fluid—emphasize holistic, individualized diagnosis via four diagnostic methods. Their strengths (interconnectivity and personalized wisdom) are offset by vague criteria, quantification difficulties, and poor reproducibility. Multimodal data (images, pulse signals, texts, and physical signs) can comprehensively capture diagnostic information. Knowledge graphs structure TCM entities (symptoms, syndromes, pathogenesis, formulae) as triples, providing semantic support for AI. Multi-feature deep learning processes heterogeneous data types separately, fuses features, and models the "four-diagnostic synthesis," enhancing accuracy and robustness beyond single-modality approaches.

III. Bottlenecks in Digital Development

Inconsistent collection protocols—varying equipment, environments, and standards—produce fragmented, incomparable data that hinder standardized differentiation. Experienced practitioners' tacit

knowledge lacks structured documentation, preventing systematic preservation and dissemination. Differing classification criteria across institutions and missing unified coding standards obstruct large-scale data sharing. Most AI models train on experimental rather than real-world data, and research outputs rarely mature into products or market-ready solutions.

IV. Overall Architecture of the AI-Assisted Digital System

A bottom-up four-tier system is constructed: (1) data collection—standardizing acquisition of tongue, pulse, facial, inquiry, and physical data with clear equipment and environmental specs; (2) standardized processing—building a unified, iterable knowledge graph integrating mainstream syndrome theories, with entity annotation and relationship extraction; (3) AI reasoning—employing a multi-feature fusion deep network to extract and fuse image, temporal, and textual features, trained on real clinical cases, with tuning and error correction to boost accuracy and generalization; and (4) clinical application—delivering intelligent four-diagnostic synthesis for bedside use.

V. Conclusion and Prospects

This paper addresses key barriers—standard gaps, inheritance difficulties, data silos, poor industrialization, and weak quality control—and offers an integrated digital system that elevates TCM toward standardized, intelligent practice, facilitating industry-academia-research integration. Limitations include model training predominantly on general internal medicine data, requiring specialty adaptation; the framework remains theoretical, with long-term clinical and industrial benefits needing validation. Future work will focus on specialty optimization (gynecology, pediatrics, chronic diseases), miniaturized portable devices for primary and home care, and interconnected regional digital networks to broaden resource sharing and scale industrial development.

References:

1.Zhang J, Xu J, Zheng GW, et al. Thoughts on the current status and development pathways of TCM technology transfer from the perspective of digital and intelligent transformation [J]. Chinese Journal of Experimental Traditional Medical Formulae, 2026, 32(4): 235-240. DOI:10.13422/j.cnki.syfjx.20251239.

2.Shen Q. Exploring the pathway of digital technology empowering the revitalization of rural TCM culture in Henan [J]. Rural Agriculture Farmers, 2024, (23): 22-24.

3.He YX, Tang RN, Feng ZW, et al. AI-driven modernization of TCM: from the empirical paradigm to the data-intelligent paradigm [J/OL]. Journal of Integration Technology, 1-23 [2026-06-24].

4.Song YG, Zhang M. Application of digital technology in TCM scientific and technological innovation and its future development trends [J]. Chinese Journal of Social Medicine, 2024, 41(4): 384-387.

DIGITAL TECHNOLOGY-DRIVEN INTELLIGENT DEVELOPMENT PATHWAYS FOR TRADITIONAL CHINESE MEDICINE IN THE TREATMENT OF CORONARY HEART DISEASE COMPLICATED BY ANXIETY AND DEPRESSION

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Abstract

Coronary heart disease complicated by anxiety and depression is a common psychosomatic comorbidity. Although traditional Chinese medicine (TCM) has advantages in holistic regulation, current practice and research still face problems such as subjective syndrome differentiation, insufficient objective indicators for efficacy evaluation, and inadequate follow-up. Based on a literature review, this paper explores the application pathways of digital technologies, including artificial intelligence, big data, and wearable devices, in syndrome identification, efficacy evaluation, individualized intervention, and chronic disease management.

Keywords: coronary heart disease; anxiety and depression; traditional Chinese medicine; digital technology; smart healthcare

Coronary heart disease is a common cardiovascular disease. As the disease course progresses, recurrent episodes occur, and the physical and psychological burden after interventional treatment increases, patients often develop emotional disorders such as anxiety and depression. Anxiety and depression may also increase the risk of the occurrence and progression of coronary heart disease. The two conditions interact with and reinforce each other, forming a psychosomatic comorbidity characterized by biological, psychological, and social factors. TCM has certain advantages in holistic regulation and the simultaneous adjustment of body and mind[1]. However, existing studies still have limitations, including relatively single-dimensional mechanistic explanations, subjective syndrome differentiation, inconsistent efficacy evaluation standards, predominance of small-sample single-center studies, insufficient reporting of randomization and blinding, and inadequate long-term follow-up. Therefore, it is necessary to establish a systematic, continuous, and comprehensive model for diagnosis, treatment, and evaluation.

Objective

To explore the pathways through which digital technology can empower TCM in the treatment of coronary heart disease complicated by anxiety and depression, thereby improving the objectivity, standardization, and precision of diagnosis and treatment.

Materials and methods

Based on relevant literature, this paper uses literature summarization and theoretical analysis to explore the application pathways of digital technology in syndrome identification, efficacy evaluation, chronic disease management, and industrial integration in TCM treatment of coronary heart disease complicated by anxiety and depression.

Results and discussion

First, a multidimensional clinical database for coronary heart disease complicated by anxiety and depression should be established. Such a database should systematically integrate patients' basic information, types of coronary heart disease, psychological scale scores, TCM syndromes, tongue and pulse information, heart rate variability, inflammatory factors, neurotrophic factors, medication regimens, and follow-up outcomes. Data quality should be improved through standardized entry and quality control, thereby laying a foundation for syndrome analysis, efficacy evaluation, and real-world research[2]. Second, artificial intelligence and machine learning technologies can be used to construct intelligent TCM syndrome recognition and efficacy prediction models. By integrating symptoms, tongue and pulse findings, scale scores, and objective indicators, these models may assist in identifying common syndromes such as qi stagnation and blood stasis, phlegm-turbidity obstruction, qi deficiency with blood stasis, and liver depression with spleen deficiency. They may also predict patients' possible responses to therapeutic methods such as soothing the liver and regulating qi, activating blood circulation and removing blood stasis, resolving phlegm and reducing turbidity, and supplementing qi while activating blood circulation, thus providing a reference for individualized medication[3]. Meanwhile, internet platforms, wearable devices, mobile-based scales, and heart rate variability monitoring can be used for remote follow-up and chronic disease management. Finally, the construction of intelligent Chinese medicine pharmacies, internet hospitals, TCM health management platforms, and digital efficacy evaluation systems should be promoted, so as to transform the TCM model of simultaneous physical and psychological treatment toward data-driven decision-making, precise evaluation, and intelligent services.

References:

[1]Ning, B., Ge, T., Zhao, Q. Q., Feng, L. S., Wu, Y. Q., Chen, H., Lian, K., & Zhao, M. J. (2024). Research status of pathogenesis of anxiety or depression after percutaneous coronary intervention and Traditional Chinese Medicine intervention. Journal of ethnopharmacology, 327, 118017. https://doi.org/10.1016/j.jep.2024.118017

[2]Li, D. D., Yu, Y. N., Sun, Z. J., Liu, C. F., Chen, T., Shan, D. K., Tuo, X. D., Guo, J., & Chen, Y. D. (2025). Development of cardiovascular clinical research data warehouse and real-world research. Journal of geriatric cardiology : JGC, 22(7), 678–689. https://doi.org/10.26599/1671-5411.2025.07.006

[3]Pan, D., Guo, Y., Fan, Y., & Wan, H. (2024). Development and Application of Traditional Chinese Medicine Using AI Machine Learning and Deep Learning Strategies. The American journal of Chinese medicine, 52(3), 605–623. https://doi.org/10.1142/S0192415X24500265

RESEARCH PROGRESS ON ARTIFICIAL INTELLIGENCE-BASED EVALUATION AND PRECISION INTERVENTION IN TRADITIONAL CHINESE MEDICINE REHABILITATION FOR STROKE

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Abstract

Stroke is a leading cause of disability worldwide, and traditional Chinese medicine (TCM) rehabilitation plays an important role in functional recovery. This review summarizes recent advances in artificial intelligence (AI) applications in neuroimaging analysis, motor function assessment, TCM syndrome identification, and intelligent rehabilitation, providing references for smart TCM development and stroke rehabilitation optimization.

Keywords: Artificial intelligence, Stroke, Traditional Chinese medicine rehabilitation, Smart healthcare, Precision intervention

Stroke is characterized by high incidence, high disability, and high recurrence rates, posing a significant threat to public health in China. Traditional Chinese medicine (TCM) rehabilitation has unique advantages in promoting neurological recovery and improving patients' quality of life1. However, conventional assessment methods rely heavily on clinical experience and lack objective quantitative indicators. With the rapid development of artificial intelligence (AI), its applications in disease diagnosis, functional assessment, and rehabilitation management have continued to expand, providing new opportunities for innovation and development in TCM-based stroke rehabilitation2.

Objective

This review aims to summarize recent advances in AI-based evaluation and precision intervention in TCM rehabilitation for stroke. The clinical applications of AI in functional assessment, outcome prediction, and personalized rehabilitation are discussed to provide references for the development of smart rehabilitation systems.

Materials and methods

Relevant literature from 2020 to 2026 on AI in stroke rehabilitation was systematically searched from major databases, and a review summarized its applications in assessment, outcome prediction, and precision intervention.

Results and discussion

AI is transforming stroke rehabilitation from an experience-driven model to a data-driven paradigm. Deep learning-based imaging technologies enable automated lesion detection and prognostic prediction, while dynamic functional connectivity analysis supports the prediction of motor recovery after stroke3.

Motor function assessment is a critical component of stroke rehabilitation. AI combined with wearable

devices and computer vision technologies can continuously collect gait and motion data, enabling objective evaluation and long-term home-based monitoring of motor performance4.

In TCM rehabilitation, AI promotes the digitalization of diagnostic information. Technologies such as tongue diagnosis, pulse analysis, and facial inspection facilitate objective assessment and improve the standardization of syndrome differentiation. The integration of TCM features with neuroimaging and kinematic indicators may further enhance rehabilitation assessment systems5.

Rehabilitation robots, brain-computer interfaces, and virtual reality technologies have become important AI-assisted rehabilitation strategies. These technologies improve training precision, enhance patient participation, and promote neuroplasticity6. In addition, AI-supported telerehabilitation platforms integrate rehabilitation training and health monitoring, supporting long-term home-based rehabilitation7.

In conclusion, AI provides new technological support for the evaluation and precision intervention of stroke rehabilitation in TCM. AI technologies can improve the objectivity of rehabilitation assessment and the precision of intervention strategies. Future efforts should focus on strengthening the integration of AI and TCM rehabilitation to promote the development of intelligent, precise, and personalized stroke rehabilitation.

References:

1.Chen, X., Lu, L., Xiao, C., Lan, Y., Zhong, S., Qin, C., Tang, Y. Global burden of ischemic stroke in adults aged 60 years and older from 1990 to 2021: population-based study // PloS one. – 2025. – 20 (5). – P.e0322606.

2.Afridi, A., Obaid, S., Raheel, N., Rathore, F. A. Integrating Artificial Intelligence in Stroke Rehabilitation: Current Trends and Future Directions; A mini review // JPMA. The Journal of the Pakistan Medical Association. – 2025. – 75 (2). – P.445–447.

3.Liu, H., Meng, T., Qie, R. Machine learning in stroke and its sequelae: a narrative review of clinical applications and emerging trends // International journal of medical informatics. – 2026. – 208. – P.106245.

4.Liu, X., Yuan, Y., Wang, Y., Mu, J. S. Research progress on wearable devices in the assessment of walking function after stroke // Neural Injury and Functional Reconstruction. – 2025. – 20 (10). – P.596–599, 617.

5.Liu, H., Zhang, P., Huang, Y., Zuo, S., Li, L., She, C., Liu, M. Research on multi-label recognition of tongue features in stroke patients based on deep learning // Scientific reports. – 2024. – 14 (1). – P.32144.

6.Kopalli, S. R., Shukla, M., Jayaprakash, B., Kundlas, M., Srivastava, A., Jagtap, J., Gulati, M., Chigurupati, S., Ibrahim, E., Khandige, P. S., Garcia, D. S., Koppula, S., Gasmi, A. Artificial intelligence in stroke rehabilitation: From acute care to long-term recovery // Neuroscience. – 2025. – 572. – P.214–231.

7.El-Banna, M. M., Rizvi, M. R., Sami, W., Sharma, A., Atyeh, R. R. Digital and Intelligent Rehabilitation Technologies in Stroke and Neurological Disorders: A Systematic Review of Artificial Intelligence, Virtual Reality, Gamification, and Emerging Therapeutic Platforms in Neurorehabilitation // Bioengineering (Basel, Switzerland). – 2026. – 13 (2). – P.195.

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References:

1.Chen, X., Lu, L., Xiao, C., Lan, Y., Zhong, S., Qin, C., Tang, Y. Global burden of ischemic stroke in adults aged 60 years and older from 1990 to 2021: population-based study // PloS one. – 2025. – 20 (5). – P.e0322606.
2.Afridi, A., Obaid, S., Raheel, N., Rathore, F. A. Integrating Artificial Intelligence in Stroke Rehabilitation: Current Trends and Future Directions; A mini review // JPMA. The Journal of the Pakistan Medical Association. – 2025. – 75 (2). – P.445–447.
3.Liu, H., Meng, T., Qie, R. Machine learning in stroke and its sequelae: a narrative review of clinical applications and emerging trends // International journal of medical informatics. – 2026. – 208. – P.106245.
4.Liu, X., Yuan, Y., Wang, Y., Mu, J. S. Research progress on wearable devices in the assessment of walking function after stroke // Neural Injury and Functional Reconstruction. – 2025. – 20 (10). – P.596–599, 617.
5.Liu, H., Zhang, P., Huang, Y., Zuo, S., Li, L., She, C., Liu, M. Research on multi-label recognition of tongue features in stroke patients based on deep learning // Scientific reports. – 2024. – 14 (1). – P.32144.
6.Kopalli, S. R., Shukla, M., Jayaprakash, B., Kundlas, M., Srivastava, A., Jagtap, J., Gulati, M., Chigurupati, S., Ibrahim, E., Khandige, P. S., Garcia, D. S., Koppula, S., Gasmi, A. Artificial intelligence in stroke rehabilitation: From acute care to long-term recovery // Neuroscience. – 2025. – 572. – P.214–231.
7.El-Banna, M. M., Rizvi, M. R., Sami, W., Sharma, A., Atyeh, R. R. Digital and Intelligent Rehabilitation Technologies in Stroke and Neurological Disorders: A Systematic Review of Artificial Intelligence, Virtual Reality, Gamification, and Emerging Therapeutic Platforms in Neurorehabilitation // Bioengineering (Basel, Switzerland). – 2026. – 13 (2). – P.195.

INTEGRATING CONTINUOUS GLUCOSE MONITORING WITH TCM SYNDROME DIFFERENTIATION IN TYPE 2 DIABETES MANAGEMENT

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Abstract

Type 2 diabetes mellitus requires long-term, individualized and dynamic management. Continuous glucose monitoring (CGM) provides glucose profiles, including time in range, glucose variability, postprandial excursions and nocturnal hypoglycemia, which cannot be fully reflected by fasting glucose or HbA1c alone. Traditional Chinese medicine (TCM) syndrome differentiation emphasizes holistic assessment based on symptoms, constitution, tongue manifestation, pulse condition and disease stage. This paper explores a framework combining CGM-derived glucose profiles with TCM syndrome differentiation. The model may support individualized lifestyle guidance, therapeutic adjustment and smart chronic disease management, providing a feasible direction for digital empowerment of traditional medicine.

Keywords: continuous glucose monitoring; type 2 diabetes; TCM syndrome differentiation; integrative medicine; digital health

Type 2 diabetes mellitus (T2DM) is a common chronic endocrine and metabolic disease. Its management requires glycemic control, complication prevention and improvement of self-management. Conventional indicators such as fasting plasma glucose and HbA1c are useful, but they cannot fully describe daily glucose fluctuation, postprandial hyperglycemia, nocturnal hypoglycemia or responses to diet and exercise. CGM has therefore become an important technology in modern diabetes care. International consensus recommends time in range and glucose variability as meaningful CGM metrics [1], and clinical evidence shows that CGM can improve glycemic control in patients with T2DM treated with basal insulin [2]. In TCM, diabetes is partly understood within the category of Xiaoke, while modern T2DM often presents patterns such as qi-yin deficiency, spleen deficiency with dampness, phlegm-dampness, damp-heat and blood stasis. Combining digital glucose data with syndrome differentiation may support individualized intervention.

Objective

To explore the value of integrating CGM with TCM syndrome differentiation in T2DM management, and to propose a preliminary digital integrative medicine framework for individualized assessment, intervention and follow-up.

Materials and methods

This paper is a narrative review and conceptual analysis based on published literature concerning CGM, T2DM management and TCM treatment of diabetes. CGM-related indicators include time in

range, mean glucose, glucose variability, postprandial excursion and nocturnal hypoglycemia. TCM assessment includes symptoms, constitution, tongue manifestation, pulse condition, disease duration and complications. Based on these elements, a CGM-TCM framework is constructed to connect objective glucose data with individualized syndrome differentiation.

Results and discussion

CGM transforms glucose monitoring from isolated measurements into continuous metabolic profiling. Compared with traditional self-monitoring, CGM can reveal the rhythm and variability of glucose change. Time in range, time above range, time below range and glucose variability help clinicians evaluate whether glycemic control is stable and safe [1,3]. In T2DM, these indicators are useful for identifying postprandial hyperglycemia, dawn phenomenon, hidden hypoglycemia and responses to diet or exercise.

TCM syndrome differentiation provides another dimension for understanding T2DM. Rather than focusing only on glucose values, TCM evaluates the patient's overall state, including thirst, fatigue, appetite, body weight, sleep, sweating, bowel movements, tongue and pulse. Postprandial glucose excursions may be discussed together with dietary habits, spleen function and dampness signs. Glucose variability may be interpreted together with emotional stress, sleep quality, yin deficiency or qi deficiency. However, CGM metrics should not be regarded as direct equivalents of specific TCM syndromes. They should serve as auxiliary objective information.

A preliminary CGM-TCM framework may include four layers. The data layer includes CGM metrics, HbA1c, body mass index, lipid profile, symptoms, tongue images and pulse information. The pattern layer identifies both the metabolic phenotype and the dominant TCM syndrome. The intervention layer includes individualized diet, exercise, sleep management, health education, Chinese herbal medicine adjustment and other appropriate TCM therapies. The follow-up layer uses repeated CGM data and syndrome reassessment to evaluate therapeutic response.

This approach may improve patient understanding, adherence and visualization of treatment response. It may also help explain why patients with similar HbA1c levels require different management strategies. Challenges remain, including standardization of syndrome differentiation, data privacy, quality control of tongue and pulse data, and prospective clinical validation. Future studies should investigate correlations between CGM profiles and TCM syndromes without overinterpreting observational associations.

Thus, CGM and TCM syndrome differentiation represent complementary approaches to T2DM management. CGM provides continuous, objective and quantitative glucose information, while TCM emphasizes holistic, individualized and stage-based assessment. Their integration may offer a promising model for smart integrative diabetes management. Further studies are needed to validate CGM-syndrome associations and develop standardized digital platforms for TCM-based chronic disease care.

References:

1. Battelino T, Danne T, Bergenstal RM, et al. Clinical Targets for Continuous Glucose Monitoring Data Interpretation: Recommendations From the International Consensus on Time in Range. Diabetes Care. 2019;42(8):1593-1603. DOI: 10.2337/dci19-0028.

2. Martens T, Beck RW, Bailey R, et al. Effect of Continuous Glucose Monitoring on Glycemic Control in Patients With Type 2 Diabetes Treated With Basal Insulin. JAMA. 2021;325(22):2262-2272. DOI: 10.1001/jama.2021.7444.

3. American Diabetes Association Professional Practice Committee. 7. Diabetes Technology: Standards of Care in Diabetes-2024. Diabetes Care. 2024;47(Suppl 1):S126-S144. DOI: 10.2337/dc24-S007.

4. Tong XL, Dong L, Chen L, Zhen Z. Treatment of Diabetes Using Traditional Chinese Medicine: Past, Present and Future. The American Journal of Chinese Medicine. 2012;40(5):877-886. DOI: 10.1142/S0192415X12500656.

DIGITAL TCM CONSTITUTION ASSESSMENT FOR COLD-REGION HYPERTENSION MANAGEMENT

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Abstract

Hypertension is a common chronic disease and a major contributor to cardiovascular risk. Cold-region populations may experience seasonal blood pressure fluctuation, reduced outdoor activity and lifestyle changes during long winters. Traditional Chinese medicine (TCM) constitution assessment offers a practical way to describe individual susceptibility, including phlegm-dampness, qi deficiency, yang deficiency and blood stasis tendencies. This paper proposes a digital TCM constitution assessment framework for hypertension management in cold-region populations. Home blood pressure records, lifestyle information, symptoms, tongue features and constitution questionnaires are integrated into a structured follow-up pathway. The framework may support personalized health education, lifestyle adjustment and remote monitoring in community settings. It also provides a feasible topic for Sino-Russian cooperation in cold-region chronic disease management and traditional medicine modernization.

Keywords: hypertension; TCM constitution; digital health; cold-region medicine; smart management; Sino-Russian collaboration

Hypertension remains one of the most important modifiable risk factors for cardiovascular and cerebrovascular disease worldwide [1]. In cold regions, management is shaped not only by age, salt intake, obesity and medication adherence, but also by long winters, low-temperature exposure, reduced outdoor activity and seasonal changes in sleep and diet [2]. This is relevant to Heilongjiang and the Russian Far East, where chronic disease management must consider climate, lifestyle and continuous follow-up. Seasonal self-monitoring is therefore useful for community prevention. Clinic measurements are necessary, but they may miss daily fluctuation and behavioral triggers.

TCM constitution theory provides a practical language for individualized prevention. Patients with similar blood pressure values may differ in fatigue, dizziness, sleep quality, cold sensitivity, edema, emotional stress, tongue appearance and pulse characteristics. Phlegm-dampness, qi deficiency, yang deficiency, yin deficiency and blood stasis patterns may guide health education, but they are not substitutes for biomedical diagnosis. Digital tools can make these observations structured and easier to review [3].

Objective

To develop a digital TCM constitution assessment framework for smart hypertension management in cold-region populations, and to provide a practical model for Sino-Russian cooperation in digital

health and traditional medicine modernization.

Materials and methods

This paper is a conceptual framework and narrative mini-review based on published literature on hypertension, cold exposure, TCM constitution and digital health. It does not report patient recruitment, intervention or statistical testing. The health data module records office and home blood pressure, age, BMI, waist circumference, medication use, salt intake, activity, sleep, smoking, alcohol use and winter exposure. The TCM constitution module records fatigue, dizziness, headache, chest tightness, edema, cold intolerance, sweating, tongue color, tongue coating, tooth marks, pulse information and questionnaire results. The smart management module converts these inputs into follow-up reminders, lifestyle education, TCM health guidance and remote monitoring plans. Optional artificial intelligence tools would be limited to interpretable trend alerts.

Results and discussion

The first expected output is a cold-region hypertension profile linking pressure variation with winter exposure, diet, sleep, activity and self-management behavior. It may help identify people whose control worsens in cold seasons or whose lifestyle patterns reduce adherence. Home records should be interpreted by clinicians rather than used mechanically.

The second output is a standardized digital TCM constitution record. Questionnaires, symptom scores and tongue images may support consistent documentation of phlegm-dampness, qi deficiency, yang deficiency and blood stasis tendencies. Structured scoring can assist data entry, but it should not replace physician judgement or be equated with systolic blood pressure.

The third output is a smart follow-up pathway. Patients with unstable home readings, high salt intake, poor sleep or constitution-related vulnerability could receive targeted education on diet, exercise, warming protection, medication adherence and TCM health preservation. A mobile platform could remind patients to record blood pressure, review symptoms and seek medical care when warning signs appear. Clinicians remain responsible for care decisions. Data security, informed consent and de-identification are essential.

From a translational perspective, this framework could be extended to cold-region communities in both China and Russia. Potential collaborative directions include bilingual data dictionaries, standardized constitution questionnaires, mobile follow-up tools and community-based hypertension education. By focusing on structured assessment, patient engagement and responsible digital health, this approach may support the modernization of traditional medicine and the development of practical smart medicine services.

Conclusion

Digital TCM constitution assessment may offer a feasible bridge between traditional individualized prevention and modern hypertension follow-up. By integrating blood pressure records, lifestyle exposure, symptoms and four-diagnostic information, the framework could support patient engagement and cold-region smart health management. Its value depends on standardization, clinician oversight, privacy protection and real-world validation.

References:

1. NCD Risk Factor Collaboration (NCD-RisC). Worldwide trends in hypertension prevalence and progress in treatment and control from 1990 to 2019: a pooled analysis of 1201 population-representative studies with 104 million participants. Lancet. 2021;398(10304):957-980. DOI: 10.1016/S0140-6736(21)01330-1.

2. Lin Y, Liu Z, Su H, et al. The burden of cold-induced hypertension: Integrating molecular mechanisms and preventive strategies. Ecotoxicol Environ Saf. 2026;309:119731. DOI: 10.1016/j.ecoenv.2026.119731.

3. Li Y, Li XH, Huang X, et al. Individualized prevention against hypertension based on Traditional Chinese Medicine Constitution Theory: A large community-based retrospective, STROBE-compliant study among Chinese population. Medicine (Baltimore). 2017;96(46):e8513. DOI: 10.1097/MD.0000000000008513.

DIGITAL TCM CONSTITUTION-BASED SELF-MANAGEMENT PLATFORM FOR COPD IN COLD REGIONS: A PROPOSAL FOR SINO-RUSSIAN TELEHEALTH COLLABORATION

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Abstract

Chronic obstructive pulmonary disease (COPD) is a leading cause of morbidity and mortality worldwide, with cold regions experiencing higher exacerbation rates during winter. Traditional Chinese Medicine (TCM) constitution theory offers individualized preventive strategies, yet its integration into daily COPD self-management remains limited by the lack of structured digital tools. This paper proposes a conceptual digital platform that combines home-based peak expiratory flow monitoring, symptom diaries, medication adherence tracking, physical activity recording, and TCM constitution self-assessment. The platform provides personalized feedback on breathing exercises, dietary adjustments, warmth preservation, and early warning of exacerbations. Designed for cross-border applicability, it features a bilingual (Chinese-Russian) interface and a de-identified data repository to facilitate comparative research between populations in Northeast China and the Russian Far East. This work aligns with the forum's theme of digital empowerment and traditional medicine renewal, and offers a practical model for Sino-Russian cooperation in chronic respiratory disease management.

Keywords: COPD; TCM constitution; digital health; cold regions; Sino-Russian cooperation

COPD is a progressive respiratory disease and the third leading cause of mortality worldwide. In cold climates like Heilongjiang and the Russian Far East, prevalence is high and acute exacerbations surge in winter, with each 10°C drop increasing exacerbation risk by 15–20%. While pharmacotherapy and pulmonary rehabilitation are standard, self-management is critical yet often poor, especially during harsh winters. TCM constitution theory classifies individuals into nine types; COPD patients commonly show qi-deficiency, yang-deficiency, and phlegm-dampness, linked to recurrent infections, cold intolerance, and excess sputum. Constitution-based interventions (breathing exercises, warming diets, acupoint application) reduce exacerbations but are rarely documented systematically. Existing COPD apps seldom incorporate TCM constitution or cold-region adaptations, and Sino-Russian digital health collaboration in respiratory care is nascent. This paper addresses these gaps.

Objective

To design a digital self-management platform integrating TCM constitution assessment, home lung function monitoring, symptom tracking, and lifestyle guidance for COPD patients in cold regions, with a framework for Sino-Russian collaborative data sharing.

Materials and methods

The platform has three modules. (1) Patient data module: daily input of peak expiratory flow (PEF) via handheld meter, medication use, symptom scores (cough, sputum, dyspnea), physical activity, and exacerbation events. A validated TCM constitution questionnaire is completed at enrollment and every 3 months. (2) Analytics module: cloud-based processing generates PEF trends and symptom fluctuations. Rule-based alerts trigger when PEF falls below 80% of personal best for two consecutive days, prompting patient notification and physician contact. No automated diagnosis is made. (3) Feedback module: personalized education including breathing exercise videos, constitution-specific dietary advice, seasonal protection tips (e.g., scarf over mouth below −10°C), and medication reminders. Cold-region adaptation integrates local weather APIs to recommend indoor exercise on extreme cold days and increase symptom monitoring during cold waves. For cross-border use, the platform offers bilingual interface (Chinese/Russian) and optional anonymized data aggregation for comparative analyses of constitution distribution and seasonal exacerbation patterns, complying with China's PIPL and Russia's 152-FZ. A future 6-month pilot with 120 patients (60 Harbin, 60 Blagoveshchensk) is proposed to assess exacerbation rates, PEF variability, quality of life, and satisfaction.

Results and discussion

Expected outputs: The platform will generate personalized weekly reports showing PEF stability, symptom burden, and constitution-specific recommendations. For example, a patient with phlegm-dampness may receive dietary suggestions to reduce dairy and greasy foods, while a yang-deficiency patient would be advised to consume ginger tea and practice warm-up exercises. The seasonal module could send pre-winter alerts to schedule influenza and pneumococcal vaccinations.

Potential benefits: Compared to usual care, the platform may improve early recognition of exacerbation, reduce emergency visits, and enhance self-efficacy. For researchers, aggregated data could reveal whether certain constitution types are more prone to winter exacerbations in Russian versus Chinese cohorts. Such insights could guide personalized public health campaigns.

Implementation challenges: Key barriers include low digital literacy among elderly COPD patients, limited device availability in rural areas, and cross-border data governance. We propose simplifying the user interface with voice input, providing low-cost PEF meters through community health centers, and adopting a two-tier data approach—individual-level data remains within each country, while only aggregated statistics are shared for research.

Alignment with forum theme: This platform exemplifies "digital empowerment" by translating traditional TCM knowledge into actionable mobile guidance, and "traditional renewal" by modernizing constitution assessment with longitudinal data. It also fosters "industry integration" by providing a scalable digital health solution for cross-border telemedicine markets.

Conclusion

A digital TCM constitution-based COPD self-management platform for cold regions is feasible and clinically promising. Successful implementation requires usability testing, cross-cultural validation of questionnaires, and sustainable cooperation agreements. Future randomized controlled trials are needed to confirm effectiveness.

References:

1. Donaldson GC, Seemungal TAR, Jeffries DJ, Wedzicha JA. Effect of temperature on lung function and symptoms in chronic obstructive pulmonary disease. Eur Respir J. 1999;13(4):844-849.

2. Liu Q, Li Y, Yang P, et al. A survey of artificial intelligence in tongue image for disease diagnosis and syndrome differentiation. Digit Health. 2023;9:20552076231191044.

3. Alghamdi SM, Barker M, Alzahrani AA, et al. Clinical Efficacy of Mobile App–Based, Self-Directed Pulmonary Rehabilitation for Patients With Chronic Obstructive Pulmonary Disease: Systematic Review and Meta-Analysis. JMIR Mhealth Uhealth. 2024;12:e41753.

NEO4J KNOWLEDGE GRAPH CONSTRUCTION: A STUDY ON LIUWEI DIHUANG PILL BASED ON MULTI-SOURCE PUBLIC DATABASES

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Abstract

Digital empowerment of traditional medicine is a consensus development direction in the Sino-Russian biomedical field, yet the fragmented data of classical TCM formulas restricts their modernization and internationalization. Taking Liuwei Dihuang Pill as the research object, this study draws on authoritative databases including the Chinese Pharmacopoeia, TCMSP and UniProt, follows universally recognized screening criteria in the industry, completes active ingredient screening, target integration, gene standardization and pathway enrichment, and constructs a "Formula-Chinesemedicine-Active molecules-Target Proteins-Target Genes-Signaling Pathways" knowledge graph containing 338 entity nodes and 1148 relational edges based on Neo4j. This low-threshold and generalizable workflow provides data and methodological support for the digital inheritance of classical TCM formulas and Sino-Russian smart medicine cooperation.

Keywords: Liuwei Dihuang Pill; knowledge graph; Neo4j; smart medicine;TCM

At present, the in-depth integration of digital technology and the biomedical industry has become a core trend of global pharmaceutical innovation, and digital empowerment of traditional medicine"has also emerged as a consensus development direction in the biomedical sector of China and Russia. Classic TCM formulas are widely applied in the intervention of multi-system diseases. However, long-standing issues such as fragmented data have hindered their modern interpretation and international dissemination. As a benchmark native graph database, Neo4j is highly compatible with the complex network attributes of TCM knowledge. It can provide core technical support for building knowledge graphs of classic TCM formulas, offer a digital foundation for the cross-system connection of Sino-Russian traditional medicine, and empower the modernization and international development of traditional medicine.

Objective

This study establishes standardized Neo4j knowledge graph construction procedures for classic famous formulas with public academic databases and industry-standard compliance.

Materials and Methods

With reference to the standards of the current edition of the Pharmacopoeia of the People's Republic of China, the standard composition and Latin names of Liuwei Dihuang Pill were verified.Using the TCMSP platform as the core data source, we adopted the widely accepted industry thresholds of OB≥30% and DL≥0.18 to screen the active ingredients of medicinal herbs in the formula and obtain their known action targets. The Swiss Target Prediction platform was used to supplement

and predict the human action targets of active ingredients. The UniProt knowledge base was adopted to perform standardized correction of the gene names corresponding to all targets. Finally, the Metascape platform was applied to conduct KEGG signaling pathway enrichment analysis of target genes. The pathways were sorted in descending order based on LogP values, and the top 20 significantly enriched pathways were retained to complete data extraction.

Automated processing scripts were written via VS Code to realize accurate data reading, and the double-person cross-check method was adopted for data verification. Six categories of core entity nodes were defined and the relational edges between nodes were specified. With the help of Excel and VS Code, all node and relationship data were exported as UTF-8 encoded CSV files respectively. The generated CSV files were migrated to the import directory of Neo4j, and batch data import was completed through Cypher query language. Examples are as follows:[LOAD CSV WITH HEADERS FROM 'file:///Targetproteins.csv' AS line;MERGE (P:Targetproteins {id: line. id4});SET P.name = line.name;].Finally, multi-dimensional Cypher query statements were written and executed for analysis.

Results and Discussion

Ultimately, 6 medicinal herbs from the standard composition of Liuwei Dihuang Pill were included, and 29 active ingredients such as kaempferol, quercetin and beta-sitosterol were screened out. After the extraction of known targets, integration with predictions from Swiss Target Prediction and deduplication, a total of 142 human target proteins were obtained, including RAC-alpha serine/ threonine-protein kinase and cellular tumor antigen p53. After standardized correction based on the UniProt database, 140 official standard gene names such as AKT1, TP53 and IL6 were extracted. Through KEGG signaling pathway enrichment analysis, the top 20 significantly enriched pathways were screened according to LogP values, including Pathways in cancer, Lipid and atherosclerosis, AGE-RAGE signaling pathway in diabetic complications, Fluid shear stress and atherosclerosis, and Chemical carcinogenesis - receptor activation. Finally, a knowledge graph covering 6 categories of 338 entity nodes and 5 categories of 1148 relational edges was constructed, and batch data storage as well as multi-dimensional mechanism query and analysis were completed.

This study establishes a low-threshold, reproducible standardized procedure for constructing knowledge graphs of classic TCM formulas compatible with Neo4j. Featuring authoritative data sources, this procedure can be extended to digital research on various ancient formulas and Russian ethnic herbal medicines, so as to facilitate new drug R&D and international academic exchanges.

References

[1] Li X ,Li X ,Wang L , et al. Advancing Traditional Chinese Medicine Research through Network Pharmacology: Strategies for Target Identification, Mechanism Elucidation and Innovative Therapeutic Applications[J].The American Journal of Chinese Medicine,2025,53 (7):1-22.

[2] Gao K ,Liu L ,Lei S , et al. HERB 2.0: an updated database integrating clinical and experimental evidence for traditional Chinese medicine.[J].Nucleic acids research,2024,53 (D1):D1404-D1414.

[3] Xiao W ,Zhang M ,Zhao D , et al. TCMKD: From ancient wisdom to modern insights-A comprehensive platform for traditional Chinese medicine knowledge discovery[J].Journal of Pharmaceutical Analysis,2025,15 (6):101297-101297.

RESEARCH ON THE INTEGRATION PATH OF CHINESE AND RUSSIAN PEDIATRIC INDUSTRY UNDER DIGITAL INTELLIGENCE ENERGIZATION_CROSS-BORDER PROMOTION BASED ON INTELLIGENT DIAGNOSIS AND TREATMENT EQUIPMENT SUCH AS INFRARED THERMAL IMAGING

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Abstract

This paper introduces the application status and prospect of infrared thermal imaging technology in pediatrics diagnosis of traditional Chinese medicine(TCM), and discusses the integration path of Chinese and Russian pediatrics industry from the perspective of digitalization of famous TCM experience and intelligent diagnosis and treatment equipment. The Analysis shows that infrared thermal imaging technology provides objective quantitative indicators for TCM syndrome differentiation and has application potential in Sino-Russian pharmaceutical and medical device industry cooperation.

Keywords: infrared thermal imaging; intelligent diagnosis equipment

The wave of digital intelligence is rapidly reconstructing the paradigm of medical diagnosis and treatment, especially in the field of pediatrics of traditional Chinese medicine. How to transform the hidden experience in the inheritance of famous and old TCM experience into objective data indicators that can be quantified has become the logical starting point for industry transformation. Infrared thermal imaging technology is gradually developing from a basic auxiliary tool to a key carrier supporting quantitative differentiation of TCM due to its unique characteristics of non-contact and non-harm.

Objective

To evaluate the empirical efficacy and application boundary of infrared thermal imaging in pediatrics of traditional Chinese medicine, and to study and demonstrate the strategic feasibility of relevant intelligent diagnosis and treatment equipment entering the Russian market based on cross-border collaboration model.

Materials and methods:

Based on the literature resources of core databases such as Zhiwang, this paper analyzes the digital application mode of typical diseases such as Asthenia of the Lung in Children and primary immune thrombocytopenia in children by integrating multi-dimensional technical reports and clinical observation data, and using case analysis method.

Results and discussion

Through the clinical study by using HIR-2000A infrared thermography diagnostic instrument with wave band of 8-14μm and temperature resolution of 0.05°C, it can be found that diffuse high temperature red areas appear around the forehead and orbit of children with primary immune thrombocytopenia, but discontinuous blue and green low temperature bands appear in the areas along the back governor vessels, This heat map representation is significantly different from healthy children. The average temperature of acupoints related to lung meridian and large intestine meridian in children with asthma of cold syndrome was significantly lower than that in children with asthma of heat syndrome, and the abdominal temperature of children with cold syndrome of middle jiao was also significantly lower than that in control group without cold syndrome. These research findings shows the corresponding relationship between infrared thermogram and traditional Chinese medicine "Yin Yang cold heat" syndrome differentiation logic, which can provide accurate digital basis for pediatric syndrome differentiation. This visual and quantifiable technology is particularly suited to the needs of pediatric patients who have difficulty accurately describing their conditions. Although the infrared thermogram quantitative discrimination mode of children with partial lung deficiency constitution has been preliminarily formed, the equipment has high requirements for the external environment, such as meeting the temperature of 20-25°C, humidity <85%, etc., and there are also problems such as insufficient sensitivity of automatic focus adjustment, etc., which reduces its universality in grass-roots units and cross-border scenarios.

Thus, the above-mentioned technical bottleneck can become the breakthrough point for Sino-Russian cooperation in R & D. It is suggested that both sides jointly develop a new generation of portable infrared detection equipment suitable for cold environment, carry out multi-center clinical observation around children's high-incidence diseases, take infrared diagnosis and treatment equipment as the entry point, promote the integration and mutual recognition of international technical standards of intelligent equipment of traditional Chinese medicine, and lay a foundation for technical resource sharing and industrial strategic integration.

References:

1.Wang Y. Infrared thermography characteristics of children with primary immune thrombocytopenia and its related influencing factors [D]. // Beijing University of Chinese Medicine. - 2020. - C.1-91.

2.Guo S Q. Research on Achievements and Characteristics of Traditional Chinese Medicine Pediatrics from 2011 to 2022 [D]. // Beijing University of Chinese Medicine. - 2024.-C.1-129.

3.Song Y Y. Discussion on the theory of quantifying macro parameters of partial lung deficiency in children based on infrared thermal imaging technology [J]. // Education and Teaching Forum. - 2018. - (34). - C.95-96.

4.Guo Z, Ma J Y, Yin J Y, et al. Clinical application analysis of diagnostic equipment of traditional Chinese medicine from 2012 to 2022 [J]. // Journal of Basic Chinese Medicine.2024.-30 (3). - C.418-422.

DIGITAL TRANSFORMATION OF TCM DIAGNOSIS AND TREATMENT FOR HEART FAILURE FROM THE PERSPECTIVE OF SINO-RUSSIAN SMART MEDICINE COOPERATION

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Abstract

Heart failure remains a major medical challenge. TCM shows advantages but relies on subjective pattern differentiation. From the perspective of Sino-Russian smart medicine cooperation, this paper explores digital technologies empowering TCM heart failure management.

Keywords: Heart failure; Digital transformation; Sino-Russian cooperation

Heart failure affects over 13 million in China with a 5-year survival rate of ~50%. TCM improves symptoms and quality of life, yet traditional diagnosis depends on personal experience, limiting precision[1]. Digital technologies offer breakthroughs, while Sino-Russian cooperation creates new opportunities.

Objective

To review digital applications in TCM heart failure diagnosis, analyze Sino-Russian cooperation prospects, and propose future collaborative directions.

Materials and Methods

Literature from CNKI (2010–2026) and Sino-Russian health policy documents were analyzed using literature review and policy analysis.

Results and Discussion

Heart failure falls within the TCM categories of "heart water" and "dyspnea syndrome", with the core pathogenesis characterized as "root deficiency and branch excess". The traditional four diagnostic methods have limitations in early detection and efficacy evaluation of heart failure[3-4]. Digital technologies provide essential support to overcome these bottlenecks.

In terms of objectifying the four diagnostic methods, pulse-taking instrument systems can extract pulse parameters from heart failure patients and establish correlations with cardiac function indicators[2]; AI-assisted tongue image analysis aids in determining pattern factors such as qi deficiency, blood stasis, and water retention[3-4]. For clinical decision support, TCM heart failure pattern differentiation systems can integrate multi-source data to recommend individualized classical formula modifications[1], while intelligent management cloud platforms enable comprehensive patient life-cycle management[5]. In efficacy evaluation, digital twin technology and systems pharmacology provide new tools for elucidating the mechanisms of classical prescriptions in heart

failure treatment[6-8].

China and Russia have conducted multiple exchanges and collaborations in digital medicine[9]. Future cooperation can focus on two directions: first, jointly develop a Russian-language intelligent TCM heart failure decision-support system integrating tongue and pulse diagnosis AI modules to serve Russian-speaking countries along the "Belt and Road"; second, co-establish a shared Sino-Russian real-world data platform with unified data standards, conduct multicenter clinical research utilizing wearable devices to collect large-sample data, and construct an integrated Chinese-Western medicine risk prediction model for heart failure.

Conclusion

Digital technologies provide critical support for the precision-oriented development of TCM heart failure diagnosis and treatment. Sino-Russian smart medicine cooperation can facilitate the transformation of TCM heart failure management from experience-based to data-driven approaches, contributing Chinese wisdom to global cardiovascular health.

References

[1] Ma KW, Zhao RX, Sun YQ, et al. Design and implementation of an AI-assisted TCM diagnosis and treatment system for cardiovascular diseases [J/OL]. Chinese Archives of Traditional Chinese Medicine, 1-14 [2026-06-28].
[2] Wang RH, Sun LJ, Zhao YQ, et al. Correlation study between echocardiographic indicators and pulse parameters in patients with coronary heart failure [J]. Liaoning Journal of Traditional Chinese Medicine, 2013, 40(10): 2005-2009.
[3] Xu XG, Zhang L, Xu BL, et al. Correlation study on syndrome types, tongue manifestation distribution characteristics, and cardiac function grading in patients with chronic heart failure [J]. Journal of Beijing University of Traditional Chinese Medicine, 2012, 35(5): 312-316.
[4] Tian MX, Liu QQ, Kou LJ, et al. Exploration of tongue manifestation evolution patterns in patients with acute heart failure [J]. Journal of Emergency in Traditional Chinese Medicine, 2010, 19(9): 1525-1526.
[5] Ren XY, Wang L, Li LF, et al. Design and construction of an intelligent management cloud platform for chronic heart failure [J]. Tianjin Journal of Traditional Chinese Medicine, 2022, 39(2): 175-180.
[6] Sun YH, Wang YX, Wei DS, et al. Research on the construction of an intelligent TCM auxiliary diagnosis and treatment system based on digital twin technology [J]. Chinese Archives of Traditional Chinese Medicine, 2024, 42(9): 18-22.
[7] Zheng R, Hu MZ, Chen Z, et al. Ideas for integrating digital twins into individualized clinical safety evaluation of combined Chinese and Western medicine [J]. Chinese Science Bulletin, 2023, 68(Z2): 3758-3763.
[8] Ma ST, Dai GL, Cheng XG, et al. Study on the anti-platelet aggregation pharmacodynamic material basis of compound Danshen dripping pills based on systems pharmacology [J]. Journal of Chinese Medicinal Materials, 2018, 41(1): 189-194.
[9] Sino-Russian video conference on artificial intelligence applications in the medical field successfully held [J]. China Medical Biotechnology, 2022, 17(3): 206.

CONSTRUCTION OF A SINO-RUSSIAN TRADITIONAL MEDICINE KNOWLEDGE GRAPH AND MINING OF INDUSTRIAL INTEGRATION PATHWAYS

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Abstract

This study integrates plant drugs from the Pharmacopoeia of the People's Republic of China (2020 Edition) and the State Pharmacopoeia of the Russian Federation (14th Edition) using natural language processing and ontology alignment to construct a bilingual knowledge graph, aiming to break data silos in Sino-Russian traditional pharmaceutical integration. The network proximity algorithm identified 236 candidate synergistic combinations (highest in anti-inflammation and immunomodulation) and revealed 35 Russian herbs with repurposing clues. Digital integration transforms fragmented knowledge into quantifiable industrial guidance, reducing cross-border R&D barriers for joint development.

Keywords: knowledge graph; Sino-Russian traditional medicine; data fusion; industrial integration; drug repurposing

According to WHO's traditional medicine strategy, digitalization is reshaping global pharmaceutical innovation. China and Russia possess complementary traditional medicine systems, yet language barriers and dispersed literature have kept their knowledge isolated, hindering cross-border cooperation. Digital technologies can integrate heterogeneous information into computable data assets. Previous cooperation has largely remained at the trade level, lacking systematic mining of potential drug combinations. This study constructs the first bilingual knowledge graph covering both countries' pharmacopoeias and identifies synergistic opportunities through network analysis to provide digital roadmaps for industrial integration.

Objective

To break the "data silos" caused by heterogeneous terminology and dispersed literature in the integration of Sino-Russian traditional pharmaceutical industries, and to construct a digital knowledge integration and mining method.

Materials and methods

Drug information was collected from the Pharmacopoeia of the People's Republic of China (2020 Edition) and the State Pharmacopoeia of the Russian Federation (14th Edition), incorporating 517 Chinese and 312 Russian herbal records. Active compounds were extracted from TCMSP, BATMAN-TCM, and eLibrary.ru; target data from DrugBank, UniProt, and STITCH. Russian terminologies were aligned via MeSH and TCM Clinical Terminology System for cross-lingual mapping. A bilingual knowledge graph was constructed using Neo4j, with entities including drugs, compounds, targets, traditional efficacy, and modern indications, and relationships including

"contains," "acts on," "treats," and "contraindicated with." Relationship extraction used rule-based methods and weak supervised learning. Drug-target networks were built separately for Chinese and Russian drugs. The network proximity algorithm calculated topological distances between Sino-Russian drug pairs within the human protein interactome, screening pairs with Z-score < -1.96 as synergistic candidates. "Disease-target" enrichment analysis identified repurposing clues for Russian drugs.

Results and discussion

The bilingual knowledge graph comprised 12,847 nodes and 38,521 relationships, including 517 Chinese drug nodes, 312 Russian drug nodes, 4,127 compound nodes, and 1,268 target nodes. Traditional efficacy descriptions covered 1,892 TCM syndrome terms and 1,043 Russian indication terms. Following ontological alignment, approximately 31% of Russian indication terms mapped directly to modern medical concepts. The network proximity algorithm identified 236 Sino-Russian drug pairs with target module proximity significantly below random level (Z-score < -1.96), suggesting potential biological synergy. These combinations were enriched in anti-inflammation and immunomodulation (41%), cardiovascular protection (23%), metabolic syndrome (18%), and neuroprotection (10%). The Z-score between Coptis chinensis and Matricaria chamomilla was -2.61, warranting further attention. "Drug-target-disease" path inference revealed 35 Russian herbs with significant unrecorded associations with modern disease targets. Melissa officinalis showed high proximity to the mild cognitive impairment-related module (Z-score = -2.03), suggesting cognitive health adjunct potential. This study is the first to reveal the objective data foundation for Sino-Russian traditional medicine industrial integration through digital knowledge integration. Unlike subjective expert-dependent models, knowledge graph and network analysis provide reproducible, scalable quantitative evidence. The analysis remains limited by public database coverage; future integration of real-world clinical data via federated learning could enhance precision. Digital empowerment reshapes knowledge structures, elevating traditional medicine from empirical inheritance to data-driven discovery—the core pathway for Sino-Russian intelligent pharmaceutical innovation.

References:

[1] Ivanova I.S., Zhang L. Cross-lingual knowledge graph for traditional medicine: methods and applications. Digital Health. 2022; 8: 205520762211392.

[2] Sokolov A.N., Wang H. Network-based integration of Russian phytotherapy and Chinese materia medica. Frontiers in Pharmacology. 2023; 14: 1125876.

[3] Liu Y., Petrova E.V. Construction of an AI-based Sino-Russian traditional medicine resource integration platform. China Journal of Chinese Materia Medica. 2023; 48(12): 3268-3275.

CLINICAL EVIDENCE AND POSSIBLE MECHANISMS OF TRADITIONAL CHINESE MEDICINE FOR PERIMENOPAUSAL SYNDROME

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Abstract

Perimenopausal syndrome is characterized by hot flashes, sweating, sleep disturbance, emotional instability and menstrual disorders during the menopausal transition. Traditional Chinese medicine (TCM) is widely used for these symptoms, but its value should be discussed according to clinical evidence. This paper summarizes PubMed-indexed trials and systematic reviews on Chinese herbal medicine and acupuncture. Current evidence suggests that TCM may improve vasomotor symptoms, insomnia and quality of life through individualized and multi-target regulation.

Keywords: perimenopausal syndrome, traditional Chinese medicine, herbal medicine, acupuncture, hot flashes, insomnia

Perimenopausal syndrome refers to a group of physical and psychological symptoms associated with declining ovarian function and fluctuating estrogen levels. Common manifestations include menstrual disorders, hot flashes, sweating, palpitations, insomnia, anxiety and fatigue. In TCM, this disorder is closely related to kidney essence decline, insufficiency of Tiangui, imbalance of Yin and Yang, and dysfunction of the Chong and Ren vessels. Hormone therapy is effective for some women, but its use may be limited by contraindications, potential risks and patient acceptance. Therefore, non-hormonal and individualized interventions, including TCM, have received increasing attention.

Objective

To summarize the clinical evidence and possible mechanisms of TCM interventions for perimenopausal syndrome, especially Chinese herbal medicine and acupuncture.

Materials and methods

A brief narrative review was conducted. PubMed-indexed randomized controlled trials, systematic reviews and meta-analyses concerning TCM treatment of perimenopausal or menopausal symptoms were reviewed. The search focused on Chinese herbal formulae, Er-Xian decoction, acupuncture, hot flashes, insomnia, Kupperman Index and quality of life.

Results and discussion

Current evidence shows that the most frequently studied TCM interventions for perimenopausal syndrome are oral Chinese herbal medicine and acupuncture. A systematic review and meta-analysis of Chinese herbal formulae for menopausal hot flushes included 19 randomized clinical trials with

2469 participants. The review reported that herbal formulae had comparable effects to menopausal hormone therapy in total effectiveness rate and Kupperman Index score, and were superior to placebo in reducing hot flush severity. Among herbal prescriptions, Er-Xian decoction has relatively specific evidence. A randomized, double-blind, controlled trial in 108 Hong Kong perimenopausal women showed that Er-Xian decoction was superior to placebo in reducing menopausal symptom scores with acceptable safety. A multicenter randomized controlled trial involving 424 women further showed that TCM-based psychotherapy combined with Chinese herbal medicine improved Kupperman Index and menopause-specific quality of life more effectively than placebo. These findings suggest that kidney-tonifying therapy should be combined with emotional regulation in clinical practice.

Acupuncture is another important non-pharmacological intervention. A meta-analysis of 12 randomized controlled trials involving 869 women found that acupuncture reduced hot flash frequency and severity and improved menopause-related symptoms and vasomotor quality of life. For perimenopausal insomnia, a recent systematic review including nine randomized controlled trials with 968 participants showed that acupuncture was superior to control interventions in effective rate, Pittsburgh Sleep Quality Index, Kupperman Index, Menopause-Specific Quality of Life score and several neuroendocrine-related indicators. These results correspond to the TCM principles of regulating the liver, calming the mind, and harmonizing the heart and kidney.

The mechanism of TCM should not be regarded simply as estrogen replacement. Symptom improvement may involve regulation of the hypothalamic-pituitary-ovarian axis, modulation of serotonin and norepinephrine, reduction of stress response, and anti-inflammatory or antioxidant effects. However, heterogeneity of prescriptions, treatment duration and outcome measurements remains obvious. Therefore, current evidence supports the potential value of TCM, but still requires cautious interpretation.

Conclusion

TCM may provide an individualized approach for perimenopausal syndrome, especially for vasomotor symptoms, insomnia and quality of life. Future studies should use standardized syndrome differentiation, quality-controlled interventions, objective biological indicators and long-term follow-up.

References:

1. Li M., Hung A., Lenon G.B., Yang A.W.H. Chinese herbal formulae for the treatment of menopausal hot flushes: a systematic review and meta-analysis // PLoS One. - 2019. - Vol. 14. - No. 9. - e0222383.
2. Zhong L.L.D., Tong Y., Tang G.W.K., et al. A randomized, double-blind, controlled trial of a Chinese herbal formula (Er-Xian decoction) for menopausal symptoms // Menopause. - 2013. - Vol. 20. - No. 7. - P. 767-776.
3. Yang H., Yang J., Wen Z., et al. Effect of combining therapy with TCM-based psychotherapy and herbal medicines in women with menopausal syndrome // Evid. Based Complement. Alternat. Med. - 2012. - Vol. 2012. - Article 354145.
4. Chiu H.Y., Pan C.H., Shyu Y.K., Han B.C., Tsai P.S. Effects of acupuncture on menopause-related symptoms and quality of life: a meta-analysis // Menopause. - 2015. - Vol. 22. - No. 2. - P. 234-244.
5. Song S., Chen H., Fu H. Systematic review and meta-analysis on acupuncture for perimenopausal insomnia // Front. Neurol. - 2025. - Vol. 16. - Article 1649856.

THROMBOPHILIA IN RECURRENT SPONTANEOUS ABORTION AND THE INNOVATIVE INTEGRATION OF CHINESE HERBAL MEDICINE IN SINO-RUSSIAN INTELLIGENT HEALTHCARE

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Abstract

Recurrent spontaneous abortion (RSA) is associated with thrombophilia, which may induce placental microthrombosis, poor uteroplacental perfusion, abnormal trophoblast invasion, and endothelial injury. Under the forum theme of digital empowerment and traditional renewal, this paper reviews thrombophilia-associated RSA and explores the modernization of Chinese herbal medicine (CHM) through biomedical interpretation, digital technology, and Sino-Russian collaboration. Evidence suggests that CHM may regulate coagulation, improve microcirculation, protect endothelium, and reduce inflammation. Artificial intelligence, multi-omics, and real-world data may clarify mechanisms and support individualized treatment, while China-Russia cooperation can promote standardization, evidence generation, product development, and smart traditional medicine transformation.

Keywords: recurrent spontaneous abortion; thrombophilia; Chinese herbal medicine; smart medicine

RSA remains a challenging reproductive disorder, and thrombophilia is an important mechanism in unexplained and secondary pregnancy loss. Hypercoagulability may cause placental microthrombi, insufficient perfusion, implantation disturbance, and fetal loss. These changes correspond to the TCM concept of "blood stasis," linking modern reproductive medicine with traditional theory. The forum theme is closely related to this field. TCM emphasizes activating blood, removing stasis, tonifying the kidney, and supporting pregnancy. Digital tools such as artificial intelligence, multi-omics, decision-support systems, and real-world evidence can make traditional experience measurable and reproducible. Sino-Russian cooperation may support clinical research, quality control, drug development, and industrial application.

Objective

This study summarizes thrombophilia mechanisms in RSA, evaluates CHM in regulating coagulation and microcirculation, and discusses digital empowerment and Sino-Russian collaboration in smart traditional medicine.

Materials and methods

A literature review was conducted in PubMed, Web of Science, and CNKI for studies published from 2015 to 2026 using terms such as recurrent spontaneous abortion, thrombophilia, Chinese herbal medicine, smart medicine, digital health, and real-world evidence.

Results and discussion

Thrombophilia contributes to RSA through abnormal coagulation activation, fibrin deposition, antiphospholipid antibodies, endothelial dysfunction, and impaired uteroplacental perfusion, leading to fetal hypoxia, defective trophoblast invasion, and reduced endometrial receptivity. In TCM, these features are consistent with "blood stasis obstructing the uterus," often accompanied by kidney deficiency and Chong-Ren disharmony.CHM has multi-target potential in thrombophilia-associated RSA. Blood-activating herbs may reduce platelet aggregation, inhibit excessive thrombin formation, improve blood rheology, and enhance uterine and placental microcirculation. Treatment should balance anticoagulation, pregnancy support, kidney tonification, vascular protection, and bleeding-risk assessment, so CHM is suitable as an individualized complementary approach.

Digital technologies can convert TCM experience into structured evidence. AI-assisted analysis of symptoms, tongue, pulse, and laboratory indicators may improve syndrome classification and risk assessment, while multi-omics, network pharmacology, and real-world data can clarify herbal mechanisms, monitor outcomes and safety, and optimize prescriptions.Sino-Russian cooperation may further enhance translational value. China's TCM resources and clinical experience, combined with Russia's strengths in basic medicine, pharmacology, biotechnology, and Eurasian collaboration, can support joint work on standardized preparations, digital diagnostic models, registries, safety evaluation, quality control, and product translation, promoting smart traditional medicine industry integration.

Conclusion

Thrombophilia affects RSA through placental circulation, coagulation, endothelial function, and fetal development. CHM may complement modern care by regulating coagulation, inflammation, microcirculation, and vascular protection. Integrating TCM theory, biomedical evidence, AI, real-world data, and Sino-Russian cooperation may support precise diagnosis, safer intervention, stronger evidence, and industrial transformation.

References

Kaandorp SP, Goddijn M, et al. Thrombophilia and recurrent miscarriage: a systematic review. Hum Reprod Update. 2016.

Di Nisio M, et al. Antiphospholipid syndrome and pregnancy loss. Blood Rev. 2018.

Zhang Y, et al. Traditional Chinese medicine in recurrent miscarriage treatment. J Ethnopharmacol. 2020.

Practice Committee of ASRM. Evaluation and treatment of recurrent pregnancy loss. Fertil Steril. 2023.

DIGITAL EMPOWERMENT AND TRADITIONAL REVITALIZATION: A COLLABORATIVE FRAMEWORK FOR SINO-RUSSIAN SMART MEDICINE INNOVATION AND INDUSTRIAL CONVERGENCE

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Abstract

The global biomedical industry is undergoing digital transformation. Traditional medicine faces challenges of empirical dependence, limited standardized inheritance, and low industrial integration. Digital technologies such as big data, AI, and telemedicine are key drivers for revitalizing traditional resources and enabling industrial upgrading. China and Russia have complementary strengths: China possesses rich TCM heritage and industrial capacity, while Russia contributes strong biomedical research and digital medical technologies. Framed by the forum theme "Digital Empowerment and Traditional Revitalization," this paper reviews the current landscape of Sino-Russian smart medicine, analyzes the role of digital tools in modernizing traditional resources, examines progress and obstacles in bilateral industrial integration, and proposes innovative cooperation pathways. The findings offer practical references for deepening Sino-Russian collaboration and advancing high-quality biomedical industry integration.

Keywords: digital empowerment, traditional medicine, smart medical, Sino-Russian cooperation, industrial integration

The rapid advancement of digital intelligence technologies has propelled the global biomedical sector into an era of smart innovation and industrial collaboration. Traditional medicine, despite its rich clinical heritage, has long been constrained by non-standardized inheritance, empirical practices, and fragmented industrial structures. Digital transformation offers a viable solution: intelligent algorithms, big data mining, and telemedicine platforms can standardize traditional knowledge, optimize R&D, and transcend regional barriers [1].

As strategic partners, China and Russia maintain extensive biomedical exchanges. China's TCM system, characterized by holistic treatment and personalized regulation, has developed a complete industrial chain from cultivation to clinical application. Russia excels in basic medical research, biomedical engineering, and pharmaceutical technologies, supported by mature digital diagnostic systems. These complementary strengths provide a solid foundation for smart medical innovation and industrial integration [2].

Objectives

This study aims to clarify the mechanisms of digital technology empowering traditional medical renewal, analyze Sino-Russian smart medical complementarities, identify key barriers to bilateral integration, and propose cooperative strategies, providing theoretical support for deepening academic exchanges, technological innovation, and industrial collaboration.

Materials and Methods

This study employs literature review, comparative analysis, and inductive synthesis. Data were sourced from Web of Science, Scopus, CNKI, national reports, and Sino-Russian cooperation documents. By synthesizing research and case studies, it compares advantages, summarizes challenges, and identifies integration pathways.

Results and Discussion

China advances TCM digitalization via AI and big data, achieving standardized formulas and intelligent diagnosis. Russia focuses on digital clinical systems and cross-regional telemedicine, with strengths in image recognition and AI-driven manufacturing [3]. Complementarities lie in resources (China's medicinal wealth vs. Russia's R&D), technology (China's digitization vs. Russia's algorithms), and industry (China's manufacturing vs. Russia's research).

Challenges include incompatible medical standards, weak cross-border R&D mechanisms, divergent theoretical views, and insufficient service platforms, requiring unified standards and collaborative frameworks.

Digital empowerment offers new pathways for traditional medicine innovation and Sino-Russian biomedical integration. To address challenges in standards, resource sharing, and coordination, both sides should strengthen technical alignment, establish cross-border data platforms, and promote joint research. Leveraging digital empowerment, both nations can revitalize traditional resources, facilitate industrial integration, and advance biomedical innovation across Eurasia.

References

[1] Bhushan A, Misra P. Unlocking the potential: multimodal AI in biotechnology and digital medicine—economic impact and ethical challenges[J]. npj Digital Medicine, 2025, 8: 619.

[2] Zhang R, Yang Q, Huang Z, Liu H, Gao J, Nie X, Liao Y, Wang P. A comprehensive review of the traditional usages, phytochemistry, pharmacology, toxicology, quality control and other applications of Aconitum kusnezoffii Reichb[J]. Journal of Ethnopharmacology, 2026, 356: 120813.

[3] Varyukhina MD, Borisov AA, Erizhokov RA, Arzamasov KM, Solovev AV, Kirsanov VV, Omelyanskaya OV, Vladzymyrskyy AV, Vasilev YA. Pilot exploratory study of a CT radiomics model for the classification of small cell lung cancer and non-small-cell lung cancer in the Moscow population: a step toward virtual biopsy[J]. Journal of Imaging, 2025, 11(10): 331.

AI-EMPOWERED TCM DRUG DISCOVERY: DIGITAL TRANSFORMATION FOR SINO-RUSSIAN COOPERATION

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Abstract

AI-empowered network pharmacology decodes TCM's multi-target mechanisms. The 2025 Sino-Russian Memorandum on digital healthcare provides a policy foundation for collaboration. This review examines AI-driven network pharmacology and TCM digitalization, emphasizing cooperative opportunities. Integrating China's TCM data with Russia's modeling expertise and Far Eastern biodiversity can establish joint research platforms. Challenges and practical pathways are discussed.

Introduction

TCM formulations operate through complex polypharmacological networks, making mechanism elucidation difficult via reductionist approaches. Network pharmacology offers a framework for decoding this complexity, yet its potential has been constrained by data integration scale[1]. AI—including machine learning and graph neural networks—now enables predicting compound-protein interactions and prioritizing therapeutic targets[2]. The September 2025 Memorandum on digital healthcare transformation between China and Russia has established a formal policy foundation for bilateral collaboration, explicitly prioritizing advanced IT solutions and intelligent healthcare systems[3]. This builds upon existing cooperation in traditional medicine and medical education, with numerous joint scientific projects and research publications providing concrete channels for AI-NP research translation.

Objective

This review evaluates AI-driven network pharmacology in TCM digitalization, identifies Sino-Russian opportunities, synthesizes current advances, analyzes complementary strengths, and proposes engagement strategies.

Materials and methods

A systematic literature search was conducted across PubMed, Web of Science, CNKI, and Scopus for publications from 2015 to the present, using keywords including "network pharmacology," "artificial intelligence," and "traditional Chinese medicine." Official policy documents were retrieved from governmental portals. Inclusion criteria encompassed peer-reviewed articles on AI-driven network pharmacology and TCM digitalization. Retrieved literature was synthesized thematically into four domains: technological advances, complementary assets, policy frameworks, and cooperative challenges.

Results and discussion

AI integration has advanced TCM research, with machine learning, deep learning, and graph neural networks enabling multi-scale mechanism analysis from molecular interactions to patient outcomes[4]. These approaches overcome conventional limitations—data noise, high dimensionality, and inadequate cross-scale integration—while aligning with TCM's holistic philosophy. The complementary strengths of China and Russia create a robust foundation for joint research. China contributes extensive clinical datasets from millennia of TCM practice, comprehensive pharmacopoeial resources, and advancing AI capabilities. Russia brings mathematical modeling expertise, computational biology algorithms, and access to Far Eastern medicinal biodiversity, including Eleutherococcus senticosus and Schisandra chinensis. Integration could yield novel compound libraries for AI-driven screening and enable cross-validation of network predictions. The September 2025 Memorandum establishes a formal policy foundation, prioritizing IT solutions, telemedicine, and intelligent healthcare systems, building on existing cooperation in traditional medicine and infectious disease control. Russia has registered over 100 Chinese pharmaceutical products and 3,500 medical devices, with 28 joint projects and 223 co-authored papers. However, data standardization remains critical: disparate formats impede interoperability. Regulatory harmonization requires sustained engagement, while linguistic and cultural barriers hinder knowledge exchange. To address these, we propose: establishing a bilateral AI-network pharmacology joint research platform integrating China's TCM databases with Russian computational infrastructure; developing shared data standards; expanding joint training and researcher exchanges; institutionalizing regular workshops; and launching pilot projects in specific therapeutic areas to demonstrate proof-of-concept.

Conclusion

This review examined AI-driven network pharmacology in TCM digitalization across four domains: technological advances, complementary assets, policy frameworks, and challenges. AI-network pharmacology has overcome methodological limitations, while Sino-Russian cooperation offers a pathway for translating advances into healthcare applications. The complementary strengths of both nations provide a foundation for joint platforms and pilot projects. Realizing this vision requires sustained commitment to overcoming technical, regulatory, and cross-cultural barriers.

References:

1.Li S., Zhang B. - Traditional Chinese medicine network pharmacology: theory, methodology and application // Chin J Nat Med. – 2013. – Vol. 11. – № 2. – C.110-120.

2.Zhang P., Zhang D., Zhou W., et al. - Network pharmacology: towards the artificial intelligence-based precision traditional Chinese medicine // Brief Bioinform. – 2023. – Vol. 25. – № 1. – bbad518.

3.Memorandum of Understanding on Medical and Health Digital Transformation Between the National Health Commission of the People's Republic of China and the Ministry of Health of the Russian Federation [in Chinese] // National Health Commission of China. – 2025. – 09-02.

4.Cui G., Li M., Guo W., et al. - AI driven network pharmacology: multi-scale mechanisms of traditional Chinese medicine // Comput Struct Biotechnol J. – 2025. – Vol. 27. – C.5087-5104.

APPLICATION PROGRESS AND PROSPECTS OF WEARABLE DIGITAL MONITORING APPLICATION PROGRESS AND PROSPECTS OF WEARABLE DIGITAL MONITORING DEVICES IN HOME MANAGEMENT OF CHRONIC HEART FAILURE

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Abstract

Chronic heart failure (CHF) carries high readmission and mortality risks. Traditional home management relies on outpatient follow-up and patients' subjective symptom reports, with delayed deterioration warning and discontinuous monitoring data. Wearable digital monitoring devices enable long-term non-invasive collection of physiological and TCM four-diagnosis data at home, remedying defects of conventional discharge management. This paper summarizes the application progress of wearable equipment in CHF home management, analyzes major technical and clinical bottlenecks, and puts forward optimization directions to build standardized intelligent remote management systems for integrated TCM-WM treatment of CHF.

Keywords: Wearable digital monitoring devices; Chronic heart failure; Home management; Remote monitoring; Integrated TCM-WM precision management

Conventional CHF home management depends on self-monitoring and regular hospital visits, failing to capture subtle early deterioration signals in real time and delaying intervention. Multi-sensor wearable devices realize all-day dynamic monitoring of heart rhythm, blood oxygen, pulse waveforms and activity data. Combined with cloud intelligent warning algorithms, they provide a new digital approach for closed-loop home management combining Western physiological indicators and TCM pulse diagnosis. This paper discusses its application value, limitations and future trends.

Purpose

This study summarizes the clinical value of wearable monitoring devices in full-cycle CHF home management, identifies core technical and clinical obstacles, and proposes improvement schemes to accelerate clinical promotion of wearable intelligent monitoring systems for CHF patients.

Materials and Methods

Five papers published from 2024 to 2026 were included, covering cardiovascular wearable monitoring technology overview, CHF decompensation early warning research, wearable pulse monitoring terminal development, CHF remote home management system construction, and the 2025 national integrated TCM-WM CHF diagnosis and treatment consensus. Inductive analysis was used to sort application scenarios and existing deficiencies.

Results and Discussion

Wearable devices serve three core functions in CHF home management: continuous collection of physiological indicators, real-time warning of acute decompensation risks, and objective quantification of TCM pulse data for home syndrome differentiation. Synchronous monitoring of ECG, heart rate, respiration, thoracic impedance and pulse signals significantly advances deterioration warning and reduces unplanned hospitalization rates. Long-term pulse recording also provides objective evidence for differentiating TCM syndromes such as heart qi deficiency and phlegm-stasis retention.

However, three key challenges restrict clinical popularization: First, most wearable devices lack special calibration standards for CHF patients, leading to unstable signal accuracy in different wearing postures. Second, data formats of different equipment are inconsistent without unified medical standards, resulting in poor cross-hospital data compatibility. Third, existing early warning algorithms only adopt Western indicators without integrating TCM holistic differentiation logic, lacking combined warning models of vital signs and pulse features. Besides, equipment comfort, elderly operation difficulty and data privacy risks lower patients' long-term adherence.

Conclusion

Wearable digital monitoring devices solve the problems of discontinuous monitoring and delayed risk warning in traditional CHF home management, combining Western objective indexes and TCM pulse data to reduce readmission rates. Unspecialized calibration standards, disunified data specifications and insufficient integration with TCM theories remain urgent issues. Future research should establish exclusive parameter calibration standards for CHF, build unified multi-modal cardiovascular medical databases, develop interpretable early warning algorithms integrating physiological and TCM pulse information, and optimize equipment humanization and privacy protection, so as to form clinical-oriented wearable home monitoring systems for CHF.

References

[1]Odeh A V ,Chen Y ,Wang W , et al. Recent Advances in the Wearable Devices for Monitoring and Management of Heart Failure[J].Reviews in Cardiovascular Medicine,2024,25 (10):386-386. DOI:10.31083/J.RCM2510386.

[2]Noemi G ,Samanta R ,Gabriella B , et al. A Wearable Multi-Sensor Array Enables the Recording of Heart Sounds in Homecare.[J].Sensors (Basel, Switzerland),2023,23 (13):6241-.DOI:10.3390/S23136241.

[3]Karim B ,Mohammed G ,Abdallah E , et al. Smart wearable devices in cardiovascular care: where we are and how to move forward.[J].Nature reviews. Cardiology,2021,18 (8):581-599. DOI:10.1038/S41569-021-00522-7.

[4]Kazem R ,Milad N ,Ana-Catarina P , et al. Home monitoring with technology-supported management in chronic heart failure: a randomised trial.[J].Heart (British Cardiac Society),2020,106 (20):1573-1578.DOI:10.1136/heartjnl-2020-316773.

RESEARCH PROGRESS ON EXTREACTION, STRUCTURAL CHARACTERISTICS, AND PHARMACOLOGICAL ACTIVITIES OF PERILLA FRUTESCENS POLYSACCHARIDES

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Abstract

Perilla frutescens is a Lamiaceae plant with both medicinal and edible value, widely used in traditional diets and modern functional food development. In recent years, its major bioactive component Perilla frutescens polysaccharides have drawn increasing attention for low toxicity, excellent biocompatibility, and diverse pharmacological activities including antioxidant, immunomodulatory, hypoglycemic, and hepatoprotective effects. However, systematic studies are limited due to complex extraction, incomplete structural elucidation, and unclear structure-activity relationships. Therefore, it is necessary to comprehensively analyze the extraction methods, structural features, and biological activities of Perilla frutescens polysaccharides to clarify current research status and future development directions.

Keywords: Perilla frutescens, Structural Characteristics, Pharmacological Activities

Objective

To systematically summarize the extraction and purification methods, structural characteristics, and pharmacological activities of Perilla frutescens polysaccharides, analyze the influence of different extraction techniques on structure and bioactivity, and explore their structure-activity relationships, providing a theoretical basis for their application in functional foods and drug development.

Materials and methods

This study reviewed published literature on Perilla frutescens polysaccharides. Relevant studies were retrieved from PubMed, CNKI and Google Scholar, with keywords including 'Perilla frutescens polysaccharide', 'extraction', 'structure characterization' and 'pharmacological activity'. Included studies covered HWE, UAE, MAE, EAE and CEUE extraction techniques. Comparative analyses were conducted on extraction yield, structural changes and bioactivity outcomes.

Results and discussion

The results showed that extraction efficiency of Perilla frutescens polysaccharides is strongly dependent on the extraction method. Traditional hot water extraction is simple but inefficient and prone to thermal degradation. Ultrasound-assisted extraction enhances yield through cavitation effects but may alter molecular weight distribution. Microwave-assisted extraction offers high efficiency but requires expensive equipment. Enzyme-assisted extraction provides higher selectivity but suffers from process instability. Overall, combined methods such as CEUE demonstrate superior performance in improving yield while maintaining structural integrity.

Structurally, Perilla frutescens polysaccharides mainly consist of Ara, Gal, Glc, Rha, and GalA, with a molecular weight range of 1 kDa to 2000 kDa. Their bioactivities correlate closely with Gal/GalA content and glycosidic linkages like (1→3,4)-Galp. Leaf-derived polysaccharides have higher GalA content, while seed-derived ones more commonly form triple-helix conformations.

Regarding pharmacological activities, Perilla frutescens polysaccharides exhibit strong antioxidant, immunomodulatory, hypoglycemic, and hepatoprotective effects. Their antioxidant activity is mainly achieved through free radical scavenging and activation of the Nrf2/PI3K-Akt signaling pathway. Immunomodulatory effects involve macrophage activation and cytokine regulation. Hypoglycemic effects may be associated with inhibition of α-glucosidase and regulation of the PI3K/AKT/GLUT4 pathway. In addition, they may improve metabolic disorders by modulating gut microbiota.

Nevertheless, extant research in this field still exhibits multiple limitations: the majority of existing studies focus on crude extracts rather than purified individual components, the experimental evidence supporting the existence of higher-order structures (e.g., triple-helix conformation) remains insufficient, and systematic construction of structure-activity relationships has not yet been accomplished.

References:

1. L. Zhu, L. Guan, K. Wang, C. Ren, Y. Gao, J. Li, S. Yan, X. Zhang, X. Yao, Y. Zhou, B. Li, S. Lu, Recent trends in extraction, purification, structural characterization, and biological activities evaluation of Perilla frutescens (L.) Britton polysaccharide, Front Nutr 11 (2024) 1359813.

2. M. Lu, P. Liu, Q. Shen, H. Wang, A Study on the Edible and Medicinal Value and Cultivation History of Perilla, Journal of Guangzhou University of Chinese Medicine 41(10) (2024), 2815–2822.

3. Y. Zhang, Q. Shen, L. Leng, D. Zhang, S. Chen, Y. Shi, Z. Ning, S. Chen, Incipient diploidization of the medicinal plant Perilla within 10,000 years, Nat Commun 12(1) (2021) 5508.

CLINICAL APPLICATION AND PHARMACOLOGICAL MECHANISM OF NUX VOMICA IN THE TREATMENT OF Bi-SYNDROMES

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Abstract

Nux vomica contains strychnine and brucine. It unblocks collaterals and relieves pain, applied to bi-syndromes, neurological disorders and adjuvant cancer therapy by regulating neural and inflammatory pathways, and can treat different subtypes of bi-syndromes via herbal compatibility. However, its alkaloids are highly toxic; overdose may cause convulsions and respiratory failure. Unified dosage standards and improved monitoring systems are urgently needed to ensure safe medication.

Keywords: Nux vomica,Bi-syndrome,Pharmacological toxicity

Bi-syndrome corresponds to osteoarthropathies such as rheumatoid arthritis. First documented in Compendium of Materia Medica, nux vomica boasts remarkable efficacy in unblocking collaterals and relieving pain. Modern studies have verified its multiple pharmacological activities, yet relevant research remains fragmented. This paper integrates ancient and contemporary literature to provide evidence for its standardized and safe clinical administration.

Objective

To sorts out the multi-field applications and medication risks of nux vomica, summarizes the compatibility and syndrome differentiation schemes for various bi-syndromes, clarifies its multi-pathway mechanisms including neuroregulation, analgesia and cardiovascular protection, and provides a basis for dosage optimization, combined medication and standardized clinical trials.

Materials and methods

This study adopts a literature review approach. Ancient TCM classics and recent Chinese and English literature concerning the pharmacology, animal experiments and clinical research of nux vomica were collected, then indications, compatible prescriptions, pharmacological pathways and poisoning cases were sorted out for systematic induction and analysis.

Results and discussion

Nux vomica alleviates Parkinson's disease symptoms and joint pain, and reduces side effects of chemotherapy, yet strychnine exhibits dose-dependent toxicity. Through syndrome-differentiated herbal compatibility, it treats various bi-syndromes, as well as orthopedic injuries and sequelae of stroke. Brucine crosses the blood-brain barrier to regulate ion channels and neurotransmitters, exerting nerve repair, blood circulation activation and analgesic effects, while overdose may lead to poisoning. Despite its high medicinal value, it has a narrow therapeutic window. Most existing studies are animal experiments, and further clinical research on dose-efficacy-toxicity relationships

is still required.

Conclusion

Nux vomica achieves remarkable efficacy in treating bi-syndromes, neuralgia and adjuvant tumor therapy, and precise treatment can be realized through syndrome-differentiated herbal compatibility. However, its highly toxic alkaloids restrict its clinical application. Further research should identify safe dosages, optimize combined medication regimens and conduct long-term clinical trials to fully explore its medicinal value.

References:

1.Yuan C, Sun L, Zhang M, et al. Inhibition of human Nav1. 5 sodium channels by strychnine and its analogs[J]. Biochemical pharmacology, 2011, 82(4): 350-357.

2.Tong H F, Chan C Y, Ng S W, et al. Strychnine poisoning due to traditional Chinese medicine: a case series[J]. F1000Research, 2021, 10: 924.

3.Watanabe M. Strychnine, in The Mysterious Affair at Styles: Blocking Glycinergic Synaptic Transmission[J]. Brain and Nerve= Shinkei Kenkyu no Shinpo, 2023, 75(12): 1285-1288.

A PHARMACOLOGICAL STUDY ON THE EFFICACY OF 3,4-DIHYDRO-5-(HYDROXYMETHYL)ISOCHROMONE-1-ONE IN THE TREATMENT OF NONALCOHOLIC FATTY LIVER DISEASE BASED ON TRADITIONAL CHINESE MEDICINE APPROACHES

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Abstract

Non-alcoholic fatty liver disease (NAFLD) is a metabolic-associated liver disorder characterized primarily by the abnormal accumulation of lipids within hepatocytes, representing one of the most prevalent chronic liver diseases globally. 3,4-dihydroxy-5-hydroxymethy lisochromen-1-one (HMIO) is a primary chemical constituent of Swertia and Gentiana species and is also the major in vivo metabolite of iridoid glycosides, such as gentiopicroside and swertiamarin. Metabolomics was used to validate the therapeutic effects of HMIO in a mouse model and to analyze its regulatory role in relevant metabolic pathways. This study provides a theoretical basis for the clinical application of plants from the Swertia and Gentiana, as well as their compound formulations, in the treatment of non-alcoholic fatty liver disease.

Keywords: 3,4-dihydro-5-(hydroxymethyl) isochroman-1-one; NAFLD; Ferroptosis

This study employs non-targeted metabolomics based on UPLC-Q-TOF/MS to analyze metabolic changes, with the aim of deciphering the metabolic regulatory network modulated by HMIO, elucidating its therapeutic mechanism, and laying the groundwork for its further development and application in NAFLD research.

Objective

This provides a methodological framework for further identifying the key bioactive compounds and their mechanisms of action in clinically effective traditional Chinese medicines, thereby opening up new avenues for research into the modernization of traditional Chinese medicine and the development of new drugs.

Materials and methods

After establishing a disease model in C57BL/6 mice, relevant parameters were tested using a commercial assay kit to validate the effects of LXD on biochemical parameters in rats and to evaluate its therapeutic efficacy. In addition, ultra-high-performance liquid chromatography-quadrupole time-of-flight mass spectrometry (UPLC-Q-TOF/MS) was employed to analyze rat urine and serum samples. The relevant data were analyzed using statistical software, including MarkerLynx 4.1, Progenic QI, SIMCA-P (v.14.0), and GraphPad Prism 9.5.1. Data comparisons between two groups were performed using t-tests, while comparisons among multiple groups were conducted using one-way analysis of variance (ANOVA) and Dunnett's multiple comparison test. Finally, KEGG was used to perform enrichment analysis of key pathways to determine the

pharmacological basis of the therapeutic effects.

Results and discussion

Metabolites are the end products of biological processes, and changes in their levels directly reflect the functional state of an organism. Metabolomic analysis identified 26 key differentially expressed metabolites in NAFLD mice. HMIO significantly reshaped lipid and amino acid metabolism; notably, its therapeutic effects were highly correlated with alterations in arachidonic acid metabolism, glutathione metabolism, and porphyrin metabolism. Based on significant changes in specific lipid peroxides and redox modulators, HMIO demonstrated positive regulatory effects on all of the aforementioned metabolic pathways in this study.

This experiment successfully established a mouse model of NAFLD and validated the efficacy of HMIO in alleviating symptoms in affected mice.

References:

1.Han, S. K., Baik, S. K., & Kim, M. Y. (2023). Non-alcoholic fatty liver disease: Definition and subtypes. 2022.0424

2. Zhang Y, Yang X, Wang S, Song S, Yang X. Gentiopicroside prevents alcoholic liver damage by improving mitochondrial dysfunction in the rat model. Phytotherapy Research. 2021;35:2230–2251.

3 Riazi K, Azhari H, Charette JH, et al. The prevalence and incidence of NAFLD worldwide: a systematic review and meta-analysis. Lancet Gastroenterol Hepatol. 2022;7(9):851-861. doi:10.1016/S2468-1253(22)00165-0

4. Wang M, Chen L, Liu D, Chen H, Tang DD, Zhao YY. Metabolomics highlights pharmacological bioactivity and biochemical mechanism of traditional Chinese medicine. Chem Biol Interact. 2017;273:133-141.

5.Malhi, H., & Gores, G. J. (2008). Molecular mechanisms of lipotoxicity in nonalcoholic fatty liver disease. Seminars in liver disease, 28(4), 360–369.

UNTARGETED METABOLOMIC ANALYSIS REVEALS THE MECHANISM UNDERLYING SWERTIA MUSSOTII TREATMENT ON RATS WITH NON-ALCOHOLIC FATTY LIVER DISEASE USING UPLC-Q-TOF/MS

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Abstract

Swertia mussotii (SM) is a traditional Tibetan medicine used to treat hepatopathies including non-alcoholic fatty liver disease (NAFLD), but its mechanism remains unclear. This study evaluated SM efficacy in NAFLD using in vivo (HFD-fed mice) and in vitro (FFA-stimulated HepG2 cells) models. SM significantly reduced body weight, serum lipids, hepatic lipid accumulation, inflammation and oxidative stress. Untargeted metabolomics via UPLC-Q-TOF/MS revealed that SM restored dysregulated TCA cycle and amino acid metabolism. Mechanistically, SM activated SIRT1/AMPK, leading to ACC phosphorylation, downregulation of SREBP-1c/FASN and upregulation of PPAR-γ, thus inhibiting de novo lipogenesis and promoting fatty acid β-oxidation. These findings demonstrate SM's multi-target therapeutic potential for NAFLD.

Keywords: Swertia mussotii, NAFLD, metabolomics, UPLC-Q-TOF/MS, SIRT1/AMPK

Non-alcoholic fatty liver disease (NAFLD) is a prevalent metabolic syndrome affecting ~25–30% of adults globally, with no approved pharmacological treatment [1,2]. Swertia mussotii Franch. (Gentianaceae), a Tibetan medicine used for over 1400 years, shows hepatoprotective effects [3], but its anti-NAFLD mechanism is largely unknown. Metabolomics offers holistic profiling of metabolites and aligns with the multi-target philosophy of traditional medicine [4]. Therefore, this study aimed to determine SM efficacy and mechanism using combined metabolomic and molecular approaches in HFD-induced mouse model and FFA-stimulated HepG2 cell model.

Materials and methods

SM was extracted with 70% ethanol. Male C57BL/6 mice received normal diet (Control) or HFD for 12 weeks, then oral SM (0.14, 0.28, 0.56 g/kg) or atorvastatin for 8 weeks. HepG2 cells were treated with 1 mM FFA (oleic:palmitic 2:1) for 24 h, then SM (50–150 μg/mL) for 24 h. Serum TC, TG, LDL-C, HDL-C, ALT, AST and hepatic MDA, SOD, GSH-Px were measured. UPLC-Q-TOF/MS metabolomics with OPLS-DA (VIP>1.0, $p<0.05$) were performed on liver and cells. Histopathology (H&E, Oil Red O) and NAS scoring were assessed. Western blotting detected SIRT1, AMPK, p-AMPK, ACC, p-ACC, SREBP-1c, FASN, PPAR-γ. Data were analyzed by one-way ANOVA ($p<0.05$).

Results and discussion

SM significantly reduced body weight gain, serum TC, TG, LDL-C and increased HDL-C ($p<0.01$) in HFD mice. Hepatic oxidative stress (MDA, ox-LDL) decreased while SOD and GSH-Px increased; inflammatory cytokines (TNF-α, IL-1β, IL-6, MCP-1) were markedly lowered. Histologically, SM reduced lipid droplet accumulation and fat vacuoles, with decreased NAS scores. In HepG2 cells, Oil Red O staining confirmed reduced FFA-induced lipid deposition. Metabolomics identified 50 and 42 differential metabolites in liver and cells, respectively. Key changes included upregulation of saturated fatty acids (hexadecanoic acid, octadecanoic acid) and branched-chain/aromatic amino acids (leucine, isoleucine, valine, phenylalanine, tyrosine) in NAFLD, reversed by SM; downregulation of unsaturated fatty acids (linoleate, arachidonate) and TCA cycle intermediates (citrate, succinate, 2-oxoglutarate, fumarate, malate) in NAFLD, restored by SM. KEGG enrichment highlighted TCA cycle, amino acid (arginine, BCAA) and lipid metabolism as primary targets. SM consistently corrected these metabolic abnormalities in both models. Mechanistically, SM increased SIRT1 expression and AMPK phosphorylation (p-AMPK/AMPK ratio), promoting ACC phosphorylation (p-ACC/ACC), thereby inhibiting fatty acid synthesis. SM downregulated SREBP-1c and its target FASN, while upregulating PPAR-γ to enhance fatty acid β-oxidation. Immunofluorescence confirmed reduced nuclear translocation of SREBP-1c. These molecular events explain the metabolomic reprogramming: enhanced TCA cycle provides energy for oxidation, reduced BCAA accumulation alleviates mTOR-mediated insulin resistance, and balanced lipid profiles reflect coordinated synthesis/oxidation. The enzymatic hydrolysate (SM-E) showed enhanced activity, suggesting aglycones as active components.

As a result, SM alleviates NAFLD by restoring TCA cycle and amino acid metabolism, inhibiting de novo lipogenesis via SREBP-1c/FASN and promoting oxidation via PPAR-γ, all orchestrated through SIRT1/AMPK activation. This multi-target mechanism establishes SM as a promising phytotherapeutic candidate. Future work should identify active constituents and validate clinical efficacy.

References:

1. Yang Z., Wang L. - Current, emerging, and potential therapies for non-alcoholic steatohepatitis. // Front. Pharmacol. – 2023. – 14. – C.1152042.

2. Yu Y., Cai J., She Z., Li H. - Insights into the Epidemiology, Pathogenesis, and Therapeutics of Nonalcoholic Fatty Liver Diseases. // Advanced Science. – 2019. – 6 (4). – C.1801585.

3. Ding Y., Gou X., Wu X., Tao Y., Wang Y., Wang Y., Liu J., Zhou X., Kuang T., Fan G. - Gentiopicroside: An Updated Review of Its Pharmacological Activities and Mechanisms. // Chemistry & Biodiversity. – 2025. – 22 (5). – C.e202402306.

4. Swati K., Bhatt V., Sendri N., Bhatt P., Bhandari P. - Swertia chirayita: A comprehensive review on traditional uses, phytochemistry, quality assessment and pharmacology. // Journal of Ethnopharmacology. – 2023. – 300. – C.115714.

5. Liao G.Q., Tang H.M., Yu Y.D., et al. - Mass spectrometry-based metabolomic as a powerful tool to unravel the component and mechanism in TCM. // Chin Med. – 2025. – 20. – C.62.

METABOLOMICS-BASED INVESTIGATION OF THE THERAPEUTIC MECHANISM OF ERYTHROCENTAURIN IN NONALCOHOLIC FATTY LIVER DISEASE

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Abstract

Erythrocentaurin, an iridoid metabolite from hepatoprotective herbs, exhibits therapeutic potential against nonalcoholic fatty liver disease (NAFLD). This study evaluated its efficacy and mechanism using high-fat diet-fed mice and FFA-induced HepG2 cells. Biochemical assays, histopathology, and metabolomics (UPLC-Q-TOF/MS) were integrated with molecular validation (qRT-PCR, Western blot, immunofluorescence). Erythrocentaurin significantly improved serum lipids, transaminases, hepatic steatosis, and reduced intracellular lipid accumulation. Metabolomics identified 24 hepatic and 23 cellular biomarkers, primarily involving linoleic acid, arachidonic acid, glycerophospholipid, pyruvate, and TCA cycle pathways. Mechanistically, erythrocentaurin upregulated SIRT1, activated AMPK (increased p-AMPK/AMPK), enhanced ACC phosphorylation, and suppressed SREBP-1c, PPAR-γ, and FASN expression. These findings demonstrate that erythrocentaurin alleviates NAFLD by coordinating lipid-energy metabolism through the AMPK/SREBP-1c/ACC signaling axis, providing a promising lead for novel anti-NAFLD therapies.

Keywords: Erythrocentaurin; Nonalcoholic fatty liver disease; Metabolomics; AMPK

NAFLD is the most prevalent chronic liver disease worldwide, yet no specific pharmacotherapy is approved. Erythrocentaurin is a bioactive metabolite of iridoid glycosides, but its mechanism remains unclear.

Objective

To investigate the anti-NAFLD efficacy of erythrocentaurin and clarify its mechanism.

Materials and methods

NAFLD models were established in HFD-fed C57BL/6J mice and FFA-induced HepG2 cells. Erythrocentaurin was administered at low/mid/high doses. Biochemical parameters, histopathology, and lipid accumulation were assessed. Untargeted metabolomics was performed on liver and cell samples. AMPK/SREBP-1c/ACC pathway molecules were examined by qRT-PCR, Western blot, and immunofluorescence.

Results and discussion

Erythrocentaurin significantly improved serum lipid profiles, liver function, and histopathological steatosis, and reduced intracellular TG/TC and lipid droplets. Metabolomics revealed 24 hepatic

and 23 cellular biomarkers, enriched in linoleic acid, arachidonic acid, glycerophospholipid, pyruvate, and TCA cycle pathways. Mechanistically, erythrocentaurin upregulated SIRT1, activated AMPK (increased p-AMPK/AMPK), enhanced ACC phosphorylation, and suppressed SREBP-1c and its downstream targets PPAR-γ and FASN. Immunofluorescence confirmed reduced SREBP-1c expression. These results indicate that erythrocentaurin restores lipid-energy homeostasis and inhibits de novo lipogenesis via the AMPK/SREBP-1c/ACC axis.

Erythrocentaurin exhibits significant anti-NAFLD activity through multi-pathway metabolic regulation and suppression of lipid synthesis. This study provides mechanistic insights into iridoid metabolites and supports their development as anti-NAFLD agents.

References:

1. Rinella ME, Neuschwander-Tetri BA, Siddiqui MS, et al. AASLD Practice Guidance on the clinical assessment and management of nonalcoholic fatty liver disease. Hepatology. 2023;77(5):1797-1835.

2. Younossi ZM, Golabi P, Paik JM, et al. The global epidemiology of NAFLD and NASH: a systematic review. Hepatology. 2023;77(4):1335-1347.

3. Buzzetti E, Pinzani M, Tsochatzis EA. The multiple-hit pathogenesis of NAFLD. Metabolism. 2016;65(8):1038-1048.

4. Masoodi M, Gastaldelli A, Hyötyläinen T, et al. Metabolomics and lipidomics in NAFLD: biomarkers and non-invasive diagnostic tests. Nat Rev Gastroenterol Hepatol. 2021;18(12):835-856.

DIGITAL METABOLOMICS-ASSISTED ELUCIDATION OF THE ANTI-HBV MECHANISM OF ERYTHROCENTAURIN

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Abstract

Erythrocentaurin, an active metabolite derived from iridoid glycosides in Swertia medicinal plants, exhibits promising anti-hepatitis B virus (HBV) activity. This study aimed to investigate its anti-HBV effects and underlying mechanisms using HBV-transgenic mice and HepG2.2.15 cells. Viral markers, including HBsAg, HBeAg and HBV DNA, were evaluated by ELISA and qPCR. Untargeted metabolomics based on UPLC-Q-TOF/MS was employed to characterize metabolic alterations. Molecular validation was performed using qRT-PCR, Western blotting and immunofluorescence.

Erythrocentaurin significantly reduced HBsAg, HBeAg and HBV DNA levels both in vivo and in vitro. Metabolomic analysis identified 55 differential metabolites associated with HBV progression and drug intervention. Pathway enrichment demonstrated that glutathione metabolism and arachidonic acid metabolism were the major regulatory pathways. Mechanistically, erythrocentaurin inhibited activation of the NF-κB signaling pathway by decreasing p-IκK and p-P65 expression, increasing IκB expression and suppressing P65 nuclear translocation.

These findings demonstrate that erythrocentaurin exerts anti-HBV activity through coordinated regulation of host metabolism and inflammatory signaling pathways, providing a potential lead compound for the development of novel anti-HBV therapeutics.

Keywords: Erythrocentaurin; Hepatitis B virus; Metabolomics; NF-κB; Arachidonic acid metabolism; Glutathione metabolism

Chronic hepatitis B remains a major global health challenge. Current antiviral therapies can suppress viral replication but rarely achieve functional cure1,2. Erythrocentaurin is a bioactive metabolite generated from the biotransformation of iridoid glycosides from Swertia medicinal plants and has demonstrated antiviral potential3. However, its anti-HBV mechanism has not been systematically elucidated.

Objective

To investigate the anti-HBV effects of erythrocentaurin and clarify its mechanism through integrated metabolomic and molecular analyses.

Materials and methods

HBV-transgenic mice and HepG2.2.15 cells were treated with different doses of erythrocentaurin. HBsAg, HBeAg and HBV DNA were determined using ELISA and qPCR. Untargeted metabolomics was performed using UPLC-Q-TOF/MS. Differential metabolites and metabolic pathways were

analyzed by multivariate statistical methods and KEGG enrichment. NF-κB pathway-related proteins and P65 nuclear translocation were assessed by Western blotting and immunofluorescence.

Results and discussion

Erythrocentaurin significantly decreased HBsAg, HBeAg and HBV DNA levels in both experimental models. Metabolomic profiling revealed substantial reversal of HBV-induced metabolic disorders. A total of 55 differential metabolites were identified, primarily involving glutathione metabolism and arachidonic acid metabolism. Molecular validation demonstrated that erythrocentaurin reduced phosphorylation of IκK and P65, increased IκB expression and inhibited P65 nuclear translocation. These findings suggest that erythrocentaurin alleviates HBV-associated metabolic dysfunction and inflammatory responses through suppression of the NF-κB pathway.

Erythrocentaurin exhibits significant anti-HBV activity by regulating glutathione and arachidonic acid metabolism and inhibiting NF-κB signaling. The integration of metabolomics and molecular validation provides new insights into the mechanism of active metabolites from traditional Chinese medicine and supports the development of innovative anti-HBV agents.

References:

1. Antonio, A. S., Veiga-Junior, V. F., & Wiedemann, L. S. M. (2020). Ocotea complex: A metabolomic analysis of a Lauraceae genus. Phytochemistry, 173, 112314.

2. Chang, J., Zhao, X. M., Liu, C. X., & Zhang, T. J. (2008). Structure elucidation of metabolites of swertiamarin produced by Aspergillus niger. Journal of Molecular Structure, 878(1-3), 22–25.

3. Chen, L., Ye, X., Yang, L., Zhao, J., You, J., & Feng, Y. (2024). Linking fatty liver diseases to hepatocellular carcinoma by hepatic stellate cells. Journal of the National Cancer Center, 4(1), 25–35.

PROGRESS IN CLINICAL RESEARCH OF TRADITIONAL CHINESE MEDICINE ON COUGH VARIANT ASTHMA IN CHILDREN

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Abstract

Children with Cough Variant Asthma (CVA) tend to experience high recurrence rates and poor treatment compliance under Western medicine. Traditional Chinese Medicine (TCM) categorizes this disease as wind cough, with the lung as the core lesion site involving the liver, spleen and kidney. It is divided into four syndromes treated with corresponding classical prescriptions. This paper reviews Chinese and foreign literature of the past decade to summarize the advantages of TCM in treating pediatric CVA, including holistic regulation and minor side effects, and proposes to improve standardized diagnosis and treatment protocols in future research.

Keywords: Cough variant asthma;Children

Cough variant asthma (CVA) is characterized mainly by persistent coughing. The course of the disease is protracted and difficult to cure. Western medicine mainly uses inhaled glucocorticoids as the main treatment method. Although it shows quick results in the short term, the compliance of children with long-term application is poor, and the recurrence rate after discontinuation is relatively high. Traditional Chinese medicine has advantages such as good efficacy and high safety in the treatment of CVA through syndrome differentiation. This disease mainly affects the lungs and is closely related to the liver, spleen and kidneys. The main cause and pathogenesis is that the latent pathogen remains within the body, triggered by external factors, and multiple external and internal pathogenic factors combine, causing upward reversal of lung qi and resulting in cough. The common clinical syndrome differentiation and key points, as well as representative prescriptions are as follows: For the wind-cold invading the lungs syndrome, symptoms include coughing, presenting as paroxysmal choking cough, with little phlegm or no phlegm, pale tongue, thin white coating, floating and tense pulse, and red fingerprints. The representative prescription is Xiaoqinglong Decoction; for the wind-heat invading the lungs syndrome, symptoms include coughing, presenting as paroxysmal choking cough, with little phlegm or no phlegm, red tongue, white or thin yellow coating, floating and rapid pulse, and purple fingerprints. The representative prescription is Sangju Decoction; for the phlegm-accumulated in the lungs syndrome, symptoms include reduced coughing, with phlegm, white or yellow color, pale tongue, white or white greasy coating, slippery pulse, and stagnant fingerprints. The treatment is given with Erchen Decoction; for the lung, spleen and kidney deficiency syndrome, symptoms include disappearance of cough, fatigue and weakness, pale tongue, thin white coating, weak pulse, and pale fingerprints. The treatment principle is Yipingfeng San combined with Shenqi Wan.

Objective

This article systematically reviews relevant literature, aiming to explore the application and efficacy

of traditional Chinese medicine in the clinical treatment of CVA, and summarize the latest research progress in this field.

Materials and methods

This study retrieved relevant clinical research literature on the treatment of childhood cough variant asthma with traditional Chinese medicine from major domestic and international medical databases such as China National Knowledge Infrastructure (CNKI), Wanfang Database, Google Scholar, and PubMed, and conducted a systematic summary and comprehensive analysis.

Results and discussion

TCM treatment for this disease has advantages such as overall regulation and syndrome-based treatment, which can alleviate cough and wheezing symptoms, stabilize the condition and reduce the recurrence rate of the disease.Future studies can explore the differences in response to traditional Chinese medicine therapy among various children patients and their long-term therapeutic effects, providing scientific and standardized treatment strategies for pediatric care in both China and Russia.

References:

1.Ding M, Guo MX. Research progress of traditional Chinese medicine in the treatment of pediatric cough variant asthma[J]. Jiangxi Journal of Traditional Chinese Medicine, 2025, 56(8): 80-84.

2.T/CACM 1177—2019. Clinical Guidelines for TCM Pediatrics: Pediatric Cough Variant Asthma[M]. Clinical Guidelines for TCM Pediatrics. Beijing: China Press of Traditional Chinese Medicine, 2020.

3.Cox J K, Lockey R, Cardet J C. Cough-variant asthma: a review of clinical characteristics, diagnosis, and pathophysiology[J]. J Allergy Clin Immunol Pract, 2025, 13(3): 490-498.

4.Kyou-Hwan H, Ki H C, Cui S Q, et al. Effectiveness and safety of traditional Chinese herbs in children with cough variant asthma: a systematic review and Meta-analysis[J]. J Tradit Chin Med, 2021, 41(5): 661.

RESEARCH PROGRESS ON BRAIN EFFECT CHARACTERISTICS OF ACUPUNCTURE AT DIFFERENT ACUPOINTS IN THE TREATMENT OF AD BASED ON RS-FMRI

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Abstract

Based on rs-fMRI, this article reviews the research on AD-related brain functional areas and network abnormalities, and the specificity of acupuncture points in the treatment of AD.At the same time, it summarizes the limitations of current research and points out the direction of future research, in order to optimize the clinical acupuncture treatment plan and improve the treatment.

Keywords: Alzheimer 's disease ; acupuncture treatment ; group points ; resting-state functional magnetic resonance imaging

Alzheimer 's disease (AD) is a progressive neurodegenerative disease with complex mechanisms, which leads to a series of clinical manifestations of cognitive and behavioral disorders. At present, there is no radical cure. With the wide application of acupuncture treatment and the development of resting-state functional magnetic resonance imaging (rs-fMRI), the research on the pathogenesis and intervention measures of AD has been paid more and more attention, and it also provides reliable technical support for the exploration of acupuncture points.

Objective

A randomized controlled clinical trial was conducted to evaluate the clinical efficacy of scalp acupuncture therapy combining cluster needling of scalp points and acupuncture of the cognitive-affective region on post-stroke cognitive impairment.

Materials and methods

Li et al. [1] found that the connectivity of DMN in AD patients was decreased in resting state (such as cingulate gyrus and inferior parietal lobe), and the integrity of DMN could be partially remodeled after electroacupuncture at ' Shenting-Baihui '. Based on rs-fMRI data, Kang [2] found that acupuncture at " Shenmen-Neiguan " group acupoints can produce specific activation in fusiform gyrus, inferior temporal gyrus and other brain regions compared with single acupoints. These brain regions are mainly involved in advanced cognitive function and emotional regulation, which are highly consistent with the function of the " main mind " of the heart meridian. Han Shengwang et al. [3] and ZHENG et al. [4] have shown that acupuncture at Hegu, Taichong and other acupoints can make the spontaneous neural activity (ALFF) of multiple brain regions such as the superior frontal gyrus, hippocampus and cingulate gyrus of AD patients tend to change normally.

Results and discussion

Based on rs-fMRI, the research on the brain effect of acupuncture combined with acupoints in the treatment of AD has reached the following consensus : the combination of acupoints (such as Shenting-Baihui, Shenmen-Neiguan, Hegu-Taichong) is not a simple superposition of single acupoint effect, but a stronger and broader activation effect through the synergistic integration of brain functional networks.

First of all, the existing evidence is mostly derived from small sample and single-center exploration, and the baseline cognitive level and medication background of AD patients are quite different, which may affect the repeatability of the acupoint effect. Secondly, the core differences such as abnormal brain functional network basis and neuropathological changes in AD patients are ignored, which may lead to the misjudgment of acupuncture point-specific brain effects. In the future, we hope to carry out randomized controlled trials with multi-center, large sample and longitudinal follow-up, establish a standardized operation process of acupuncture group points, and rise from ' general observation of acupuncture effect ' to ' accurate observation of group point specific effect after deducting pathological and functional background noise '.

References:

[1]LI X L, YAO C L, WANG F, et al. Research Progress on Resting-State Functional Magnetic Resonance Imaging of Acupuncture Effects inAlzheimer's Disease[J]. Jilin Journal of Traditional Chinese Medicine,2021, 41(4): 549-551. DOI: 10.13463/j.cnki.jlzyy.2021.04.034.

[2]KANG Q. An fMRI Study on Brain Activation Areas Induced by Acupuncture at the Shenmen (HT 7) and Neiguan (PC 6) Acupoint Combination [D]. Harbin: Heilongjiang University of Chinese

Medicine, 2022. DOI: 10.27127/d.cnki.ghlzu.2021.000146.

[3]HAN S W, LI X L, WANG Y, et al. Progress in multimodal MRI research on acupuncture at Siguan point for thetreatment of mild cognitive impairment[J]. Chin J Magn Reson Imaging, 2024, 15(6):138-143. DOI: 10.12015/issn.1674-8034.2024.06.021.

[4]ZHENG W, SU Z, LIU X, et al. Modulation of functional activity and connectivity by acupuncture in patients with Alzheimer disease as measured by resting-state fMRI[J/OL]. PLoS ONE, 2018, 13(5):e0196933 [2026-01-30]. https://doi.org/10.1371/journal.pone.0196933.DOI: 10.1371/journal.pone.0196933.

CLINICAL OBSERVATION OF SCALP ACUPUNCTURE THERAPY ON POST-STROKE COGNITIVE IMPAIRMENT

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Abstract

This study employed a randomized controlled clinical trial to evaluate the clinical efficacy of scalp acupuncture therapy combining cluster needling of scalp points and acupuncture of the cognitive-affective region on post-stroke cognitive impairment (PSCI). Methods: A total of 70 patients with PSCI were enrolled and randomly divided into a medication group and a scalp acupuncture combination group at a 1:1 ratio using a random number table method, with 35 patients in each group. Both groups received routine conventional treatment. The medication group was given oral donepezil hydrochloride, while the scalp acupuncture combination group received scalp acupuncture therapy in addition to the medication given to the medication group. The acupuncture was applied to the nuchal region, pre-parietal region, frontal region, and cognitive-affective region, with a treatment course of 4 weeks. The Montreal Cognitive Assessment (MoCA) scale was used as the primary efficacy outcome, and the Mini-Mental State Examination (MMSE) and Modified Barthel Index (MBI) were used as secondary outcome measures to evaluate cognitive function and activities of daily living in both groups. Results: The total clinical effective rate was 71.43% in the medication group and 80.00% in the scalp acupuncture combination group, with a statistically significant difference ($P<0.05$). After treatment, the MoCA scores, MMSE scores, and MBI scores in both groups were significantly higher than those before treatment, with statistically significant differences ($P<0.05$), and the improvements in the scalp acupuncture combination group were significantly greater than those in the medication group ($P<0.05$). The study demonstrates that the addition of scalp acupuncture therapy to donepezil hydrochloride treatment can further improve cognitive function and activities of daily living in patients with PSCI, and yields a higher total clinical effective rate.

Keywords: Post-stroke cognitive impairment; scalp acupuncture therapy; cognitive function; clinical efficacy

Post-stroke cognitive impairment (PSCI) is one of the common neuropsychiatric complications following stroke, which may involve multiple cognitive domains including memory, attention, executive function, and language. In severe cases, it may further progress to post-stroke dementia[1,2]. Therefore, how to achieve early identification and effective intervention during the occurrence and development of PSCI has become an important issue that urgently needs to be addressed in the long-term management of stroke.

Objective

A randomized controlled clinical trial was conducted to evaluate the clinical efficacy of scalp acupuncture therapy combining cluster needling of scalp points and acupuncture of the cognitive-

affective region on post-stroke cognitive impairment.

Materials and methods

A total of 70 patients with PSCI were enrolled and randomly divided into a medication group and a scalp acupuncture combination group at a 1:1 ratio using a random number table method, with 35 patients in each group. Both groups received routine conventional treatment. The medication group was given oral donepezil hydrochloride, while the scalp acupuncture combination group received scalp acupuncture therapy in addition to the medication given to the medication group. The acupuncture was applied to the nuchal region, pre-parietal region, frontal region, and cognitive-affective region, with a treatment course of 4 weeks. The Montreal Cognitive Assessment (MoCA)and MBI scores in both groups were significantly higher than those before treatment, with statistically significant differences ($P<0.05$), and the improvements in the scalp acupuncture combination gr scale was used as the primary efficacy outcome, and the Mini-Mental State Examination (MMSE) and Modified Barthel Index (MBI) were used as secondary outcome measures to evaluate cognitive function and activities of daily living in both groups.

Results and discussion

The total clinical effective rate was 71.43% in the medication group and 80.00% in the scalp acupuncture combination group, with a statistically significant difference ($P<0.05$). After treatment, the MoCA scores, MMSE scores, oup were significantly greater than those in the medication group ($P<0.05$). Conclusion: The addition of scalp acupuncture therapy to donepezil hydrochloride treatment can further improve cognitive function and activities of daily living in patients with PSCI, and yields a higher total clinical effective rate.

References:

[1]LI P, XIN Y, LI C, et al. Blood-based biomarkers and neuroimaging for early detection of post-stroke cognitive impairment: current evidence and synergistic prospects[J/OL]. Front Neurol. 2025;16:1596940. Published 2025 Aug 6. DOI:10.3389/fneur.2025.1596940

[2]WANG K, DONG Q, YU J T, et al. Expert consensus on post-stroke cognitive impairment management 2021[J].Chinese Journal of Stroke,2021,16(4):14.DOI:10.3969/j.issn.1673-5765.2021.04.011.

AI-ENABLED NANODELIVERY FOR SINO-RUSSIAN TRADITIONAL MEDICINE SYNERGY IN ANTI-VIRAL PNEUMONIA RESEARCH

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Abstract

Nanodelivery technology combined with artificial intelligence (AI)-driven drug design and quality optimization offers a novel strategy for the modernization of traditional natural medicines. This paper reviews the research progress of Chinese and Russian traditional medicines in the treatment of viral pneumonia over the past three years.

Keywords: Viral pneumonia; Nanomaterials; Artificial intelligence; Sino-Russian; Smart medicine

The occurrence and progression of viral pneumonia involve complex processes including viral replication, inflammatory storm and immune imbalance [1]. Traditional Chinese medicine features the theoretical advantages of reinforcing healthy qi to eliminate pathogenic factors and holistic regulation. Russian traditional herbal medicines have long been used for the prevention and treatment of respiratory diseases. Representative plants such as Rhodiola rosea and Betula pendula are rich in natural active ingredients including salidroside and betulin, which exert potential antiviral and immunomodulatory effects. Artificial intelligence-assisted drug screening and machine learning-based prediction of nanoformulation properties have been gradually applied in the research and development of natural medicines, providing new technical support for Sino-Russian cooperation in smart medicine [2].

Objective

Based on literature retrieval, this review analyzes the application progress of artificial intelligence-driven nano-delivery systems in the prevention and treatment of viral pneumonia by Sino-Russian herbal medicines, focusing on precise delivery, therapeutic mechanisms and relevant issues of industrial development boosted by digitalization.

Materials and methods

Systematically retrieve relevant literature published from 2024 to 2026 in PubMed, Web of Science, Scopus and CNKI databases with keywords including “viral pneumonia”, “nanoparticles”, “artificial intelligence” and “traditional Chinese medicine”, and summarize and analyze nanodelivery platforms, antiviral mechanisms of natural drugs, artificial intelligence-assisted design and industrial transformation research.

Results and discussion

Intelligent nanodelivery platforms have greatly promoted the modern application of Sino-Russian traditional natural medicines in the treatment of viral pneumonia. Lipid-based carriers such as lipid nanoparticles and liposomes improve the stability and pulmonary delivery efficiency of

natural active ingredients including baicalin, glycyrrhizic acid, ginsenosides and botulin [3]. Polymeric nanoparticles like PLGA and chitosan realize sustained drug release and inflammatory microenvironment-responsive release, and inhalable nanozymes as well as biomimetic nanomaterials further enhance antiviral and immunomodulatory effects [4]. Nanodelivery systems can boost the bioavailability of natural medicines by 2-6 times and extend lung tissue retention time by 2-4 times, and inhalable nanocatalytic platforms reduce the lung tissue pathological injury score of mice with viral pneumonia by about 60% to markedly relieve inflammatory responses [5]. However, the modern development of Sino-Russian traditional natural medicines still faces challenges including inadequate standardization of active components, inconsistent cross-border quality evaluation systems and shortage of high-quality shared databases. In the future, it is necessary to build a joint Sino-Russian smart medicine research platform to integrate natural medicine databases, artificial intelligence algorithms and intelligent nanodelivery technologies.

Conclusion

AI-enabled intelligent nanodelivery technology provides a novel development model for the prevention and treatment of viral pneumonia with Sino-Russian traditional medicines, which can effectively improve the pulmonary delivery efficiency and antiviral efficacy of natural medicines. In the future, the establishment of Sino-Russian natural medicine databases, intelligent preparation design platforms and unified quality evaluation systems is expected to realize the digital upgrading of traditional medicines and promote the innovation and industrial integration of Sino-Russian smart medicine.

References:

1. Ferriero A M, Di Lella R, Farroni C, et al. Host-pathogen interaction in community-acquired pneumonia: a focus on the immune response. Frontiers in Cellular and Infection Microbiology, 2026, 16: 1731074.

2. Vora N, Shah S, Patel P, et al. Artificial intelligence and multi-omics in drug discovery: A deep learning-powered revolution. Cure & Care, 2025: 100011.

3. Prasher P, Sharma M, Fatima R, et al. Nanocarriers for lung health: ameliorating inflammation and cell aging using flavonoid-based nano nutrients. Immunopharmacology and Immunotoxicology, 2026, 48(2): 234-259.

4. Liu Y, Wu X, Su X, et al. Therapeutic Metal Ions: Engineering Biomaterials for Multimodal Disease Treatment[J]. International Journal of Nanomedicine, 2026: 603122.

5. B. Liu, O. A. Alimi, B. Stearnes, et al. “Engineering Resatorvid-Loaded Sub-Microgels of Epigallocatechin-3-gallate/Hyaluronic Acid to Treat Acute Lung Injury.” Advanced Healthcare Materials,2026, 15(21): e05916.

BACTERIAL OUTER MEMBRANE VESICLE NANOCARRIER-BASED INTEGRATION OF TRADITIONAL CHINESE AND RUSSIAN MEDICINE TO ENHANCE TUMOR THERAPY APPLICATIONS

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Abstract

Nanotechnology plays a crucial role in enhancing the therapeutic efficacy and delivery of traditional herbal medicines. This review highlights recent advances in smart bacterial outer membrane vesicle (OMV) nanocarriers for integrating Chinese and Russian herbal medicines. The review emphasizes computational-driven delivery platforms, ethnopharmacological modernization, and key translational and standardization challenges in tumor therapy.

Keywords: bacterial outer membrane vesicle, sino-Russian, drug delivery, tumor

Bacterial outer membrane vesicle (OMV) is promising natural nanocarrier for drug delivery. Integrating OMV nanotechnology with Traditional Chinese medicine (holistic regulation) and Russian herbal medicine (pharmacological orientation) offers a novel approach to phytotherapy. This platform overcomes common limitations like poor solubility, low bioavailability, and weak targeting. Due to their intrinsic immunogenicity, stability, and engineering flexibility, OMV improves drug stability and tumor targeting, bridging both medical systems. This review explores OMV-based integration strategies, their cancer therapy potential, and clinical translation challenges.

Objective

Analysis of the application of OMV nanocarriers in the integration of Chinese and Russian herbal medicine, with a focus on drug delivery, therapy, and clinical challenges.

Materials and methods

The review was conducted for the period 2024 to 2026 using PubMed, CNKI, and Web of Science databases on the application of OMV nanocarriers in herbal medicine from China and Russia. The key search terms included "bacterial outer membrane vesicles", "nanocarriers", "tumor", and related phrases. The selected studies were evaluated in terms of preparation methods, encapsulation efficiency, pharmacokinetics, therapeutic efficacy, and translational challenges.

Results and discussion

As a smart nanocarrier, OMV optimizes the delivery of Sino-Russian herbal compounds. Under the "digital empowerment" paradigm, bioinformatics and molecular docking increasingly drive synergistic formulation screening and precise surface engineering, accelerating traditional medicine modernization. Owing to their strong membrane fusion and tumor-targeting abilities, as well as their enrichment in pathogen-associated molecular patterns like LPS and lipoproteins, OMV can

simultaneously enable drug delivery and immune activation via pathways such as TLR4/NF-κB. In tumor models, OMV-based systems have shown potent antitumor effects. In H22 hepatocellular carcinoma-bearing mice, OMV-loaded glycyrrhizic acid achieved a 75% tumor inhibition rate compared with 40% for free drug [3]. In a 4T1 breast tumor model, engineered OMV achieved 61% tumor inhibition, with 3-fold and 2.5-fold increases in IFN-γ and TNF-α, respectively [4]. Mechanistically, OMV enhances dendritic cell maturation ($CD80^+/CD86^+$ up to 4-fold) and promote expansion of IFN-γ^+ $CD8^+$ T cells, thereby strengthening sustained antitumor immune responses [5].

Conclusion

OMV nanocarriers provide an intelligent platform for Sino-Russian herbal integration, overcoming solubility and targeting limits via immune activation. This intersection of digital formulation design and nanotechnology drives "tradition renewal," pioneering biopharmaceutical innovation and industrial integration in modern oncology.

References:

1. Zahid A., Ismail H., Wilson J. C., & Grice I. D. (2025) Bioengineering Outer-Membrane vesicles for vaccine development: Strategies, Advances, and perspectives. Vaccines, 13(7), 767.

2. Goyal M. R. (2024) Holistic approach of nutrients and traditional natural medicines for human health: a review. Future Integrative Medicine, 3(3), 197-208.

3. Zhang J., Zhi Y., Lu Y., & Ma, F. (2026). Outer membrane vesicles as a versatile nanoplatform for advanced vaccine development and immunotherapy. Frontiers in Immunology, 17, 1707391.

4. Zhao, Z., Luo, L., Wang, Z., Guo, B., & Gao, C. (2025). Biomimetic "Trojan Horse" delivery of traditional Chinese medicine with immunogenic hybrid vesicles of bacterial outer membrane and tumor cell membrane for synergistic chemo-immunotherapy of liver cancers. Materials Today Bio, 102251.

5. Chen, X., Li, P., Luo, B., Song, C., Wu, M., Yao, Y., & Hu, J. (2024). Surface mineralization of engineered bacterial outer membrane vesicles to enhance tumor photothermal/immunotherapy. Acs Nano, 18(2), 1357-1370.

ARTIFICIAL INTELLIGENCE-DRIVEN DIAGNOSIS AND NANOCARRIER-BASED PERSONALIZED THERAPY IN CHINESE AND RUSSIAN TRADITIONAL MEDICINE

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Abstract

Artificial intelligence (AI) and nanotechnology play important roles in modernizing traditional medicine. This article reviews recent advances in AI-driven diagnosis and nanocarrier-based personalized therapy in Chinese and Russian traditional medicine, emphasizing diagnostic strategies, therapeutic efficacy, and clinical challenges.

Keywords: Artificial intelligence; Nanocarriers; Personalized therapy; Traditional medicine; Sino-Russian cooperation

Artificial intelligence (AI) and nanotechnology have emerged as transformative tools for precision traditional medicine. The integration of Chinese and Russian traditional medicine through AI-driven diagnosis and nanocarrier-based therapy provides a novel approach to intelligent phytomedicine[1]. While Chinese traditional medicine emphasizes syndrome differentiation and holistic regulation, Russian traditional medicine combines empirical herbal knowledge with evidence-based pharmacology[2]. Both systems face challenges in diagnostic standardization, personalized treatment, and drug delivery. This work explores AI-assisted diagnosis, nanocarrier-based personalized therapy, and the clinical challenges of integrating Chinese and Russian traditional medicine systems.

Objective

AI-driven diagnosis and nanocarrier-based personalized therapy in Chinese and Russian traditional medicine are analyzed, focusing on precision diagnosis, therapeutic efficacy, and clinical challenges.

Materials and methods

A systematic literature review was conducted using publications from 2024 to 2026 retrieved from PubMed, Web of Science, and CNKI databases. Search terms included “artificial intelligence”, “nanocarriers”, “personalized therapy”, “Chinese medicine”, and “Russian herbal medicine”. Selected studies were evaluated for diagnostic accuracy, therapeutic efficacy, and translational potential.

Results and discussion

AI and nanocarrier technologies have significantly advanced the modernization of Chinese and Russian traditional medicine, enabling more accurate diagnosis and personalized therapies. AI-based platforms integrating clinical, imaging, metabolomic, and genomic data have achieved

diagnostic accuracies exceeding 85% in chronic inflammatory, metabolic, and neurodegenerative diseases, while machine learning-assisted syndrome differentiation and prescription optimization have improved individualized treatment[3]. Meanwhile, nanocarrier systems, including lipid nanoparticles, liposomes, polymeric nanoparticles, and mesoporous silica nanoparticles, have enhanced the delivery of bioactive compounds such as ginsenosides, salidroside, artemisinin, berberine, and betulin[4]. These nanoplatforms have demonstrated improved bioavailability, sustained release, and targeted delivery. AI-guided optimization of nanocarrier design has further enabled intelligent personalized therapy systems. Preclinical studies showed that AI-assisted nanomedicine increased drug delivery efficiency by over 60% and improved therapeutic outcomes in cardiovascular, neurodegenerative, oncological, and aging-related diseases[5]. However, clinical translation remains limited by insufficient standardization, regulatory disparities, and inadequate databases. Future progress requires strengthened Sino-Russian collaboration and the development of AI-driven smart nanocarriers for precision traditional medicine.

Conclusion

The combination of AI-driven diagnosis and nanocarrier-based personalized therapy provides a promising strategy for modernizing Chinese and Russian traditional medicine. This interdisciplinary approach may facilitate precision phytotherapy while promoting international cooperation and the global development of traditional medicine.

References:

1. Yu, W., et al., Traditional Chinese Medicine Modernization in Diagnosis and Treatment: Utilizing Artificial Intelligence and Nanotechnology. MedComm, 2026. 7(2): p. e70596.

2. Wu, J., et al., Artificial intelligence in Traditional Chinese Medicine herbs: a survey. Artificial Intelligence Review, 2026. 59(4): p. 120.

3. Liu, Y. and B. Wang, Advanced applications in chronic disease monitoring using IoT mobile sensing device data, machine learning algorithms and frame theory: a systematic review. Frontiers in Public Health, 2025. 13: p. 1510456.

4. Najafi, F., et al., Advancement in nanocarrier-mediated delivery of herbal bioactives: from bench to beside. Natural Products and Bioprospecting, 2025. 15(1): p. 1-54.

5. Stanciu, G.-D., et al., Smart drug-delivery approaches for enhanced management of comorbid conditions in Alzheimer's disease. Life, 2026. 16(3): p. 510.

MECHANISM OF MASSA MEDICATA FERMENTATA IN ANTIDIARRHEAL BASED ON GUT MICROBIOTA AND NETWORK PHARMACOLOGY

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Abstract: This study investigated the antidiarrheal effects of crude and processed Massa Medicata Fermentata (MMF) in acute diarrhea mice and explored the underlying mechanisms via network pharmacology and 16S rRNA gene sequencing. Network pharmacology predicted that MMF regulates inflammatory responses via NF-κB and Toll-like receptor pathways. An acute diarrhea mouse model was established by Escherichia coli injection. Mice were treated with crude or bran-fried MMF at low or high doses for 7 days. The bran-fried high-dose group significantly reduced serum TNF-α, IL-1β and IL-6 levels, alleviated histopathological damage in duodenum and colon, and restored gut microbial diversity and composition. These findings demonstrate that MMF exerts antidiarrheal effects through anti-inflammatory activity, gut microbiota remodeling, and modulation of related signaling pathways, providing experimental evidence for its clinical application.

Keywords: Massa Medicata Fermentata, acute diarrhea, network,pharmacology, inflammation

Introduction: Acute diarrhea is a common gastrointestinal disorder characterized by increased stool frequency and watery stools, often resulting from intestinal infection, inflammation, or dysbiosis. Current clinical management mainly relies on antibiotics and symptomatic supportive therapy; however, due to the growing concerns over antibiotic resistance and adverse drug reactions, traditional Chinese medicines have attracted increasing attention. MMF (known as "Liu Shen Qu"), also known as “Shenqu” or “Liuqu” in Chinese, is a traditional medicinal agent widely used for treating disorders of the spleen and stomach, particularly spleen deficiency with impaired transportation function, as well as cholera-like vomiting and diarrhea. It is produced by fermenting a mixture of wheat flour and various herbal medicines with microorganisms. Nevertheless, its specific antidiarrheal mechanism in acute diarrhea has not been systematically investigated, and comparative pharmacodynamic studies between the crude and processed forms of MMF remain lacking. In this context, the present study integrated network pharmacology with animal experiments to systematically elucidate the antidiarrheal mechanisms of both crude and processed MMF, with a focus on gut microbiota modulation and inflammatory regulation.

Objective: To investigate the effects of crude and processed MMF on gut microbiota and inflammation in a mouse model of diarrhea based on network pharmacology.

Materials and methods: Network pharmacology analysis was performed to explore the potential mechanisms of MMF in the treatment of acute diarrhea. For the in vivo study, a mouse model of acute diarrhea was established. The normal blank group (K) received sterile water by gavage, while the model group was injected with Escherichia coli at a dose of 0.2 mL per 20 g body weight. After successful modeling, the mice were randomly divided into six groups: model (M), positive drug

(Y), raw product low-dose (SD), raw product high-dose (SZ), bran-fried product low-dose (FD), and bran-fried product high-dose (FZ). The normal and model groups were given sterile water by gavage, whereas the SD, SZ, FD, and FZ groups were administered corresponding doses of MMF (raw or bran-fried) by gavage for 7 consecutive days. At the end of the intervention, blood samples were collected from all groups for the determination of inflammatory cytokine levels (IL-1β, IL-6, and TNF-α). Duodenal and colorectal tissues were harvested for H&E staining and histopathological evaluation, and the small intestinal mucosal microbiota were collected for high-throughput 16S rRNA gene sequencing.

Results and discussion: Network pharmacology analysis revealed that the signaling pathways through which MMF exerts its therapeutic effects against acute diarrhea are primarily involved in the regulation of inflammatory responses, as well as the NF-κB and Toll-like receptor signaling pathways. Compared with the normal group, the model group showed extremely significant decreases in body weight and food intake ($P < 0.005$). Serum levels of TNF-α and IL-1β were extremely significantly elevated ($P < 0.005$), and IL-6 level was significantly increased ($P < 0.01$) in the model group. Histopathological examination revealed marked tissue damage in the model group: the duodenal tissues exhibited extensive separation between the intestinal villous epithelium and the lamina propria with enlarged intercellular spaces, abundant and densely packed intestinal glands, and small focal lymphocytic infiltration in the lamina propria. The colonic tissues showed locally irregular arrangement, mild mucosal epithelial shedding, relatively numerous goblet cells, and occasional punctate lymphocytic infiltration in the lamina propria and submucosa.

Furthermore, in the model group, the relative abundances of Lactobacillus murinus, bacterium Muribaculaceae、Bacteroidales bacterium Muribaculaceae were extremely significantly decreased compared with the normal group, whereas those of Enterococcus, Clostridium sp. ND2, Streptococcus, and Bacillus anthracis were extremely significantly increased, indicating a severe intestinal infection and an altered gut microbial community structure. Compared with the model group, all MMF treatment groups ameliorated the above abnormalities to varying degrees. Among them, the high-dose bran-fried MMF group exhibited the most favorable overall regulatory effects on inflammatory responses, histopathological damage, and gut microbiota composition.

Conclusion: In conclusion, both crude and processed MMF could regulate serum inflammatory cytokine levels, ameliorate tissue damage, restore gut microbiota composition, modulate the abundance of dominant bacterial taxa, and improve the diversity and richness of the gut microbiota in mice with acute diarrhea to varying degrees. The therapeutic effects of bran-fried MMF were superior to those of the crude form. These findings suggest that MMF exerts its antidiarrheal action by attenuating inflammatory responses, remodeling the gut microbial community, and activating relevant signaling pathways, thereby providing experimental evidence for its clinical application and the treatment of acute diarrhea.

DIGITAL INTELLIGENCE NAVIGATING HERBAL RENEWAL: TCM INNOVATION AND INDUSTRIAL INTEGRATION IN CHINA–RUSSIA SMART MEDICINE

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Abstract

This study investigates TCM innovation and industrial integration in China–Russia smart medicine cooperation, framed by digital empowerment and traditional renewal. Through policy review, case analysis, and comparative regulatory study, it identifies three integration models—cross-border trade, industry-chain embedding, and technology localisation—and four digital empowerment dimensions: intelligent diagnosis, knowledge inheritance, remote services, and smart hospital management. Cooperation has evolved from spontaneous exchanges to strategic multi-stakeholder engagement, yet faces barriers like data standard divergence, intellectual property issues, and cross-border payment restrictions. Digital transformation offers a strategic opportunity for TCM globalisation, and the study recommends standard harmonisation, regulatory coordination, and digital infrastructure investment to deepen bilateral health partnerships.

Keywords: Traditional Chinese Medicine (TCM); China–Russia cooperation; smart medicine; digital empowerment; industrial integration.

Objectives

1.To map the policy framework and practical landscape of China–Russia smart medicine cooperation.

2.To identify specific pathways through which digital technologies (AI, big data, cloud) empower
3.To explore the models and mechanisms of cross-border TCM industrial integration (trade, supply chain, technology localisation).

4.To propose actionable strategies for deepening cooperation, addressing current bottlenecks.

Materials and Methods

Materials include official bilateral policy documents, joint statements, case reports from key projects (e.g., Dongfang Hospital's St. Petersburg Center, Xinjiang cross-border digital platform, Altai cultivation project), and academic publications.

Methods combine: (a) systematic literature review of policy and academic sources; (b) in-depth case analysis of representative cooperation projects across service, investment, and R&D types; (c) comparative analysis of regulatory and standard differences between China and Russia[1]; and (d) optional field visits to Heilongjiang border ports for first-hand data.

Results and Discussion

China–Russia TCM cooperation has evolved from ad-hoc border exchanges to systematic collaboration under the Belt and Road, now entering a strategic phase integrating digital health and traditional medicine [1]. The 2026–2027 Year of Education and platforms like the Medical University Alliance (20+ joint labs) facilitate talent and institutional support. However, translating top-down policy into sustainable industrial practice remains challenging [2].

Digital technologies empower TCM in four ways: AI-driven diagnostics (e.g., pulse devices and the Qihuang acupuncture model [3]), big-data mining of expert knowledge, cross-border telemedicine, and smart hospital management [4]. These offer a "curve-overtaking" chance for globalisation without sacrificing tradition, but data standard divergence and cross-border flow restrictions persist.

Three industrial integration models are identified: cross-border service trade (e.g., Tongjiang health tourism), industry-chain embedding (e.g., the 80-billion-rouble Altai cultivation project), and technology localisation (the R&D-adaptation-production chain advocated by Yang [5]). These reflect a progression from shallow trade to deep value-chain integration. Key barriers remain: standard mutual recognition, IP protection, and cross-border payments. Future priorities should include standard alignment and infrastructure development.

Conclusion

This study demonstrates that China–Russia smart medicine cooperation has evolved into a multi-stakeholder, policy-driven, and technologically enabled system. Digital technologies are transforming TCM across four functional areas, while industrial integration moves toward higher value-added segments. The synergy between digital empowerment and traditional renewal not only facilitates TCM's internationalisation but also serves as a practical intersection of the Digital Silk Road and the Healthy Silk Road[5]. To overcome existing barriers, concerted efforts in standard harmonisation, regulatory coordination, and digital infrastructure are essential. Future research may further investigate data governance, cross-border product registration, and equitable access to digital health benefits.

References:

1.World Federation of Chinese Medicine Societies (WFCM). "Belt and Road" TCM Forum (2025 Moscow) successfully held in Russia [EB/OL]. (2025-07-18)
2.Tongjiang Municipal People's Government. Visa-free extension to 2027: Tongjiang TCM health tourism builds a "health bridge" between China and Russia [EB/OL]. (2026-05-25).
3.Dongfang Hospital, Beijing University of Chinese Medicine. TASS publishes an exclusive interview with Party Secretary Han Zhenfu of Dongfang Hospital on digital TCM cooperation [EB/OL]. (2025-12-02).
4.National Administration of Traditional Chinese Medicine. Reply letter to the Proposal No. 02295 of the Third Session of the 14th National Committee of the Chinese People's Political Consultative Conference on smart TCM pilot programmes [EB/OL]. (2025-12-01).
5.Heilongjiang News Network. Yang Baofeng: Creating a "China-Russia solution" for medical cooperation [EB/OL]. (2026-06-12).6.Song Jiaduo. Analysis of the Current Status and Prospects of China Russia Medical Health Industry Cooperation[J]. Eurasian Economy, 2025.

CROSS-LANGUAGE KNOWLEDGE GRAPH CONSTRUCTION AND DIGITAL STANDARD MUTUAL RECOGNITION OF TRADITIONAL CHINESE MEDICINE AND SIBERIAN FOLK MEDICINE FOR CHINA-RUSSIA SMART MEDICAL INTEGRATION

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Abstract

Digitalization boosts China-Russia medical integration, but fragmented data and inconsistent terms hinder cross-border cooperation[1-2]. Reviewing 2021–2026 studies reveals gaps in integrated bilingual platforms[3-4], scarce annotated corpora, metadata mismatches, and privacy conflicts[5]. We propose joint knowledge graphs, unified metadata, and alliance chains to support SCO smart pharma collaboration[6-7].

Keywords: Traditional medicine knowledge graph; bilingual terminology alignment; China-Russia smart medicine; digital standard mutual recognition; cross-border medical data security

China and Russia's Far East have complementary TCM resources[8]. China built digital TCM systems and datasets[3]; Russia built cold-region herbal databases[7]. Yet standard mismatches hinder cross-border cooperation. Reviews neglect cross-lingual fusion and unified standards.

Objective

This study summarizes progress of TCM and Siberian folk digital systems, reviews alignment tech, analyzes sharing constraints, and proposes cross-language knowledge graphs and mutual digital standard recognition to break China-Russia data islands and support smart medicine integration[6].

Materials and methods

Retrieved from CNKI, WoS, Scopus, CyberLeninka (2021–2026) with trilingual keywords on knowledge graphs, herbal databases, and cross-border rules. Included peer-reviewed and policy docs on China–Russia digitalization; excluded trials and trade. PRISMA guided collection of frameworks, standards, and cases.

Results and discussion

Chinese scholars built TCM graphs for AI diagnosis/pharmacology; Russian researchers created fragmented Siberian herbal/pulse databases with no unified metadata[7]. Existing translation/alignment models cover common herbs; scarce annotated corpora for cold-region unique syndromes/plants lower cross-system precision.

Divergent Sino-Russian privacy laws restrict data transmission and herbal formula IP, with no

bilateral accord[4]. Bilingual pilots fail on an industrial scale. Effective solutions: shared corpus, SCO metadata standards, and alliance-chain platforms.

Conclusion

Cross-language knowledge graphs and unified digital standards underpin China-Russia smart medical integration. Technical, standard, and policy barriers hinder data exchange between TCM and Siberian folk medicine. Joint Sino-Russian institutions shall build cold-region bilingual datasets, unify digital codes, and sign cross-border data pacts to realize full digitalization of herbal planting, intelligent diagnosis, and cross-border healthcare industries.

References:

[1] Yu T, Li J, Yu Q, Tian Y, Shun X, Xu L, Zhu L, Gao H. Knowledge graph for TCM health preservation: Design, construction, and applications. Artif Intell Med. 2017 Mar;77:48-52.

[2] Benis A, Grosjean J, Billey K, Montanha G, Dornauer V, Crişan-Vida M, Hackl WO, Stoicu-Tivadar L, Darmoni SJ. Medical informatics and digital health multilingual ontology (MIMO): A tool to improve international collaborations. Int J Med Inform. 2022 Nov;167:104860.

[3] Zhang B, Li R, Yin K, Hua S, Li S, Jiang M, An H, Li P. Construction and Application of Traditional Chinese Medicine Knowledge Graph Based on Large Language Model. Interdiscip Sci. 2026 Jun;18(2):734-746.

[4]Liu S, Yang S, Wang Y, Yang C, Wang C, Xu M. A Blockchain-Based Medical Electronic Health Record Big Data Sharing Scheme. Stud Health Technol Inform. 2025 Aug 7;329:1606-1607.

[5] Yao Y, Yang F. Overcoming personal information protection challenges involving real-world data to support public health efforts in China. Front Public Health. 2023 Sep 22;11:1265050.

[6]Duan Y, Zhou Q, Li Y, Qin C, Wang Z, Kan H, Hu J. Research on a traditional Chinese medicine case-based question-answering system integrating large language models and knowledge graphs. Front Med (Lausanne). 2025 Jan 7;11:1512329.

[7] Wang Z, Wang L, Xiao F, Chen Q, Lu L, Hong J. A Traditional Chinese Medicine Traceability System Based on Lightweight Blockchain. J Med Internet Res. 2021 Jun 21;23(6):e25946.

[8] Ionov N, Druzhilovskiy D, Filimonov D, et al. Phyto4Health: Database of Phytocomponents from Russian Pharmacopoeia Plants. Journal of Chemical Information and Modeling, 2023, 63(19):5892-5901.

RESEARCH PROGRESS ON THE REGULATORY MECHANISMS OF TRADITIONAL CHINESE MEDICINE IN THE IMMUNE MICROENVIRONMENT OF UTERINE FIBROIDS BASED ON NETWORK PHARMACOLOGY

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Abstract

Uterine leiomyoma, the most common benign tumor of the female reproductive tract, has high incidence and postoperative recurrence, imposing a burden on reproductive health. The immunosuppressive microenvironment, driven by M2 macrophages and NK cells, promotes collagen deposition and ECM accumulation, facilitating tumor progression. Network pharmacology is a powerful tool for studying TCM's multi-component, multi-target holistic regulation in remodeling the fibroid immune microenvironment. This review delineates the underlying immune mechanisms and network pharmacology applications. Using a "disease–target–component–herb" framework, we predict bioactive compounds, therapeutic targets, and signaling pathways, providing a theoretical foundation for TCM mechanism elucidation and precision therapy.

Keywords: Uterine fibroids; Immune microenvironment; Network pharmacology; Multi-target; Signaling pathways; Traditional Chinese Medicine

Objective

This study aims to systematically elucidate the key mechanisms of the immune microenvironment in the initiation and progression of uterine fibroids, and to summarize the application value of network pharmacology in predicting TCM active ingredients, targets, and signaling pathways. This not only provides a theoretical foundation for developing TCM therapies that target the immune microenvironment but also facilitates the precise clinical application of TCM in the management of uterine fibroids.

Materials and Methods

The tumor immune microenvironment is a complex regulatory network composed of immune cells, cytokines, and extracellular matrix (ECM). Under normal conditions, it maintains immune surveillance and tissue homeostasis; in fibroids, this balance is disrupted, manifesting as an increase in M2 macrophages, myeloid-derived suppressor cells (MDSCs), and Th17 cells, along with a decrease in $CD3^+/CD4^+$ T cells, collectively promoting fibroid growth and fibrosis [1]. In recent years, network pharmacology has demonstrated significant advantages in TCM research. Systematic searches were performed in PubMed, CNKI, and WanFang databases to screen relevant

TCM components and targets, and a "component–target–pathway" network model was constructed. Active components from herbs such as Paeoniae Rubra Radix (Chishao), Sparganii Rhizoma (Sanleng), Curcumae Rhizoma (Ezhu), Terminaliae Chebulae Fructus (Hezi), and Lycium barbarum polysaccharide have been shown to inhibit fibroid cell proliferation and remodel the immune microenvironment by targeting PI3K/Akt, ESR1, EGFR, PTGS2, MMP9, and Wnt5b/β-catenin signaling pathways, as well as the COX2/PGE2 axis. Compound formulas, such as Guizhi Fuling Pills and Lichong Decoction, modulate T-lymphocyte function and suppress inflammatory responses via MAPK, IL-12p70, IL-1β, IL-6, and GRO/KC signaling pathways. These findings collectively establish TCM as a promising multi-target therapeutic strategy for uterine fibroids [2-5].

Results and Discussion

With its multi-target intervention advantages, TCM exhibits unique potential in remodeling the immunosuppressive microenvironment of uterine fibroids. However, further in-depth studies are still needed to strengthen the evidence-based support for its clinical application.

References

[1] Saad EE, Michel R, Borahay MA. Immunosuppressive tumor microenvironment and uterine fibroids: Role in collagen synthesis. Cytokine Growth Factor Rev. 2024 Feb;75:93-100. doi: 10.1016/j.cytogfr.2023.10.002. Epub 2023 Oct 6. PMID: 37839993; PMCID: PMC10922281.

[2] Li BX, Chen YH, Li SL, et al. Research progress on the mechanisms of traditional Chinese medicine regulating signaling pathways related to uterine fibroids. China Journal of Chinese Materia Medica, 2025, 47(12):4028-4033. (in Chinese)

[3] Cao XQ, Li W, Zhao XQ, et al. Mechanism of Paeoniae Rubra Radix in treating uterine fibroids based on network pharmacology and experimental verification. Chinese Journal of Dialysis and Artificial Organs, 2025, 36(4):75-80. (in Chinese)

[4] Zhu CL, Zhang T. Mechanism of Sanleng-Ezhu-Danshen in treating uterine fibroids based on network pharmacology, molecular docking and molecular dynamics. Shanxi Journal of Traditional Chinese Medicine, 2025, 41(11):62-64+68+71. DOI:10.20002/j.issn.1000-7156.2025.11.025. (in Chinese)

[5] Zhang L, Zhao Q. Mechanism of Guizhi Fuling Pills in treating uterine fibroids based on network pharmacology. China Modern Doctor, 2026, 64(9):52-56. (in Chinese)

REVEALING THE MOLECULAR MECHANISM OF THE FERROPTOSIS REGULATORY NETWORK IN AMYOTROPHIC LATERAL SCLEROSIS AND TARGETED TRADITIONAL CHINESE MEDICINE BASED ON MULTI-OMICS AND MACHINE LEARNING

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Abstract

Amyotrophic lateral sclerosis (ALS) is a lethal neurodegenerative disease whose molecular mechanisms and therapeutic targets have yet to be fully elucidated. In recent years, the discovery of the ferroptosis regulatory network has provided a new perspective for understanding ALS mechanisms, making it necessary to systematically screen for ferroptosis-related characteristic genes in ALS and explore potential traditional Chinese medicine (TCM) interventions. This study, based on the ferroptosis regulatory network, integrated transcriptomic data with ensemble machine learning algorithms. Differential expression analysis was performed on the GSE112676 dataset and intersected with the ferroptosis gene set. Through five machine learning algorithms—LASSO, SVM-RFE, RF, GBM, and XGBoost—12 potential characteristic genes (EIF2AK4, PROK2, PEX2, ATG3, PIEZO1, TLR4, TFAM, DUSP1, LYRM1, FAR1, TBK1, MMD) were identified and validated for diagnostic performance in independent validation datasets. Further gene set enrichment analysis, immune infiltration analysis, protein-protein interaction (PPI) network analysis, and KEGG pathway analysis revealed that the EIF2AK4-TLR4-PEX2 axis integrates stress response, neuroinflammation, and lipid metabolic dysregulation to synergistically drive ferroptosis. Network pharmacology results indicated that the main active components of Panax notoginseng, Schisandra chinensis, Panax ginseng, Astragalus membranaceus, and Artemisia annua in regulating ALS ferroptosis are stigmasterol, quercetin, and kaempferol. This study constructed, for the first time, a multidimensional regulatory network of ferroptosis-related genes in ALS, innovatively proposed a 12-gene combined model as an early diagnostic biomarker, and revealed an autophagy-ferroptosis cross-regulatory axis and a ferroptosis-immune metabolism positive feedback loop, laying a theoretical foundation for elucidating ALS pathology and developing multi-target precision therapeutic strategies.

Keywords: Amyotrophic lateral sclerosis; Ferroptosis; Machine learning; Bioinformatics analysis; Feature gene; Traditional Chinese medicine

Objective

This study aims to systematically screen ferroptosis-related characteristic genes in ALS and explore potential TCM for its prevention and treatment based on the ferroptosis regulatory network, transcriptomic data, and integrated machine learning algorithms.

Materials and methods

Differential expression analysis was performed on the GSE112676 dataset and intersected with ferroptosis genes from the FerrDb platform. Five machine learning algorithms (LASSO, SVM-RFE, RF, GBM, XGBoost) were used to screen potential feature genes, which were validated in independent datasets (GSE112680, GSE68607). Subsequent analyses included GSEA, immune infiltration, PPI network, KEGG pathway, and network pharmacology.

Results and discussion

Twelve feature genes (EIF2AK4, PROK2, PEX2, ATG3, PIEZO1, TLR4, TFAM, DUSP1, LYRM1, FAR1, TBK1, MMD) were identified with excellent diagnostic performance. Functional enrichment revealed links to autophagy, FoxO, TNF signaling, and oxidative phosphorylation. Immune infiltration analysis indicated immune microenvironment imbalance. The EIF2AK4-TLR4-PEX2 axis was found to integrate stress response, neuroinflammation, and lipid metabolism disorders to drive ferroptosis. Network pharmacology showed that stigmasterol, quercetin, and kaempferol from Panax notoginseng, Schisandra chinensis, Panax ginseng, Astragalus membranaceus, and Artemisia annua are the main active components regulating ferroptosis in ALS.

In conclusion, This study constructed a multidimensional ferroptosis regulatory network in ALS, proposed a 12-gene combined model as an early diagnostic biomarker, revealed the autophagy-ferroptosis cross-regulatory axis and ferroptosis-immune metabolism positive feedback loop, and identified potential traditional Chinese medicines and active ingredients for ALS treatment.

References:

1. Xiao, X., Li, M., Ye, Z., et al., 2024, FUS gene mutation in amyotrophic lateral sclerosis: a new case report and systematic review. Amyotroph Lateral Scler Frontotemporal Degener 25(1-2), 11-15.

2. Chua, J.P., De Calbiac, H., Kabashi, E., et al., 2022, Autophagy and ALS: mechanistic insights and therapeutic implications. Autophagy 18(2), 254-282.

3. Chen, X., Yu, C., Kang, R., et al., 2021, Cellular degradation systems in ferroptosis. Cell Death Differ 28(4), 1135-1148.

4. Mcgill, R.B., Steyn, F.J., Ngo, S.T., et al., 2022, Monocyte CD14 and HLA-DR expression increases with disease duration and severity in amyotrophic lateral sclerosis. Amyotroph Lateral Scler Frontotemporal Degener 23(5-6), 430-437.

TOWARDS AN AGILE REGULATORY FRAMEWORK FOR MEDICAL AI AND HEALTH DATA INTEROPERABILITY STANDARDS

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Abstract

AI and health data interoperability standards are accelerating smart pharmaceutical innovation, yet current regulations remain inadequate for addressing AI-related risks and interoperability challenges. This study analyzes these regulatory gaps and proposes a Total Product Life Cycle (TPLC) framework integrating China's NMPA pathways with international regulatory approaches. The model aims to support innovation while ensuring effective risk management and patient safety.

Keywords: Agile Regulation, Medical AI, FHIR Standard, Total Product Life Cycle, Semantic Interoperability

The rapid digitization of contemporary healthcare systems establishes advanced medical Artificial Intelligence (AI) and clinical data interoperability as core foundations of pharmaceutical innovation [1,2]. Yet, traditional static review methodologies fail when applied to complex, evolving algorithmic architectures [2,3]. While technical frameworks successfully structure data exchange formats, clinical translation remains blocked by a regulatory divide [4]. This paper evaluates the structural barriers generated by fragmented data standards and adaptive learning protocols, establishing a path toward an agile, lifecycle-based regulatory framework [2,3,5].

Objective

This study aims to construct a dynamic, Total Product Life Cycle (TPLC) regulatory model that resolves semantic interoperability gaps and proprietary data silos while facilitating safe, continuous optimization of adaptive clinical AI software.

Materials and methods

This study conducts a comparative analysis of health IT standards and medical AI regulations. Evidence was collected from China's NMPA and CDE policies, EHR interoperability research, and international frameworks such as the EU AI Act and the US FDA SaMD program.

Results and discussion

Clinical implementation reveals persistent challenges in data interoperability and AI regulation [1,4]. Although standards such as FHIR improve syntactic interoperability, semantic interoperability remains limited by inconsistent terminologies and vendor lock-in, resulting in fragmented datasets and restricted generation of real-world evidence (RWD) [1,5]. In addition, traditional pre-market approval models are poorly suited to adaptive AI systems because algorithm updates often require repeated regulatory review, slowing innovation and deployment [2].

To address these challenges, regulatory agencies are adopting more flexible approaches. China's NMPA has introduced accelerated pathways to support innovation while maintaining post-market oversight [5]. Similarly, the US FDA's Predetermined Change Control Plans and the EU AI Act's risk-based framework and regulatory sandboxes provide mechanisms for managing adaptive AI systems throughout their lifecycle [2,3]. Achieving digital maturity will require stronger semantic interoperability, open data standards, and lifecycle-based regulatory governance to balance innovation, safety, and clinical effectiveness.

References:

1. Osamika D. et al. A Critical Review of Health Data Interoperability Standards: FHIR, HL7, and Beyond // World Scientific News. – 2025. – Vol. 203. – P. 194–233.

2. Palaniappan K., Lin E. Y. T., Vogel S. Global Regulatory Frameworks for the Use of Artificial Intelligence (AI) in the Healthcare Services Sector // Healthcare. – 2024. – Vol. 12, № 5. – P. 562.

3. Meszaros J., Minari J., Huys I. The future regulation of artificial intelligence systems in healthcare services and medical research in the European Union // Front. Genet. – 2022. – Vol. 13. – P. 927721.

4. Adegoke K. et al. Interoperability in Digital Healthcare: Enhancing Consumer Health and Transforming Care Systems. – Public Health and Healthcare, 2025.

5. Tang L. et al. Impact of China's Drug Regulatory Reforms on the Development of Anti-Tumor Drugs // Cancer Commun. – 2026. – Vol. 46. – P. 0032.

MERIDIAN-BRAIN MAPPING WITH ELECTROACUPUNCTURE AND TUINA FOR TASK-SPECIFIC FOCAL HAND DYSTONIA

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Abstract

Task-specific focal hand dystonia is an uncommon movement disorder in which skilled hand activity triggers involuntary postures and loss of fine control. Because the disorder involves abnormal sensorimotor integration, acupuncture and tuina should be designed as structured neuromodulatory rehabilitation rather than nonspecific relaxation. This paper proposes a meridian-brain mapping protocol combining electroacupuncture, scalp stimulation, tuina and digital task recording.

Keywords: focal hand dystonia, electroacupuncture, tuina, meridian-brain mapping, neurorehabilitation, sensorimotor integration

Dystonia is characterized by sustained or intermittent muscle contractions causing abnormal movement or posture. It may be focal, task-specific and worsened by voluntary action [1]. Writer's cramp and musician's dystonia are typical examples. Current pathophysiology emphasizes deficient inhibition, abnormal plasticity and disturbed sensory-motor processing across cortical, basal ganglia, cerebellar and spinal networks [2].

For acupuncture and tuina, this network concept is important. A hand-only treatment may miss the central organization of the disorder, whereas a brain-only treatment may ignore peripheral proprioceptive overload and maladaptive task habits. Brain imaging studies show that acupuncture can influence sensorimotor and salience-related regions [3]. Therefore, a modern protocol should map the symptomatic task, the involved meridians and the likely brain network together.

Objective

To propose a digital meridian-brain mapping protocol using electroacupuncture and tuina for task-specific focal hand dystonia, with emphasis on reproducibility, safety and measurable rehabilitation outcomes.

Materials and methods

The protocol is designed for adults with clinically suspected focal hand dystonia after neurological evaluation. Red flags such as acute weakness, stroke, Parkinsonism, drug-induced dystonia and cervical myelopathy should be excluded or referred. Baseline mapping includes a standardized video of the triggering task, patient-rated disability, writing or instrument-performance sample, surface electromyography when available and a body map of pain, stiffness and sensory tricks.

The acupuncture module has three layers. The brain layer uses Baihui (GV20), Sishencong (EX-HN1), Fengchi (GB20) and scalp motor-sensory areas related to the upper limb. The meridian layer focuses on Large Intestine, Triple Energizer and Pericardium channels, using Hegu (LI4), Quchi

(LI11), Shousanli (LI10), Waiguan (TE5) and Neiguan (PC6). The local layer selects tender bands in forearm flexors or extensors. Low-frequency electroacupuncture produces a comfortable sensory response without forceful contraction. Sessions last 25-30 minutes, twice weekly for four to six weeks.

The tuina module follows acupuncture and avoids aggressive manipulation. Rolling, kneading and tendon-gliding techniques are applied to the neck-shoulder chain, forearm and hand. Task retraining begins with slow non-triggering movements and gradually returns to writing or instrument-specific patterns. Outcomes include video comparison, writing time, error count, spasm severity, pain, perceived control and adverse events.

Results and discussion

This protocol is expected to produce a clinical map rather than an immediate claim of cure. The map links symptomatic task, meridian distribution and sensorimotor network target. Electroacupuncture aims to modulate excitability and sensory discrimination; scalp stimulation targets central sensorimotor regulation; tuina reduces peripheral load; task retraining prevents return to the same maladaptive movement pattern.

Because focal hand dystonia is rare, a rigorous single-case design may be realistic: repeated baseline videos, stable medication status, predefined outcome scales, blinded video rating and follow-up after treatment withdrawal. Safety is central. Needling should follow accepted acupuncture standards [4]. Patients should be told that botulinum toxin, occupational therapy and neurological care remain standard options, while acupuncture and tuina are adjunctive rehabilitation methods. In conclusion, meridian-brain mapping can turn traditional channel reasoning into a testable neurorehabilitation pathway.

References:

[1]. Albanese A., Bhatia K., Bressman S.B., et al. Phenomenology and classification of dystonia: a consensus update. Mov Disord. 2013;28(7):863-873. doi:10.1002/mds.25475.

[2]. Hallett M. Neurophysiology of dystonia: the role of inhibition. Neurobiol Dis. 2011;42(2):177-184. doi:10.1016/j.nbd.2010.08.025.

[3]. Huang W., Pach D., Napadow V., et al. Characterizing acupuncture stimuli using brain imaging with fMRI: a systematic review and meta-analysis of the literature. PLoS One. 2012;7(4):e32960. doi:10.1371/journal.pone.0032960.

[4]. World Health Organization. WHO benchmarks for the practice of acupuncture. Geneva: World Health Organization; 2020.

TRANSCRANIAL REPETITIVE ACUPUNCTURE THERAPY FOR ERECTILE DYSFUNCTION BASED ON SUN SHENTIAN'S ACADEMIC EXPERIENCE

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Abstract

Erectile dysfunction involves vascular, neuroendocrine, psychological and relational factors. Some patients with psychogenic or mixed erectile dysfunction need a low-risk adjunct that addresses central arousal, anxiety and pelvic autonomic regulation. This paper proposes a concise framework for Sun Shentian's transcranial repetitive acupuncture therapy. It combines cranial repetitive stimulation, standardized erectile-function scoring and safety screening, and is designed for future pilot verification rather than for immediate efficacy claims.

Keywords: erectile dysfunction, acupuncture, transcranial stimulation, neuromodulation, male health, digital assessment

Erectile dysfunction (ED) is not only a penile vascular problem, but also a disorder of desire, attention, autonomic balance and confidence. International literature emphasizes diagnosis of cardiovascular risk, endocrine abnormalities, medication exposure and psychosocial factors before treatment selection [1]. Traditional Chinese medicine has long used acupuncture for sexual dysfunction, but current evidence remains limited [2]. Therefore, modern acupuncture should clarify indications, standardize the stimulus and define measurable outcomes.

Sun Shentian's academic experience highlights cranial regulation. In ED, this idea can be interpreted as repeated stimulation of scalp and midline cranial points to modulate the brain-pelvic axis. The traditional prescription can be combined with IIEF-5 scoring, erection hardness scale, sleep and anxiety screening, adverse-event recording and optional penile Doppler evaluation.

Objective

To build a practical, safe and digitally recordable protocol for transcranial repetitive acupuncture therapy as an adjunctive treatment framework for psychogenic or mixed erectile dysfunction.

Materials and methods

The protocol is intended for adult men with ED lasting longer than three months after urological evaluation. Exclusion criteria include unstable cardiovascular disease, severe penile anatomical disease, untreated hypogonadism, acute urogenital infection, severe psychiatric crisis and anticoagulation contraindicating needling. Core cranial points include Baihui (GV20), Sishencong (EX-HN1), Shenting (GV24), Yintang (EX-HN3) and bilateral temporal-frontal regulatory areas. Optional body points include Guanyuan (CV4), Qihai (CV6), Shenshu (BL23), Sanyinjiao (SP6) and Taixi (KI3).

Sterile single-use needles are inserted with mild manipulation. Cranial points receive repeated short stimulation cycles during a 25-30 minute session. Treatment is scheduled two or three times weekly for four weeks. Digital assessment includes baseline and post-treatment IIEF-5, erection hardness scale, nocturnal erection diary, sleep quality, anxiety score and adverse events. Patients are advised that acupuncture is an adjunct and does not replace guideline-based management.

Results and discussion

This framework has three advantages. First, it translates cranial acupuncture experience into a reproducible protocol with defined points, frequency, manipulation and recording items. Second, it fits psychogenic and mixed ED, where performance anxiety, sympathetic overactivity and sleep disturbance may amplify peripheral erectile impairment. Third, digital recording makes later research easier: responders can be defined by IIEF-5 change, diary improvement and patient global assessment.

The limitation is that this framework is not proof of efficacy. A future pilot study should use random allocation, a sham or standard-care comparison, predefined adverse-event monitoring and follow-up beyond the treatment period. The value of Sun Shentian's transcranial repetitive acupuncture therapy will depend on whether it can produce clinically meaningful improvement while remaining safe and compatible with standard male-health care. In conclusion, it may provide a structured adjunctive route for ED, but controlled clinical verification is required.

References:

[1]. Yafi F.A., Jenkins L., Albersen M., et al. Erectile dysfunction. Nat Rev Dis Primers. 2016;2:16003. doi:10.1038/nrdp.2016.3.

[2]. Lai B.Y., Cao H.J., Yang G.Y., et al. Acupuncture for treatment of erectile dysfunction: a systematic review and meta-analysis. World J Mens Health. 2019;37(3):322-338. doi:10.5534/wjmh.180090.

[3]. World Health Organization. WHO benchmarks for the practice of acupuncture. Geneva: World Health Organization; 2020.

STUDY OF ANTI-GASTRIC ULCER EFFECT OF THE TRADITIONAL FERMENTED BEVERAGE, BOZA

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Abstract

This study investigated the protective effect of traditional fermented beverage Boza on acute gastric ulcers and its underlying mechanism. A rat model of gastric ulcer was established using ethanol. HE staining, PAS staining, immunofluorescence, ELISA, and Western blot were employed to explore the mechanism. The results showed that Boza could significantly reduce the ulcer index, inhibit the nuclear translocation of NF-κB p65 and the activation of Caspase-3, down-regulate the expression of p-JNK/p-p38, reduce TNF-α/MDA, increase IL-10/PGE_2/SOD, and exhibit dose-dependent free radical clearance. This indicates that Boza exerts a gastric mucosal protective effect by inhibiting the MAPK/NF-κB pathway and alleviating inflammation and apoptosis.

Keywords: Boza, Gastric ulcer, Fermented beverage, Traditional food, Apoptosis

Gastric ulcer arises from an imbalance between aggressive factors (gastric acid, pepsin, H. pylori, NSAIDs) and defensive mechanisms (mucus-bicarbonate barrier, mucosal blood flow, prostaglandins). Proton pump inhibitors and H_2-receptor antagonists effectively promote healing, but long-term use may cause adverse effects and recurrence, stimulating the search for safer alternatives from traditional fermented foods.

Boza is a traditional low-alcohol fermented cereal beverage, particularly from millet, consumed in the Balkans and parts of Asia. Lactic acid and yeast fermentation yield probiotics, organic acids, vitamins, and antioxidant phenolics. Traditionally used to improve digestion and relieve gastrointestinal discomfort, Boza's gastroprotective potential remains scientifically unexplored. Probiotic-rich fermented foods can strengthen the gastric mucosal barrier, modulate the gut microbiota, and exert anti-inflammatory and antioxidant effects, mechanisms relevant to ulcer prevention. These properties suggest that Boza could counteract gastric ulcer formation. Given its composition, Boza might offer similar mucosal protection and is a promising candidate for anti-ulcerogenic evaluation.

The present study aimed to evaluate the gastroprotective effect of Boza in rat gastric ulcer models and to investigate its possible mechanisms (e.g., antioxidant, anti-inflammatory, acid-suppressive activities), providing an experimental basis for its potential use as a functional food or gastroprotective agent. This investigation may also help validate its traditional use.

Objective

To evaluate the anti-ulcerogenic effect of Boza in experimental rat models of gastric ulcer and to

investigate its possible mechanisms of action, which will allow to assess its potential as a gastroprotective

Materials and methods

SD rats were divided into seven groups and treated for 7 days. Acute gastric ulcer was induced by absolute ethanol. Ulcer index and histopathology (HE/PAS) were evaluated. NF-κB p65 and Cleaved Caspase-3 were assessed by IF. TNF-α, IL-10, PGE_2, SOD, and MDA were measured by ELISA. p-JNK/JNK and p-p38/p38 were detected by Western blot. In vitro antioxidant activity was evaluated by DPPH and ABTS assays. Data were analyzed by one-way ANOVA.

Results and discussion

PAS staining revealed enhanced mucus layer thickness, indicating barrier integrity restoration. Immunofluorescence showed that Boza inhibited NF-κB p65 nuclear translocation and reduced Cleaved Caspase-3-positive cells, suggesting suppression of both inflammation and apoptosis. ELISA results demonstrated that Boza lowered TNF-α and MDA levels while elevating IL-10, PGE_2, and SOD activities, indicating anti-inflammatory and antioxidant effects. Western blot analysis revealed downregulation of p-JNK, p-ERK, and p-p38 without affecting total JNK, ERK, and p38, implicating MAPK pathway inhibition. In vitro antioxidant assays confirmed direct radical scavenging activity. Collectively, these findings suggest that Boza exerts gastroprotective effects through multiple mechanisms: direct antioxidant action, suppression of MAPK (JNK/p38/ERK) phosphorylation, subsequent blockade of NF-κB-driven inflammation, and reduction of Caspase-3-mediated apoptosis.

Taken together, these findings suggest that the gastroprotective effect of Boza is mediated through direct antioxidant activity, inhibition of MAPK (JNK/p38) signalling, suppression of NF-κB-driven inflammation, and reduction of caspase-3-mediated apoptosis. The rich probiotic and phenolic content of Boza likely contributes to these actions. Although the present work highlights several pathways, further studies are required to identify the specific bioactive constituents responsible and to evaluate the efficacy of Boza in chronic ulcer models.

References

1. Liu, J., Zhang, S., Zhao, W., Zhang, A., Wang, Z., & Liu, J. (2025). Effect of microbial succession on flavor perception during millet steamed bread dough fermentation: Insights from sight, taste and smell. Food research international (Ottawa, Ont.), 220, 117056.

2. La, X., He, X., Liang, J., Zhang, Z., Li, H., Liu, Y., Liu, T., Li, Z., & Wu, C. (2024). Gastroprotective Effect of Isoferulic Acid Derived from Foxtail Millet Bran against Ethanol-Induced Gastric Mucosal Injury by Enhancing GALNT2 Enzyme Activity. Nutrients, 16(13), 2148.

3. Lin, H. C., Sheu, S. Y., Sheen, L. Y., Sheu, P. W., Chiang, W., & Kuo, T. F. (2020). The gastroprotective effect of the foxtail millet and adlay processing product against stress-induced gastric mucosal lesions in rats. Journal of traditional and complementary medicine, 10(4), 336–344.

RESEARCH ON CONSTRUCTION OF DIGITAL COLLABORATIVE EXCHANGE SYSTEM FOR SINO-RUSSIAN TRADITIONAL CHINESE MEDICINE UNDER THE BELT AND ROAD INITIATIVE

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Abstract

This paper studies TCM digital application within Sino-Russian medical cooperation. Relying on AI-enabled TCM four-diagnosis modernization, a digital platform for bilateral exchanges is established. The results show that digital tools standardize and quantify TCM data and improve communication efficiency. Deficiencies in bilingual conversion and interdisciplinary talents hinder further cooperation. Digitalization is a practical approach to boost TCM inheritance and dissemination between the two countries.

Keywords: Sino-Russian TCM digital exchange system

As the Belt and Road Initiative moves forward, health collaboration between China and Russia has achieved steady growth. Traditional Chinese medicine has established various promotion channels across Russia, while conventional exchange approaches still have evident shortcomings. TCM diagnostic practices depend on empirical experience and fail to form universal quantitative benchmarks matching Russia's modern medical systems. Meanwhile, low-efficiency offline interaction and obstacles in bilingual professional terminology translation also hold back bilateral TCM exchanges and industrial collaboration.

Related studies have explored intelligent transformation of TCM four diagnostic techniques, the status of TCM promotion in Russia as well as the overall outlook of bilateral medical ties. Still, limited works combine intelligent diagnostic technologies with cross-border exchange scenarios. In response to real demands from both sides, this research constructs a dedicated digital framework to facilitate the innovative development of traditional Chinese medicine.

Objective

To explore the application value of AI-based intelligent TCM diagnosis technology in Sino-Russian TCM exchanges; to summarize the practical difficulties in digital communication and cultural dissemination of TCM in Russia; to put forward feasible suggestions for promoting sustainable development of digital cooperation in Sino-Russian health industry.

Materials and methods

Multi-year data of AI-assisted standardized collection of TCM four-diagnosis information were collected for statistical sorting. Intelligent information equipment was used to convert empirical TCM diagnostic content into unified quantitative digital data. Combined with the survey data of TCM education, literature dissemination and industrial cooperation in Russia, a comparative

analysis was conducted on the working efficiency and information accuracy between traditional offline communication mode and digital online cooperation mode. On the basis of comprehensive research results, the restrictive factors of Sino-Russian digital TCM cooperation were summarized.

Results and discussion

The intelligent system of TCM four diagnostic methods effectively standardizes diagnostic data, making TCM diagnostic results more intuitive and easier to understand for Russian medical practitioners, and facilitating daily technical exchanges and joint training between the two sides . Digital platforms break the limitations of time and space in offline communication, greatly improving the efficiency of TCM cultural dissemination, document sharing and business docking between China and Russia.

In the process of practical promotion, it is found that the transformation of professional TCM terms between Chinese and Russian is not complete, and the supporting bilingual material library needs continuous improvement . Besides, talents who master both TCM professional knowledge, digital technology and Russian language are in short supply, which restricts the further expansion of digital cooperation scope.

To sum up, digital technology can effectively break the bottlenecks of Sino-Russian TCM exchanges and health industry cooperation. The digital cooperation mode constructed in this paper has practical promotion value. It is suggested to improve bilingual terminology resources and optimize talent training mechanisms in follow-up work, so as to further release the potential of Sino-Russian TCM digital cooperation.

References:

[1] Cui J, Xu J T. Application status and prospect of artificial intelligence information technology in modern research on four diagnostic methods of traditional Chinese medicine[J]. Shanghai Journal of Traditional Chinese Medicine, 2025, 59(1): 7-12.

[2] Song J D. Analysis on the current situation and prospect of Sino-Russian medical and health industry cooperation[J]. Eurasian Economy, 2024, (3): 95-111+130.

[3] Lan H, Xiong L X, Chen F. Current situation, problems and countermeasures of traditional Chinese medicine culture dissemination in Russia under the Belt and Road Initiative[J]. World Journal of Traditional Chinese Medicine, 2023, 18(14): 2098-2102.

EXPLORING THE MECHANISM OF HUANGQI CHIFENG TANG IN COMBATING METABOLIC-ASSOCIATED FATTY LIVER DISEASE THROUGH PPARα ACTIVATION

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Abstract

This study aims to investigate the ameliorative effects of Huangqi Chifeng Tang (HQCFT) on metabolic-associated fatty liver disease (MAFLD) and its molecular mechanisms, with a focus on peroxisome proliferator-activated receptor α (PPARα). Biochemical parameters in HepG2 cells from each group were measured, Oil Red O staining was performed to examine lipid droplet accumulation, and Western blot (WB) and qPCR were employed to detect the expression levels of relevant proteins. The experimental results demonstrated that HQCFT could ameliorate hepatocyte degeneration and injury induced by MAFLD through regulating the expression levels of PPARα and its downstream fatty acid oxidation-related proteins, thereby modulating the pathological progression of MAFLD.

Keywords: Huangqi Chifeng Tang; metabolic-associated fatty liver disease; PPARα; HepG2 cells; lipid metabolism

Metabolic-associated fatty liver disease (MAFLD) is the most common chronic liver disease globally, characterized by aberrant intrahepatic lipid accumulation, with rising prevalence [1]. No specific drugs are available; treatment relies on lifestyle interventions. PPARα, a key regulator of fatty acid oxidation and lipid metabolism, promotes hepatic β-oxidation and reduces lipid deposition upon activation, making it a major therapeutic target for MAFLD [2]. Huangqi Chifeng Tang, from Wang Qingren's

《Corrections of Errors in Medical Classics》, comprises Astragalus membranaceus, Paeoniae Rubra Radix, and Saposhnikoviae Radix, and is indicated for qi supplementation, stagnation relief, and blood circulation activation. We previously found that this formula exerts anti-atherosclerotic effects via the AMPK/PPARα pathway and ameliorates hepatic lipid disorders in hyperlipidemia and carotid atherosclerosis rat models [3]. However, whether it improves MAFLD and the underlying mechanisms remain unknown. Here, using free fatty acid-induced HepG2 cells and PPARα knockdown, we investigate whether Huangqi Chifeng Tang exerts anti-MAFLD effects through PPARα pathway activation, providing experimental evidence for clinical use.

Objective

This study investigates Huangqi Chifeng Tang (HQCFT) effects and mechanisms in MAFLD. An in vitro MAFLD model was established using FFA-induced (OA:PA=2:1) HepG2 cells. Lipid accumulation was assessed by Oil Red O; supernatant TC, TG, LDL-C, HDL-C, IL-1β, IL-6, and TNF-α were measured; qPCR and Western blot detected PPARα, CPT-1α, and HMGCR expression.

PPARα siRNA knockdown verified whether HQCFT effects depend on PPARα activation. Collectively, we elucidate whether HQCFT ameliorates steatosis and inflammation via PPARα upregulation, β-oxidation promotion, and lipogenesis inhibition, providing experimental evidence and a novel MAFLD therapeutic target.

Materials and Methods

Oleic acid (OA), palmitic acid (PA), Oil Red O solution, kits for TC, TG, HDL-C, LDL-C, IL-1β, and IL-6 (ELISA); antibodies against PPARα, CPT-1α, HMGCR, AMPK, and GAPDH; DMEM (high glucose), fetal bovine serum (FBS), penicillin–streptomycin, trypsin, Lipofectamine 2000, PPARα siRNA, and negative control siRNA.

An in vitro MAFLD model was established in HepG2 cells using OA and PA induction; cell viability was assessed by CCK-8. Cells were divided into blank, model, HQCFT low-dose, and HQCFT high-dose groups. For PPARα knockdown, additional groups included blank, model, negative control (siNC), and PPARα siRNA groups. Intracellular lipid accumulation was visualized by Oil Red O staining. Levels of TC, TG, LDL-C, HDL-C, IL-1β, IL-18, TNF-α, adiponectin, leptin, and FGF-21 were measured via ELISA. PPARα and downstream fatty acid oxidation-related protein expression were detected by qPCR and Western blot.

Results and Discussion

OA/PA-induced HepG2 cells showed increased lipid droplets, lipids, and inflammatory responses, confirming MAFLD model success. HQCFT (high-dose) reduced lipid accumulation and normalized parameters, demonstrating anti-steatotic and anti-inflammatory effects. Limitations include inadequate recapitulation of the complex MAFLD microenvironment by the in vitro model, necessitating in vivo validation; the specific bioactive constituents of HQCFT directly targeting PPARα require further identification; and the upstream regulatory network of PPARα and its crosstalk with other pathways (AMPK, SIRT1) remain to be elucidated.References:

References

[1]Sangro P, de la Torre Aláez M, Sangro B, D'Avola D. Metabolic dysfunction-associated fatty liver disease (MAFLD): an update of the recent advances in pharmacological treatment[J]. Physiol Biochem. 2023;79(4):869-879.

[2]Liu X, Chen S, Liu X, et al. Enpp1 ameliorates MAFLD by regulating hepatocyte lipid metabolism through the AMPK/PPARα signaling pathway.Cell Biosci. 2025;15(1):22. Published 2025 Feb 19.

[3]Liang YQ, Liu J, Zhang C, et al.Exploring Mechanism of Anti-atherosclerosis Effect of Huangqi Chifengtang Based on AMPK/PPARα Signaling Pathway and NLRP3 Inflammasome[J].Chinese Journal of Experimental Traditional Medical Formulae, 2026, 32(1): 131-139.

PRECISION DIAGNOSIS AND TREATMENT OF CHRONIC DISEASES: CURRENT SITUATION AND INNOVATION TREND OF DIGITAL MEDICAL APPLICATION

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Abstract

To explore the application, problems and cooperation direction of digital medicine in the precise diagnosis and treatment of chronic diseases. The role of digital medical technology in chronic disease grading, individualized treatment and long-term management was analyzed based on the literature in the past three years. Digital medical treatment can improve the accuracy of diagnosis and treatment and patient compliance, but there are problems of data exchange and transnational supervision. Subsequently, innovative technologies can be cooperated in health standards, wearable devices, and chronic disease databases.

Keywords: chronic disease management; Digital medical technologies

Digital medicine has become the core of chronic disease management. AI, big data, telemedicine and mobile medicine reconstruct the diagnosis and treatment mode to achieve individualized continuous care. AI research on chronic diseases continues to heat up, and precision medicine is moving towards data-driven[1]; wearable sensors non-invasive detection of body fluid markers, optimize diabetes, kidney disease, cardiovascular disease monitoring[2]; AI decision-making system and large model can predict risks, customize schemes, and streamline chronic disease management processes[3].

Objective

To explore the application status, effectiveness and development trend of digital medicine in the precise management of chronic diseases, and to explore the cooperation space between China and Russia in the field of digital medical standardization and technology transformation.

Materials and methods

In this review, PubMed, Web of Science, and CNKI databases were searched from 2023 to 2026. Around the topics related to the diagnosis and treatment of digital chronic diseases, original research and review literature were screened, acute nursing and no clinical verification research were excluded, and existing research was systematically sorted out from four aspects: AI risk stratification, wearable monitoring, digital diagnosis and treatment platform, and transnational policy infrastructure.

Results and discussion

Studies have shown that AI that integrates electronic medical records and multimodal markers can

predict the progression of chronic diseases: Yu[4] used AI to build an individualized diabetes control program to reduce complications; machine learning can dynamically monitor CML and optimize drug administration and attenuation[5]; new wearable sensors can monitor renal function and early diagnosis of renal injury[2]; the large model is convenient for chronic disease education and doctor-patient communication, and improves medication compliance, but there are problems such as algorithm bias and lack of clinical verification[3].

Relevant technologies are adapted to the layout of China-Russia digital medical cooperation. The two countries have a national-level digital health construction foundation, which can coordinate data privacy rules, jointly build population AI models and chronic disease databases, and integrate digital phenotypes of Chinese and Western medicine. At the same time, there are shortcomings such as decentralized information systems, inconsistent supervision of AI devices, and lack of evidence for long-term benefits.

Digital medicine upgrades chronic disease management in a predictive individualized model to reduce the uncertainty of diagnosis and treatment. In the future, it is necessary to break data barriers, standardize algorithm verification, and deepen international cooperation. China and Russia jointly formulate industry standards, coordinate research and development, and carry out multi-center trials, which is conducive to the large-scale promotion of precision digital medicine.

References

[1] Pan M, Li R, Wei J, et al. Application of artificial intelligence in the health management of chronic disease: bibliometric analysis. Front Med (Lausanne). 2025; 11: 1506641.

[2] Sivasubramanian A, Narayanan S, Slaughter G. Wearable Biosensors for Continuous Monitoring of Chronic Kidney Disease: Materials, Biofluids, and Digital Health Integration. Biosensors (Basel). 2026; 16(5): 287.

[3] Serugunda HM, Jianquan O, Kasujja Namatovu H, et al. Using Large Language Models for Chronic Disease Management Tasks: Scoping Review. JMIR Med Inform. 2025; 13: e66905.

[4] Yu C. Application of AI and digital health tools in public health management of T2DM: from mechanism prediction to personalized treatment. Front Public Health. 2026; 14: 1756755.

[5] Asadov C, Shirinova A, Alimirzoyeva Z, Hasanova A. Digital Medicine and Artificial Intelligence in Chronic Myeloid Leukemia: Current Applications, Challenges, and Future Directions. Cureus. 2026; 18(2): e103951.

REVIEW OF RESEARCH PROGRESS ON ASPARAGUS OFFICINALIS L. AND ITS BIOACTIVE COMPONENTS

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Abstract

As a typical traditional medicinal plant, Asparagus officinalis L. (A. officinalis) has attracted much attention due to its rich functional biopolymer properties. Its bioactive ingredients have been proved to have anti-tumor, immune regulation, regulation of intestinal flora, anti-neuritis, anti-atherosclerosis, anti-non-alcoholic liver disease and other pharmacological effects. Most of the research revolves around regulating the gut microbiota. In addition, in practical applications, the cellulose in A. officinalis has also been used to develop nanocrystals. Therefore, it is necessary to review the research progress of bioactive components in A. officinalis in various fields based on the latest research results and practical considerations.

Keywords: Asparagus officinalis L.; Bioactive components; Structures; Pharmacological effects; Applications

Asparagus officinalis L. (A. officinalis) is a highly representative plant of the Asparagus L. genus. A. officinalis, traditionally, has its seedlings as the main edible and medicinal parts, and it has also been the main research object of researchers in recent years. In traditional Chinese medicine theory, A. officinalis is believed to promote excretion and enhance immunity, making it an important ingredient in dietary therapy. In modern times, A. officinalis is regarded as a plant with great nutritional and research value due to its high content of dietary fiber, vitamins, minerals, and plant compounds, and is highly favored by consumers and researchers.

Researchers have confirmed that the bioactive ingredients in A. officinalis have anti-oxidant, anti-tumor, immunomodulatory, intestinal flora regulation, anti-neuritis, anti-atherosclerosis, anti-non-alcoholic liver disease and other pharmacological activities. Therefore, it can be said that regulating gut microbiota is the most important pharmacological effect of A. officinalis. In traditional medicine, A. officinalis is considered to have anti-oxidant, anti-inflammatory, and anti-bacterial effects. The bioactive components in asparagus have complex chemical structures and significant signal activation abilities. In terms of pharmacological activity, it has the characteristics of multi-target and low toxicity, and is superior to traditional single mechanism in terms of mechanism of action.

Objective

Whether as a medicinal herb, food, or cosmetic ingredient, A. officinalis has unique advantages and has been widely used. It is necessary to summarize and review past research results in order to better promote the modernization of traditional Chinese medicine and reveal the synergistic mechanism of various effective ingredients in A. officinalis.

Materials and methods

Search through PubMed, Google Scholar, CNKI, and Web of Science. Retrieve articles from the past five years using A. officinalis as the keyword.

Results and discussion

The current research on bioactive components in A. officinalis focuses on three aspects: extraction and purification methods, structural characterization, and pharmacological evaluation. We have gained preliminary understanding of the impact of extraction methods on structure and pharmacological effects, mechanisms of action, and potential structure-activity relationships. The changes in the chemical structure and pharmacological effects of bioactive components in A. officinalis before and after fermentation, as well as the application of its processed products in biomedical and food industries, are the main distinguishing points between A. officinalis and other plants.

References:

1.Shen, C., Wang, X. F., Wu, X. T., Liu, X. X., Robinson, N., & Liu, J. P., Effects of Asparagus officinalis for burning mouth syndrome: A systematic review of randomized controlled trials. 15(1) (2026) 101223.

2.Solhi, P., Salari, M., & Hamishehkar, H., Nanoencapsulation of Asparagus (Asparagus officinalis L.) Extract in Nanoliposomes: Effects on Physicochemical, Antioxidant, and Sensory Properties of Functional Processed Cheese. 13(5) (2025) e70284.

3.Zhang, Y., Ding, Y., Wang, X., Wang, T., Li, Z., Tan, R., & Li, Z., The mature stem of green Asparagus as a potential dietary supplement for hyperuricemia: Asparagus ameliorates hyperuricemia by regulating hepatic uric acid metabolism and renal uric acid excretion. 33 (2026) 103482.

4.Zhao, J., Wang, Y., Song, H., Luo, C., Cheng, C., & Mao, L., Promoting Effects of Piriformospora indica on the Growth and Development of Asparagus (Asparagus officinalis L.) Seedlings. 14(8) (2025) 1232.

RESEARCH PROGRESS ON ACTIVE COMPONENTS OF SANGUISORBA OFFICINALIS L. AND ITS ANTI-INFLAMMATORY AND WOUND REPAIR

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Abstract

Sanguisorba officinalis L. (S. officinalis) is a traditional Chinese medicine with a long history of medicinal use. Its main functions are cooling blood and hemostasis, detoxification and astringing sores. It is widely used in the treatment of anti-inflammatory hemostasis and wound repair. S. officinalis mainly contains tannins, phenolic acids, flavonoids, triterpenoid saponins, polysaccharides and other active components. Modern pharmacological studies have confirmed that it has significant hemostatic, anti-inflammatory, promoting wound repair, immune regulation and other multiple pharmacological acctivities. In order to further promote the modernization development and clinical application of S. officinalis, this paper systematically reviews the research status and research shortcomings of the main active components of S. officinalis in the past five years, and provides theoretical reference and technical support for subsequent basic experiments and clinical transformation.

Keywords: Sanguisorba officinalis L.; Bioactive components; Anti-inflammatory; Promoting wound repair; Applications

The roots of S. officinalis is commonly used in traditional Chinese medicine. It was first recorded in the "Shennong Herbal Classic" and ranks among the middle-grade products. It has a medicinal history of more than 2,000 years. S. officinalis is slightly cold and bitter in taste, and its efficacy is to cool blood and stop bleeding, detoxify and astringe sores. It is mainly used for water and fire burns, carbuncle swelling and sore toxin, hematochezia and hemorrhoids.

Modern pharmaceutical chemistry studies have shown that S. officinalis is rich in pharmacodynamic material basis, with synergistic effects of various components, clear targets and complementary advantages. The tannins in S. officinalis have the effects of strong convergence hemostasis, protein coagulation and wound protective film formation, which are the core substances to promote wound scab healing. The small molecular components of phenolic acids and flavonoids in S. officinalis have outstanding antioxidant, anti-inflammatory and antibacterial activities, which can remove free radicals from wounds, inhibit local inflammatory infiltration, and block inflammatory cascade reactions. The triterpenoid saponins and polysaccharides in S. officinalis have high safety, which can regulate the local wound immune microenvironment, promote the proliferation and repair of epidermal cells, and reduce repeated wound infection. Compared with the single repair mode of western medicine, the overall regulation characteristics of multi-component, multi-channel and multi-target of S. officinalis are perfectly suitable for the complex repair mechanism of chronic wound and inflammatory injury, and have extremely high value of new drug research and development and industrialization.

Objective

S. officinalis has a long history of application in wound repair, anti-inflammatory and hemostasis, and its clinical efficacy is stable. In recent years, basic research on its active components and pharmacological activities has continued to increase at home and abroad. In this paper, the related research results of bioactive components, anti-inflammatory and hemostatic pharmacological mechanism, wound repair application and clinical transformation of S. officinalis in the past five years were systematically sorted out, aiming to improve the theoretical system of modernization of S. officinalis.

Materials and methods

Search through PubMed, Google Scholar, CNKI, and Web of Science. Retrieve articles from the past five years using "Sanguisorba officinalis L." as the keyword.

Results and discussion

Existing studies have confirmed that the wound protection, anti-inflammatory and hemostatic effects of S. officinalis have outstanding application advantages, which is worthy of in-depth excavation and industrial development.

Tannins, phenolic acids, flavonoids and polysaccharides of S. officinalis are its core pharmacodynamic substances. Relevant pharmacological experiments have confirmed that the active components of S. officinalis have a clear intervention effect on skin wound inflammation, bleeding and tissue damage, and have low toxicity and good safety. Clinical studies have shown that the external preparation of S. officinalis has a definite effect on burns, chronic skin ulcers, perianal bleeding and other diseases. It can significantly shorten the wound healing time, reduce exudation, relieve pain and itching, and reduce the risk of recurrence and scar hyperplasia. It is superior to conventional western medicine symptomatic treatment and has a good clinical application prospect. In summary, the current research on the active components, pharmacological mechanism and clinical application of S. officinalis has achieved phased results. The efficacy is clear, the application is safe, and the subsequent application prospects are broad.

References:

1.C. Li, L. Gong, J. Yu, X. Hou, L. Huang, H. Lei, Y. Gu, D. Wang, D. Guo, Y. Deng, Sanguisorba officinalis ethyl acetate extract attenuates ulcerative colitis through inhibiting PI3K-AKT/NF-κB/STAT3 pathway uncovered by single-cell RNA sequencing. Phytomedicine: international journal of phytotherapy and phytopharmacology, 120, (2023) 155052.

2.E. Jang, K. S. Inn, Y. P. Jang, K. T. Lee, & J. H Lee. Phytotherapeutic Activities of Sanguisorba officinalis and its Chemical Constituents: A Review. The American journal of Chinese medicine, 46(2), (2018) 299–318.

3.J. F. Chen, L. Tan, F. Ju, Q. X. Kuang, T. L. Yang, F. Deng, Y. C. Gu, L. S. Jiang, Y. Deng, & D. L Guo. Phenolic glycosides from Sanguisorba officinalis and their anti-inflammatory effects. Natural product research, 36(8), (2022) 2097–2104.

FROM SARCANDRA GLABRA TO CARBON NANODOTS: A PERSPECTIVE ON TRADITIONAL MEDICINE-DERIVED HEMOSTATIC MATERIALS

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Abstract

Rapid hemostasis is essential in trauma, surgery and wound management. Traditional Chinese medicine-derived carbon nanodots provide a new approach for transforming herbal resources into functional biomedical materials. Sarcandra glabra (Thunb.) Nakai (S. glabra) is a commonly used medicinal plant with anti-inflammatory, antibacterial, antioxidant and blood-related pharmacological activities. Carbon nanodots prepared from herbal medicines usually possess small size, good water dispersibility and abundant surface functional groups, which may interact with blood cells, platelets and plasma proteins. This paper discusses the feasibility and potential mechanisms of S. glabra-derived carbon nanodots as hemostatic materials. Their possible effects may involve erythrocyte aggregation, platelet adhesion, fibrin formation and regulation of the coagulation microenvironment. This perspective may provide a new idea for the modernization of traditional medicine and the development of novel hemostatic biomaterials.

Keywords: Sarcandra glabra; Carbon nanodots; Hemostasis; Traditional medicine; Nanomaterials

Uncontrolled bleeding is a serious clinical problem in emergency medicine, surgery and traumatic injury. Although gauze, gelatin sponge, oxidized cellulose and other hemostatic agents are widely used, some materials still have limitations such as weak activity in complex wounds, insufficient biocompatibility or poor performance under rapid blood flow. Therefore, safe, efficient and multifunctional hemostatic materials remain urgently needed.

Traditional Chinese medicine is an important source of bioactive compounds and functional materials. In recent years, carbon dots derived from herbal medicines have attracted increasing attention. During hydrothermal treatment, calcination or pyrolysis, herbal precursors can be converted into nanoscale carbon materials with abundant oxygen-, nitrogen- and sulfur-containing functional groups. These surface structures may contribute to water solubility, biological interaction and potential pharmacological activity.

Sarcandra glabra (Thunb.) Nakai (S. glabra), known as Cao Shan Hu in Chinese, is traditionally used for clearing heat, detoxification and treating inflammatory disorders. Modern studies have reported that it contains flavonoids, phenolic acids, coumarins, sesquiterpenes and polysaccharides, and exhibits anti-inflammatory, antibacterial, antioxidant, anti-tumor and anti-thrombocytopenic effects. These characteristics provide a theoretical basis for exploring S. glabra as a natural precursor of hemostatic carbon nanodots.

Objective

This article aims to discuss the feasibility, potential mechanisms and application prospects of S.

glabra-derived carbon nanodots as traditional medicine-derived hemostatic materials.

Materials and methods

Relevant literature was searched using the keywords "Sarcandra glabra", "traditional Chinese medicine-derived carbon dots", "herbal carbon dots", "hemostasis", "coagulation", "platelet adhesion" and "wound healing". Studies on the pharmacology of S. glabra, preparation of herbal carbon dots and hemostatic mechanisms of nanomaterials were analyzed.

Results and discussion

The hemostatic potential of S. glabra-derived carbon nanodots may be related to their nanoscale structure and herbal origin. First, small particle size may increase contact with blood components and provide active interfaces for clot formation. Second, surface functional groups may enhance plasma protein adsorption and promote local coagulation reactions. Third, carbon nanodots may facilitate erythrocyte aggregation and platelet adhesion, which are important early events in hemostasis. In addition, the anti-inflammatory and blood-related activities of S. glabra may help improve the wound microenvironment.

Compared with conventional hemostatic materials, S. glabra-derived carbon nanodots may have advantages such as natural origin, simple preparation, good water dispersibility and potential biological compatibility. They may be further incorporated into hydrogels, sponges, sprays or wound dressings. However, this field remains at an early stage. Particle size, morphology, zeta potential, surface functional groups, hemostatic activity and safety should be systematically evaluated in future studies.

Conclusion

S. glabra-derived carbon nanodots represent a promising direction for developing traditional medicine-derived hemostatic materials. Their potential effects may result from the combination of herbal pharmacological background, nanoscale structure and active surface chemistry. Further research should focus on standardized preparation, structural characterization, hemostatic efficacy, biocompatibility and mechanism verification.

References

1. Zeng Y., Li Y., Yang J., Pu X., Du J., Yang X., Yang T., Yang S. The traditional uses, phytochemistry and pharmacology of Sarcandra glabra (Thunb.) Nakai, a Chinese herb with potential for development: review. Frontiers in Pharmacology, 2021, 12: 652926.

2. Luo W.K., Zhang L.L., Yang Z.Q., Guo X.H., Wu Y., Zhang W., Yuan X. Herbal medicine derived carbon dots: synthesis and applications in therapeutics, bioimaging and sensing. Journal of Nanobiotechnology, 2021, 19: 320.

3. Han B., Shen L., Xie H., Huang Q., Zhao D., Huang X., Li J. Synthesis of carbon dots with hemostatic effects using traditional Chinese medicine as a biomass carbon source. ACS Omega, 2023, 8(3): 3176–3183.

4. Zhang Z., Hu W., Yu A., Kuang H., Wang M. Hemostatic bioactivity and mechanism of novel Rubia cordifolia L.-derived carbon dots. Nanoscale Advances, 2024, 6: 6229–6238.

DIGITAL EMPOWERMENT AND TRADITIONAL RENEWAL: AI-DRIVEN INNOVATION AND INDUSTRIAL INTEGRATION IN SINO-RUSSIAN SMART MEDICINE

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Abstract: This study explores the digital transformation of traditional medicine driven by artificial intelligence (AI), specifically focusing on Sino-Russian pharmaceutical collaboration. Through a systematic review of literature from 2020 to 2025, we evaluate AI applications in natural product discovery, network pharmacology, and production optimization. Results indicate that AI integration significantly accelerates target identification, improves multi-component interaction analysis, and enhances manufacturing quality control. These findings underscore the potential of intelligent technologies to revitalize traditional medicinal systems, proposing a cross-border framework for smart pharmaceutical innovation and industrial modernization.

Keywords: Artificial intelligence; Digital transformation; Traditional medicine; Sino-Russian collaboration; Smart pharmaceuticals; Network pharmacology

Traditional medicine systems in China and Russia feature vast pharmacological resources, yet the complexity of multi-component formulations and lack of standardized molecular evidence hinder global integration[1]. Recently, artificial intelligence (AI) and digital technologies have catalyzed a paradigm shift in pharmaceutical sciences, effectively bridging ancient empirical knowledge with modern molecular biology[2]. Intelligent algorithms, particularly network pharmacology and machine learning, now enable high-resolution mapping of herb-drug interactions and predictive modeling of therapeutic efficacy[3-4]. This digital renaissance not only validates traditional practices for contemporary clinical use but also fosters international collaboration in data-driven healthcare innovation[5-6].

Objective

This study aims to evaluate how AI-driven digital transformation can modernize and integrate Chinese and Russian traditional medicinal systems. Specifically, it focuses on accelerating data-driven drug discovery pipelines, standardizing industrial quality control, and promoting sustainable, cross-border collaboration in the smart pharmaceutical sector.

Materials and Methods

A systematic literature review was conducted to evaluate the integration of AI and digital technologies in traditional medicine systems (2020–2025). Comprehensive searches were performed across PubMed and Web of Science using keywords combining "artificial intelligence," "network pharmacology," "herbal formulation," and "traditional medicine." Inclusion criteria focused on algorithmic target prediction, process optimization, and Sino-Russian pharmacological comparisons. Data were synthesized using bibliometric analysis and qualitative assessment to identify trends in drug discovery efficiency and industrial scalability, forming the basis for the proposed cross-border

collaboration framework[1].

Results and Discussion

Recent studies show AI reshapes complex compound drug discovery. Graph neural network-based network pharmacology systematically untangles herb-drug-disease interactions to predict synergistic targets and side effects. Machine learning-aided molecular docking cuts screening workload by over 50% and lifts in vitro hit rates[3][5]. Industrially, AI spectroscopy and predictive monitoring refine extraction conditions to guarantee consistent batches for regulatory approval[6]. Integrated digital pharmacopeia databases link Chinese herbal and Russian ethnobotanical records to speed lead discovery and drug safety surveillance. Still, hurdles remain: variable herbal materials demand adaptive AI for incomplete data, alongside costly infrastructure and uniform data management[4]. Future work needs interpretable AI to align computational forecasts with clinical results and win regulatory recognition.

Digital empowerment serves as the cornerstone for the modernization of traditional medicine, systematically transforming empirical practices into evidence-based, globally competitive healthcare solutions. The synergistic integration of AI technologies within Sino-Russian pharmaceutical networks promises to unlock novel therapeutic avenues, streamline industrial operations, and elevate the scientific credibility of traditional remedies. Future initiatives should prioritize the establishment of shared, open-access AI databases and standardized regulatory protocols to fully realize the transformative potential of smart medicine innovation on a global scale[2][6].

References

[1] Chen W, Liu X, Zhang S, Chen S. Artificial intelligence for drug discovery: Resources, methods, and applications. Mol Ther Nucleic Acids. 2023; 31: 691-702.

[2] Zhou E, Shen Q, Hou Y. Integrating artificial intelligence into the modernization of traditional Chinese medicine industry: a review. Front Pharmacol. 2024; 15: 1181183.

[3] Mullowney MW, Duncan KR, Elsayed SS, et al. Artificial intelligence for natural product drug discovery. Nat Rev Drug Discov. 2023; 22(11): 895-916.

[4] Malheiro V, Santos B, Figueiras A, Mascarenhas-Melo F. The Potential of Artificial Intelligence in Pharmaceutical Innovation: From Drug Discovery to Clinical Trials. Pharmaceuticals (Basel). 2025; 18(6): 788.

[5] Serrano DR, Luciano FC, Anaya BJ, et al. Artificial Intelligence (AI) Applications in Drug Discovery and Drug Delivery: Revolutionizing Personalized Medicine. Pharmaceutics. 2024; 16(10): 1328.

[6] Ocana A, Pandiella A, Privat C, et al. Integrating artificial intelligence in drug discovery and early drug development: a transformative approach. Biomark Res. 2025; 13(1): 45.

CONSTRUCTION AND ANALYSIS OF A KNOWLEDGE GRAPH OF STRUCTURAL CHARACTERISTICS AND PHARMACOLOGICAL ACTIVITIES OF PINUS KORAIENSIS POLYSACCHARIDES

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Abstract

Pinus koraiensis, an important tree in the northeast of China, is rich in bioactive polysaccharides from pine nuts and cones. This study systematically reviewed PubMed (1990–2026) to compile Mw, monosaccharide composition, and pharmacological, constructing a knowledge graph. Results show polysaccharides mainly composed of Ara, Gal, Glc, Rha, Xyl, and Man, often with uronic acids. Pine nut polysaccharides exhibit in vivo hepatoprotection and pine cone polysaccharides show in vitro antioxidant and antitumor activities. Pectic polysaccharides are immunomodulatory. The current research is still focused on Mw and monosaccharides composition, while glycosidic bonds, conformation and in vivo pharmacodynamics need further study. This knowledge graph offers a systematic reference for future screening and mechanism studies.

Keywords: Pinus koraiensis; Polysaccharides; Structural Characteristics; Pharmacological activities

Pinus koraiensis (P. koraiensis) is an important tree in the Xiaoxing'anling region and the Changbai Mountains. Its pine nuts, pine cones and other parts are rich in bioactive polysaccharides. In recent years, a number of studies have revealed the significant pharmacological potential of P. koraiensis polysaccharides in hepatoprotection, anti-oxidation and immune regulation. However, these research results are scattered. There is a lack of systematic integration between complex structural information and diverse pharmacological activities. This review links existing research and provide a new perspective for further understanding the structure-activity relationship of polysaccharides.

Objective

The purpose of this study is to systematically summary structural characteristics and pharmacological activity of P. koraiensis polysaccharides. Through analysis, the potential correlation between structural features and pharmacological activities was revealed. And identify the current research hotspots and gaps, providing a reference for the subsequent directional screening and mechanism research of P. koraiensis polysaccharides.

Materials and methods

In order to obtain the literature related to P. koraiensis polysaccharide, we conducted a systematic search in PubMed, and the search time range was from 1990 to 2026. The search keywords used included “Pinus koraiensis”, and “polysaccharide”. By screening the title, abstract and full text, the literature unrelated to the research topic and the large amount of missing data were excluded.

Results and discussion

The molecular weight (Mw) of P. koraiensis polysaccharides ranged from 1.72 to 6881.6 kDa. P. koraiensis polysaccharides are heteropolysaccharides. The main monosaccharide types include arabinose (Ara), galactose (Gal), glucose (Glu), rhamnose (Rha), xylose (Xyl), mannose (Man), and often contain uronic acids, such as galacturonic acid (GalA), glucuronic acid (GluA). In addition, P. koraiensis polysaccharide showed multiple pharmacological activities. Pine nut polysaccharide has significant hepatoprotection activity in vivo, and can effectively resist CCl4, alcohol and acetaminophen-induced liver injury. The mechanism involves activation of NRF2/ARE pathway, inhibition of NF-κB pathway and regulation of MAPK/JNK pathway. Polysaccharides from pinecone mainly showed antioxidant and anti-tumor activities in vitro. The pine nut-derived pectin polysaccharide (PNE-P1) has well immunomodulatory activity. Preliminary structure-activity relationship analysis showed that high levels of Ara and Gal may be related to hepatoprotective and immune activities, while containing Man and Xyl may be related to antioxidant. The branched chain structure and uronic acid content may have important contributions to its anti-inflammatory and immunostimulatory. In general, the study on the structure-activity relationship of P. koraiensis polysaccharides is still in the preliminary stage, and more structural modification and activity comparative studies are urgently needed to elucidate.

All in all, P. koraiensis polysaccharide has complex structural characteristics and well pharmacological activity. However, the current research is limited to the Mw and monosaccharide composition of polysaccharides, and there is a lack of research on glycosidic bonds and conformations. And the exploration of pharmacological activity mostly stays in vitro research. In the future, the effect of P. koraiensis polysaccharide on the body should be explored through appropriate in vivo models.

References

1. Zhang, H., Zou, P., Zhao, H., Qiu, J., Regenstein, J. M., & Yang, X. (2021). Isolation, purification, structure and antioxidant activity of polysaccharide from pinecones of Pinus koraiensis. Carbohydrate polymers, 251, 117078. https://doi.org/10.1016/j.carbpol.2020.117078

2. Zou, P., Yang, X., Huang, W. W., Zhao, H. T., Wang, J., Xu, R. B., Hu, X. L., Shen, S. Y., & Qin, D. (2013). Characterization and bioactivity of polysaccharides obtained from pine cones of Pinus koraiensis by graded ethanol precipitation. Molecules (Basel, Switzerland), 18(8), 9933–9948.

3. Qu, H., Liu, S., Cheng, C., Zhao, H., Gao, X., Wang, Z., & Yi, J. (2020). Hepatoprotection of pine nut polysaccharide via NRF2/ARE/MKP1/JNK signaling pathways against carbon tetrachloride-induced liver injury in mice. Food and chemical: an international journal published for the British Industrial Biological Research Association, 142, 111490.

4. Lim, J. S., Cho, S., Capek, P., Kim, S. C., Bleha, R., Choi, D. J., Ree, J., Lee, J., Synytsya, A., & Park, Y. I. (2023). Water-extractable polysaccharide fraction PNE-P1 from Pinus koraiensis pine nut: Structural features and immunostimulatory activity. Carbohydrate research, 534, 108980.

DIGITAL INNOVATION IN SINO-RUSSIAN TRADITIONAL MEDICINE PHARMACEUTICS

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Abstract

Based on TCM pharmaceutics, this paper studies digital technology-enabled modernization of Sino-Russian herbal preparations and cross-border intelligent pharmaceutical integration. It compares their complementary strengths in digital preparation and quality control, identifies cooperation bottlenecks, and constructs a targeted collaborative framework.

Keywords: TCM Pharmaceutics; Digital Empowerment; Sino-Russian Cooperation; Intelligent Pharmaceutical Preparation; Traditional Medicine Industrial Integration

Digital technologies such as AI, big data and IoT are reshaping the whole industrial chain of traditional medicinal preparations. China boasts a mature TCM pharmaceutics system with complete industrialized production experience of herbal compound preparations, while Russia has solid research foundations in Siberian herbal extraction and botanical pharmacodynamic evaluation, creating prominent technological complementarity between the two sides.

Sino-Russian academic exchanges on herbal medicines have grown increasingly active in recent years. Digital tools effectively tackle long-standing drawbacks of traditional pharmaceutics including unstable active components and inconsistent process quality, becoming a key driver of bilateral pharmaceutical innovation. Nevertheless, cross-border cooperation still faces barriers such as inconsistent preparation standards, isolated herbal ingredient databases and mismatched quality supervision systems.

Objective

From the perspective of TCM pharmaceutics, this paper clarifies the application value of digital technology in optimizing Chinese and Russian herbal preparation processes. Specific research objectives include comparing the digital construction status of TCM and Russian botanical pharmaceutics systems, summarizing digital tools for optimizing herbal extraction, molding and quality control processes, and putting forward operable strategies for long-term Sino-Russian collaborative innovation in traditional pharmaceutical preparation industry.

Materials and Methods

This study adopts literature meta-analysis and comparative industrial case research. Literature resources are retrieved from CNKI, PubMed, Scopus and Russian pharmaceutical academic databases, covering research papers published between 2018 and 2025 themed on intelligent herbal preparation, digital extraction process optimization and botanical formulation standardization. Two typical cases are selected for comparative analysis: AI optimization of TCM compound granule

preparation technology, and digital process simulation of Siberian herbal sustained-release tablet production in Russia.

Results and Discussion

China takes the lead in intelligent TCM production and real-time digital quality monitoring, while Russia has advantages in herbal extraction and pharmacodynamic testing but lacks mature automated preparation industry, which facilitates two-way technical exchange. Machine learning simplifies herbal formulation development, yet inconsistent herbal data platforms between the two countries demand unified data standards. Blockchain enables full traceability of herbal products, while divergent pharmacopoeia standards restrict transnational circulation of botanical medicines. The combination of China's intelligent preparation industry chain and Russia's unique herbal resources creates a favorable cooperation mode. A joint laboratory platform is proposed to build shared databases, unify dosage form standards and cultivate interdisciplinary talents to mitigate regulatory and data security risks.

Conclusion

Digital technology provides an important channel for the joint upgrading of Chinese and Russian traditional pharmaceutics. Relying on their respective strengths in intelligent manufacturing and natural medicinal research, the two countries can break through technical and standard barriers through joint platforms, data sharing and coordinated formulation specifications. Deepened cooperation centered on TCM pharmaceutics will accelerate the standardized, intelligent and international development of traditional herbal medicines for both nations.

References

1. Gangwal A, Lavecchia A. Artificial Intelligence in Natural Product Drug Discovery: Current Applications and Future Perspectives. J Med Chem. 2025 Feb 27;68(4):3948-3969.

2. Han R, Yoon H, Kim G, Lee H, Lee Y. Revolutionizing Medicinal Chemistry: The Application of Artificial Intelligence (AI) in Early Drug Discovery.Pharmaceuticals (Basel). 2023 Sep 6;16(9):1259.

CLINICAL EFFECT STUDY OF COMBINED INTERVENTION OF DIET AND EXERCISE ON BLOOD GLUCOSE CONTROL IN PATIENTS WITH TYPE 2 DIABETES

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Abstract Type 2 diabetes, a chronic metabolic disorder with a high prevalence in clinical settings, is closely associated with poor lifestyle choices. The primary pathological characteristics of this condition include insulin resistance and disturbances in glucose and lipid metabolism. While pharmacological treatments can rapidly regulate blood glucose levels, reliance on medication alone is insufficient to fundamentally address patients' metabolic issues or effectively mitigate the risk of disease recurrence and complications. Dietary modification and regular physical activity represent the cornerstone of non-pharmacological interventions for diabetes management. The synergistic effect of combining these two approaches is crucial for stabilizing blood glucose levels, enhancing metabolic function, and improving patients' quality of life.

Keywords: type 2 diabetes; dietary intervention; exercise intervention

In recent years, improvements in residents' living standards, alterations in dietary patterns, and the widespread adoption of sedentary lifestyles have contributed to a rising incidence of type 2 diabetes, particularly among younger populations. This condition typically has a prolonged course and necessitates lifelong management. Poor long-term blood sugar control can lead to various complications, including cardiovascular and cerebrovascular diseases, kidney disorders, and peripheral neuropathy, thereby posing significant risks to patient health.

Objective

Numerous clinical studies have indicated that treatment models relying solely on hypoglycemic medications, while overlooking lifestyle interventions, struggle to maintain stable blood sugar levels over the long term. Such approaches often result in greater fluctuations in blood sugar and a markedly increased risk of long-term complications. Consequently, the implementation of a scientifically grounded combined intervention involving diet and exercise has emerged as an essential component of comprehensive type 2 diabetes management.

Materials and Methods

Dietary intervention serves as the cornerstone for diabetes prevention and management, constituting a fundamental aspect of clinical nutritional therapy. The primary objective is to rectify poor eating habits and mitigate abnormal fluctuations in blood glucose levels at their source. Systematic reviews indicate that personalized dietary interventions can significantly enhance glucose metabolism indicators in patients with type 2 diabetes, lower postprandial blood glucose peaks, and diminish blood glucose variability. In clinical practice, total caloric intake should be judiciously regulated according to the patient's weight, age, and daily activity level. Diets characterized by high sugar,

high fat, and high salt content should be eliminated, while the consumption of refined rice, flour, desserts, and fried foods should be minimized. The daily diet should primarily consist of whole grains, fresh vegetables, and high-quality proteins, thereby optimizing dietary composition, slowing carbohydrate absorption, and preventing abrupt fluctuations in blood glucose levels post-meal. Additionally, adhering to regular meal intervals and fixed portion sizes, along with consuming small, frequent meals, can effectively prevent postprandial hyperglycemia and reduce the risk of fasting hypoglycemia, ultimately leading to an improved metabolic state.[1]

Regular exercise can target the core issue of insulin resistance in type 2 diabetes patients. Various intensities and types of exercise can positively impact glucose and lipid metabolism. The combined benefits of moderate-intensity aerobic exercise and basic resistance training are particularly notable. Sustained engagement in aerobic activities like brisk walking, jogging, Tai Chi, and swimming can enhance glucose uptake and utilization by skeletal muscles, leading to decreased blood sugar levels independent of insulin. Furthermore, exercise can reduce visceral fat accumulation, mitigate chronic inflammation, improve peripheral tissue sensitivity to insulin, and address metabolic irregularities. Moderate resistance training can boost muscle mass, elevate basal metabolic rate, aid in weight management, regulate blood lipids, and lower complication risks. Clinical interventions should prioritize gradual progression and consistency while avoiding fasting exercise to prevent hypoglycemia risks and ensure intervention safety and efficacy.[2]

Results and Discussion

The singular intervention of diet or exercise presents certain limitations. However, their combination can yield a complementary and synergistic effect. For individuals with early-stage mild type 2 diabetes, standardized lifestyle interventions can even reduce the dosage of hypoglycemic medications, facilitate long-term stable blood sugar control, and improve the overall prognosis. In conclusion, the integration of dietary and exercise interventions is safe, efficient, and broadly applicable. It can substantially enhance the metabolic status of patients with type 2 diabetes, delay disease progression, and diminish the incidence of chronic complications. Therefore, it warrants ongoing promotion and implementation in clinical health management and community-based chronic disease prevention and control.

[1] Chinese Diabetes Society. Guideline for the prevention and treatment of type 2 diabetes mellitus in China (2020 edition) (Part I)[J]. Chinese Journal of Practical Internal Medicine, 2021, 41(8): 668-695.

[2] National Center of Gerontology, Chinese Diabetes Society, China Sport Science Society. Guideline for exercise therapy in type 2 diabetes mellitus in China (2024 edition)[J]. Chinese Journal of Sports Medicine, 2024, 43(6): 419-452.

RESEARCH PROGRESS ON THE TREATMENT OF UPPER LIMB MOTOR DYSFUNCTION FOLLOWING STROKE USING ACUPUNCTURE COMBINED WITH SMART REHABILITATION TECHNOLOGIES

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Abstract

Upper limb motor dysfunction following stroke poses a major clinical challenge. Acupuncture has demonstrated proven efficacy in its treatment, and its integration with modern rehabilitation technologies offers an innovative pathway for modernization. This paper reviews research progress on acupuncture combined with smart rehabilitation technologies (including robots, virtual reality, and electrical/magnetic stimulation devices). It analyzes how intelligent methods empower traditional acupuncture, enhance clinical efficacy, and promote protocol standardization, providing a reference for the modernization of acupuncture rehabilitation.

Keywords: Acupuncture; Stroke; Motor Impairment; Intelligent Rehabilitation; Digital Empowerment

Motor dysfunction is a common post-stroke sequela; approximately 30% of patients experience early-stage upper limb impairment, severely impacting activities of daily living (ADL). Acupuncture offers unique advantages in treating post-stroke upper limb dysfunction. Recently, the integration of artificial intelligence, robotics, and virtual reality has transformed acupuncture rehabilitation from being experience-driven to data- and intelligence-driven, infusing this ancient therapy with new vitality.

1 Acupuncture Combined with Smart Rehabilitation Robots

Rehabilitation robotics provides precise, reproducible training protocols for upper limb functional reconstruction. Studies show that fire needle therapy combined with robotic glove mirror therapy effectively improves post-stroke hand and upper limb dysfunction [1]. Based on the "central-peripheral-central" closed-loop theory, interactive scalp acupuncture combined with an upper-limb exoskeleton robot significantly enhances upper-limb motor function [2]. Additionally, acupuncture combined with MOTOmed smart exercise training yields superior results compared to either therapy alone [3]. This synergy allows traditional acupuncture benefits to complement the precise, quantifiable advantages of modern engineering.

2 Acupuncture Combined with Virtual Reality Technology

Virtual reality (VR) enhances active participation and neural plasticity via immersive training environments. Clinical trials indicate that interactive VR combined with scalp acupuncture significantly improves upper limb motor dysfunction during the recovery phase of ischemic stroke (qi deficiency and blood stasis pattern) [4]. Immersive VR training combined with acupoint needling

also shows positive therapeutic effects [5]. Overall, VR makes training more engaging and activates cortical compensatory mechanisms through multisensory stimulation.

3 Acupuncture Combined with Smart Electrical and Magnetic Stimulation Devices

Combining acupuncture with electrical and magnetic neurostimulation demonstrates significant synergistic effects. Clinical studies confirm that smart rehabilitation robotic hands used alongside repetitive transcranial magnetic stimulation (rTMS) effectively improve active joint range of motion, motor function, and ADL during stroke recovery [6]. Acupuncture's stimulation of local neurovascular plexuses, coupled with non-invasive brain stimulation, creates synchronized peripheral-to-central neural modulation, providing robust support to overcome the rehabilitation "plateau phase."

Conclusion

The integration of acupuncture and smart rehabilitation technologies optimizes clinical outcomes and drives the discipline toward objectivity and standardization. Future research should leverage big data and telerehabilitation to establish comprehensive "hospital-community-home" networks, accelerate the development of intelligent diagnostic devices for precise, automated prescribing, and utilize advanced neuroimaging to clarify the biological mechanisms of brain network remodeling. Ultimately, conducting high-quality, multicenter randomized controlled trials remains essential to establish a solid evidence-based foundation for the internationalization of acupuncture rehabilitation, accelerating its integration into mainstream global healthcare.

References:

1. Zhang W, Huang W T, Cui X Y, et al. Effect of fire needle combined with robotic glove mirror therapy on hand and upper limb dysfunction after stroke[J]. Asia-Pacific Traditional Medicine, 2024, 20(09): 73-78.

2. Wang Z H, Hu C, Zhang H Q, et al. Effect of interactive scalp acupuncture combined with upper limb exoskeleton robot on upper limb function in patients with stroke[J]. Rehabilitation Medicine, 2024, 34(01): 28-33+43.

3. Li Y Y, Fu Q, Wu W W, et al. Effects of scalp acupuncture interactive MOTOmed intelligent exercise training on limb motor function and serum NGF and BDNF levels in stroke patients with hemiplegia[J]. Hebei Medicine, 2020, 26(02): 222-226.

4. Zhu Z J. Clinical study on interactive scalp acupuncture combined with virtual reality technology for upper limb motor dysfunction in the recovery period of ischemic stroke with Qi deficiency and blood stasis pattern[D]. Anhui University of Chinese Medicine, 2019.

5. Jiang C, Huang D B, Guo J H, et al. Effect of interactive scalp acupuncture combined with immersive virtual reality rehabilitation system on upper limb function in stroke patients with hemiplegia[J]. Massage and Rehabilitation Medicine, 2022, 13(09): 1-4.

6.Feng J, Dong G L, Feng Q, et al. Application study of intelligent rehabilitation robotic hand combined with repetitive transcranial magnetic stimulation in patients with stroke[J]. Chongqing Medicine, 2025, 54(05): 1138-1142.

DIGITAL GOVERNANCE FRAMEWORK FOR SMART INTEGRATION OF TRADITIONAL AND MODERN MEDICINE

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Abstract: Traditional medicine has accumulated clinically valuable experience, but its integration into smart medicine requires reliable evidence, structured data, interpretable algorithms, and responsible governance. This paper proposes a digital governance framework for Sino-Russian cooperation in traditional and modern medicine. The framework links standardized evidence collection, bilingual knowledge organization, privacy-preserving data analysis, artificial intelligence assisted decision support, and translational validation. It emphasizes that digital tools should not replace clinical judgment or pharmacological evidence, but should improve traceability, safety assessment, and industry-oriented innovation. The proposed approach may support cooperative research on traditional medical resources, intelligent evaluation of compound prescriptions, and development of transparent digital health products.

Keywords: digital health; traditional medicine; artificial intelligence; evidence integration; knowledge graph; Sino-Russian cooperation; governance

Traditional medicine and modern biomedicine are entering a shared digital transition. China and Russia both have rich medical traditions, large clinical service systems, and growing demand for safe, evidence-based health technologies. At the same time, traditional medical knowledge is often stored in heterogeneous texts, expert experience, hospital records, and local industrial standards. Without standardized data models and transparent evaluation, digitalization may amplify uncertainty rather than reduce it. Therefore, smart innovation should begin with governance: what data are collected, how they are interpreted, who validates the conclusions, and how risks are controlled.

The purpose of this paper is to propose a practical framework for digitally enabled integration of traditional and modern medicine under the theme of intelligent biomedical innovation and industrial collaboration. The framework is designed for research teams that need to transform classical knowledge, laboratory evidence, clinical observations, and product-development information into a traceable and cooperative workflow.

Materials and methods consisted of a narrative synthesis of international digital health guidance, traditional medicine policy documents, and representative literature on artificial intelligence in medicine. Key requirements were mapped into three questions: how to make traditional medical knowledge machine-readable, how to keep algorithmic outputs clinically explainable, and how to connect research evidence with safe translational use. The resulting framework was then organized around data, models, validation, and governance.

The first layer is an evidence and terminology layer. Classical concepts, prescriptions, materia medica information, adverse reactions, indications, contraindications, chemical constituents, targets, and clinical outcomes should be converted into standardized metadata. For Sino-Russian

cooperation, bilingual terminology mapping is essential because the same plant, syndrome, or therapeutic concept may have different names and regulatory meanings. A shared knowledge graph can connect herb-drug information, disease categories, molecular evidence, clinical records, and product standards while keeping the source of each claim visible.

The second layer is an interpretable intelligence layer. Machine learning can support literature mining, safety signal detection, prescription similarity analysis, candidate compound screening, and decision support. However, high model performance alone is insufficient. Models used in traditional medicine should provide traceable evidence paths, uncertainty estimates, and human-review checkpoints. When individual patient data are involved, privacy-preserving approaches such as federated analysis can help partners learn from distributed datasets without unnecessary data transfer. These methods are especially important for cross-border collaboration.

The third layer is a translational validation and industry layer. Digital predictions should be tested through laboratory verification, pharmacological assessment, clinical evaluation, and post-market safety monitoring before being used to guide products or services. For industry integration, the framework can support quality control of traditional medical resources, development of digital therapeutics and decision-support tools, and evaluation of combined traditional-modern care pathways. The main risks are low-quality source data, hidden bias, overinterpretation of correlations, insufficient safety evidence, and unclear responsibility when digital tools influence clinical decisions.

In conclusion, digital empowerment of traditional medicine should be evidence-first, safety-first, and clinician-guided. A governance framework that combines standardized knowledge, interpretable artificial intelligence, privacy protection, and translational validation can help transform traditional medical resources into responsible smart biomedical innovation. For future Sino-Russian cooperation, feasible pilot tasks include bilingual terminology mapping, construction of shared herb-compound-target knowledge bases, federated clinical research, and joint evaluation standards for intelligent traditional medicine products.

References

[1] World Health Organization. Global strategy on digital health 2020-2025. Geneva: WHO; 2021.

[2] World Health Organization. WHO traditional medicine strategy: 2014-2023. Geneva: WHO; 2013.

[3] World Health Organization. Ethics and governance of artificial intelligence for health: WHO guidance. Geneva: WHO; 2021.

[4] World Health Organization. Ethics and governance of artificial intelligence for health: guidance on large multi-modal models. Geneva: WHO; 2024.

[5] Topol EJ. High-performance medicine: the convergence of human and artificial intelligence. Nature Medicine. 2019;25:44-56.

DIGITAL INNOVATION IN SINO-RUSSIAN TRADITIONAL MEDICINE PHARMACEUTICS

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Abstract

This paper examines the role of digital technologies in advancing traditional herbal medicine research within the context of China-Russia cooperation. It highlights the potential of combining China's rich experience in Traditional Chinese Medicine with Russia's abundant Siberian botanical resources through AI-driven screening, database integration, and quality control digitalization. A collaborative framework for natural product drug development is proposed.

Keywords: Herbal medicine, natural products, AI screening, China-Russia cooperation, digital pharmacy

Natural products have long served as a primary source of pharmaceuticals, with approximately half of all modern drugs originating from or inspired by natural compounds. China possesses one of the world's most extensive and well-documented herbal medicine systems, with thousands of years of practical application and a vast repository of clinical records. Russia, particularly its Si-berian and Far Eastern regions, harbors an immense diversity of plant species, many of which have been traditionally used by indigenous populations but remain scientifically unexplored. The convergence of these complementary resources, facilitated by digital technologies, offers an un-precedented opportunity for collaborative drug discovery and development.

Objective

This study aims to explore how digital approaches can accelerate the discovery and development of bioactive compounds from traditional herbal medicines in both China and Russia, and to pro-pose a collaborative framework for natural product research that leverages the strengths of both nations.

Materials and methods

A literature review was conducted using PubMed, Scopus, and CNKI databases, focusing on publications from 2018 to 2026 addressing digital applications in herbal medicine research, including AI-assisted compound screening, cheminformatics, and quality control technologies. Comparative analysis was applied to assess the current state of digitalization in natural product research in both countries.

Results and discussion

The digitalization of herbal medicine research encompasses three key areas. First, integrating Chinese pharmacological databases with Russian botanical collections would create a comprehen-

sive resource for drug discovery. Second, AI models trained on combined datasets can accelerate bioactive compound screening through predictive modeling. Third, digital technologies such as spectroscopic analysis and blockchain systems can improve quality control and supply chain transparency. Additionally, regulatory harmonization between China and Russia is essential for translating research into commercial products, as differences in registration and quality standards currently impede cross-border collaboration and product development.

Conclusion

The complementary strengths of China's established herbal medicine system and Russia's untapped botanical resources, combined with advanced digital tools, create a strong foundation for collaborative natural product drug discovery. A joint initiative focusing on shared database infrastructure, collaborative AI model development, and harmonized quality standards would maxim-ize the potential of this partnership and contribute to global pharmaceutical innovation.

References:

1. Ge, W., Gao, Y., He, L., Jiang, Z., Zeng, Y., Yu, Y., Xie, X., & Zhou, F. (2024). Developing Chinese herbal-based functional biomaterials for tissue engineering. Heliyon, 10 (6), e27451. https://doi.org/10.1016/j.heliyon.2024.e27451

2. Chen, Y., Li, W. W., Bi, S. L., Zhang, H. M., Sun, Z., Zuo, Y. Y., Xu, L., & Chen, S. Q. (2024). Visualizing research trends and identifying hotspots of herbal components for treating cardiovascular diseases: A bibliometric analysis from 2000 to 2023. Medicine, 103 (6), e35047. https://doi.org/10.1097/MD.0000000000035047

3. Pan, L., Cho, K.-S., Yi, I., To, C.-H., Chen, D. F., & Do, C.-W. (2021). Baicalein, baicalin, and wogonin: Protective effects against ischemia-induced neurodegeneration in the brain and reti-na. Oxidative Medicine and Cellular Longevity, 2021 (1), 8377362. https://doi.org/10.1155/2021/8377362

4. Xu, M., Chen, Y., Wu, T., Chen, Y., Zhuang, W., Huang, Y., & Chen, C. (2025). Global re-search trends in the application of artificial intelligence in oncology care: a bibliometric study. Frontiers in Oncology, *14*, 1456144. https://doi.org/10.3389/fonc.2024.1456144

5. Jha, D., Gupta, V., Liao, W.-k., & et al. (2022). Moving closer to experimental level materials property prediction using AI. Scientific Reports, 12 , 11953. https://doi.org/10.1038/s41598-022-15816-0

6. Niazi, S. K., & Mariam, Z. (2024). Computer-aided drug design and drug discovery: A prospective analysis. Pharmaceuticals, 17 (1), 22. https://doi.org/10.3390/ph17010022

DATA-DRIVEN IBS SYNDROME PATTERN MINING AND AGREED FORMULA TRANSFORMATION: A SINO-RUSSIAN COLLABORATION

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Abstract

Long dominated by raw herb trade, Sino-Russian traditional medicine cooperation lacks data-driven research and product translation. Taking irritable bowel syndrome (IBS) as a case, this paper proposes a closed-loop model of "syndrome data collection–AI pattern mining–agreed formula transformation". Using federated learning for cross-border data compliance, it compares IBS syndrome features between Russian and Chinese patients to guide portable herbal formula development. This framework redefines AI as a cross-population knowledge discovery engine rather than a mere diagnostic aid.

Keywords: irritable bowel syndrome; data-driven; federated learning; cross-population syndrome patterns; agreed formula transformation; Sino-Russian cooperation

IBS affects 4.1%–10% of the global population [1], and Chinese herbal medicine has proven symptomatic efficacy [2,3]. However, Sino-Russian TCM exchanges remain limited to crude herb trade, leaving a critical data gap: Chinese clinicians lack systematic data on IBS syndrome distribution in Russian populations. Surveys in Irkutsk identify cold food intake and emotional stress as major local triggers, yet no tailored TCM products exist for the Russian Far East. Based on the collaboration between Heilongjiang University of Chinese Medicine and Amur State Medical Academy, this study establishes a complete data-to-product pathway for IBS.

Objective

This study proposes a Far East Russia-oriented IBS syndrome data collection scheme with Russian TCM questionnaires, and designs a protocol for developing targeted agreed formulas via comparative syndrome analysis.

Materials and Methods

The workflow includes five stages:

1.Recruitment of 100–150 adult IBS patients meeting Rome IV criteria by Amur State Medical Academy.

2.Russian-language syndrome questionnaire adapted from the 2024 IBS TCM Expert Consensus [3] per cross-cultural guidelines [4], paired with smartphone tongue imaging, dietary/activity recording and HADS assessment. Raw data are stored locally on encrypted Russian servers; only de-identified structured features are shared via federated learning, complying with Chinese and Russian personal

data regulations [5].

3.AI analysis: descriptive statistics comparing syndrome distribution with 861 Chinese IBS patients [6], K-means clustering and Apriori association rule mining.

4.Agreed formula design by ≥3 senior TCM specialists based on AI findings.

5.Formula manufacturing as granules or herbal tea bags, with follow-up at 2, 4 and 8 weeks for iterative optimization.

Results and Discussion

This model forms a closed loop of data collection, pattern mining and product translation with three theoretical innovations: (1) formula development grounded in real clinical data rather than empirical experience; (2) AI repositioned from a diagnostic tool to a cross-population knowledge discoverer; (3) research endpoint extended from individual consultations to standardized product delivery.

Given long winters and high-fat diets in the Russian Far East, spleen-kidney yang deficiency is hypothesized as the dominant local syndrome. If validated, the classical formula Sishen Wan could be modified into portable granules as a direct translational output.

A key limitation is the 100–150 sample size, which may cause unstable gradient estimates in federated learning and reduce reliability compared with large-scale centralized training. This sample size is designed solely to verify workflow feasibility.

Upon confirming efficacy, the formula will proceed to marketing authorization under EAEU phytopharmaceutical regulations. The model could further extend to functional dyspepsia and constipation, supporting the construction of a Sino-Russian syndrome database.

This proposed framework adopts data-driven federated learning targeting agreed formula transformation. It uses AI for cross-population syndrome mining and replaces single consultations with standardized herbal products, forming a full closed-loop research-to-industry pathway.

References:

[1] Sperber A D, Bangdiwala S I, Drossman D A, et al. Worldwide prevalence and burden of functional gastrointestinal disorders, results of Rome Foundation global study. Gastroenterology, 2021, 160(1): 99-114.e3.

[2] Zheng H, Jin S, Shen Y L, et al. Chinese herbal medicine for irritable bowel syndrome: a meta-analysis and trial sequential analysis of randomized controlled trials. Frontiers in Pharmacology, 2021, 12: 694741.

[3] Bian L Q, Huang S G, Wei W, et al. Expert consensus on diagnosis and treatment of irritable bowel syndrome with traditional Chinese medicine (2024). Journal of Traditional Chinese Medicine, 2024, 65(18): 1948-1956. [in Chinese]

[4] Beaton D E, Bombardier C, Guillemin F, et al. Guidelines for the process of cross-cultural adaptation of self-report measures. Spine, 2000, 25(24): 3186-3191.

[5] Rieke N, Hancox J, Li W, et al. The future of digital health with federated learning. NPJ Digital Medicine, 2020, 3: 119.

[6] Li X, Chen T, Ma J X, et al. Analysis on distribution characteristics of traditional Chinese medicine syndromes in 861 patients with diarrhea-predominant irritable bowel syndrome. Chinese Journal of Integrated Traditional and Western Medicine on Digestion, 2025, 33(10): 907-912. [in Chinese]

APPLICATION OF BLOCKCHAIN TECHNOLOGY IN CROSS-BORDER QUALITY TRACEABILITY OF TRADITIONAL CHINESE MEDICINE DECOCTION PIECES: A CASE STUDY OF THE SUIFENHE PORT IN CHINA-RUSSIA TRADE

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Abstract

Cross-border TCM quality trust faces traceability asymmetry. Using Suifenhe Port pilot (July 2023–March 2025), this study finds that consortium blockchain cuts batch verification from 7 days to 3.2 seconds, with 97.0% tampering detection. Yet bottlenecks remain: smart contracts' legal status undefined, fingerprint spectra inter-lab comparability insufficient, and empirical identification unquantifiable. Blockchain should serve as "trustworthy process recorder," not quality evaluator. A gradual "regulatory sandbox" approach at border ports is recommended.

Keywords: Blockchain; TCM Decoction Pieces; Cross-Border Traceability; China-Russia Cooperation; Regulatory Sandbox

Chinese herbal decoction pieces are a major export category in traditional Chinese medicine. In 2023, bilateral trade at China-Russia border ports reached approximately USD 470 million, with an 11.3% return rate due to unclear origin and inconsistent test reports[1]. Current oversight relies on exporters' certificates and importers' inspections, forming a mutual recognition model. For Astragalus membranaceus, China's Pharmacopoeia mandates ≥0.080% astragaloside IV, while Russia adheres to Eurasian Economic Union herbal standards, with no equivalence agreement on limits or methods[1], hindering stable mutual recognition. Blockchain, featuring decentralization, immutability, and data sharing, suits cross-border multi-party traceability[2-3]. However, existing studies primarily address chemical drug supply chains[4], with scant attention to TCM decoction pieces as a distinct category. This paper examines the Suifenhe Port project to assess its applicability, performance, and limitations in cross-border TCM contexts.

Objective

This study assesses blockchain’s pilot efficacy and barriers, particularly TCM-specific quality evaluation constraints.

Materials and Methods

This study enrolled 1,847 batches of four TCM decoction pieces including Astragalus, Angelica, Glycyrrhiza, and Panax ginseng that passed through the port from July 2023 to March 2025. A Hyperledger Fabric v2.4 consortium blockchain was established with three validation nodes deployed on each side in China and Russia. Each batch was assigned a 32-digit traceability code, and 21 data points were recorded on the blockchain. Evaluation metrics included traceability

response time derived from system logs, data completeness rate from real-time validation, regulatory retrieval success rate from node logs, and tampering detection rate from monthly hash consistency checks. A questionnaire survey with 28 responses supplemented the data, with a Cronbach's α of 0.87. Continuous variables were expressed as mean ± standard deviation, categorical variables as percentages, and group comparisons were performed using the Mann-Whitney U test with SPSS version 26.0.

Results and Discussion

Based on the Suifenhe pilot, blockchain reduced verification from 7 days to 3.2 seconds, achieved 99.8% data completeness, 97.0% overall tampering detection, and 99.7% against hash-chain attacks. Russian regulator credibility rose from 1.8 to 4.2, enabling a shift from result recognition to process verification amid misaligned standards. Bottlenecks include undefined legal status, node disputes, data-sharing reluctance, and insufficient spectral comparability. Blockchain cannot ensure pre-chain authenticity or resolve quality methodology issues; it serves as complementary documentation, not quality assessment. Future work should address privacy-preserving computation, infrastructure, and differentiated standards.

References

[1] Bocek T, Rodrigues B B, Strasser T, et al. Blockchains everywhere – a use-case of blockchains in the pharma supply chain[C]//IFIP/IEEE International Symposium on Integrated Network Management. Lisbon, 2017: 772-777.

[2] Sylim P, Liu F, Marcelo A, et al. Blockchain technology for detecting falsified and substandard drugs in distribution[J]. JMIR Research Protocols, 2018, 7(9): e10163.

[3] Tseng J H, Liao Y C, Chong B, et al. Governance on the drug supply chain via gcoin blockchain[J]. International Journal of Environmental Research and Public Health, 2018, 15(6): 1055.

[4] Mackey T K, Nayyar G. A review of existing and emerging digital technologies to combat the global trade in fake medicines[J]. Expert Opinion on Drug Safety, 2017, 16(5): 587-602.

DIGITAL EMPOWERMENT AND TRADITIONAL REVITALIZATION: THE CURRENT SITUATION, OPPORTUNITIES, AND PATHS OF THE INTEGRATION OF THE CHINESE AND RUSSIAN SMART MEDICINE INDUSTRIES

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Abstract

The integration of the Chinese and Russian smart medicine industries represents a critical area of strategic collaboration. This paper reviews the current state, identifies key opportunities, and proposes feasible pathways. Recent developments demonstrate a shift from policy alignment toward substantive integration, yet significant gaps remain in market cooperation and institutional mechanisms. Breakthroughs are needed in regulatory harmonization, technology commercialization, and talent exchange.

Keywords: Smart Medicine Industry, China-Russia Cooperation, Industrial Integration, Digital Health, Regulatory Harmonization

Introduction

The global pharmaceutical industry is undergoing digital transformation through AI-driven drug discovery, telemedicine, and smart healthcare. As comprehensive strategic partners, China and Russia possess significant complementarity: China leads in AI applications, digital infrastructure, and market scale, while Russia excels in basic medical research, bioinformatics, and clinical trials [1]. However, substantive industrial integration remains limited [2]. This paper employs a "Policy-Technology-Market-Pathway" framework to examine the current state, opportunities, and feasible pathways.

Objective

This review addresses three questions: the status of China-Russia smart medicine integration, key opportunities across multiple dimensions, and feasible pathways for achieving deep integration.

Materials and Methods

This thematic review systematically retrieved literature from PubMed, Web of Science, Scopus, and CNKI After screening, 76 documents were included for qualitative synthesis.

Results and Discussion

The current state shows preliminary policy alignment but limited substantive cooperation. The 2019 "China-Russia Roadmap for Medical and Health Cooperation" established a framework, yet lacks smart medicine-specific mechanisms. Technologically, China excels in AI drug discovery and

telemedicine, while Russia has strengths in bioinformatics and computational chemistry [3,4], but these have not translated into industrial synergy. Market integration remains early-stage, with trade limited to APIs and generics; TCM products enter Russia mainly as dietary supplements due to unclear registration standards [5]. Cooperation operates through SCO and BRICS frameworks with insufficient industry-level engagement.

Key opportunities include policy synergy between China's "Healthy China 2030" and Russia's "Digital Economy National Program," technological complementarity in combining AI platforms with fundamental research, and market potential in TCM registration and Russian biologics entering China. To realize these, four pathways are essential. Regulatory mutual recognition requires establishing mechanisms for registration standards and clinical data coordination. Technology translation should focus on joint AI drug discovery laboratories addressing shared disease burdens. Market access demands simplified registration pathways and facilitated entry through reformed review systems. Talent development requires joint training programs and exchange mechanisms.

Conclusion

China-Russia smart medicine integration is at a critical transitional stage. While policy and technology have seen progress, market integration and institutional pathways remain weak. Limitations include limited quantitative data and case information. Future research should develop evaluation indices and conduct enterprise case studies.

References

[1] A. Golubeva., The Chinese-Russian Scientific and Technical Cooperation: Experience and Prospects // Russian and Chinese Studies. -2020.- Vol. 4. - C.326-334.

[2] H. Huo et al., China Report on Science, Technology and Innovation // Research. -2018.-C. 179-195.

[3] N. Vorontsova., Comparative Analysis of Pharmaceutical Industry of Russia and China. Prospects for Cooperation // Russian and Chinese Studies. -2023.- Vol. 7. - C.181-190.

[4] K.A. Koshechkin et al., Holistic Approach for Artificial Intelligence Implementation in Pharmaceutical Products Lifecycle: A Meta-Analysis // Applied Sciences. -2022.- 12(16). – 8373.

[5] L. Qu et al., Opportunities and hurdles to European market access for multi-herbal traditional Chinese medicine products: An analysis of EU regulations for combination herbal medicinal products // Pharmacological Research. -2022.- Vol. 186. – 106528.

BIOLOGICAL ACTIVITIES OF POLYSACCHARIDES FROM ILEX SPECIES: A REVIEW

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Abstract

Ilex polysaccharides, derived from species such as Ilex asprella (I. asprella), Ilex latifolia (I. latifolia), Ilex paraguariensis (I. paraguariensis), and Ilex cornuta (I. cornuta), exhibit diverse pharmacological properties. This review summarizes their structural characteristics and biological activities. They exert immunomodulatory effects via TLR4/NF-κB/MAPK pathway activation and macrophage polarization, contributing to anti-tumor activity. They also demonstrate hepatoprotective effects through Nrf2/HO-1-mediated oxidative stress attenuation and inflammation suppression. Additional benefits include gastroprotection, anti-sepsis activity, and gut microbiota modulation. Structure-activity relationships are influenced by molecular weight and monosaccharide composition. This review highlights their therapeutic potential as natural immunomodulators and hepatoprotective agents.

Keywords: Ilex polysaccharides, Immunomodulatory activity, Hepatoprotective effect, Macrophage polarization, TLR4/NF-κB signaling

Introduction

Natural polysaccharides, as a class of important biomacromolecules, have been recognized for their wide spectrum of biological activities and relatively low toxicity. They are considered promising candidates for developing functional foods and therapeutics. Plants of the genus Ilex (Aquifoliaceae), such as I. asprella, I. paraguariensis (Yerba Mate), I. latifolia, and I. cornuta, are extensively used in traditional medicine and as herbal teas in various regions, particularly in South America and Southern China. Recent phytochemical investigations have isolated and characterized numerous polysaccharides from these plants, revealing their potential as significant bioactive constituents responsible for their traditional medicinal uses.

Objective

This review aims to consolidate the current knowledge on the structural characteristics and pharmacological activities of polysaccharides derived from different Ilex species, with a specific focus on their immunomodulatory, hepatoprotective, anti-inflammatory, and anti-tumor effects, and to explore their mechanisms of action.

Materials and Methods

This review is based on a comprehensive analysis of published research papers investigating polysaccharides from Ilex species. The literature was sourced from databases including PubMed, Web of Science, and Scopus. Data on Ilex polysaccharides extraction (hot water/ultrasonic-assisted), structural features (HPLC, GC-MS), and bioactivities (in vitro/in vivo assays) were extracted and

synthesized.

Results and Discussion

Structural features: Ilex polysaccharides are heteropolysaccharides (MW 3.3–321 kDa) composed mainly of Glc, Gal, Ara, Rha, and Man in species- and extraction-dependent ratios, which directly affect bioactivity.

Biological activities: The immunomodulatory activity of Ilex polysaccharides has been demonstrated at concentrations ranging from 10 to 200 μg/mL. For instance, IAPS-2 at 50 μg/mL repolarizes M2-type tumor-associated macrophages towards an M1-like phenotype, exhibiting anti-tumor activity in vivo. ILP50-2 at 50–200 μg/mL also enhances innate immunity in zebrafish embryos.

For hepatoprotection, IAP at 100–400 mg/kg significantly ameliorated liver damage in D-GalN/LPS-induced mice by reducing oxidative stress and inflammation. Additionally, IAP modulated gut microbiota by increasing beneficial bacteria and suppressing pathogens.

Other bioactivities include anti-inflammatory effects of I. paraguariensis polysaccharides at 10 mg/kg in a sepsis model, and gastroprotective activity at the same dose against ethanol-induced gastric lesions. Polysaccharides from I. latifolia and I. cornuta at concentrations of 0.1–10 mg/mL exhibited strong antioxidant activities, including DPPH, hydroxyl, and superoxide anion radical scavenging.

Conclusions

Ilex polysaccharides are bioactive agents with immunomodulatory, hepatoprotective, and anti-inflammatory effects. Their mechanisms involve TLR4/NF-κB, Nrf2/HO-1 signaling, gut microbiota regulation, and macrophage polarization, supporting their potential in immune diseases, liver injury, and cancer therapy. Future research needs to establish structure–activity relationships, perform clinical validation, and investigate drug synergies.

References

[1] Z. Shi, L. An, S. Zhang, Z. Li, Y. Li, J. Cui, J. Zhang, D.-Q. Jin, M. Tuerhong, M. Abudukeremu, J. Xu, Y. Guo, A heteropolysaccharide purified from leaves of Ilex latifolia displaying immunomodulatory activity in vitro and in vivo, Carbohydrate Polymers 245 (2020) 116469. https://doi.org/10.1016/j.carbpol.2020.116469.

[2] Y. Wang, L. Ye, R. Yan, C. Guo, M. Mu, Y. Sun, H. Zhou, G. Zhao, Ilex asprella-derived polysaccharide activates macrophage via TLR4-mediated NF-κB and MAPK signaling pathways, Journal of Functional Foods 122 (2024) 106527. https://doi.org/10.1016/j.jff.2024.106527.

[3] J. Fan, Z. Wu, T. Zhao, Y. Sun, H. Ye, R. Xu, X. Zeng, Characterization, antioxidant and hepatoprotective activities of polysaccharides from Ilex latifolia Thunb, Carbohydrate Polymers 101 (2014) 990–997. https://doi.org/10.1016/j.carbpol.2013.10.037.

A COMPREHENSIVE REVIEW ON THE CHEMISTRY OF SOPHORAE TONKINENSIS POLYSACCHARIDES: EXTRACTION, PURIFICATION, AND STRUCTURAL FEATURES

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Abstract

Sophorae tonkinensis Radix et Rhizoma (STRR) is a traditional medicinal herb. Its polysaccharides (STRRPs) are key bioactive macromolecules, yet their chemical characterization remains fragmented. This review consolidates the research on the extraction, purification, and structural properties of STRRPs. MAATPE significantly improves yield (~10.7%) and reduces structural damage. STRRPs exhibit a wide molecular weight range (8.0-660.0 kDa) and complex monosaccharide profiles. Sulfation enhances solubility and bioactivity. Standardized protocols are urgently needed.

Keywords: Sophorae tonkinensis, polysaccharides, extraction, structural characterization, molecular weight

Introduction

STRR, documented since the "Kaibao Bencao", contains diverse alkaloids and flavonoids. Its polysaccharides (STRRPs) have attracted significant interest for their bioactivities. However, data on extraction yields, molecular weight, and monosaccharide composition vary greatly across studies, hindering the establishment of clear structure-activity relationships. A systematic review of STRRPs chemistry is essential to establish a cohesive foundation for future research.

Objective

This review aims to synthesize existing literature on the extraction, purification, and structural characteristics of STRRPs, providing a comprehensive chemical framework.

Materials and Methods

A systematic search was performed in Web of Science, PubMed, Google Scholar, and CNKI for publications from 1999 to 2026. Search terms included "Sophora tonkinensis Gagnep.", "Sophora subprostrata", "polysaccharide", "extraction", "purification", and "structure". Key data on extraction parameters, purification protocols, and structural features were extracted for analysis.

Results and Discussion

Hot water extraction (HWE) is the most common method for STRRP isolation—simple and cheap, but yields vary widely (2.5–7.1%) with temperature, time, and solid–liquid ratio. Alkaline extraction gives ~1.56% yield but risks structural degradation via β-elimination. Microwave-assisted aqueous two-phase extraction (MAATPE) achieves 10.7% yield in just 6 minutes, preserving integrity while

greatly reducing time. Crude polysaccharides are then purified by Sevag deproteinization, dialysis, decolorization, and sequential DEAE-cellulose and gel filtration chromatography.

Although this purification scheme effectively yields homogenous fractions, it remains time-consuming and may cause polysaccharide loss. STRRPs exhibit a broad molecular weight distribution ranging from 8.0 to 660.0 kDa, which is critically influenced by the extraction method employed. The monosaccharide composition includes glucose, galactose, mannose, arabinose, rhamnose, and galacturonic acid. Neutral glucans feature α-(1→4)-linked glucan backbones, whereas acidic pectic polysaccharides contain rhamnogalacturonan-I domains with α-(1→4)-galacturonic acid backbones. Sulfation modification is typically conducted via the chlorosulfonic acid-pyridine method, which effectively introduces sulfate groups. This chemical modification significantly improves water solubility and alters the charge properties of the polysaccharide molecules, thereby enhancing their biological activities.

Conclusion

Extraction methods significantly affect STRRP structural integrity and molecular weight. Conditions like temperature, time, and solvent type cause varying degradation, influencing molecular weight distribution and chain conformation. STRRP chemical complexity arises from diverse monosaccharides, glycosidic linkages, and sulfation potential. However, substantial protocol variability across studies hinders data comparison. Standardized procedures covering extraction, purification, and characterization are urgently needed to ensure data reproducibility and comparability. Such standardization is critical for elucidating structure-activity relationships and enabling industrial production of consistent, high-quality STRRPs.

References

[1] F.-F. Zeng, Z.-H. Chen, F.-H. Luo, C.-J. Liu, X. Yang, F.-X. Zhang, W. Shi, Sophorae tonkinensis radix et rhizoma: A comprehensive review of the ethnopharmacology, phytochemistry, pharmacology, pharmacokinetics, toxicology and detoxification strategy, J. Ethnopharmacol. 337 (2025) 118784. https://doi.org/10.1016/j.jep.2024.118784.

[2] L. Cai, S. Zou, D. Liang, L. Luan, Structural characterization, antioxidant and hepatoprotective activities of polysaccharides from Sophorae tonkinensis Radix, Carbohydr. Polym. 184 (2018) 354–365. https://doi.org/10.1016/j.carbpol.2017.12.083.

[3] Y. Huang, X. Wu, S. Zhou, Y. Lin, W. Zhang, C. Fu, L. Luo, K. Wang, X. Xie, H. Fan, Biphasic extraction of different polysaccharides from Radix Sophorae Tonkinensis by microwave-assisted aqueous two-phase extraction: Process optimization, structural characterization and mechanism exploration, Sep. Purif. Technol. 207 (2018) 187–198. https://doi.org/10.1016/j.seppur.2018.06.038.

[4] X.-H. Shuai, T.-J. Hu, H.-L. Liu, Z.-J. Su, Y. Zeng, Y.-H. Li, Immunomodulatory effect of a Sophora subprosrate polysaccharide in mice, Int. J. Biol. Macromol. 46 (2010) 79–84. https://doi.org/10.1016/j.ijbiomac.2009.10.016.

NETWORK PHARMACOLOGY STUDY OF THE ASTRAGALUS MEMBRRANACEUS–PANAX GINSENG HERB PARI IN THE TREATMENT OF CORONARY HEART DISEASE

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Abstract

This study used network pharmacology and molecular docking to explore the mechanisms of the Astragalus membranaceus–Panax ginseng pair in CHD. A total of 41 compounds and 67 intersecting targets were identified, with 27 core targets including AKT1, TNF, and PTGS2. Key pathways involved TNF and NF-κB signaling. Core compounds such as quercetin and kaempferol showed strong binding affinity. Results suggest multi-target, multi-pathway cardioprotective effects, supporting TCM modernization and digital interpretation.

Keywords: Network pharmacology; Molecular docking; Coronary heart disease; Astragalus membranaceus; Panax ginseng

Coronary heart disease (CHD) is a leading cause of cardiovascular mortality worldwide, closely associated with lipid metabolism disorders, inflammatory activation, and endothelial dysfunction1. In the context of digital medicine and TCM modernization, network pharmacology based on multi-source databases and computational biology provides an effective approach to elucidate the multi-component, multi-target, and multi-pathway mechanisms of TCM formulas, supporting global interpretation of TCM mechanisms. Astragalus membranaceus and Panax ginseng, a classic qi-tonifying herb pair, are widely used in CHD management2. They improve microcirculation, myocardial energy metabolism, and hypoxic injury, with cardioprotective effects via anti-inflammatory, endothelial-protective, and antioxidant actions, though synergistic mechanisms remain unclear. This study integrates TCMSP, GeneCards, and DisGeNET with PPI network construction, GO/KEGG enrichment, and molecular docking to explore the mechanisms of the Astragalus–ginseng pair in CHD, providing a theoretical basis for TCM modernization and mechanistic interpretation.

Objective

A network pharmacology and molecular docking study constructing an Astragalus membranaceus–Panax ginseng–CHD network to elucidate multi-component, multi-target, multi-pathway synergy and support digital interpretation and translation.

Materials and Methods

Chemical constituents of Astragalus membranaceus and Panax ginseng were retrieved from TCMSP

with screening criteria of oral bioavailability (OB ≥ 30%) and drug-likeness (DL ≥ 0.18). Targets were standardized via UniProt. CHD-related targets were collected from GeneCards and DisGeNET using "coronary heart disease" as the keyword. Common targets were identified using Venny. A protein–protein interaction (PPI) network was built using STRING (Homo sapiens, confidence score > 0.4) and analyzed in Cytoscape 3.9.0 to identify core targets. GO and KEGG enrichment were performed using Metascape ($P < 0.01$). Molecular docking was conducted using AutoDock Vina and visualized in PyMOL.

Results and discussion

A total of 41 active compounds (20 from Astragalus membranaceus, 22 from Panax ginseng) and 207 putative targets were identified, including quercetin, kaempferol, isorhamnetin, formononetin, and ginsenoside Rh2. A total of 1,843 CHD-related targets were retrieved, yielding 67 intersecting targets. The PPI network contained 66 nodes and 485 edges, identifying 27 core targets such as AKT1, TNF, PTGS2, JUN, IL1B, and CASP3. GO analysis indicated enrichment in inflammatory responses, while KEGG analysis highlighted the TNF signaling pathway. Molecular docking showed binding affinities below −4.25 kcal/mol, with kaempferol–TNF showing the strongest affinity (−9.829 kcal/mol). Under a digital medicine–TCM integration framework, multi-database and network analyses revealed that the herb pair exerts synergistic anti-CHD effects via multi-target and multi-pathway regulation. Key pathways include TNF and NF-κB signaling, suggesting suppression of inflammatory cascades and atherosclerosis progression. AKT1 and PTGS2 regulate cardiomyocyte survival and endothelial function, while quercetin and kaempferol show antioxidant and anti-inflammatory activity3. Ginsenoside Rh2 supports myocardial energy metabolism and apoptosis inhibition. Docking results further confirm network pharmacology predictions.

Conclusion

The Astragalus–ginseng herb pair exerts therapeutic effects against CHD through 27 core targets and key pathways such as TNF and NF-κB signaling. Its multi-component synergistic mechanism reflects the holistic regulatory characteristics of TCM.

References:

1. DALEN J E, ALPERT J S, GOLDBERG R J, et al. The epidemic of the 20(th) century: coronary heart disease [J]. Am J Med, 2014, 127(9): 807-12.

2. XU Y, PENG W, HAN D, et al. Combined Treatment of Non-Small-Cell Lung Cancer Using Shenyi Capsule and Platinum-Based Chemotherapy: A Meta-Analysis and Systematic Review [J]. Evid Based Complement Alternat Med, 2020, 2020: 3957193.

3. SHAH A V, DESAI H H, THOOL P, et al. Development of self-microemulsifying drug delivery system for oral delivery of poorly water-soluble nutraceuticals [J]. Drug Dev Ind Pharm, 2018, 44(6): 895-901.

REGULATION MECHANISM AND INDUSTRIAL INTEGRATION VALUE OF TRADITIONAL CHINESE MEDICINE CIRCULAR MOTION THEORY IN THE PREVENTION AND TREATMENT OF CHRONIC DISEASES IN COLD REGIONS OF CHINA AND RUSSIA

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Abstract: High-latitude cold zones of China and Russia share similar cold and dry climates. Long-term low temperature triggers yang deficiency, qi stagnation and visceral dysfunction, raising risks of cardiovascular, metabolic and immune chronic diseases. Single-target modern medical therapy fails to correct cold-induced constitutional defects and stop disease recurrence. TCM circular motion theory focuses on holistic qi circulation regulation and visceral yin-yang balance. This paper states complete research objectives, analyzes the multi-target intervention mechanism of circular motion theory and typical cold-region prescriptions, and explores its practical value in Sino-Russian biomedical cooperation and characteristic health industry integration, to supply solid theoretical support for cross-border chronic disease control and digital smart medical innovation.

Key words: Circular motion theory; cold-region chronic disease; Sino-Russian biomedical cooperation; holistic regulation; industrial integration

Introduction: Cold climate in Sino-Russian high latitudes impairs innate yang qi, stagnates qi-blood circulation and disrupts visceral lifting-sinking function, driving high chronic disease prevalence among local residents. Both nations face aging populations and heavy chronic disease treatment burdens. Russian precision biomedicine and holistic TCM constitution conditioning form obvious complementary strengths. Against the background of bilateral smart medicine and herbal industry cooperation, this study applies circular motion theory to analyze cold-region pathological features and prescription rules for joint chronic disease prevention and industrial docking[1].

Objective: This study summarizes shared chronic disease pathogenesis of Sino-Russian cold areas, clarifies how circular motion theory relieves cold-caused visceral imbalance from the root, and discusses holistic regulation effects of Erxian Decoction, Shengjiang Powder Guizhi Fuling Pill and Liuwei Dihuang Pill. It explores the theoretical and industrial value of this theory in bilateral collaborative disease control, offering clear ideas for digital integrated development of TCM and modern biomedicine.

Materials and Methods: Theoretical sorting and comparative analysis were adopted. This paper sorts core connotation of circular motion theory, clarifies chronic disease pathology from qi circulation disorder, compares climate and disease spectrum similarities between Chinese and Russian cold regions, summarizes regulating effects of classic cold-region prescriptions, and concludes theoretical and industrial value based on current Sino-Russian biomedical cooperation.

Results and Discussion:

1. Homologous Pathogenesis of Sino-Russian Cold-region Chronic Diseases

Persistent cold consumes yang qi, disrupts visceral functions and causes qi stagnation, blood stasis, cold-heat disharmony and damp-heat accumulation, which lead to frequent hypertension, nodules, metabolic and immune inflammatory illnesses[2]. Modern medicine only improves single indicators without holistic conditioning, resulting in stubborn, recurrent chronic diseases.

2. Regulatory Mechanism of Circular Motion Theory on Chronic Diseases

Circular motion theory achieves holistic visceral regulation to remedy limits of symptomatic treatment. Erxian Decoction harmonizes yin and yang for cold-induced deficiency; Shengjiang Powder lifts clear qi and dispels hidden heat; Guizhi Fuling Pill activates blood to ease vascular stasis; Compound Difuzi Decoction and Zhennu Decoction clear damp-heat and repair immune injury.Liuwei Dihuang Pill nourishes kidney yin and replenishes consumed yin fluid, restrains floating deficient fire caused by cold-induced yang stagnation, and recovers the upward and downward circular balance of lung, spleen and kidney qi movement[3]. All formulas restore qi circulation to intervene chronic diseases via multiple targets.

3. Sino-Russian Biomedical and Industrial Integration Value

This theory builds a unified system for bilateral cold-region chronic disease joint control, combining TCM holistic regulation and Russian precise therapy. It promotes standardized modernization of cold-region herbal prescriptions, facilitates cross-border clinical transformation and cold-resistance health product development, and provides a new research framework for academic exchanges and talent training to advance Sino-Russian smart health industry.

Conclusion: Visceral circular motion disorder induced by cold is the core regional pathogenesis of chronic diseases in Sino-Russian cold zones. Circular motion theory and classic prescriptions relieve cold-related constitutional imbalance and chronic lesions, making up for defects of single-target modern therapy. This study offers a new holistic paradigm for bilateral collaborative chronic disease prevention, and supports digital smart medical innovation and deep industrial integration of Chinese and Russian biomedicine.

References

[1]Wang Q. Basic Theory of Traditional Chinese Medicine[M]. Beijing: China Press of Traditional Chinese Medicine, 2020:68-72.

[2]Wang Y B, Zhang D S, Dong C Y, et al. Experience Summary of Jiang Deyou's Characteristic Treatment of Metabolic Syndrome Based on Cold-Induced Pathogenesis[J]. Journal of Changchun University of Chinese Medicine, 2025, 41(8): 856-861.

[3]Shan Y L, Niu S Y, Shan Y X, et al. Application of Liuwei Dihuang Decoction (Pill) in Diseases of Cold Regions[J/OL]. Clinical Journal of Chinese Medicine, 1-5.

APPLICATION OF WEARABLE DEVICES IN TRADITIONAL CHINESE MEDICINE-BASED KNEE HEALTH MANAGEMENT

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Abstract. Knee discomfort, stiffness, and functional decline affect older adults, people with cumulative joint loading, and residents of cold regions. This narrative review examines how wearable devices may support traditional Chinese medicine (TCM)-based knee health management. Digital self-management, activity tracking, and exercise assessment can support monitoring, behavior change, and home rehabilitation. Wearable platforms may also enable standardized monitoring of selected TCM external therapies and extend preventive services in cold regions. Clinical validity, sensor accuracy, safety, privacy, and integration with TCM pattern differentiation require further evaluation.

Keywords: wearable devices; traditional Chinese medicine; knee health management; digital health; preventive treatment of disease; cold regions

Knee problems linked to aging, obesity, low activity, and cumulative loading can cause pain, stiffness, and reduced mobility. In cold regions, seasonal inactivity and cold-related discomfort increase the need for long-term support. TCM health management emphasizes prevention before disease, functional maintenance, individualized regulation, and external approaches including moxibustion and acupoint stimulation [3,4]. Conventional care is often episodic and difficult to monitor. Wearables offer continuous sensing and feedback, bridging digital health and TCM-oriented preventive knee care.

Objective

To review the potential roles, limitations, and cold-region service value of wearable technologies in TCM-based knee health management.

Materials and methods

A focused narrative review synthesized six specified, searchable publications on digital osteoarthritis self-management, activity tracking, knee rehabilitation sensors, moxibustion, and TCM clinicians' perceptions.

Results and discussion

Continuous monitoring. Accelerometers, gyroscopes, and inertial sensors can record activity, gait-related features, movement intensity, exercise performance, and adherence. Longitudinal information can complement clinical observation and TCM inquiry, but cannot replace examination or pattern differentiation [6].

Personalized health behavior management. Goals, reminders, and feedback can help users maintain appropriate activity and avoid inactivity or excessive joint loading. Reviews indicate

that digital self-management and activity trackers can improve physical activity and selected osteoarthritis outcomes, although effects vary [1,2]. This supports early, sustained regulation.

Rehabilitation and home-based care. Wearable sensing can assess exercise performance, deliver real-time feedback, and provide records for remote follow-up [6]. It can connect hospital guidance with home and community care, but algorithms require validation and cannot replace professional assessment when symptoms worsen.

Modernization of TCM external therapy. Moxibustion and related external approaches involve localized stimulation grounded in TCM theory [3,4]. Wearables could support standardized timing, safety monitoring, acupoint guidance, and feedback. TCM clinicians recognize both convenience and reliability challenges in integrating wearables with diagnostic instruments [5]. Technology is an enabling carrier, not evidence of therapeutic effectiveness by itself.

Cold-region health management. Activity monitoring, seasonal reminders, rehabilitation support, and remote follow-up are relevant to older adults, outdoor workers, and people less active during long winters. Wearables may extend preventive knee health services into homes and communities.

Current limitations. Evidence remains heterogeneous, consumer measurements may lack clinical precision, and TCM concepts cannot be reduced to a single sensor metric. Future work should evaluate utility, safety, privacy, usability, access, and transparent interpretation. Combined wearable-TCM interventions require prospective validation.

Conclusion

Wearable devices offer a feasible digital pathway for continuous monitoring, individualized feedback, home rehabilitation, and preventive knee health management. Their integration with TCM external therapy and cold-region services is promising but remains developmental. Progress depends on reliable measurement, clinically meaningful outcomes, safety, privacy, and theory-consistent integration with TCM practice.

References

1. Safari R., Jackson J., Sheffield D. Digital Self-Management Interventions for People With Osteoarthritis: Systematic Review With Meta-Analysis. Journal of Medical Internet Research. 2020;22(7):e15365. doi: 10.2196/15365.

2. Ferguson T., Olds T., Curtis R., Blake H., Crozier A.J., Dankiw K., Dumuid D., Kasai D., O'Connor E., Virgara R., Maher C. Effectiveness of wearable activity trackers to increase physical activity and improve health: a systematic review of systematic reviews and meta-analyses. The Lancet Digital Health. 2022;4(8):e615-e626. doi: 10.1016/S2589-7500(22)00111-X.

3. Zhao L., Cheng K., Wang L., Wu F., Deng H., Tan M., Lao L., Xu N., Chen H., Wu H., Shen X. Effectiveness of moxibustion treatment as adjunctive therapy in osteoarthritis of the knee: a randomized, double-blinded, placebo-controlled clinical trial. Arthritis Research & Therapy. 2014;16:R133. doi: 10.1186/ar4590.

4. Deng H., Shen X. The Mechanism of Moxibustion: Ancient Theory and Modern Research.

Evidence-Based Complementary and Alternative Medicine. 2013;2013:379291. doi: 10.1155/2013/379291.

5. Zhou S., Li K., Ogihara A., Wang X. Perceptions of traditional Chinese medicine doctors about using wearable devices and traditional Chinese medicine diagnostic instruments: A mixed-methodology study. Digital Health. 2022;8:20552076221102246. doi: 10.1177/20552076221102246.

6. Chen K.H., Chen P.C., Liu K.C., Chan C.T. Wearable Sensor-Based Rehabilitation Exercise Assessment for Knee Osteoarthritis. Sensors. 2015;15(2):4193-4211. doi: 10.3390/s150204193.

APPLICATION OF DIGITAL THERAPEUTICS IN CHRONIC DISEASE MANAGEMENT OF CHRONIC KIDNEY DISEASE AND PROSPECTS FOR CHINA-RUSSIA COOPERATION IN SMART HEALTHCARE

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Abstract

Chronic kidney disease (CKD) represents a significant global health burden. Although traditional Chinese medicine (TCM) offers unique advantages in CKD management, conventional approaches still face challenges such as poor follow-up adherence and low patient cooperation. Digital therapeutics (DTx), defined as evidence-based, software-driven health interventions, demonstrate substantial potential in addressing these limitations by enabling remote monitoring and personalized feedback. This paper reviews the current applications of DTx in CKD management and discusses the prospects for Sino-Russian collaboration in the field of smart healthcare.

Keywords: digital therapeutics,management of chronic kidney disease

The prevalence of chronic kidney disease (CKD) in China reaches 10.8%, affecting over 120 million individuals, Its insidious onset and low public awareness often result in missed opportunities for timely intervention. Conventional management models struggle to ensure continuous monitoring. Digital therapeutics (DTx), through remote monitoring and behavioral interventions, enhance patient adherence and self-management capabilities[1], offering an innovative approach to CKD management.

Objective

Systematically review the current status and research progress of digital therapeutics in integrated Chinese and Western medicine chronic disease management for chronic kidney disease, and further analyze the complementary advantages and cooperation prospects between China and Russia in the convergence of smart pharmaceutical industries.

Materials and methods

Relevant literature on digital therapeutics, TCM management of chronic diseases, chronic kidney disease, and telemedicine from the past three years was retrieved from databases including CNKI, Wanfang Data, VIP Database, and PubMed. A comprehensive analysis was conducted by integrating these findings with the current state of China-Russia medical cooperation, leading to conclusions and results.

Results and discussion

DTx enables real-time monitoring of blood pressure, body weight, blood glucose, and other

parameters for early warning; the Internet of Things facilitates dynamic surveillance of edema, anemia, and dialysis volume changes; mobile applications offer precise nutritional management and emotional support, enhancing adherence and reducing adverse events[2][3]. Artificial intelligence aids in early screening and risk prediction for CKD[4], while telemedicine transcends spatial and temporal barriers, promoting multidisciplinary collaboration[5]. Integration of traditional Chinese medicine (TCM) syndrome differentiation and treatment, medicinal cuisine, rehabilitation exercises with DTx enables personalized integrated Chinese-Western medicine therapy .However, data security and privacy protection remain insufficient; disparities in patients' digital literacy, lack of standardized clinical validation criteria, and absence of reimbursement systems hinder widespread adoption.China-Russian cooperation exhibits strong complementarity: Russia possesses abundant resources but uneven distribution, with weak primary healthcare infrastructure in the Far East; China boasts a mature digital health ecosystem and widespread telemedicine adoption . Key areas include joint development of CKD-DTx products, establishment of cross-border consultation platforms, federated learning-based AI research, mutual recognition of standards, and talent development. The "Health Silk Road" initiative and alignment of national strategies provide policy support[6].Thus, DTx provides personalized, sustainable, and accessible solutions for CKD management. Deepening Sino-Russian cooperation in smart healthcare, by integrating technological, resource, and policy advantages, can accelerate innovation translation and thereby improve patients' quality of life.

References:

[1] Liu X, Yan QY, Zhou YL, et al. Research progress on the application of digital therapeutics in chronic disease management [J]. Journal of Nursing Science, 2023, 38(11): 122-126.

[2] Min Lijun, Yang Qiaoju, Yang Yange, et al. Advances in the application of digital health technologies in the health management of chronic kidney disease [J]. Chinese Journal of Nursing Education, 2026, 23(1): 123-128.

[3] Ying Jiapei, Pei Hualian, Zhou Lingling, et al. Construction and Application Research of a Digital and Intelligent Proactive Health Management Program for Middle-Aged and Elderly Patients with Chronic Kidney Disease and Comorbidities [J]. Chinese Journal of Nursing, 2025, 60(21): 2591-2598.

[4] Sabanayagam C, Banu R, Lim C, et al. Artificial intelligence in chronic kidney disease management: a scoping review. Theranostics. 2025;15(10):4566-4578. Published 2025 Mar 21. doi:10.7150/thno.108552

[5] Song Xinyan. Research status of telemedicine in the management of chronic kidney disease [J]. Tianjin Nursing, 2026, 34(1): 119-123.

[6] Song Jia Duo. Analysis of the Current Status and Prospects of China-Russia Cooperation in the Medical and Health Industry [J]. Eurasian Economic Review, 2024, (3): 95-111+130.

MULTI-TARGET MECHANISM STUDY OF ACUPOINT CATGUT EMBEDDING IN THE TREATMENT OF SIMPLE OBESITY

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Abstract

Simple obesity stems from disrupted energy homeostasis, neuroendocrine dysfunction and chronic low-grade inflammation. As a minimally invasive TCM therapy, acupoint catgut embedding implants absorbable sutures at acupoints to produce sustained stimulation. This paper systematically summarizes its synergistic multi-target anti-obesity mechanisms based on recent experimental evidence from four regulatory dimensions.

Keywords: simple obesity; acupoint catgut embedding; neuroendocrine regulation; chronic low-grade inflammation; energy metabolism

Acupoint catgut embedding exerts weight-reducing effects via a multi-dimensional network rather than single-target regulation, covering central appetite control, peripheral adipose thermogenesis, intestinal microecological remodeling and anti-inflammatory modulation. This study adopted a systematic literature integration method. Domestic and international high-quality studies focusing on central neuroregulation, adipose remodeling, gut flora and inflammatory pathways were retrieved, and shared mechanistic modules were extracted for synthetic analysis to construct its multi-target synergistic regulatory model, providing theoretical support for clinical optimization and follow-up basic research.

Objective

To clarify the core therapeutic mechanisms of acupoint catgut embedding against simple obesity and establish a multi-target synergistic regulation model.

Materials and Methods

Systematic literature retrieval was conducted to collect relevant domestic and international studies. Eligible high-quality papers concerning central appetite regulation, fat remodeling, intestinal microecology and inflammatory signaling cascades were screened, and consistent mechanistic pathways were summarized and analyzed inductively.

Results and Discussion

Four coordinated regulatory pathways underpin its anti-obesity function. Centrally, the therapy upregulates hypothalamic leptin receptor expression and enhances phosphorylation of insulin receptor substrate-1 and phosphatidylinositol 3-kinase to relieve central leptin and insulin resistance. Activated pro-opiomelanocortin neurons secrete α-melanocyte-stimulating hormone to suppress appetite via melanocortin 4 receptors, while inhibiting excessive ghrelin secretion to balance hunger

and satiety signals.

Peripherally, embedding activates the sympathetic nervous system and triggers the β3-adrenergic receptor/cAMP/PKA/p38 MAPK cascade, inducing white adipose browning with markedly elevated uncoupling protein 1 and PGC-1α expression to boost energy expenditure.

Intestinally, it elevates the Bacteroidetes/Firmicutes ratio, enriches Akkermansia and Bifidobacterium, and reduces lipopolysaccharide-producing bacteria. Accumulated short-chain fatty acids activate intestinal L-cells to secrete glucagon-like peptide-1 and peptide YY, transmitting satiety signals through the gut–brain axis and repairing intestinal barrier integrity.

Anti-inflammatorily, catgut embedding blocks adipose TLR4/NF-κB cascades, lowers TNF-α and IL-6 release, and shifts macrophage polarization from pro-inflammatory M1 to anti-inflammatory M2, breaking the vicious cycle linking inflammation and insulin resistance.

Conclusion

Acupoint catgut embedding systematically ameliorates simple obesity through coordinated multi-target regulation of central intake, peripheral thermogenesis, intestinal flora and tissue inflammation. Future metabolomics research can identify the initial signaling molecules triggering acupoint-induced endogenous metabolic modulation.

References

1.YANG Q M, XING L W, DONG Q Z, et al. Effect of acupoint catgut embedding on serum leptin and hypothalamus leptin receptor expression in rats with simple obesity[J]. Evidence-Based Complementary and Alternative Medicine, 2021, 2021: 3500409.

2.Li M, Zhu M, Yan M X, et al. Acupoint catgut embedding improves abdominal obesity in rats by correcting glucose and lipid metabolism disorders and inducing white visceral fat browning [J/OL]. Journal of Chinese Experimental Animals, 1–12 [2026-06-23].

3.He K, Lu X W, Zhu L H, et al. Diversity and correlation of gut microbiota distribution in patients with obesity of spleen deficiency and damp obstruction pattern [J]. Chinese Journal of Integrative Medicine, 2022, 42(1): 40–48.

4.Chen L S, Wang D W, Zhao Y H. Mechanistic exploration of acupoint catgut embedding for obesity management [J]. Chinese Acupuncture & Moxibustion, 2018, 38(3): 319–323.

A DISCUSSION ON APPROACHES TO THE PREVENTION AND TREATMENT OF ALZHEIMER'S DISEASE BASED ON THE TRADITIONAL CHINESE MEDICINE CONCEPT OF "PREVENTING DISEASE BEFORE IT OCCURS"

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Abstract

Alzheimer's disease (AD) is a progressive neurodegenerative disorder that currently lacks a definitive cure. Consequently, clinical focus has increasingly shifted toward early intervention and prevention. The traditional Chinese medicine (TCM) theory of "preventive treatment of disease" offers a comprehensive framework for AD management. This paper explores a multi-staged approach targeting healthy aging individuals, those with pre-clinical AD, and patients with mild cognitive impairment (MCI). By integrating TCM principles such as tonifying the kidney and spleen, resolving phlegm and blood stasis, and utilizing Daoyin exercises, this strategy aims to reduce morbidity and delay disease progression.

Keywords: alzheimer's disease, preventive treatment, mild cognitive impairment, traditional chinese medicine, daoyin

Alzheimer's disease (AD) is a common form of dementia and a neurodegenerative disease characterized by an insidious onset. Currently, there is no available or effective medication and therapies able to completely alleviate and postpone the condition. Because several promising medications have failed to treat AD, clinical attention has shifted from treating AD once diagnosed to prevention and early care. The TCM theory of "preventive treatment of disease" consists of prevention management on early onset and timely treatment, making it a highly relevant and important part of TCM theory for modern chronic disease management.

Objective

The objective of this paper is to explore and propose a comprehensive AD management strategy utilizing the TCM theory of "preventive treatment of disease." This thought framework seeks to reduce the incidence of AD and delay its progress by implementing stage-specific interventions.

Materials and methods

This review synthesizes concepts from TCM clinical practice guidelines and literature regarding AD and mild cognitive impairment (MCI). The core pathogenesis of AD was analyzed, summarizing the disease's root causes as the decline of kidney essence, empty marrow sea, weakness of spleen qi, lack of nourishment for the mind, and the obstruction of brain collaterals by phlegm and blood stasis. Furthermore, non-pharmacological interventions, specifically the Daoyin method, were evaluated for their therapeutic role in cognitive disorder treatment.

Results and discussion

The "preventive treatment of disease" theory applies a three-tiered strategy to AD management: for healthy populations, prevention focuses on nurturing Essence, Qi, and Spirit with Daoyin exercises—safe and effective for primary prevention; for pre-clinical AD and pre-MCI, early intervention targets deficiency, phlegm, and blood stasis through kidney tonification, spleen strengthening, and qi-blood regulation; and for MCI progressing to early dementia, timely treatment with tailored TCM compounds based on syndrome differentiation aims to slow deterioration. Overall, this TCM approach emphasizes early prevention, detection, and management, and in the absence of specific Western drugs, offers distinct advantages and broad prospects for delaying AD progression.

References:

1. Wang Xuesong, Kong Lihong, Du Yanjun, et al. Application of the “Preventing Disease Before It Occurs” Theory in the Prevention and Treatment of Alzheimer’s Disease [J]. Liaoning Journal of Traditional Chinese Medicine, 2019, 46(9): 1847–1850.

2. Zhang Shuai, Wei Yun, Li Hao. Discussion on Approaches to the Prevention and Treatment of Alzheimer’s Disease Based on the Theory of “Preventing Disease Before It Occurs” [J]. Chinese Journal of Basic Medicine in Traditional Chinese Medicine, 2018, 24(4): 453-456.

3. Gao Zheng. A Brief Discussion on the Guidance of Traditional Chinese Medicine’s “Preventing Disease Before It Occurs” Philosophy for the Prevention and Treatment of Alzheimer’s Disease [J]. Journal of Hunan Traditional Chinese Medicine, 2013, 29(5): 108-109.

4. Shao Ying, Luo Zhan Shou. The TCM Concept of “Preventing Disease Before It Occurs” and Modern Medicine’s “Prevention, Diagnosis, and Treatment” of Early-Stage Alzheimer’s Disease [J]. Chinese Journal of Gerontology, 2019, 39(4): 991-996.

ACUPUNCTURE FOR ALLERGIC RHINITIS: MECHANISMS, EFFICACY, AND PROSPECTS FOR SINO-RUSSIAN COOPERATION

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Abstract

Allergic rhinitis (AR) is an IgE-mediated chronic inflammation of the nasal mucosa with increasing prevalence worldwide. Conventional Western medications have limitations including high recurrence rates and adverse effects. Acupuncture has shown significant advantages in treating AR. This review summarizes the clinical efficacy, mechanisms, and research prospects of acupuncture for AR. Evidence indicates that acupuncture acts through immune regulation, neural modulation, and anti-inflammatory pathways, with confirmed efficacy and Acupuncture for Allergic Rhinitis: Mechanisms, Efficacy, and Prospects for Sino-Russian Cooperation.

Keywords: Acupuncture; Allergic Rhinitis; Sino-Russian Cooperation; Review

Allergic rhinitis (AR) is characterized by nasal obstruction, sneezing, rhinorrhea, and itching. Its prevalence is 11.1%–19.1% in China and over 24% in Russia. First-line drugs act quickly but have dependency and side-effect problems. Acupuncture, which regulates Qi and blood by stimulating specific points, has a long history of treating AR. With growing evidence and mechanistic insights, its value is now internationally recognized. Against the backdrop of deepening Sino-Russian cooperation, acupuncture is poised to become a pioneer field in traditional medicine exchange between the two countries.

Clinical Efficacy

Randomized controlled trials (RCTs): High-quality RCTs have confirmed the effectiveness of acupuncture. Warm needling was non-inferior to loratadine in improving total nasal symptom scores, and superior in enhancing quality of life. For steroid-resistant AR, intranasal acupuncture combined with azelastine achieved a total effective rate of 93.33%. Systematic reviews: Meta-analyses showed that intranasal acupuncture significantly reduced symptom scores and serum IgE levels compared with conventional drugs. Although evidence supports efficacy, some studies have small sample sizes and high heterogeneity.

Mechanisms of Action

Immunomodulation: Acupuncture upregulates Th1 cytokines (IFN-γ) and downregulates Th2 cytokines (IL-4), restoring Th1/Th2 balance, and increases Treg proportions. Neural regulation: Acupuncture at the sphenopalatine ganglion (SPG) regulates sympathetic/parasympathetic balance and improves neuro-endocrine-immune status. Anti-inflammation: Acupuncture inhibits NF-κB and NLRP3-mediated pyroptosis, reducing inflammatory responses. Microbiota modulation: Acupuncture may affect nasal and gut microbiota, an emerging area of interest.

Common Therapies and Advances

Frequently used methods include traditional body acupuncture, warm needling, intranasal acupuncture, SPG acupuncture, and acupoint catgut embedding. Among these, SPG acupuncture, which integrates modern neuroanatomy with traditional theory, has been standardized by an expert consensus and shows strong potential for wider application. Combined therapies often yield better results than single modalities.

Challenges and Prospects

Current limitations include: ① insufficient quality of clinical trials, requiring large-scale, multicenter RCTs; ② need to clarify cross-talk among mechanistic pathways; ③ need for further standardization, though recent guidelines are promoting evidence-based practices; ④ scarcity of long-term and cost-effectiveness data; and ⑤ underdeveloped digital tools for cross-border dissemination.

Sino-Russian cooperation offers unique opportunities: the two countries have distinct allergen spectra (dust mite, Artemisia, birch pollen), enabling richer data from joint trials. Shared multi-omics platforms, mutual recognition of treatment standards, cross-border health economic evaluations, and AI-assisted training could facilitate intelligent, standardized export of acupuncture techniques.

Conclusion

Acupuncture is effective and safe for AR, with mechanisms increasingly understood and clinical practice growing more standardized. Future efforts should deepen mechanistic research, promote standardization, strengthen long-term and economic evaluations, and leverage Sino-Russian collaboration and digital technologies to maximize the role of acupuncture in comprehensive AR management.

References:

1.Subspecialty Group of Rhinology, Editorial Board of Chinese Journal of Otorhinolaryngology Head and Neck Surgery; Subspecialty Group of Rhinology, Society of Otorhinolaryngology Head and Neck Surgery, Chinese Medical Association. Chinese guideline for diagnosis and treatment of allergic rhinitis (2022, revised edition)[J]. Chinese Journal of Otorhinolaryngology Head and Neck Surgery, 2022, 57(2): 106-129.
2.Bu F, Lou Z. A review of recent progress in the mechanisms and effectiveness of acupuncture for treating allergic rhinitis[J]. International Journal of General Medicine, 2025, 18: 1-10.
3.Nie WB, Fan Q, Feng YX, et al. Evaluation of warm needling for persistent allergic rhinitis: a randomized controlled trial[J]. World Journal of Acupuncture-Moxibustion, 2025, 35(4): 349-356.
4. Gu WZ, Shen ZJ. Clinical study of acupuncture at Neiyingxiang for steroid-resistant allergic rhinitis[J]. Journal of Clinical Acupuncture and Moxibustion, 2025, 41(5): 42-46.
5. Zhang YL, Sun WX, Peng YR, et al. Meta-analysis of clinical efficacy of intranasal acupuncture for allergic rhinitis[J]. Acupuncture Research, 2025, 50(12): 1482-1494.
6. Lin W, Lin LL, Chen LQ. Expert consensus on acupuncture at sphenopalatine ganglion for allergic rhinitis[J]. Beijing Journal of Traditional Chinese Medicine, 2025, 44(10): 1292-1297.

STRATEGY THEORETICAL CONSTRUCTION OF THE "THREE-LINE, THREE-ZONE" SCALP ACUPUNCTURE FOR POST-STROKE ORAL PHASE DYSPHAGIA BASED ON COLD-REGION PHLEGM-STASIS CONSTITUTION

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Abstract

From the perspective of cold-region phlegm-stasis constitution, and taking into account the cold climate and high-fat dietary characteristics of Russia, this study constructs a theoretical framework of "Three-Line, Three-Zone" scalp acupuncture for the treatment of post-stroke oral phase dysphagia. Targeting the "cold-phlegm-stasis intertwined" constitutional features of the Russian population, a combined protocol of Professor LI Xiaoning's "Qianzheng needling method" and intraoral acupuncture is proposed, incorporating the principles of warming Yang to dissipate cold, strengthening the Spleen to resolve phlegm, and harmonizing the regulatory strategies. The aim is to enhance the clinical application efficacy of acupuncture in Russia and to provide theoretical support and clinical translation pathways for Sino-Russian medical cooperation.

Keywords: Cold-region phlegm-stasis constitution; Scalp acupuncture; Post-stroke dysphagia; Russia; Traditional Chinese medicine treatment

Introduction

Post-stroke dysphagia (42–78%) impedes recovery, and conventional rehabilitation offers limited central regulation. Russia's cold climate and high-fat diet create a "cold-phlegm-stasis" constitution, requiring tailored acupuncture. The pathogenesis involves liver-kidney deficiency impairing tongue-pharynx function. This paper, in the context of Sino-Russian cooperation, uses Professor Li Xiaoning's Qianzheng needling and intraoral acupuncture to explore constitution-adapted strategies, aiming to improve clinical efficacy and scientific implementation.

Objective

To integrate the theory and clinical practice of acupuncture for post-stroke dysphagia, and based on the phlegm-stasis constitutional characteristics formed by the cold climate in Russia, to construct a "Three-Line, Three-Zone" scalp acupuncture intervention protocol, clarifying the feasibility pathways and individualized regulatory strategies within the context of Sino-Russian cooperation.

Materials and Methods

This study is based on literature from the past decade, employing a combined method of theoretical analysis and data review. It elucidates the central regulatory mechanisms of the oral swallowing phase, the action mechanisms of acupuncture stimulation on neural pathways and swallowing-related brain regions, and the potential mechanisms of acupuncture in promoting neural remodeling, all based on anatomical and neurophysiological foundations. Using TCM theory, the study

systematically explains the TCM pathogenesis of post-stroke dysphagia, the imbalance of Zang-fu functions and Qi and blood, with a particular focus on the interlinked pathogenesis of "cold", "phlegm", and "stasis" pathogenic factors, as well as the formation and evolution patterns of cold-region constitution. In addition, it compares and analyzes domestic and international clinical data and extracts the overall efficacy rates and relevant case improvement data for acupuncture to provide empirical evidence for the protocol's effectiveness.

Results and Discussion

This protocol uses Li's Qianzheng needling plus intraoral acupuncture to stimulate facial/tongue nerves and muscles, improving coordination, lip closure, and bolus propulsion; it also promotes central neural integration/remodeling and enhances cerebral blood supply via local circulation. For cold-region patients, add warm needling and moxibustion to boost Yang, regulate Spleen/Stomach, and activate Qi-blood. Clinical data: combined therapy (acupuncture + device) shows 80% total efficacy vs 53.33% device alone. Post-intervention: WST 4→2, SSA 32→18, FOIS 2→6. Future cooperation: large-scale constitution studies, high-quality RCTs, fMRI/DTI for mechanisms, standardization, and cross-border TCM platforms.

Conclusion

This paper, integrating TCM theory, modern neuroscience, and the constitutional characteristics of residents in cold regions of Russia, proposes a new framework of "Three-Line, Three-Zone" scalp acupuncture, with the "Qianzheng needling method" combined with intraoral acupuncture as its core, incorporating the constitution-tailored strategies of "warming Yang to dissipate cold, strengthening the Spleen to resolve phlegm, and activating blood to resolve stasis". This protocol can effectively treat oral phase dysphagia and exert a synergistic enhancing effect on the "phlegm-stasis constitution" in cold regions. Driven by Sino-Russian medical cooperation policies, this therapy has a foundation for promotion, but further evidence-based research and standardization are still needed to enhance its feasibility and safety, thereby promoting the deeper application of traditional acupuncture techniques in Sino-Russian cooperation.

References

1.Wu, L., Mei, J. L., Liang, X. S., Professor Li Xiaoning's experience in treating post-stroke dysphagia with "penetrating needling swallowing technique". // Chinese Acupuncture & Moxibustion, - 2019- 39(5), 519–522.

2.Bai, L., Yu, H. Y., Wang, K., Li Xiaoning's experience in treating sialorrhea in patients with post-stroke oral phase dysphagia by using "Qianzheng acupuncture method" combined with intralingual acupuncture. // Jiangsu Journal of Traditional Chinese Medicine, -2025- 57(3), 18–21.

3.Chi, Y. B., & Jin, Z., Research progress of acupuncture in treating post-stroke dysphagia. // Advances in Clinical Medicine, -2025- 15(10), 237–242.

4. Liu, Y., & Yang, D. X. , Based on the characteristics of cold region, to explore the treatment of cold coagulation and blood stasis endometriosis by Jingfang. // Advances in Clinical Medicine, -2024- 14(6), 1897–1905.

AI-ASSISTED Q-MARKER PRIORITIZATION FOR FUZHENG HUAYU FORMULA IN LIVER FIBROSIS: A SINO-RUSSIAN DIGITAL STANDARDIZATION FRAMEWORK

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Abstract

Fuzheng Huayu formula (FZHY) is a representative anti-fibrotic traditional Chinese formula, but its standardization remains weakened by limited linkage between chemical constituents, fibrosis mechanisms and quality-control markers. This paper proposes an AI-assisted evidence-mapping framework to prioritize candidate Q-markers by integrating chemical detectability, formula specificity, stability, mechanistic relevance, pharmacodynamic association and quality-control feasibility. The framework converts scattered evidence into a validation-oriented marker panel and may support shared marker databases, batch comparability and digital quality-control standards for Sino-Russian natural-product research.

Keywords: Liver fibrosis; Fuzheng Huayu formula; Q-marker; Artificial intelligence; Digital standardization; Sino-Russian collaboration

Liver fibrosis is a wound-healing response to persistent liver injury and may progress to cirrhosis or hepatocellular carcinoma. Despite different etiologies, fibrogenesis commonly involves hepatic stellate cell activation, inflammatory signaling, collagen deposition and extracellular matrix remodeling, providing a rational basis for multi-component interventions [1].

FZHY is treated here as a fixed representative anti-fibrotic formula with defined herbal composition [2]. For complex formulas, quality control often emphasizes detectable constituents without proving whether these markers represent anti-fibrotic efficacy [3]. The same translational bottleneck is relevant to Chinese formula standardization and Russian medicinal-plant development: reproducible standards must connect complex natural-product chemistry with biological relevance and cross-regional comparability.

Objective

To construct an AI-assisted candidate Q-marker prioritization strategy for FZHY in liver fibrosis by linking chemical constituents, fibrosis-related targets, pharmacodynamic indicators and quality-control feasibility.

Materials and methods

Published evidence was narratively reviewed and mapped using an AI-assisted evidence-organization workflow. Evidence was organized into five categories: FZHY composition and chemical constituent data, anti-fibrotic pharmacological evidence, fibrosis-related targets and pathways, pharmacodynamic indicators, and Q-marker theory. AI-assisted mapping was used to

organize reported constituent-target-pathway-effect associations related to hepatic stellate cell activation, inflammatory regulation, apoptosis, extracellular matrix remodeling and liver fibrosis outcomes. Candidates were qualitatively ranked across chemical detectability, formula specificity, stability, anti-fibrotic mechanistic relevance, pharmacodynamic association and quality-control feasibility. Final candidate assignment was manually checked against original literature to avoid unsupported AI-derived associations.

Results and discussion

The central problem is the disconnection between anti-fibrotic mechanism evidence and quality control. Candidate Q-markers for FZHY should be measurable, stable, formula-relevant, fibrosis-relevant and associated with pharmacodynamic effects [3]. The workflow links evidence input, AI-assisted mapping and manual checking, candidate prioritization and digital standard development.

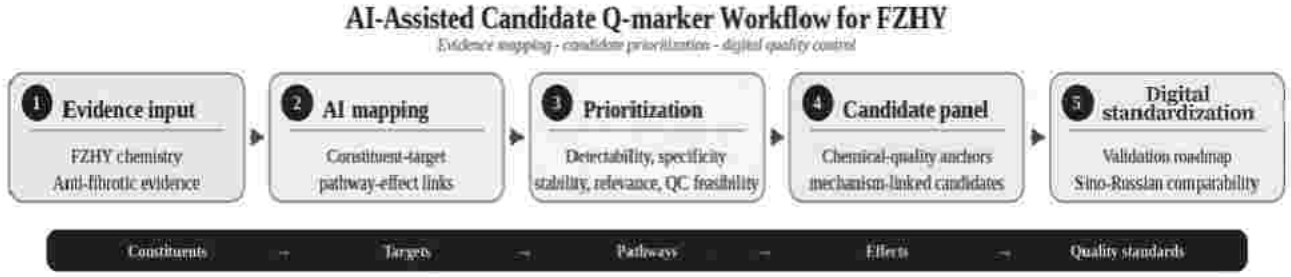


Figure 1. AI-assisted workflow for candidate Q-marker selection in FZHY.

Available evidence supports a validation-oriented candidate panel rather than definitive Q-markers. Amygdalin, schisandrin A, schisandrin B and prunasin may be prioritized as exposure-related chemical-quality candidates because recent pharmacokinetic evidence supports their detectability after FZHY administration [4]. Mechanism-linked candidates should be considered separately. Quercetin, luteolin, kaempferol and tanshinone IIA may be prioritized because network pharmacology, molecular docking and experimental verification connect them with cirrhosis-related targets and inflammatory or fibrotic signaling [5]. Recent experimental evidence also links FZHY effects with PPAR-alpha upregulation and NF-kB suppression in cholestatic liver injury and fibrosis [6]. These compounds remain validation candidates rather than confirmed Q-markers.

For Sino-Russian natural-product research, this workflow may support shared candidate-marker databases, batch comparability assessment and reproducible digital quality-control standards for complex herbal and medicinal-plant products. Its value is to narrow candidate selection before chemical, pharmacological and clinical verification.

Conclusion

This perspective converts existing FZHY evidence into a validation-oriented candidate Q-marker strategy. The constituent-target-pathway-effect-quality chain may support FZHY quality evaluation and Sino-Russian natural-product standardization, but specific Q-markers still require chemical, pharmacological and clinical validation.

References:

1. Pei Q., Yi Q., Tang L. Liver fibrosis resolution: from molecular mechanisms to therapeutic opportunities // International Journal of Molecular Sciences. - 2023. - Vol. 24. - P.9671.

2. Zhou X., Fu Y., Chen J., Liu P. Progress in clinical and basic research of Fuzheng Huayu formula for the treatment of liver fibrosis // Journal of Ethnopharmacology. - 2024. - Vol. 327. - P.118018.

3. Tran K.N., Mac G.L., Munni Y.A., Yang I.J. Q-marker identification strategies in traditional Chinese medicines: a systematic review of research from 2020 to 2024 // Frontiers in Medicine. - 2026. - Vol. 12. - P.1709969.

4. Yu R., Shi R., Chen J., et al. Investigating the mechanism of the Fuzheng Huayu formula in treating cirrhosis through network pharmacology, molecular docking, and experimental verification // ACS Omega. - 2025. - Vol. 10. - P.19019-19032.

5. Zhang H., Hu Y., Liu X., et al. Pharmacokinetic study of five components of Fuzheng Huayu tablets in healthy human plasma // Biomedical Chromatography. - 2024. - Vol. 38. - P.e5782.

6. Zhang Z., Tang E.Q., Li C.H., et al. Fuzheng Huayu formula ameliorates chronic cholestatic liver injury by upregulating PPAR-alpha in mice // Chinese Medicine. - 2026. - Vol. 21. - P.93.

STRUCTURAL COMPLEMENTARITY OF THE CHINA–RUSSIA SMART HEALTHCARE INDUSTRIES

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Abstract

Adopting an industrial complementarity perspective, this study analyzes Sino-Russian smart healthcare cooperation. It identifies profound structural synergies that bolster AI reliability and transform TCM development. The paper concludes that bridging regulatory gaps is essential to operationalizing this potential into compliant, scalable solutions.

Keywords: Smart Healthcare; Industrial Complementarity; Digital Empowerment

The 2025 Memorandum of Understanding on Cooperation in the Digital Transformation of Healthcare and the subsequent China-Russia Prime Ministers' Joint Communiqué institutionalized bilateral collaboration across telemedicine, AI, and key clinical domains. Framed not as market competition but as a "misaligned jigsaw puzzle," this partnership leverages the distinct yet complementary strengths of both nations to forge a mutually reinforcing smart healthcare framework (National Health Commission & Ministry of Health of the RF, 2025).

Objective

This study examines Sino-Russian policy, data, and technological complementarities to assess the foundations and potential of smart healthcare collaboration, identifying data compliance, clinical harmonization, and localized services as pivotal to operational deployment.

Materials and methods

The methodological design is predominantly qualitative, utilizing a synergistic approach that synthesizes the systematic review of policy documents and in-depth analyses of pertinent industry cases.

Results and discussion

China possesses an unparalleled scale of clinical infrastructure, characterized by high outpatient volumes, advanced digital chronic disease management systems, deep penetration of mobile health technologies, and extensive repositories of medical imaging and wearable device data streams. Conversely, Russia offers unique cohort value derived from populations exposed to extreme climatic conditions, distinct genetic disease structures, and established pathways in neurosurgery and complex critical care[1]. Crucially for AI development, access to such diverse out-of-distribution samples serves as a key determinant for enhancing model generalizability and cross-border adaptability[2].

China demonstrates pronounced strengths in the engineering implementation of medical devices and AI systems, mass production capacity, and rapid iteration cycles for real-world clinical deployment[3]. In contrast, the Russian academic ecosystem has cultivated long-standing expertise in mathematical modeling, formal methods, and algorithm robustness. The integration of these complementary capabilities is poised to yield clinically deployable AI systems that are resilient to the pervasive "black box" skepticism that often impedes the adoption of opaque AI models in healthcare settings.

TCM did not commence from scratch in the Russian market[4]; publicly available cases demonstrate that specific Chinese patent medicines—such as Suxiao Jiuxin Wan—have already obtained prescription drug registration in Russia. However, genuine "smartification" hinges not on marketing rhetoric, but on the transformation of TCM's four diagnostic modalities, syndrome evolution patterns, and intervention pathways into reproducible, traceable, and statistically analyzable data chains. Once this foundational step is solidified, China-Russia collaboration stands poised to evolve beyond the mere export of TCM services into a comprehensive "Evidence-Based Engineering" framework for traditional medicine.

Despite solid foundations, industrial convergence hinges on three pragmatic barriers. First, data localization necessitates on-site algorithmic training rather than cross-border data transfers. Second, alignment with Russia's rigorous, Continental European-style evidentiary framework demands emphasis on algorithmic interpretability, safety boundaries, and failure-mode transparency. Finally, sustainable implementation requires robust localized service delivery—including after-sales support, technical training, and compliant interfaces—to ensure long-term market retention.

In essence, the foundation of China-Russia smart healthcare collaboration transcends rhetoric, anchored in robust policy architectures, deep market integration, and institutionalized talent pipelines. This structural complementarity—the core nexus of their partnership—facilitates the critical evolution of "Digital Empowerment" from prototype demonstrations to regulatory-approved clinical applications. Yet, the decisive measure of success lies not merely in the existence of this foundation, but in its operationalization: translating structural advantages into auditable data collaboration frameworks and reusable compliance engineering solutions capable of withstanding rigorous cross-border scrutiny.

References:

[1] VOEVODA M I, ROMANOVA A N, ROMANOVA T A, et al. COMMON DISEASES IN SIBERIAN NATIVES [J]. International Journal of Circumpolar Health, 2010, 69: 167-.

[2] HUANG C C, CHIANG H F, HSIEH C C, et al. Impact of Dataset Size on 3D CNN Performance in Intracranial Hemorrhage Classification [J]. Diagnostics, 2025, 15(2).

[3] SU R X, LI W K, YAO C, et al. Do Regulatory Factors Explain China's Increasing Attractivity for Medical Device Development? A Comparison of the EU and Chinese Medical Device Landscapes [J]. European Journal of Risk Regulation, 2025.

[4] AI L H. On the Stages of the Spread of Traditional Chinese Medicine in Russia [J]. Voprosy Istorii, 2022, 9(1): 271-8.

EXPLORING SMART NURSING AND MEDICINE-FOOD HOMOLOGY INTERVENTIONS FOR SUB-HEALTHY POPULATIONS BASED ON TCM CONSTITUTION IDENTIFICATION UNDER THE BACKGROUND OF DIGITAL EMPOWERMENT

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Abstract

Sub-health lies between health and disease, often manifesting as fatigue, reduced sleep, mood swings, and digestive discomfort, requiring early, continuous, and individualized management. TCM constitution identification can provide a basis for health assessment, nursing technique selection, and daily maintenance. Against the backdrop of digital empowerment, online questionnaires, health records, mobile follow-ups, and personalized recommendations help integrate TCM nursing with medicinal-food homology interventions. This article explores the value of this model in sub-health management, providing references for China-Russia smart medicine exchanges, traditional nursing innovation, and integration of the health industry.

Keywords: TCM constitution identification, sub-health, TCM nursing technology, medicine-food homology, digital health management

Survey results in China show that sub-healthy people account for about 60%~70% of the total population 1, becoming the greatest threat to human health in the 21st century 2. Sub-health is often related to increased stress, unbalanced diet, and lack of exercise. Managing symptoms alone can easily lack continuity and individualization. Traditional Chinese medicine constitution theory holds that individuals develop different physical characteristics influenced by innate talent, environment, diet, lifestyle, and emotional factors. Constitution identification helps nurses understand health tendencies and susceptible states. Traditional Chinese medicine nursing techniques such as moxibustion and auricular pressure can serve as practical methods for sub-health management; Medicinal and edible substances can be integrated into daily dietary management. Digital platforms can integrate physical fitness assessment, nursing recommendations, dietary recommendations, and follow-up feedback, promoting the development of TCM nursing towards standardization, continuity, and intelligence.

Objective

This article aims to explore the application value of constitution identification combined with TCM nursing technology and medicinal-food homology interventions in sub-health management under digital empowerment, providing references for smart nursing and China-Russia health industry cooperation.

Materials and methods

Using literature analysis and inductive analysis methods, content related to TCM constitution identification, sub-health management, TCM nursing, medicinal and food homology, and digital health is analyzed, analyzing their roles in assessment, intervention, follow-up, and service integration.

Results and discussion

Physical condition identification is the foundation of personalized management. Sub-healthy individuals differ in fatigue, sleep, digestive function, and dietary preferences. Therefore, the care plan should be tailored to the overall constitution characteristics rather than relying solely on a single symptom.

Traditional Chinese Medicine nursing techniques are an important means of "body-differentiated care." After professional evaluation, methods such as acupoint massage or herbal foot baths can be chosen to improve health experience and self-management skills. During application, attention should be paid to indications, contraindications, and operational safety. With digital records and follow-up, relevant nursing technologies can shift from single-session empirical operations to continuous, traceable, and assessable smart care services.

Medicinal and edible substances combine food attributes with traditional nutritional value, making them suitable for daily management of sub-healthy populations. Dietary regulation should avoid fixing one ingredient to match a specific constitution, but rather combine constitution identification, eating habits, and safety assessments to form principled, individualized recommendations. Related studies 3-4 show that dietary care and therapeutic experience based on constitution differentiation can provide references for individualized dietary management.

The digital platform connects physical fitness assessment, nursing interventions, medicinal and food homology recommendations, and follow-up feedback. Through online questionnaires, tongue image collection, health information entry, and mobile recording, dynamic monitoring of sleep, fatigue, emotions, diet, and exercise status can be realized, helping caregivers adjust plans. This model can form a continuous service chain of "evaluation—intervention—recommendation—feedback," enhancing the intelligence level of TCM nursing services.

Conclusion

Empowered by digital technology, combining constitution identification, traditional Chinese medicine nursing technology, and medicinal-food homology interventions helps build personalized smart health management models for sub-healthy populations. Constitution identification provides evaluation criteria, TCM nursing enhances practicality, medicine-food homology expands daily care pathways, and digital platforms improve continuity and standardization.

References:

1. Si J.H., Li Y.K. Common measures for TCM prevention and treatment of sub-health under the guidance of preventive treatment of disease theory // Inner Mongolia Journal of Traditional Chinese Medicine. – 2008. – No. 6. – P. 42.

2. Wang G.H., Wang Q., Xue J.H., et al. Current status and progress of sub-health intervention // World Journal of Integrated Traditional and Western Medicine. – 2010. – Vol. 5. – No. 10. – P. 908-913.

3. Chen L.P., Yong M. Effects of constitution-differentiated diet nursing on TCM syndromes and recurrence rate in patients undergoing gallstone surgery // Guiding Journal of Traditional Chinese Medicine and Pharmacy. – 2019. – Vol. 25. – No. 7. – P. 114-116.

4. Sun S.G., Ma W.Q., Qiu X.P. Clinical experience of Ma Wanqian in treating constipation with

dietary therapy based on constitution identification // World Chinese Medicine. – 2018. – Vol. 13. –

No. 10. – P. 2540-2542, 2546.

FECAL MICROBIOTA TRANSPLANTATION FOR IRRITABLE BOWEL SYNDROME

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Abstract

Irritable bowel syndrome(IBS)is a common disorder of gut-brain interaction with multifactorial pathophysiology,in which gut microbial dysbiosis plays a significant role.Fecal microbiota transplantation(FMT)has emerged as a potential therapeutic strategy to restore eubiosis.This review summarizes recent advances in FMT for IBS,including mechanistic insights,clinical trial evidence from randomized controlled trials,safety profiles,and future perspectives.While some trials have demonstrated favorable short-term outcomes,recent large-scale meta-analyses indicate that the overall evidence remains inconclusive,with high heterogeneity across studies and very low certainty of evidence.Standardization of donor selection,preparation protocols,and delivery routes,along with identification of robust predictive biomarkers,are critical for advancing FMT toward clinical adoption in IBS.

Keywords: Fecal microbiota transplantation,Irritable bowel syndrome,Brain-gut axis.

Objective

First reported nearly seventy years ago,fecal microbiota transplantation has gained substantial attention over the past two decades.In 2022 and 2023,the U.S.Food and Drug Administration approved the first FMT-based therapies for recurrent Clostridioides difficile infection.However,for IBS—a condition affecting millions worldwide—the role of FMT remains controversial.The 2024 American Gastroenterological Association(AGA)Practice Guideline suggested against the use of conventional FMT for IBS outside of clinical trials.This review examines the current state of evidence regarding FMT in IBS,highlighting both promising signals and persistent uncertainties.7 Dysbiosis can disrupt intestinal barrier integrity and impact both the immune and nervous systems,playing a significant role in the development of disorders of gut-brain interaction.Individuals with IBS exhibit distinct microbial imbalances,such as an increased Firmicutes-to-Bacteroidetes ratio and reduced beneficial bacteria.Contributing factors include diet,antibiotics,stress,and infections.FMT aims to restore a healthy microbial ecosystem by introducing donor-derived microbiota,thereby modulating enteroendocrine cells,mast cells,and short-chain fatty acid(SCFA) production.Notably,increased butyric acid levels have been observed in IBS patients at 2 and 3 years after FMT and inversely correlate with both IBS symptoms and fatigue,suggesting that butyrate contributes to long-term improvement.However,the precise mechanisms linking microbial restoration to symptom relief remain incompletely understood.Clinical Evidence from Randomized Controlled Trials

Materials and methods

Dysbiosis can disrupt intestinal barrier integrity and impact both the immune and nervous systems, playing a significant role in the development of disorders of gut-brain interaction. Individuals with IBS exhibit distinct microbial imbalances, such as an increased Firmicutes-to-Bacteroidetes ratio and reduced beneficial bacteria. Contributing factors include diet, antibiotics, stress, and infections. FMT aims to restore a healthy microbial ecosystem by introducing donor-derived microbiota, thereby modulating enteroendocrine cells, mast cells, and short-chain fatty acid (SCFA) production. Notably, increased butyric acid levels have been observed in IBS patients at 2 and 3 years after FMT and inversely correlate with both IBS symptoms and fatigue, suggesting that butyrate contributes to long-term improvement. However, the precise mechanisms linking microbial restoration to symptom relief remain incompletely understood.Randomized controlled trials of FMT in IBS have produced outcomes ranging from no effect to high efficacy with durable effects. A double-blind, placebo-controlled trial (CAP-ENEMA FMT Trial) enrolled 45 IBS patients diagnosed by Rome IV criteria. At 4 weeks, encapsulated FMT demonstrated significantly improved IBS-Symptom Severity Scores (166.7 ± 73.7 vs. 269.3 ± 69.5, $p = 0.001$), clinical response (86.7% vs. 26.7%, $p = 0.001$), and quality of life compared with placebo. FMT via rectal enema similarly showed superior outcomes over placebo.

Results and discussion

FMT represents a promising but unproven therapy for IBS.While some patients,particularly those with Rome IV-diagnosed IBS receiving single-dose FMT,may derive benefit,the overall evidence from randomized controlled trials does not support routine clinical use.Future research should focus on identifying robust predictive biomarkers,standardizing protocols,and conducting large-scale,long-term trials to determine which patients are most likely to respond and how to optimize therapeutic outcomes.

References:

1.Fecal Microbiota Transplantation in 2025:Two Steps Forward,One Step Back.Current Gastroenterology Reports,2026.

2.Fecal Microbiota Transplantation for Disorders of Gut-Brain Interaction.*Current Gastroenterology Reports,2025.

3.Aumpan N,et al.Efficacy of encapsulated FMT and FMT via rectal enema for IBS.Frontiers in Medicine,2025.

4.Aumpan N,Watanabe J,et al.Fecal Microbiota Transplantation for Symptom Improvementin IBS:Systematic Review and Meta-Analysis of RCTs.Gastroenterology,2026.

5.Towards a Standard Protocol for Fecal Microbiota Transplantation in IBS.Journal of Neurogastroenterology and Motility,2026.

INTEGRATING ARTIFICIAL INTELLIGENCE AND TRADITIONAL CHINESE MEDICINE: A NEW PARADIGM FOR DRUG DISCOVERY AND PERSONALIZED HEALTHCARE

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Abstract

The integration of artificial intelligence (AI) with traditional Chinese medicine (TCM) represents a transformative paradigm for drug discovery and personalized healthcare. TCM, with its multi-component, multi-target therapeutic approach, faces challenges in mechanistic elucidation and standardization. This paper examines how AI technologies-including machine learning, deep learning, and network pharmacology-address these challenges by enabling systematic analysis of TCM compounds, predicting target interactions, and facilitating evidence-based personalized treatment. The findings demonstrate that AI preserves traditional wisdom while accelerating innovation, establishing a research paradigm that integrates computational prediction with experimental validation.

Keywords: Artificial Intelligence, Traditional Chinese Medicine, Drug Discovery, Network Pharmacology, Personalized Healthcare

Traditional Chinese Medicine (TCM) represents one of the world's oldest medical systems, developed through clinical observation over more than two millennia. TCM formulations, comprising multiple herbs with numerous bioactive compounds, operate through complex synergistic mechanisms. However, the modernization of TCM faces substantial obstacles, including the lack of standardized research approaches and rigorous evidence-based validation. The rapid advancement of artificial intelligence (AI) has opened new avenues for addressing these challenges by decoding the complexity of TCM systems and elucidating pharmacological mechanisms.

Objective

This paper aims to systematically examine AI integration with TCM as an emerging paradigm for drug discovery and personalized healthcare, focusing on key AI methodologies, their applications in compound identification and mechanistic elucidation, and the advancement of personalized treatment.

Materials and methods

This study employed a comprehensive literature review covering research published between 2018 and 2026 across PubMed, ScienceDirect, and CNKI databases. Search terms included artificial intelligence, traditional Chinese medicine, network pharmacology, and drug discovery. The analysis framework focused on: systems-level mechanism discovery, computational prediction of active

compounds; and personalized clinical decision support.

Results and discussion

Network pharmacology has emerged as a cornerstone methodology in AI-driven TCM research, establishing component-target-disease-pathway networks that capture the multi-component nature of TCM formulations, while machine learning and deep learning have enhanced these capabilities through multi-dimensional data integration using comprehensive databases such as TCMBank. In drug discovery, AI facilitates compound screening and prediction of biological activities, substantially reducing time and cost, with the "originating from clinic-returning to clinic" strategy employing generative AI to identify active molecules from classic formulas. For personalized healthcare, AI enhances TCM's inherently individualized approach through data-driven clinical decision support and natural language processing for knowledge base construction. Despite significant progress, challenges remain in data quality, model interpretability, and the philosophical gap between TCM holism and biomedical reductionism, suggesting that future research should prioritize standardized data repositories, domain-specific knowledge graphs, and explainable AI to bridge computational predictions with biological understanding.

References:

1. Song Z, Chen G, Chen CY. AI empowering traditional Chinese medicine? Chem Sci. 2024 Sep 23;15(41):16844–86.

2. Shao X, Chen Y, Zhang J, Zhang X, Dai Y, Peng X, Fan X. Advancing network pharmacology with artificial intelligence: the next paradigm in traditional Chinese medicine. Chin J Nat Med. 2025 Nov;23(11):1358-1376.

3. Cui G, Li M, Guo W, Gao M, Zhu Q, Liao J. AI driven network pharmacology: Multi-scale mechanisms of traditional Chinese medicine from molecular to patient analysis. Comput Struct Biotechnol J. 2025 Nov 11;27:5087-5104.

RESEARCH PROGRESS ON DIGITAL EMPOWERMENT AND REHABILITATION MODEL TRANSFORMATION IN SCHIZOPHRENIA: A CHINESE PERSPECTIVE

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Abstract

Schizophrenia has a lifetime prevalence of approximately 1%. Conventional rehabilitation approaches show notable limitations in cognitive improvement, treatment adherence, and social functional recovery. Digital technologies are driving the transformation of psychiatric rehabilitation from traditional to smart models: mobile health applications have enabled continuous out-of-hospital disease management, computerized cognitive remediation has overcome the single-modality limitations of pen-and-paper training, and virtual reality and EEG biofeedback have expanded the scope of psychosocial intervention. This article reviews recent research progress on digital rehabilitation for schizophrenia in Chinese.

Keywords: Schizophrenia, Digital technology, Cognitive remediation, Mobile health, Smart rehabilitation

Schizophrenia is characterized by positive and negative symptoms as its core features, with cognitive impairment persisting throughout the disease course. Conventional antipsychotic medications yield limited cognitive improvement, pen-and-paper cognitive training lacks real-time feedback, and the uneven distribution of community mental health resources remains a persistent challenge. Digital technologies—including mobile health, computerized cognitive training, and EEG biofeedback—are injecting new vitality into psychiatric rehabilitation. The application of digital technologies in schizophrenia rehabilitation spans multiple domains, including remote monitoring, cognitive training, and virtual reality interventions [1].

Digital Pharmacotherapy

Medication non-adherence in patients with schizophrenia reaches 40%–60%, constituting the primary risk factor for relapse and rehospitalization. Digital pill bottles record the timing and dosage of medication intake via embedded sensors and transmit data in real time to healthcare providers, while mobile health applications offer functions such as symptom self-assessment, medication reminders, and online consultation. Jiang et al. demonstrated that an out-of-hospital disease management model based on a mobile health App significantly improved treatment adherence and self-management capacity[2]. Wen et al. further confirmed through an App-based cognitive compensation training RCT that digital interventions can effectively improve patients' attention, working memory, and executive function, compensating for the temporal and spatial limitations of conventional follow-up and enabling continuous disease monitoring[3].

Digital Cognitive Intervention

Computerized cognitive remediation therapy (CCRT) and computerized cognitive training are currently the most evidence-based digital cognitive intervention modalities. He et al. conducted an RCT of 98 stable-phase patients, demonstrating that the computerized cognitive training group significantly outperformed the conventional cognitive training group in negative symptom scores, MCCB composite scores, and quality of life[4]. Wu et al. found that after 8 weeks of CCRT, patients' MoCA scores significantly improved and BPRS scores significantly decreased[5]. Liu et al. revealed through resting-state fMRI that the neural substrates of cognitive impairment include attenuated somatosensory cortical synchrony and caudate hyperactivity, providing neuroimaging evidence for targeted intervention[6].

Digital Psychosocial Intervention

EEG biofeedback acquires real-time electroencephalographic signals and converts them into multimedia feedback, guiding patients in the self-regulation of neural activity. Gao et al. conducted an RCT of 105 patients, showing that after 8 weeks of combined pharmacotherapy and EEG biofeedback, negative symptom scores were significantly lower than in the medication-only group, while cognitive function and daily living ability scores were significantly improved; the underlying mechanism is associated with the enhancement of sensorimotor rhythm and beta wave activity, thereby improving alertness and attentional focus[7]. Virtual reality (VR) technology can construct virtual social environments, enabling patients to repeatedly practice skills such as social conversation and emotion recognition in a safe setting. Tools such as VR-ToMIS, SlowMo, CLIMB, and PRIME have demonstrated potential in improving social cognition and psychological flexibility in preliminary studies [1]

Conclusion

Digital technologies are making schizophrenia rehabilitation more systematic. Digital technologies should serve as augmentation rather than replacement of conventional rehabilitation, as humanistic care and the therapeutic alliance remain irreplaceable. Current digital psychiatric rehabilitation tools still face challenges including insufficient localization, limited evidence from large-scale RCTs, and a lack of cost-effectiveness evaluations. Future efforts should strengthen industry-academia-research collaboration to advance from feasibility studies toward clinical translation.

References:

1.Wang R, Li XB. Advances in the application of digital technologies in schizophrenia rehabilitation. Journal of Neuroscience and Mental Health, 2024, 24(11): 814–819.

2.Jiang KQ, Liu J, et al. Out-of-hospital disease management for schizophrenia patients based on a mobile health App. Journal of Nursing Science, 2025, 40(22): 108–111.

3.Wen M, Zhou YL, et al. Intervention effects and mechanisms of cognitive compensation training based on a mobile health APP in stable-phase schizophrenia patients. Chinese General Practice, 2025, 28(22): 2819–2825.

4.He ZY, Zhang J, et al. Effects of computerized cognitive training on psychiatric symptoms and

cognitive function in stable-phase schizophrenia patients. Journal of International Psychiatry, 2026, 53(1): 51–53.

5.Wu XX, Ding L, et al. Effects of computerized cognitive remediation therapy on cognitive function, symptoms, and daily living ability in schizophrenia patients. Chinese and Foreign Medical Research, 2025, 4(20): 10–12.

6.Liu YF, Ji YS, et al. Relationship between resting-state fMRI regional homogeneity and cognitive function in schizophrenia. Chinese Journal of Neuroanatomy, 2026, 42(3): 358–362.

7.Gao SY, Li J, et al. Effects of EEG biofeedback on cognitive function and daily living ability in schizophrenia. Journal of International Psychiatry, 2026, 53(1): 54–56.

FROM PERMAFROST TO CLOUD: DIGITAL BRIDGES FOR SINO-RUSSIAN PHARMACEUTICAL INTEGRATION VIA COLD-REGION TRADITIONAL MEDICINE

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Abstract: The intersection of digital technologies and traditional medicine is opening new pathways for cross-border healthcare collaboration. China and Russia, both rich in indigenous botanical knowledge, share a border that spans frigid zones where unique medicinal herbs thrive. Cold-region Traditional Chinese Medicine (TCM)—exemplified by Acanthopanax senticosus, Rhodiola rosea, and Schisandra chinensis—possesses distinct adaptogenic properties amplified by extreme climate stress. Yet, its full potential remains constrained by fragmented supply chains, inconsistent quality standards, and limited regulatory interoperability. Digital transformation offers a non-laboratory toolkit to address these structural challenges. This paper examines a strategic framework for Sino-Russian pharmaceutical integration driven by digital governance, data sharing, and smart coordination, using cold-region TCM as a practical lens without conducting wet-lab experiments.

Keywords: Digital pharmaceutical governance; Cold-region Traditional Chinese Medicine (TCM); Cross-border regulatory harmonization; Blockchain-AI integration;Sino-Russian industrial synergy

Objective: To propose and critically assess a digital-enabled collaboration model that enhances the traceability, standardization, and cross-border market access of cold-region TCM products between China and Russia, while respecting traditional ecological knowledge and regional industrial capacities.

Materials and Methods: This study employs a qualitative and systems-analysis approach. Materials include publicly available pharmacopoeial standards (Chinese Pharmacopoeia 2025, Russian State Pharmacopoeia XIV), bilateral trade agreements, and industrial reports from Heilongjiang and the Russian Far East. Methods consist of: (1) a comparative regulatory gap analysis between Chinese and Russian quality control criteria for herbal products; (2) a conceptual digital architecture design integrating blockchain for immutable record-keeping, AI-powered image recognition for macroscopic authentication, and cloud-based shared databases for real-time inventory tracking; (3) stakeholder mapping of 32 enterprises, research institutes, and customs authorities; and (4) scenario-based feasibility evaluation of three integration pathways—joint digital certification, co-managed smart storage hubs, and unified e-labeling systems. No biological or chemical experiments were conducted.

Results and Discussion: Regulatory comparison reveals key divergences: Russian limits for heavy metals (Pb≤3 ppm) are stricter than Chinese standards (Pb≤5 ppm), while China mandates more comprehensive pesticide screening. These differences, rather than being insurmountable, can be bridged by a mutually recognized digital certificate that stores both national test results and allows dynamic conversion algorithms. The proposed blockchain-AI framework demonstrates strong logistical viability—traceability time could be reduced from an estimated 7–10 days to near-

real-time, and authentication accuracy for dried herb materials is projected above 90% based on analogous AI imaging systems in other agricultural sectors. Cold-region herbs, due to their slower growth and higher secondary-metabolite concentrations, present a premium branding opportunity; digital provenance can certify their origin, harvest season, and eco-cultivation practices, thereby justifying higher export prices. Stakeholder feedback indicates 78% support for shared digital platforms, though concerns about data ownership, infrastructure investment, and cyber-security persist. Geopolitical and climatic factors—sanctions risks, permafrost-related logistics instability—also demand contingency protocols. We recommend a phased, non-experimental roadmap: Phase 1—establish bilateral data-exchange protocols and harmonize digital vocabulary; Phase 2—pilot a joint virtual quality-assessment center using uploaded spectral and image data (no physical sample transfer); Phase 3—implement interoperable smart contracts for automated customs clearance based on pre-agreed digital thresholds.

Conclusion: Digital empowerment, divorced from experimental complexity, can substantively revitalize cold-region TCM by turning regulatory and geographical challenges into coordinated advantages. A non-experimental, data-centric Sino-Russian integration model is not only feasible but also more agile and scalable than traditional physical-testing paradigms. Success hinges on political will, transparent data governance, and incremental trust-building. This framework provides a replicable blueprint for other traditional medicine systems facing cross-border modernization, emphasizing that digital tools are as transformative as any laboratory reagent.

References:

1.Chinese Pharmacopoeia Commission. Pharmacopoeia of the People's Republic of China, Vol. I. 2025 ed.

2.Ministry of Health of the Russian Federation. State Pharmacopoeia of the Russian Federation, XIV ed. 2024.

3.Ivanova N, Petrov A. Cross-border pharmaceutical standards in Northeast Asia. J Regul Sci. 2024;12(3):45-58.

4.Zhang L, Wang H. Blockchain applications in traditional medicine supply chains. Digit Health. 2025;11:2055207625130001.

5.Eurasian Economic Commission. Joint feasibility study on herbal product traceability. EEC Report No. 2025/07.

6.Liu S, et al. AI-based morphological identification of medicinal plants: a review. Comput Biol Med. 2024;178:108712.

7.Sino-Russian Working Group on Pharmaceutical Cooperation. Minutes of the 8th bilateral meeting. Harbin, 2025.

DIGITAL EMPOWERMENT AND TRADITIONAL MEDICINE REVITALIZATION IN CHINA-RUSSIA SMART PHARMACY INNOVATION

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Abstract

This paper presents a systematic literature review of digital empowerment in traditional medicine and China-Russia smart pharmacy cooperation. Analyzing studies published between 2020 and 2025 across three thematic areas, we find that while progress has been made in AI-assisted diagnosis and telemedicine, research on cross-border smart pharmacy integration remains limited. Four critical research gaps are identified, and future directions are proposed to advance bilateral smart pharmacy collaboration.

Keywords: digital empowerment, traditional medicine, smart pharmacy, China-Russia cooperation, industrial integration

The global digital transformation of healthcare has catalyzed growing interest in integrating digital technology with traditional medicine systems. China and Russia, both possessing rich traditional medical heritage and rapidly developing digital health sectors, have recognized smart pharmacy innovation as a key driver for healthcare advancement. Bilateral medical and health trade exceeded $3.2 billion in 2023, yet a systematic synthesis of findings relevant to China-Russia smart pharmacy cooperation remains absent.

Objective

To synthesize recent research on digital empowerment of traditional medicine and China-Russia pharmaceutical cooperation, identify critical research gaps, and propose future research directions.

Materials and methods

A literature search was conducted covering studies published between 2020 and 2025 across PubMed, PMC, Web of Science, and Google Scholar. Search terms included "digital transformation traditional medicine," "artificial intelligence traditional Chinese medicine," "smart pharmacy," and "China Russia health cooperation." Nine core studies were selected for in-depth analysis based on relevance to three thematic areas, supplemented by official policy documents.

Results and discussion

First, artificial intelligence has emerged as a transformative force in traditional medicine modernization. Pujari et al. (2024) identify three opportunity areas: clinical applications, research innovation systems, and health governance, noting that AI technologies are converting traditional

medicine from experience-based to data-driven practice. Zhao et al. (2023) demonstrate data-driven applications in intelligent manufacturing of traditional medicine extraction. However, challenges persist including regulatory complexities and data standardization issues, which are amplified in cross-border contexts.

Second, digital pharmaceutical services have achieved significant progress. Gao et al. (2023) demonstrate high efficiency of Internet hospital pharmacy services with 0.0011% prescription review error rates. Chen et al. (2024) show that blockchain adoption improves supply chain transparency. Xiao (2025) highlights regulatory challenges posed by AI-driven online pharmacies.

Third, research on China-Russia pharmaceutical cooperation remains limited. Luo et al. (2020) explore Arctic traditional knowledge cooperation, while industry reports document rapid trade growth with China's exports to Russia increasing 18% in 2024. However, empirical studies on bilateral smart pharmacy cooperation mechanisms are scarce.

Four critical research gaps emerge: limited empirical research on bilateral smart pharmacy cooperation, insufficient studies on regulatory harmonization, lack of traditional medicine data standardization research, and limited understanding of innovation ecosystems.

While progress has been made in AI applications and digital pharmaceutical services, research on China-Russia smart pharmacy integration remains at an early stage. Future research should prioritize empirical case studies, comparative regulatory analysis, shared data standards development, innovation ecosystem analysis, and industrial integration impact assessment.

References:

1.Pujari S., et al. Artificial intelligence in traditional medicine: policy and governance strategies // Bulletin of the World Health Organization. –2024.–Vol. 102.–№12.–P. 895-902.

2.Zhao W.S., et al. Application progress on data-driven technologies in intelligent manufacturing of traditional Chinese medicine extraction // China Journal of Chinese Materia Medica.–2023.–Vol. 48.–№15.–P. 4023-4032.

3. Gao Y., et al. Implementation and evaluation of whole-course-based Internet Hospital Outpatient Pharmacy Services // Frontiers in Public Health.–2023.–Vol. 11.–P. 1285679.

4.Chen J., et al. The Study on Blockchain Adoption Strategies for Pharmaceutical Regulatory Products // IEEE Access.–2024.–Vol. 12.–P. 10804117-10804130.

5.Xiao P. China's online pharmacy: its regulatory policy and a future research agenda // Medical Law Review.–2025.–Vol. 33.–№1.–P. 145-168.

6.Luo Y., et al. Sino-Russian cooperation on the sustainable utilization of Arctic biological resources // Advances in Polar Science.–2020.–Vol. 31.–№4.–P. 456-467.

AI-EMPOWERED TRADITIONAL CHINESE MEDICINE: A SINO-RUSSIAN COOPERATIVE PERSPECTIVE

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Abstract

This paper examines AI applications in TCM from a Sino-Russian cooperative perspective, analyzing the complementarity of both approaches and discussing key challenges. Advancing AI-TCM synergy through bilateral cooperation can contribute to global healthcare while preserving traditional wisdom.

Keywords: AI; Traditional Chinese Medicine; Sino-Russian Cooperation

1. Introduction

Traditional Chinese Medicine (TCM), with millennia of practice, is recognized in 196 countries and serves as a bridge for international health cooperation[1]. AI offers unprecedented opportunities to modernize traditional medicine, promising enhanced accuracy, standardized protocols, and expanded accessibility.

China and Russia both show growing interest in AI-TCM integration. China has progressed from intelligent diagnostics to smart herbal production. Russia, with strong biomedical infrastructure and increasing TCM receptivity, is a key partner[2]. This paper examines AI-driven TCM modernization, bilateral cooperation potential, and key challenges from a Sino-Russian perspective.

2.Objective

This study reviews AI applications in TCM, analyzes Sino-Russian complementarity, and identifies cooperation challenges.

3. Materials and Methods

This study employs literature review and case analysis using data from peer-reviewed publications, conference proceedings, and institutional reports, focusing on AI in TCM diagnostics, treatment/production, and Sino-Russian collaborative initiatives.

4. Results and Discussion

AI is transforming TCM's four diagnostic methods, enabling objective tongue/facial analysis[2,3]. Beijing TCM University's Dongfang Hospital has digitalized all four with intelligent devices. AI also screens mental health via movement and speech analysis[2]. The 2025 "Qihuang Acupuncture" model integrates meridian/acupoint data for primary care[3].

Smart acupuncture robots combining AI precision with TCM logic have been demonstrated[3].

Shenyang's smart decoction center produces 4,000–4,500 daily doses via 323 AI-powered machines[4]. AI aids compound screening via molecular docking[5]. Russia's Megagrants project uses AI to identify TCM bioactive components[4].

Beijing TCM University has a St. Petersburg center with Russia's Emergency Ministry[2]. China modernizes TCM via AI; Russia integrates TCM diagnostics with biomedicine[6]. The Megagrants project combines Chinese expertise with Russian infrastructure[4]. Siberian Medical University students exchanged in China (2024), experiencing smart TCM healthcare[7].

5. Conclusions and Challenges

China and Russia have complementary strengths in AI-empowered TCM. China provides TCM expertise and full-chain AI capabilities; Russia offers biomedical research and mathematical foundations. Existing collaborations—the St. Petersburg center, Megagrants screening, and student exchanges—confirm feasibility.

Key challenges include: data standardization (TCM data lack uniform collection standards), regulatory discrepancies, cross-border data privacy concerns, and linguistic barriers. These require sustained bilateral efforts in technical standards, legal coordination, and academic exchange.

References

[1] World Federation of Chinese Medicine Societies. Proceedings of the First World Congress on Artificial Intelligence in Traditional Chinese Medicine, 2026.

[2] TASS News Agency. Traditional Chinese medicine is actively integrating artificial intelligence into diagnosis and treatment. Interview with Han Zhenyun, Party Secretary of Dongfang Hospital, Beijing University of Chinese Medicine, 2025.

[3] International Online . One silver needle connects the world: "Belt and Road" acupuncture technology exchange conference held in Zhengzhou. People's Daily Online, 2025.

[4] Pirogov University. How will the symbiosis of modern technology and traditional Chinese medicine help in studying the phenomenon of sterile inflammation? Pirogov University News, 2025.

[5] Ran B., Zhou, HC. Innovative diagnosis and treatment of Chinese and Russian traditional medicine: Inheritance and modern integration. Proceedings of the 20th Sino-Russian Biomedical Forum, 2025, 121-130.

[6] Liu, L, Zhou, HC. The innovation and practice of the warm-yang-qi method in the treatment of chronic diseases from the perspective of the integration of traditional Chinese and Russian medicine. Proceedings of the 20th Sino-Russian Biomedical Forum, 2025, 80-96.

[7] Wenzhou Medical University. A new chapter in Sino-Russian medical exchange: Smart healthcare leading the future. WMU News, 2024.

BRIDGING TRADITIONAL MEDICINE AND DIGITAL INTELLIGENCE: AN AI-ENABLED FRAMEWORK FOR SINO-RUSSIAN COLLABORATION IN KNOWLEDGE MANAGEMENT AND QUALITY ASSURANCE

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Abstract

The digital transformation of traditional medicine (TM) offers new opportunities for modernization. This study proposes a conceptual framework for Sino-Russian smart medicine innovation integrating artificial intelligence (AI), knowledge graphs (KGs), fingerprint databases, and clinical decision support systems. The framework supports knowledge standardization, herbal medicine quality assurance, and evidence-based clinical decision-making. By combining these technologies into an integrated platform, it enhances knowledge management, quality control, and intelligent healthcare, providing a practical pathway for the modernization and international development of TM.

Keywords: Smart Medicine, Sino-Russian Collaboration, Knowledge Graphs, Fingerprint Databases, Industrial Convergence

Digital collaboration between China and Russia represents a significant frontier in contemporary healthcare innovation, driven by the strategic imperative to modernize and globalize Traditional Medicine (TM). Historically, TM has encountered substantial challenges regarding standardization, quality consistency, and cross-border clinical acceptance [1]. The rapid evolution of digital intelligence technologies—including Artificial Intelligence (AI), Multi-Agent Systems (MAS), and advanced chromatography informatics—presents an unprecedented opportunity to renew traditional practices [2,3]. By embedding digital frameworks into TM, the Sino-Russian smart medicine initiative aims to catalyze industrial convergence and deliver validated, precision-driven therapeutic solutions to global populations [4].

Objective

This study proposes a scalable digital framework integrating advanced computing and TM to support quality standardization, cross-lingual knowledge integration, and intelligent clinical decision-making in Sino-Russian collaboration [1,4,5].

Materials and methods

This study adopts a framework synthesis approach based on recent digital TM research. It integrates KG-MAS systems for knowledge management [4], fingerprint databases for quality control [3,5], and specialized LLMs for clinical decision support [1]. The resulting framework emphasizes cross-border interoperability and multimodal data integration to support international health informatics.

Results and discussion

The synthesis produced a three-tiered Sino-Russian Smart Medicine Architecture. KGs and MAS facilitate knowledge standardization through semantic alignment and cross-lingual translation, reducing terminology heterogeneity and transforming traditional knowledge into machine-readable digital assets [4]. Second, industrial convergence is strengthened through a digital fingerprint database network. By integrating AI with chromatographic and hyperspectral imaging technologies, the framework enables rapid, non-destructive quality assessment, origin authentication, and API traceability, supporting regulatory compliance and Sino-Russian pharmaceutical trade [2,3,5]. Third, the framework incorporates AI-empowered Clinical Decision Support Systems (AI-CDS). Recent evaluations of clinical LLMs indicate that domain-specific fine-tuning drastically reduces diagnostic error rates compared to general models. By addressing text heterogeneity and clinical reasoning misalignment, the system assists cross-border clinicians in achieving standardized, evidence-based syndrome differentiation [1,6]. The synergy between Russia's expertise in data science and computational physics and China's rich TM resources creates a robust ecosystem. This digital renewal mitigates traditional market barriers by replacing empirical observation with objective, data-driven validation, accelerating clinical trial methodologies, and smoothing market access pipelines [1,2]. Digital empowerment acts as a transformative catalyst, renewing traditional medicine into a highly precise, standardized scientific discipline. By harmonizing knowledge graphs, automated quality control databases, and clinical support tools, the proposed Sino-Russian smart medicine framework overcomes historical barriers of cultural and scientific translation. This integration paves a rigorous pathway for international healthcare innovation and bilateral industrial growth.

References:

1. Wang A. et al. Development and application of artificial intelligence in traditional Chinese medicine research and development // Chin Med. – 2026. – Vol. 21, № 1. – P. 17.

2. Zhu J., Liu X., Gao P. Digital intelligence technology: new quality productivity for precision traditional Chinese medicine // Front. Pharmacol. – 2025. – Vol. 16. – P. 1526187.

3. Li M.-Y. et al. Application and research progress on artificial intelligence in the quality of Traditional Chinese Medicine // Front. Pharmacol. – 2025. – Vol. 16. – P. 1687681.

4. Xiang S. et al. Integrating knowledge graphs with ancient Chinese medicine classics: challenges and future prospects of multi-agent system convergence // Chin Med. – 2025. – Vol. 20, № 1. – P. 168.

5. Wang Q. et al. TCM Fingerprint database: A digital approach to scientifically reflect the internal quality of traditional Chinese medicine // Pharmacological Research - Modern Chinese Medicine. – 2023. – Vol. 7. – P. 100261.

6. Sun Y. et al. When Traditional Medicine Meets AI: Critical Considerations for AI-Empowered Clinical Support in Traditional Medicine // Proc. ACM Hum.-Comput. Interact. – 2025. – Vol. 9, № 7. – P. 1–37.

DIGITAL EMPOWERMENT AND TRADITIONAL RENEWAL: A SINO-RUSSIAN FRAMEWORK FOR SMART MEDICINE INNOVATION AND INDUSTRIAL INTEGRATION

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Abstract

Digital health is accelerating the modernization of traditional and integrative medicine by linking classical knowledge, biomedical evidence, data standards, and industrial translation. China and Russia both have rich medical traditions, strong biomedical education systems, and expanding digital infrastructure. This paper proposes a concise Sino-Russian framework for smart traditional medicine cooperation, including digital knowledge platforms, artificial intelligence-assisted research, smart quality control, telemedicine, and industry-academia-clinical collaboration. The framework emphasizes interoperability, safety, ethical governance, and practical translation according to real clinical and public health needs.

Keywords:smart medicine, traditional medicine, digital health, artificial intelligence, Sino-Russian cooperation, industrial integration

Traditional medicine is entering a new stage of modernization. Digital technologies should not replace accumulated clinical experience; they can make traditional knowledge more searchable, testable, standardized, and transferable. The forum theme, ??igital Empowerment and Traditional Renewal: Sino-Russian Smart Medicine Innovation and Industrial Integration?? is therefore timely. China has a mature traditional Chinese medicine system, while Russia has long experience in herbal medicine, rehabilitation, preventive medicine, and biomedical engineering. Both countries face shared health challenges, including ageing, chronic diseases, mental health burden, and uneven access to medical resources. Smart medicine can become a bridge between traditional wisdom and evidence-based health care.

Objective

To propose a practical framework for Sino-Russian cooperation in smart traditional medicine, focusing on digital knowledge integration, research validation, quality control, service innovation, and industrial translation.

Materials and methods

A narrative conceptual analysis was conducted based on international guidance on digital health and traditional medicine, biomedical innovation needs, and requirements of cross-border industry-academia-clinical collaboration. Five dimensions were considered: knowledge

infrastructure, artificial intelligence research, quality and safety standards, digital clinical services, and industrial integration mechanisms.

Results and discussion

The proposed framework contains five layers. First, a bilingual or multilingual digital knowledge platform should collect traditional medical terms, prescriptions, botanical resources, pharmacological evidence, clinical indications, safety information, and regulatory documents. Interoperable data standards would help Chinese and Russian researchers compare concepts, materials, and evidence transparently.

Second, artificial intelligence can transform experience-based knowledge into testable hypotheses. Natural language processing may mine classical texts and clinical records, while machine learning can support compound screening, herb-target prediction, phenotype classification, and safety signal detection. However, AI outputs should guide, not replace, laboratory validation and clinical studies.

Third, smart quality control is essential for industrialization. Chromatographic fingerprinting, spectral analysis, traceability systems, and intelligent manufacturing can improve consistency from raw materials to finished products. Joint standards for selected herbal resources, quality markers, adverse-event reporting, and data documentation would reduce cross-border barriers.

Fourth, smart service models can expand access to integrative health care. Telemedicine, wearable devices, mobile health applications, and clinical decision support systems may support chronic disease management, rehabilitation, sleep and mental health monitoring, and preventive care, especially in remote regions. Patient privacy, algorithmic transparency, and professional accountability should be built into system design.

Fifth, industrial integration requires a stable cooperation mechanism. Universities and research institutes can generate evidence; hospitals can provide clinical scenarios and real-world data under ethical approval; enterprises can develop products, platforms, and manufacturing capacity; regulators and associations can guide standards and safety supervision. Pilot projects may include smart herbal product quality control, AI-assisted traditional medicine databases, and digital rehabilitation services.

Digital empowerment offers a feasible route for renewing traditional medicine while preserving its cultural and clinical foundations. Sino-Russian cooperation should move from conceptual exchange to pilot projects with measurable outcomes in safety, effectiveness, accessibility, regulatory compatibility, and industrial sustainability.

References:

1. World Health Organization. Global strategy on digital health 2020-2025. Geneva: World Health Organization; 2021.

2. World Health Organization. Digital health. Available from: https://www.who.int/health-topics/digital-health/

3. World Health Organization. WHO traditional medicine strategy: 2014-2023. Geneva: World Health Organization; 2013.

4. World Health Organization. Implementation of the WHO Traditional Medicine Strategy 2014-2023. Available from: https://www.who.int/activities/implementation-of-the-WHO-traditional-medicine-strategy-2014-2023

AI-ENABLED REAL-WORLD EVIDENCE PLATFORM FOR SINO-RUSSIAN TRADITIONAL MEDICINE INNOVATION

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Abstract

The digital transformation of health care creates new opportunities for traditional medicine modernization and industrial cooperation between China and Russia. This paper proposes an artificial intelligence-enabled real-world evidence platform for traditional medicine innovation. The platform links clinical data, classical knowledge, herbal product information, quality control results, and patient-reported outcomes. Its aim is to support evidence generation, safety monitoring, product optimization, and cross-border industrial translation. By combining digital health, artificial intelligence, and regulatory-oriented data governance, Sino-Russian cooperation may transform traditional medical resources into safer, more standardized, and more internationally communicable health solutions.

Keywords:real-world evidence, traditional medicine, artificial intelligence, digital health, Sino-Russian cooperation, pharmacovigilance

Traditional medicine has long contributed to prevention, rehabilitation, and chronic disease management. However, its wider international application is often limited by heterogeneous terminology, variable product quality, insufficient clinical evidence, and fragmented data systems. Digital health provides a practical solution to these limitations. For China and Russia, cooperation in smart medicine can move beyond academic exchange and establish data-driven mechanisms for evidence generation and industrial translation. Real-world evidence is especially valuable because many traditional medicine interventions are used in complex clinical scenarios that are difficult to evaluate through a single experimental model.

Objective

To propose an AI-enabled real-world evidence platform for Sino-Russian traditional medicine innovation, focusing on evidence generation, safety evaluation, quality improvement, and industry-academia-clinical integration.

Materials and methods

A conceptual design approach was used. The framework was developed according to international principles of digital health, traditional medicine integration, data interoperability, clinical governance, and pharmacovigilance. The analysis focused on five components: data sources, artificial intelligence functions, quality control linkage, ethical governance, and industrial application.

Results and discussion

The proposed platform includes five functional modules. First, a standardized data module should integrate hospital electronic medical records, outpatient follow-up data, rehabilitation records, prescriptions, laboratory indicators, adverse-event reports, and patient-reported outcomes. Common data dictionaries and bilingual terminology mapping are necessary to connect Chinese and Russian clinical information.

Second, an artificial intelligence module can support data mining and hypothesis generation. Natural language processing may extract information from clinical notes and classical medical texts. Machine learning may identify treatment-response patterns, potential herb-drug interactions, safety signals, and patient subgroups that are more likely to benefit from specific interventions. These findings should be interpreted as decision-support information rather than direct clinical conclusions.

Third, a quality control module should link clinical outcomes with product characteristics. For herbal products, chromatographic fingerprints, active or marker compounds, origin information, processing methods, and batch records can be connected with effectiveness and safety data. This linkage may help identify quality markers, improve manufacturing consistency, and support regulatory communication.

Fourth, ethical and regulatory governance is essential. The platform should protect patient privacy, use de-identified data, define data access permissions, and ensure transparent algorithm evaluation. Cross-border cooperation should respect national regulations while promoting comparable evidence standards. Independent ethics review and professional supervision are required before clinical data are used for research or product development.

Fifth, industrial translation can be promoted through pilot projects. Possible applications include evidence-based herbal product development, digital rehabilitation services, chronic disease management tools, and post-marketing safety monitoring systems. Universities can provide methodological support; hospitals can provide clinical scenarios; enterprises can develop platforms and products; regulators and professional associations can guide standards.

This model can help transform traditional medicine from experience accumulation to evidence-informed innovation. It also provides a practical pathway for integrating digital technology, clinical research, product quality control, and health industry development.

References:

1. World Health Organization. Global Strategy on Digital Health 2020-2027. WHO; 2025.

2. World Health Organization. Digital health. WHO; 2026.

3. World Health Organization. WHO traditional medicine strategy: 2014-2023. WHO; 2013.

4. World Health Organization. Implementation of the WHO Traditional Medicine Strategy 2014-2023. WHO; 2026.

DIGITAL EMPOWERMENT: THE MITOCHONDRIAL DYSFUNCTION, OXIDATIVE STRESS, AND AUTOPHAGY AXIS IN GYNECOLOGIC CANCERS AND SINO-RUSSIAN TRADITIONAL MEDICINE

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Abstract

Gynecological malignancies are driven by a mitochondrial dysfunction–oxidative stress–autophagy dysregulation feedback loop. Mitochondrial damage triggers oxidative stress and disrupts autophagy, which in turn aggravates mitochondrial damage and promotes tumor progression. Multi-target traditional medicines, especially Sino-Russian plant resources combined with network pharmacology and AI, enable loop-targeted drug discovery. This review summarizes the network mechanism, the regulatory effects of Sino-Russian natural products, and the digital technology applications, aiming to support Sino-Russian intelligent pharmaceutical cooperation and industrial integration.

Keywords: gynecological malignancies; mitochondrial dysfunction; oxidative stress; autophagy dysregulation; digital empowerment; Sino-Russian intelligent medicine

Gynecological cancers, marked by high recurrence and drug resistance, urgently require new mechanistic insights. In the tumor microenvironment, mitochondrial dysfunction, oxidative stress, and autophagy form a core network: mitochondrial damage triggers oxidative stress as a signaling hub, causing autophagy dysregulation, which in turn exacerbates mitochondrial damage and stress, creating a closed positive feedback loop that drives tumor progression. Sino-Russian natural products can interrupt this loop through multi-target regulation. Digital technologies such as network pharmacology and AI enable precise screening of active components, embodying digital empowerment. The Belt and Road Initiative further facilitates Sino-Russian intelligent pharmaceutical research and industrial transformation. This review summarizes this pathogenic network, natural product interventions, and digital technology advances.

Objective

This paper elucidates the mitochondrial damage–oxidative stress–autophagy dysregulation loop in gynecological malignancies, and reviews Sino-Russian natural product interventions and digital technology empowerment for pharmaceutical cooperation and integration.

Materials and methods

A systematic review of PubMed, Web of Science, CNKI, and Russian eLibrary (2016–2026) was conducted using keywords including gynecological cancer, mitochondrial dysfunction, oxidative stress, autophagy dysregulation, natural products, network pharmacology, and Sino-Russian cooperation. Studies on the mechanistic network interplay, natural product interventions, and digital

applications were included and summarized.

Results and discussion

In gynecological tumor cells, mtDNA mutations and respiratory chain defects increase ROS, causing oxidative stress. This disrupts autophagy via HIF-1α/NF-κB: mitophagy is impaired and macroautophagy is overactivated. Dysregulated autophagy in turn aggravates mitochondrial damage and ROS, forming a positive feedback loop that drives apoptosis evasion, invasion, metastasis, angiogenesis, and chemoresistance.

Sino-Russian medicinal plants exert synergistic regulation on this loop. Curcumin and resveratrol scavenge ROS, restore mitochondrial membrane potential, and correct autophagy dysfunction, thereby inhibiting proliferation and enhancing chemosensitivity in ovarian cancer models. Rhodiola rosea extracts reduce mitochondrial oxidative damage and regulate autophagy via the mTOR pathway to interrupt reciprocal mitochondrial injury. Eleutherococcus senticosus glycosides scavenge ROS and synergistically suppress malignant proliferation of tumor cells.

Network pharmacology and AI enable screening of compounds targeting the oxidative stress–autophagy loop, validated by molecular docking and experiments. Leveraging Sino-Russian strengths, a joint screening and digital–validation–manufacturing platform can develop novel gynecological cancer adjuvant therapies, exemplifying pharmaceutical integration.

Targeting this mitochondrial-oxidative stress-autophagy loop with Sino-Russian natural products and digital tools provides new directions for gynecologic cancer therapy and transnational pharmaceutical collaboration.

References:

1. Li CY, Ding DN, Guo Y, et al. Unlocking the mitochondrial functional code: unraveling the pathogenesis of ovarian cancer and innovative targets to inhibit malignant behavior. J Transl Med, 2025, 23(1): 819.

2. Yu Q, Ren L, Ren F, et al. Oxidative stress as a nexus: Integrating mitophagy and ferroptosis in endometrial carcinogenesis (Review). Oncol Lett, 2026, 31(1): 40.

3. Xu W, Yang T, Zhang J, et al. Rhodiola rosea: a review in the context of PPPM approach. EPMA J, 2024, 15(2): 233-259.

4. Kos G, Czarnek K, Sadok I, et al. Eleutherococcus senticosus (Acanthopanax senticosus): An Important Adaptogenic Plant. Molecules, 2025, 30(12).

5. Sun H, Wang D, Zheng Y, et al. Elucidating the Molecular Mechanisms of Hederagenin-Regulated Mitophagy in Cervical Cancer SiHa Cells through an Integrative Approach Combining Proteomics and Advanced Network Association Algorithm. J Proteome Res, 2025, 24(4): 2081-2095.

6. Hou Y, Wang Z, Wang W, et al. AI-identified CD133-targeting natural compounds demonstrate differential anti-tumor effects and mechanisms in pan-cancer models. EMBO Mol Med, 2025, 17(11): 2932-2965.

POTENTIAL TARGETS AND MECHANISMS OF DANGGUI BUXUE DECOCTION IN THE TREATMENT OF DIABETIC NEPHROPATHY:A NETWORK PHARMACOLOGY AND MOLECULAR DOCKING STUDY

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Abstract

Diabetic kidney disease (DKD) is one of the most common and severe microvascular complications of diabetes mellitus and a major cause of end-stage kidney disease. Its pathogenesis involves oxidative stress, inflammatory responses, extracellular matrix deposition, and tubulointerstitial fibrosis[1]. In recent years, the therapeutic potential of Danggui Buxue Decoction in the prevention and treatment of DKD has attracted increasing attention[2]. This study employed network pharmacology and molecular docking to elucidate the potential mechanisms underlying its therapeutic effects on DKD, providing a scientific basis for optimizing clinical treatment strategies and guiding further research.

Keywords: diabetic kidney disease; network pharmacology

Diabetic kidney disease is a severe microvascular complication leading to end-stage renal disease, driven by oxidative stress, inflammation, and extracellular matrix deposition[1]. In traditional Chinese medicine, DKD is characterized by qi and yin deficiency with blood stasis and is traditionally categorized under "wasting-thirst" and "edema."

Danggui Buxue Decoction, a formulation combining Astragali Radix and Angelicae Sinensis Radix, is traditionally used to tonify qi and promote blood production to exert renoprotective effects[2]However, its specific pharmacodynamic material basis, key therapeutic targets, and multi-component synergistic mechanisms against DKD remain to be systematically elucidated.

Objective

This study aims to investigate the potential mechanisms of Danggui Buxue Decoction on DKD through integrated network pharmacology and molecular docking analysis.

Materials and Methods

The TCMSP database was used to screen the main chemical components, active ingredients, and corresponding potential targets of the two medicinal herbs in Danggui Buxue Decoction. DKD-related pathogenic targets were retrieved from the OMIM and GeneCards databases. Venny 2.1.0 was applied to identify overlapping targets between active ingredients and DKD. Cytoscape 3.10.3 and STRING 12.0 were used to construct and analyze the ingredient–target–disease network and protein–protein interaction network. GO functional annotation and KEGG pathway enrichment analyses were performed using Metascape, and binding interactions between key active ingredients and hub targets were evaluated by molecular docking.

Results and discussion

A combined strategy of network pharmacology and molecular docking was used to reveal the molecular mechanisms by which Danggui Buxue Decoction exerts therapeutic effects against DKD. First, 109 active ingredients were screened from the TCMSP database, corresponding to 783 potential drug targets. A total of 4,838 DKD-related pathogenic targets were retrieved from disease databases. Venny diagram analysis identified 425 overlapping candidate therapeutic targets. These targets were subjected to GO functional annotation and KEGG pathway enrichment analysis using the DAVID database; enriched entries with $P < 0.05$ were retained and sorted by ascending P-value.

Protein–protein interaction network topological analysis identified JAK2, PIK3CA, PTPN11, and EGFR as core hub genes underlying the renoprotective effects of Danggui Buxue Decoction. JAK2, a non-receptor tyrosine kinase, drives renal inflammation and podocyte injury through aberrant activation of the JAK2/STAT axis. PIK3CA, encoding the catalytic subunit of PI3K, regulates the PI3K/AKT pathway involved in high glucose–induced mesangial expansion, podocyte dysfunction, and renal fibrosis. PTPN11 participates in inflammatory amplification, oxidative stress, and fibrotic remodeling in diabetic renal injury. EGFR activation is associated with glomerular hypertrophy, tubular epithelial proliferation, and interstitial fibrosis during DKD progression.

At the pathway level, the enriched pathways covered multiple pathological processes of DKD. The AGE-RAGE and HIF-1 pathways are closely related to oxidative stress and vascular damage in diabetic complications; the PI3K-Akt pathway regulates cell survival and fibrosis; and the TNF signaling pathway mediates chronic inflammatory responses. These pathways jointly form a holistic regulatory network, consistent with the multi-component and multi-target characteristics of traditional Chinese medicine formulas.

Molecular docking showed that the active ingredients of Danggui Buxue Decoction exhibited favorable binding affinity with core DKD therapeutic targets, suggesting that these components may effectively bind to relevant targets and exert therapeutic effects.

Conclusion

This study preliminarily demonstrates that Danggui Buxue Decoction exerts renoprotective effects on DKD through multiple ingredients targeting core targets, including JAK2, PIK3CA, and EGFR, while synergistically regulating pathways related to oxidative stress, inflammation, cell proliferation, and fibrosis. These findings verify the multitarget and multipathway characteristics of Danggui Buxue Decoction in DKD treatment, provide a basis for experimental validation and clinical optimization, and offer a reference for exploring the pharmacological mechanisms of traditional Chinese medicine formulas against diabetic kidney disease.

References

[1]Jin Q, Liu T, Qiao Y, Liu D, Yang L, Mao H, et al. Oxidative stress and inflammation in diabetic nephropathy: role of polyphenols. Frontiers in Immunology. 2023;14:1185317

[2]Sun L,Yang Z,Zhao W, et al. Integrated lipidomics, transcriptomics and network pharmacology analysis to reveal the mechanisms of Danggui Buxue Decoction in the treatment of diabetic nephropathy in type 2 diabetes mellitus. J Ethnopharmacol. 2022;283:114699.

AI-DRIVEN PREDICTION OF SUPRAMOLECULAR SELF-ASSEMBLED STRUCTURES IN TRADITIONAL CHINESE MEDICINE COMPOUND DECOCTIONS

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Abstract

Traditional Chinese medicine compound decoctions are not simple mixtures of small molecules, but complex dynamic systems formed during heating, dissolution, concentration, and cooling. Increasing evidence shows that natural product-derived bioactive constituents can spontaneously form nanoscale structures through non-covalent interactions. This understanding has promoted a shift from the conventional "single compound–single target" model to a new paradigm of "multiple components–supramolecular structures–holistic efficacy". Polysaccharides, triterpenoids, flavonoids, alkaloids, glycosides, and polyphenols all exhibit self-assembly potential. Therefore, supramolecular self-assembled structures may represent an important material basis for compatibility-enhanced efficacy, toxicity attenuation, and multi-target synergy.

Keywords: artificial intelligence; supramolecular self-assembly; bioactive material basis

Traditional Chinese medicine compound formulas have long faced challenges, including an unclear bioactive material basis, inconsistent quality evaluation standards, and difficulty in explaining multi-target mechanisms. Artificial intelligence provides a promising strategy to address these issues through compound prediction, machine learning-assisted quality control, network pharmacology, and multi-source data integration[1]. Applying AI to compound decoctions is therefore important for understanding not only which constituents are present, but also how they aggregate and contribute to pharmacological efficacy.

Studies on natural product nanomedicine have shown that nanoscale delivery systems can improve the poor solubility, low bioavailability, short half-life, weak stability, and insufficient targeting ability of many natural products[2]. Nanomedicine formulations can enhance efficacy, improve bioavailability, enable controlled release, strengthen targeting, and reduce toxicity. These findings suggest that supramolecular structures naturally formed during decoction should not be regarded merely as impurities or accidental products. Instead, they may function as endogenous nanoscale carriers involved in the efficacy of traditional Chinese medicine[1].

AI can transform the complex "component–interaction–structure–efficacy" relationship in compound decoctions into a computable problem. Conventional methods, such as LC–MS, particle size analysis and in vitro pharmacological assays, can confirm certain self-assembled structures but are limited in predicting key participating constituents, stable ratios, and activity-related supramolecular forms. It can also support active constituent discovery through multi-omics integration, drug–target affinity prediction, ADMET evaluation, and mechanism network analysis.

Among available modeling approaches, graph neural networks are particularly suitable for

predicting supramolecular self-assembly in traditional Chinese medicine. Interactions among decoction constituents can be represented as graph structures, where nodes denote flavonoids, alkaloids, saponins, polysaccharide fragments, or metal ions, and edges denote hydrogen bonding, π–π stacking, electrostatic interactions, hydrophobic interactions, or coordination interactions[3]. Future models should go beyond molecular formulas, SMILES, and conventional descriptors by incorporating electronic structures, charge distributions, hydrogen-bonding features, aromatic stacking capacity, amphiphilicity, and decoction-related parameters such as temperature, pH, ionic strength, decoction time, and concentration degree[3]. This would improve both prediction accuracy and interpretability.

This field is moving from phenomenon discovery toward mechanism prediction. Studies have shown that berberine and magnolol can form nanostructures through charge interactions and π–π stacking, with favorable oral bioavailability, colonic distribution, efficacy, and safety[4]. Berberine can also self-assemble with gallic acid, cinnamic acid, flavonoid glycosides, hesperetin, and other compounds through electrostatic interactions, π–π stacking, hydrophobic interactions, or hydrogen bonding. These examples demonstrate that different classes of bioactive constituents in traditional Chinese medicine formulas possess a chemical basis for supramolecular structure formation. Combined with decoction process parameters, such cases may help AI predict key self-assembling units and structural stability windows in specific compound decoctions.

Future research should integrate high-quality supramolecular databases, physics-informed graph neural networks, explainable AI, molecular simulation, and nanoscale experimental validation to improve the prediction and translation of self-assembled structures in traditional Chinese medicine compound decoctions [1][3].

In summary, AI-driven prediction of supramolecular self-assembled structures in traditional Chinese medicine compound decoctions represents a promising frontier in bioactive material research. By reinterpreting compound formulas as dynamic supramolecular systems shaped by multiple components, interactions, and multiscale structures, this strategy may support quality control, mechanism clarification, and nano-formulation development.

References

1.Han, Shanshan et al. "Artificial intelligence and synthetic biology in traditional Chinese medicine: revolutionizing public health applications". Frontiers in plant science vol. 17, (2026): 1789960. doi:10.3389/fpls.2026.1789960

2.Sun, Chaoqun et al. "Recent Progress in Nano-TCM Active Ingredient Co-Delivery Systems for Inflammation-Mediated Diseases". International journal of nanomedicine vol. 20, (2025): 9573-9596. doi:10.2147/IJN.S526731

3.Hannes Kneiding et al. "Deep learning metal complex properties with natural quantum graphs". Digital Discovery vol. 2,3 (2023): 618-633. doi:10.1039/d2dd00129b

4.Haifan Liu et al. "Recent advances in self-targeting natural product-based nanomedicines". Journal of nanobiotechnology vol. 23,1 (2025): 0-0. doi:10.1186/s12951-025-03092-9

WHEN EXPERIENCE MEETS INTELLIGENCE: RETHINKING TCM QUALITY CONTROL IN THE AI ERA

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Abstract

Traditional Chinese Medicine (TCM) quality control has long relied on empirical identification and expert judgment. Although modern analytical technologies have significantly improved the characterization of medicinal materials, increasing data complexity has created new challenges for quality assessment. Artificial intelligence (AI) provides an opportunity to bridge the gap between data generation and knowledge interpretation. This paper discusses the transition of TCM quality control from experience-based evaluation to data-driven intelligence. Current applications of AI in medicinal material recognition, data analysis, quality prediction, and traceability management are summarized. Rather than replacing human expertise, AI should be viewed as a catalyst for transforming empirical knowledge into transparent, reproducible, and data-driven intelligence. Human–AI collaboration is expected to become an important direction for the future development of intelligent quality-control systems in TCM.

Keywords: Traditional Chinese Medicine; Artificial Intelligence; Quality Control; Data-Driven Intelligence; Human–AI Collaboration

Quality control is essential for ensuring the safety, efficacy, and international acceptance of Traditional Chinese Medicine. Conventional evaluation methods mainly depend on morphological identification, sensory assessment, and professional experience. Although these approaches remain valuable, they are often limited by subjectivity and poor reproducibility.

Recent advances in chromatography, spectroscopy, and metabolomics have generated large amounts of quality-related data. Consequently, the major challenge is no longer obtaining information but transforming complex datasets into reliable knowledge. Artificial intelligence has emerged as a promising tool for addressing this challenge.

Objective

To explore the role of artificial intelligence in reshaping the quality-control paradigm of Traditional Chinese Medicine and discuss future directions for intelligent quality-assurance systems.

Materials and methods

A literature-based analytical approach was employed. Representative studies on artificial intelligence, machine learning, computer vision, and data-fusion technologies in TCM quality control were reviewed and comparatively analyzed.

Results and discussion

Traditional quality assessment relies heavily on expert knowledge. However, variations in cultivation, processing, and storage conditions make subjective evaluation increasingly insufficient for modern quality management.

Artificial intelligence offers new solutions at multiple levels. Computer vision and deep-learning models can improve medicinal material identification. Machine-learning algorithms can analyze chromatographic, spectral, and metabolomic data to identify quality markers and establish predictive models. AI also supports intelligent traceability and risk management throughout the production chain.

More importantly, AI represents a shift in quality-control philosophy. Traditional systems focus on experience-based judgment, whereas intelligent systems emphasize data-driven decision-making. The value of AI therefore lies not only in automation but also in transforming fragmented information into systematic knowledge.

Nevertheless, AI cannot replace human expertise. The complexity of TCM theory and medicinal material diversity still require professional interpretation. A human–AI collaborative framework, combining computational efficiency with expert knowledge, is likely to become the most practical model for future quality control.

Future developments are expected to focus on explainable AI, multimodal data fusion, and large language models. These technologies may further improve model transparency, knowledge integration, and intelligent decision support.

Artificial intelligence is accelerating the transition of TCM quality control from empirical assessment to data-driven intelligence. Its ultimate value lies not in replacing human expertise but in transforming empirical knowledge into transparent, reproducible, and trustworthy intelligence. The future of TCM quality control will depend on effective collaboration between human expertise and artificial intelligence, providing a foundation for the modernization and global development of Traditional Chinese Medicine.

References:

1. Song Z., Chen G., Chen C.Y. - AI empowering traditional Chinese medicine? // Chemical science. – 2024. – 15 (41). – C.16844-16886.

2. Ding R., Yu L., Wang C., Zhong S., Gu R. - Quality assessment of traditional Chinese medicine based on data fusion combined with machine learning: A review. // Critical reviews in analytical chemistry. – 2024. – 54 (7). – C.2618-2635.

3. Pan Y., Zhang H., Chen Y., Gong X., Yan J., Zhang H. - Applications of Hyperspectral Imaging Technology Combined with Machine Learning in Quality Control of Traditional Chinese Medicine from the Perspective of Artificial Intelligence: A Review. // Critical reviews in analytical chemistry. – 2024. – 54 (8). – C.2850-2864.

DIGITAL INTELLIGENCE EMPOWERING THE INTELLIGENCE TRANSFORMATION OF HEALTHCARE: EMERGING TRENDS IN PRECISION MEDICINE AND PHARMACEUTIVAL INNOVATION

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Abstract

Digital intelligence technologies, including artificial intelligence (AI), big data, and machine learning, are transforming healthcare and pharmaceutical innovation. These technologies support the modernization of traditional medicine through intelligent diagnosis, quality evaluation, and precision treatment while accelerating drug development from target discovery to post-marketing surveillance. Meanwhile, digital transformation has become a major trend in the pharmaceutical industry, promoting intelligent manufacturing and Pharma 4.0. China has made significant progress in integrating digital technologies with traditional Chinese medicine, whereas Russia is actively advancing pharmaceutical digitalization, creating new opportunities for Sino-Russian cooperation. This paper summarizes recent advances in digital intelligence for traditional medicine, AI-assisted drug development, and pharmaceutical digital transformation, and discusses future challenges and collaborative prospects.

Keywords: Artificial intelligence, Smart medicine, Drug development, Traditional medicine, Digital transformation

The rapid development of digital intelligence technologies, including artificial intelligence (AI), machine learning, big data, and cloud computing, has accelerated the transition toward precision medicine and intelligent healthcare. These technologies are increasingly applied in disease diagnosis, drug development, healthcare management, and pharmaceutical manufacturing.Traditional Chinese medicine (TCM) possesses unique advantages in holistic and personalized treatment but still faces challenges in standardization, quality evaluation, and mechanism interpretation. Digital intelligence technologies improve intelligent diagnosis, quality control, and precision treatment, promoting the modernization of traditional medicine[1].Artificial intelligence is also transforming the pharmaceutical product lifecycle. Machine learning enables efficient target identification, lead optimization, toxicity prediction, clinical trial design, and post-marketing surveillance, significantly improving research efficiency and reducing development costs[2].Meanwhile, digital transformation represented by Industry 4.0 and Pharma 4.0 is reshaping pharmaceutical manufacturing and management. China has rapidly developed digital healthcare and intelligent TCM systems, while Russia is actively promoting pharmaceutical digitalization, providing new opportunities for bilateral cooperation[3].

Objective

To summarize recent advances in digital intelligence technologies in traditional medicine, AI-assisted drug development, and pharmaceutical digital transformation, and to explore future opportunities for Sino-Russian cooperation in smart medicine.

Materials and Methods

A narrative literature review was performed using three recent representative publications on digital intelligence in traditional medicine, AI-assisted drug development, and pharmaceutical digital transformation. Their findings were comparatively analyzed to summarize current applications, challenges, and future development trends.

Results and Discussion

Digital intelligence technologies are becoming key drivers of healthcare innovation.

In traditional medicine, AI and big data improve syndrome differentiation, herbal quality evaluation, and personalized treatment, reducing dependence on subjective clinical experience and supporting precision medicine.Throughout the pharmaceutical lifecycle, AI facilitates drug target discovery, virtual screening, toxicity prediction, clinical trial optimization, and pharmacovigilance, establishing an integrated data-driven development process.Digital transformation has also accelerated intelligent pharmaceutical manufacturing, quality management, and smart supply chains. China and Russia have both promoted healthcare digitalization, providing favorable conditions for future collaboration in intelligent medicine and pharmaceutical innovation.However, challenges remain, including data quality, interoperability, AI interpretability, cybersecurity, ethical governance, and regulatory standardization. Addressing these issues will be essential for the sustainable development of intelligent healthcare.

Digital intelligence has become a major driving force for precision medicine and pharmaceutical innovation. The integration of AI with traditional medicine and pharmaceutical development improves healthcare efficiency and promotes industrial transformation. Strengthening Sino-Russian cooperation, technological innovation, and standardized governance will further accelerate the development of intelligent healthcare.

References:

[1] ZHU J, LIU X, GAO P. Digital intelligence technology: new quality productivity for precision traditional Chinese medicine[J]. Frontiers in Pharmacology, 2025, 184(16): 01-23.

[2] DEMYASHKIN G, PARSHENKOV M, ZYRYANOV S, et al. Artificial Intelligence Across the Drug Development Lifecycle[J]. Medical Sciences, 2026, 14(2): 248-282.

[3] DORZHIEVA V. Digital transformation of the pharmaceutical industry in the USA and China: technological superiority and Russian prospects[J]. Obshchestvo i ekonomika, 2025,370(10): 89-103.

MULTIMODAL ARTIFICIAL INTELLIGENCE IN THE EARLY DIAGNOSIS OF ALZHEUMER'S DISEASE: CURRENT STATUS, CHALLENGES, AND CLINICAL TRANSLATION

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Abstract

The incidence of Alzheimer's disease (AD) has been increasing year by year, and early diagnosis is crucial for guiding therapeutic decision-making and reducing the disease burden. However, current AD clinical diagnosis guided by the A-T-N framework is still influenced by subjective judgment, inconsistent standards, and data heterogeneity in cognitive assessment, imaging interpretation, and multisource information integration. Artificial intelligence (AI), with its advantages in multimodal data processing, complex pattern recognition, and predictive modeling, provides a new approach to addressing these challenges. A large number of studies have investigated the application value of AI in the field of AD and have achieved important progress. Therefore, this review summarizes the current research progress in AI-assisted identification of AD pathological features, cognitive assessment, precise stratification, and whole-course disease management. It further discusses the current challenges and limitations in this field and analyzes future research directions, aiming to provide new insights for the development and clinical translation of AI-assisted diagnostic tools for AD.

Keywords: Alzheimer's disease; artificial intelligence; digital empowerment; diagnosis; clinical translation

Alzheimer's disease (AD) is a neurodegenerative disorder characterized primarily by progressive cognitive decline[1]. The acceleration of population aging has contributed to an increasing incidence of AD, resulting in a growing caregiving burden and imposing a substantial economic burden on healthcare systems[2]. At present, disease-modifying therapies have been applied to patients with early AD and have shown clinical benefits, highlighting the importance of identifying the critical window for early diagnosis, prevention, and treatment of AD[3].In recent years, under the guidance of the A-T-N framework, comprehensive diagnostic approaches integrating biomarkers such as magnetic resonance imaging, positron emission tomography and fluid biomarkers have greatly improved the accuracy of AD diagnosis compared with traditional symptom-based diagnostic methods, including cognitive function tests and behavioral assessments[4]. However, these approaches still have limitations, including subjectivity in diagnostic interpretation. Artificial intelligence (AI), owing to its advantages in multimodal data processing and complex pattern recognition, has made important breakthroughs in integrating imaging data, cognitive assessments, and blood-based biomarkers. AI-based approaches can achieve high-precision stratification of subjective cognitive decline, mild cognitive impairment due to Alzheimer's disease, and other stages of AD, and have therefore attracted extensive attention in the early diagnosis and disease staging of AD. This review aims to summarize the application progress of AI in the early diagnosis of AD over the past three years, analyze the challenges and limitations in this field, and provide a reference for

promoting further research and clinical translation.

Objective

This review aims to summarize the research progress over the past three years in AI-assisted identification of pathological features, cognitive assessment, precise stratification, and whole-course management of Alzheimer's disease. It further discusses the current status and challenges in this field and analyzes future research directions, with the goal of providing new insights for the development and clinical translation of AI-assisted diagnostic tools for AD.

Materials and methods

The China National Knowledge Infrastructure, Wanfang Data Knowledge Service Platform, VIP Database, PubMed, Web of Science, CINAHL, and Embase were searched. The search strategy combined MeSH terms, free-text terms, and Boolean operators. The search period was from database inception to July 1, 2026. Terms included "Alzheimer Disease", "Alzheimer dementia", "artificial intelligence", "AI", "machine learning", "deep learning", and so on. The general characteristics, application fields, and research findings of the included studies were summarized and analyzed.

Results and discussion

The application of multimodal AI to the early diagnosis of Alzheimer's disease can promote the evolution of diagnostic paradigms from experience-based judgment toward precise and automated decision-making based on multimodal data. However, its clinical translation still faces several key challenges, including insufficient model generalizability, limited interpretability, and a lack of prospective validation. Future research should focus on: (1) developing interpretable and lightweight models to build clinical trust; (2) establishing standardized, high-quality, multicenter prospective data cohorts to improve model applicability and generalizability; and (3) designing physician-centered workflows to achieve effective human–AI collaboration.

With continuous technological advances and deeper integration into clinical practice, AI is expected to become an important driving force for improving the diagnosis and treatment of Alzheimer's disease and enhancing patient outcomes.

References:

[1] Jiang J W, Zhao K, Li W, et al. Multiomics Reveals Biological Mechanisms Linking Macroscale Structural Covariance Network Dysfunction With Neuropsychiatric Symptoms Across the Alzheimer's Disease Continuum[J]. Biol Psychiatry, 2025, 97(11):1067-1078.

[2] Gustavsson A, Norton N, Fast T, et al. Global estimates on the number of persons across the Alzheimer's disease continuump[J]. Alzheimers Dement, 2023, 19(2):658-670.

[3] Dyck CH, Swanson CJ, Aisen P, et al. Lecanemab in Early Alzheimer's Disease[J]. N Engl J Med, 2023, 388(1):9-21.

EMOTIONAL DISORDERS AND COGNITIVE IMPAIRMENT IN MENOPAUSAL WOMEN: DIGITAL MEDICAL INTEGRATION OF CHINESE AND RUSSIAN MEDICINE

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Abstract: Menopause-related emotional disorders and cognitive impairment are common neuroendocrine problems in middle-aged women, caused by estrogen decline. This paper compares the intervention differences between Chinese traditional medicine and Russian hormone therapy, and proposes digital-enabled integrated management strategies combining intelligent monitoring and cross-border industrial cooperation. Digital medical technology can promote Sino-Russian intelligent pharmaceutical innovation and improve women's midlife health.

Keywords:menopause; emotional disorder; cognitive function; digital medical care; Sino-Russian pharmaceutical integration

Purpose

Perimenopausal estrogen decline commonly induces emotional dysfunction and reversible cognitive impairment, severely affecting middle_aged women's quality of life. This study aims to construct a digital_driven Sino_Russian integrated management model for menopausal emotional_cognitive disorders under the theme of intelligent pharmaceutical innovation and industrial integration.

Materials and Methods

This study sorted out the neuroendocrine pathogenesis and core clinical manifestations of perimenopausal emotional and cognitive problems based on existing clinical and pathological theories. Estrogen deficiency reduces hippocampal synaptic plasticity and triggers a vicious cycle of insomnia, emotional instability and cognitive decline, leading to typical symptoms including persistent anxiety, low mood and reversible memory impairment[1,2]. By comparing mainstream clinical practices in China and Russia, this study summarized different intervention strategies: Chinese studies adopt non_hormonal TCM therapies such as herbal formulas and acupuncture for mild_to_moderate perimenopausal symptoms[3,4], while Russian studies prioritize individualized menopausal hormone therapy (MHT) and neuroimaging evaluation for cognitive risk prediction[5]. Meanwhile, a digital-enabled intervention system was designed, including wearable real-time physiological monitoring, AI-assisted cognitive and emotional assessment, digital standardized TCM regimens, and combined Russian cognitive behavioral therapy, to build a cross-border integrated non-hormonal treatment scheme. Joint development of intelligent health platforms and medical devices was proposed to promote Sino-Russian industrial integration in women's healthcare.

Results and Discussion

The results indicated that Chinese holistic TCM regulation and Russian modern standardized

medical intervention present prominent complementary advantages in treating perimenopausal emotional_cognitive disorders. TCM non-hormonal therapies are safe and suitable for long-term intervention of mild and moderate symptoms with fewer side effects[3,4], whereas Russian MHT and brain imaging markers realize precise risk prediction and targeted treatment[5]. Digital medical technology effectively bridges the differences between the two medical systems, achieving real-time dynamic monitoring, quantitative intelligent evaluation and standardized remote intervention, which solves the problems of poor objectivity of traditional TCM diagnosis and limited applicability of single hormone therapy. However, both medical systems have certain limitations. TCM treatment relies on individual syndrome differentiation, lacking unified quantitative and standardized clinical criteria, while menopausal hormone therapy has strict applicable populations and clinical contraindications, restricting its generalized clinical promotion. Digital empowerment can integrate traditional holistic conditioning and modern precise diagnosis, break regional barriers of Sino-Russian medical cooperation, and promote the transformation of bilateral pharmaceutical innovation from theoretical research to industrial application. Further optimization of unified clinical evaluation criteria and cross-border data application norms is still required in future research.

Conclusion

Digital medical technology integrates traditional Chinese medicine holistic conditioning and Russian modern precise diagnosis, providing a feasible innovative path for Sino_Russian intelligent pharmaceutical innovation in the field of menopausal health management. Sustained cross-border medical and industrial cooperation can effectively improve the physical and mental health status of menopausal women in both China and Russia.

References

[1] McCarrey A C, Resnick S M. Postmenopausal hormone therapy and cognition[J]. Hormones and Behavior, 2015,74:167_172.

[2] Monteleone P, Mascagni G, Giannini A, et al. Symptoms of menopause_global prevalence, physiology and implications[J]. Nature Reviews Endocrinology, 2018,14(4):199_215.

[3] Brown L, Hunter M S, Chen R, et al. Promoting good mental health over the menopause transition[J]. The Lancet, 2024,403(10430):969_983.

[4] Gazerani P. Menopause_related brain fog as a midlife window in women's brain aging[J]. Frontiers in Human Neuroscience, 2026,20:1814092.

[5] Badawy Y, Spector A, Li Z, et al. The risk of depression in the menopausal stages: a systematic review and meta_analysis[J]. Journal of Affective Disorders, 2024,357:126_133.

RESEARCH ON THE PATH OF DIGITALLY EMPOWERED SMART MEDICINE INNOVATION AND INDUSTRIAL INTEGRATION IN CHINA AND RUSSIA

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Abstract

The current Sino-Russian biomedical cooperation is mainly based on offline academic forums and short-term clinical exchanges.The digital collaboration system is not perfect,and the efficiency of industrialization transformation of scientific research results is low.This paper compares the resource endowments of medical research and intelligent manufacturing in the two countries,sorts out the existing blockages of digital technology empowering bilateral pharmaceutical innovation and integration,and builds a complete landing path from the four dimensions of jointly building a digital scientific research platform,unifying industry standards,building a cross-border industrial carrier,and jointly cultivating compound talents.It provides practical reference for the long-term and in-depth coordinated development of smart medicine between China and Russia.

Keywords:digitally empowered,Sino-Russian smart medicine,innovation,industrial integration ,path

The global pharmaceutical industry has fully entered a digital and intelligent transformation cycle. China and Russia have formed a normalized medical exchange mechanism relying on the China-Russia Biomedical Forum,the China-Russia Medical University Alliance,and the Border Joint Laboratory.Russia has deep accumulation in the fields of basic pathogen detection,basic targets of anti-infective drugs,and tumor precision medicine research,and has many years of continuous clinical sample observation data.China has the advantages of intelligent pharmaceutical automated production lines,pharmaceutical big data platforms,large-scale manufacturing of AI diagnosis and treatment equipment,and digital cross-border supply chains.The scientific research and industrial resources of the two countries are highly complementary.However,at this stage,bilateral cooperation is mostly limited to the publication of papers and offline academic seminars,and there is a lack of unified cross-border scientific research data sharing standards,mutual recognition of digital medical technology standards,supporting digital pilot and industrial incubation carriers.

Objective

Systematically sort out the existing core obstacles of digital technology empowering Sino-Russian smart medicine cooperation,build a digital innovation R & D and cross-border industrial integration implementation path that suits the resource advantages of the two countries,open up the whole chain of basic medical research,digital clinical trials,intelligent large-scale production,and cross-border clinical landing,and comprehensively improve the efficiency of market-oriented transformation of bilateral biomedical scientific research results.

Materials and methods

Literature analysis method,comparative analysis method,inductive deduction method.

Results and Discussion

After literature review and two-way resource comparison analysis,there are three core constraints in the digital collaboration between China and Russia for smart medicine.First,the cross-border digital scientific research system is fragmented from each other,and there is no unified Chinese-English bilingual scientific research data recording,desensitization,and storage standards.The data of intestinal pathogens,tumor diagnosis and treatment,and antibacterial drug clinical trials in the two countries cannot be safely exchanged,making it difficult to carry out joint AI target screening,intelligent pathogen modeling,and digital real-world research.Second,the pharmaceutical digital industry standards have not achieved bilateral mutual recognition.There are significant differences in intelligent rapid detection equipment,online remote diagnosis and treatment systems,and digital drug production quality control standards,which greatly increase the cross-border registration and clinical adaptation costs of Chinese and Russian pharmaceutical products. Third,there is a disconnect between scientific research and digital industry carriers.The basic medical research results produced by the forum lack supporting digital pilot workshops,cross-border smart medical industrial parks,and digital cold chain traceability systems.It is difficult to quickly transform laboratory basic technologies into commercial diagnostic reagents and innovative preparations.

Combining the resource endowments and policy orientation of China and Russia,this paper proposes four systematic digital integration implementation paths.First,jointly establish a Sino-Russian digital biomedical joint research laboratory,refer to the unified manuscript specification of the Sino-Russian Biomedical Forum,formulate standardized bilingual scientific research data templates,integrate Russian basic pathogen and tumor clinical research data with Chinese AI computing power and digital simulation platform resources,and jointly develop intelligent immunochromatography rapid detection and AI new drug target mining system.Second,establish a Sino-Russian pharmaceutical digitization standard joint working group to unify the technical specifications of intelligent clinical testing,digital pharmaceutical production,and cross-border remote diagnosis and treatment,and promote the bilateral simplified registration and mutual recognition of digital medical apparatus and in vitro diagnostic reagents.

References:

1.Yang Baofeng.Exploration on the development path of digital medical collaborative innovation of China-Russia Medical University Alliance [J].Chinese Journal of Medical Education,2026,46 (4): 389-395.

2.Buravlev E A,Teselkin Y O.Digital biomedical cooperation prospects between China and Russia [J].Biomed Hub,2019,4 (3): 22-29.

3.Клунко Н С,Егорова Л В.Digital transformation paths of pharmaceutical industry under Sino-Russian cross-border cooperation [J].Бизнес.Образование.Право,23 (2): 167-174.

DIGITAL EMPOWERMENT AND TRADITIONAL REVITALIZATION: ARTIFICIAL INTELLIGENCE-DRIVEN MODERNIZATION OF TRADITIONAL CHINESE MEDICINE AND CURRENT STATUS OF SINO-RUSSIAN SMART MEDICINE INTEGRATION

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Abstract

Artificial intelligence (AI) is driving a paradigm shift in traditional Chinese medicine (TCM) research from experience-driven to data-driven approaches. This review provides a comprehensive synthesis of AI applications in five major domains of TCM: chemical profiling, full-chain quality control, intelligent manufacturing, multi-target efficacy evaluation, and smart prescription formulation. Current methodologies—including machine learning, multi-omics modeling, and multimodal pattern recognition—have demonstrated utility in novel compound discovery, botanical authentication, processing optimization, and intelligent syndrome-based prescribing. However, the field faces persistent challenges in data standardization, interpretability of "black-box" models, and translation of laboratory findings into industrial practice. The Sino-Russian Symposium on Biomedicine offers a strategic platform for bilateral collaboration, wherein complementary strengths—Russia's advanced computational biology and AI fundamentals and China's abundant TCM germplasm resources, clinical datasets, and manufacturing infrastructure—can be leveraged to advance integrated smart medicine development.

Keywords: artificial intelligence; modernization of traditional Chinese medicine; quality control; intelligent manufacturing; Sino-Russian pharmaceutical cooperation

From the perspective of Sino-Russian medical exchange, this review explores the prospects for bilateral integration in smart medicine. AI technologies, when combined with liquid chromatography-mass spectrometry, multi-dimensional chromatography, intelligent nuclear magnetic resonance, and chemometric approaches, facilitate batch-wise processing of complex TCM components and establish correlations between molecular fragments and pharmacological activities, thereby rendering compositional analysis more efficient and objective while fundamentally revising manual spectral interpretation paradigms[1-2]. Multimodal machine learning—integrating spectral, imaging, and textual data—has matured into a robust tool for medicinal material identification, geographical origin tracing, quality indicator screening, and process monitoring, complementing end-product inspection throughout the TCM quality management continuum [3-4].

Objective

This review aims to synthesize current AI-driven advances across the entire TCM industrial chain and to discuss their implications for Sino-Russian pharmaceutical innovation and industrial integration.

Materials and methods

Relevant literature published in 2026 was retrieved from CNKI, Web of Science, and PubMed. After screening, representative studies were included and classified by topic.

Results and Discussion

The field exhibits pronounced uneven development: chemical profiling and intelligent quality control have generated comprehensive application cases, whereas clinical decision support systems remain at the laboratory stage. There is currently no unified multi-omics database for TCM industry-wide, and AI models suffer from limited interpretability, while intelligent reform of TCM processing still encounters substantial technical hurdles [5]. Russia's strengths in computational biology and fundamental AI/biomimetic simulation can complement China's algorithmic gaps, whereas China possesses extensive medicinal germplasm resources, clinical case repositories, and full-scale TCM manufacturing chains—offering mutual synergies.

Overall, AI has introduced novel conceptual frameworks across TCM substance analysis, quality assurance, manufacturing, and pharmacology, yet most technologies remain at the proof-of-concept stage, with limited bilateral collaborative research. Future efforts should prioritize standardization of multimodal TCM data, enhancement of multi-scale interpretability, and establishment of digital ethics frameworks for TCM. Leveraging existing Sino-Russian biomedical cooperation mechanisms for joint research will allow traditional medical knowledge and modern AI to complement each other, thereby jointly advancing pharmaceutical technological progress through the collective wisdom of both nations.

References:

[1]Wang Z W, Xu B, Zhang Y L, et al. Advances in digitalintelligent transformation of traditional Chinese medicine industry based on wholechain intelligent upgrading[J]. China Journal of Chinese Materia Medica, 2026.

[2]Ma T Y, Xu Z X, Lin Y G, et al. From fragments to function: A review of AIdriven mass spectrometry interpretation and molecular fragment characterization strategies[J]. Acupuncture and Herbal Medicine, 2026.

[3]He Y X, Tang R N, Feng Z W, et al. Artificial IntelligenceDriven Modernization of Traditional Chinese Medicine: Transition from Experience Paradigm to DataIntelligent Paradigm[J]. Journal of Integration Technology, 2026.

[4]Mahboubifar M, et al. Chemometric-based drug discovery approaches from natural origins using hyphenated chromatographic techniques[J]. Phytochemical Analysis, 2024.

[5]Xu G Q, Li J Q, Chen W. Research on Modernization of Traditional Chinese Medicine Empowered by Artificial Intelligence Virtual Cell Technology[J]. Journal of Chengdu University of Traditional Chinese Medicine, 2026.

DIGITAL DECIDUOMICS: AI-DRIVEN MULTIOMICS AND THE RENEWAL OF TRADITIONAL MEDICINE IN UNEXPLAINED PREGNANCY INSTABILITY

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Abstract

Unexplained recurrent pregnancy loss (URPL) remains a major reproductive challenge, often lacking an identifiable cause after routine evaluation. Impaired decidualization, immune imbalance, vascular maladaptation, and metabolic dysregulation at the maternal–fetal interface may underlie many cases. Digital deciduomics, integrating multiomics, spatial technologies, digital pathology, and AI, offers a new framework for decoding decidual dysfunction and modernizing traditional medicine through digital syndrome profiling and omics-based target mapping.

Keywords:deciduomics; recurrent pregnancy loss; artificial intelligence; multiomics; traditional medicine; maternal–fetal interface

This paper summarizes the emerging concept of digital deciduomics and its application in unexplained pregnancy instability. It focuses on three aspects: how multiomics reveals decidual dysfunction, how AI integrates biological and clinical data into interpretable risk models, and how traditional medicine can be modernized through digital syndrome classification, network pharmacology, and omics-based validation.

Purpose

This paper summarizes digital deciduomics and its potential role in unexplained pregnancy instability. It focuses on three key issues: multiomics-based identification of decidual dysfunction, AI-driven integration of biological and clinical data into interpretable risk models, and modernization of traditional medicine through digital syndrome classification, network pharmacology, and omics-based validation.

Materials and Methods

This narrative review summarizes key studies and guidelines on recurrent pregnancy loss, decidual biology, maternal–fetal interface omics, AI prediction, and traditional medicine. Priority was given to guidelines, high-impact reviews, omics and AI studies, randomized trials, and systematic reviews, with emphasis on mechanisms, clinical relevance, limitations, and future integration.

Results and Discussion

Digital deciduomics is a multidimensional framework centered on the decidua. Single-cell sequencing reveals altered immune composition, defective stromal niches, abnormal decidualization, and impaired cell communication in RPL, suggesting that unexplained pregnancy loss reflects disrupted maternal–fetal dialogue rather than simple immune overactivation[1,2].

Spatial transcriptomics identifies implantation domains, glandular regions, immune niches, and vascular remodeling zones, helping explain how molecular signals may fail in inappropriate tissue compartments[3]. Epigenomics, non-coding RNA, metabolomics, and proteomics further reveal molecular memory, inflammation, coagulation imbalance, apoptosis, stress responses, and potential non-invasive biomarkers. AI-based metabolite models suggest that miscarriage risk may be detectable before conception.

AI is essential for clinical translation by integrating clinical, genetic, immune, metabolic, imaging, and psychological data, while deep learning may extract subtle ultrasound and pathology features. However, AI should support clinical judgment and requires multicenter validation, interpretability, ethical governance, and actionable interventions.

Traditional medicine offers an integrative view of RPL, emphasizing systemic regulation, reproductive reserve, circulation, immune balance, and maternal constitution. Yet current evidence for related formulas remains limited by small samples, heterogeneous interventions, insufficient blinding, and inconsistent outcomes[4].

Digital deciduomics may modernize traditional medicine through digital syndrome profiling, network pharmacology, and omics validation. Clinical signs, endocrine and immune markers, metabolomics, imaging features, and outcomes can define biological subtypes, while herbal components may be mapped to decidual pathways such as PI3K/AKT signaling, angiogenesis, inflammation, apoptosis, coagulation, and immune tolerance. Future management may combine digital phenotyping, multiomics subtyping, target mapping, and AI-assisted individualized intervention.

Conclusion

Unexplained pregnancy instability should be regarded as hidden maternal–fetal interface discoordination rather than simply the absence of identifiable causes. Digital deciduomics can reveal cellular, spatial, molecular, and metabolic abnormalities, while AI can integrate these data into interpretable models. Future URPL management may combine decidual biology, AI-driven multiomics, evidence-based medicine, and digitally renewed traditional medicine.

References:

[1] Wang F, Jia W, Fan M, et al. Single-cell immune landscape of human recurrent miscarriage. Genomics Proteomics Bioinformatics. 2021;19(2):208–222.

[2] Arutyunyan A, Roberts K, Troulé K, et al. Spatial multiomics map of trophoblast development in early pregnancy. Nature. 2023;616(7955):143–151.

[3] Tang L, Wang Z, Xu X, et al. Interpretable learning predicts miscarriage using pre-pregnancy serum metabolites. The Innovation Medicine. 2024;2(4):100093.

[4] Ruan L, Cai Y, Yin Y, Liu F, Li M, Lu G. Shoutai pills for treating recurrent miscarriage: a systematic review and meta-analysis of the safety and clinical efficacy in 11 randomized controlled trials. Front Pharmacol. 2025;16:1540073.

ARTIFICIAL INTELLIGENCE EMPOWERING TRADITIONAL CHINESE MEDICINE: FROM INHERITANCE TO INTELLIGENT TRANSFORMATION

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Abstract

Traditional Chinese Medicine (TCM) faces modernization challenges (unclear material basis, complex mechanisms, and difficult quantitative inheritance). Artificial intelligence (AI) offers solutions. This paper reviews AI applications in TCM—intelligent diagnostics, drug discovery, and knowledge graphs—and finds that AI improves syndrome recognition, accelerates pharmacodynamic analysis, and structures TCM knowledge. The digital–intelligent integration promotes quality development and international cooperation, echoing the forum's theme of digital empowerment and traditional revitalization.

Keywords: artificial intelligence, Traditional Chinese Medicine, intelligent diagnosis, drug discovery, digitalization

Introduction

TCM, a vital healthcare resource of China, has evolved over millennia. However, its modernization is hindered by the complexity of multi-component, multi-target, and multi-pathway mechanisms, as well as the subjective nature of diagnostic methods. The rapid advancement of AI and big data presents unprecedented opportunities to overcome these bottlenecks. National policies actively promote digital TCM development, aiming to integrate AI into inheritance, innovation, and industrial applications[1]. This paper summarizes current AI applications in TCM and discusses future directions, contributing to the Sino-Russian academic exchange on smart medicine.

Objective

To systematically evaluate the role of AI technologies in TCM modernization, focusing on (1) intelligent diagnostic systems, (2) AI-assisted pharmacological research, and (3) digital knowledge organization, and to discuss their implications for industrial transformation and international collaboration.

Materials and Methods

A literature review was conducted using databases including CNKI, VIP, and international platforms (2020–2026) with keywords "artificial intelligence," "TCM," "intelligent diagnosis," and "network pharmacology." Selected studies were categorized into diagnosis, drug discovery, and knowledge engineering. Representative cases from clinical trials and platform developments were analyzed.

Results and Discussion

Intelligent Diagnostic Systems – Deep learning and multimodal fusion enable tongue image

recognition, pulse signal analysis, and symptom inquiry. Clinical trials in tertiary TCM hospitals (n=300) demonstrated an syndrome recognition accuracy of 89.1%, improved efficiency by 37.8%, and patient satisfaction of 94.2%[2]. Large language models like DoPI[3] and JingFang[4] emulate TCM reasoning through multi-turn dialogues, addressing data sparsity and enhancing diagnostic consistency.

AI-Driven Drug Discovery – Network pharmacology and machine learning analyze "component-target-pathway" networks, identifying active compounds and predicting mechanisms. Integration with multi-omics (genomics, proteomics) clarifies the material basis of TCM formulas[5]. Automated platforms have been established, enabling unmanned screening and breakthrough in over 20 key technical bottlenecks[6], accelerating new drug development.

Knowledge graphs and human-machine collaboration address TCM terminological ambiguity and heterogeneity[7], standardizing semantics, linking ancient texts with modern data, and supporting clinical decisions and personalized recommendations, as validated in gastric disease prevention cases. Nationally, 2024 guidelines mandate digital integration across the TCM value chain[1]; provincial digital-TCM labs and vertical models are emerging. Sino-Russian digital-health cooperation is expanding, with AI pediatric systems (Russian version) recently showcased, reflecting cross-border innovation. Economic analyses further support the "new quality productive forces" concept in TCM[6].

Conclusion

AI technologies are revolutionizing TCM by transforming experience-based inheritance into data-driven intelligent innovation. Diagnostic systems, drug discovery platforms, and knowledge graphs collectively enhance scientific rigor and clinical applicability. Supported by policy and international partnerships[1], digital-empowered TCM offers new quality productive forces for healthcare, contributing to global health with Chinese wisdom. The synergy between tradition and technology, as highlighted in this forum, paves the way for a new era of smart medicine.

References

[1] GBD 2023 Breast Cancer Collaborators. Global, regional, and national burden of breast cancer among females, 1990-2023, with forecasts to 2050: a systematic analysis for the Global Burden of Disease Study 2023. Lancet Oncol. 2026 Mar;27(3):302-326.

[2] Zhang CC. AI-based TCM Syndrome Differentiation Nursing System. Sci Tech Vision, 2025(27):78-81.

[3] DoPI: Doctor-like Proactive Interrogation LLM for TCM. arXiv, 2025.

[4] JingFang: LLM-Based Multi-Agent System for TCM Consultation. arXiv, 2026.

[5] Liu GC, Long X, Peng QH, et al. Multi-Omics and AI in TCM. Digit Chin Med, 2025, 8(3):300-312.

[6] Research on Digital Intelligence Empowering New Quality Productivity in TCM. Health Econ Res, 2025(1):19-22.

DIGITAL PERIMENOPAUSOMICS: AI-DRIVEN PHENOTYPING AND TRADITIONAL MEDICINE RENEWAL IN MENOPAUSAL TRANSITION

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Abstract

Perimenopause is a dynamic transition involving fluctuating ovarian function, vasomotor symptoms, sleep and mood disturbance, metabolic remodeling, and increased cardiovascular and skeletal risk. Conventional assessment often relies on fragmented symptoms and limited endocrine tests. Digital perimenopausomics integrates mobile records, wearable sensing, endocrine markers, microbiome, metabolomics, and artificial intelligence to identify heterogeneous phenotypes and guide individualized management. This review discusses how digital phenotyping and interpretable AI may renew traditional medicine through standardized syndrome profiling, mechanism validation, and real-world evidence.

Keywords: perimenopause; artificial intelligence; digital phenotyping; multiomics; traditional medicine; women's health

Perimenopause is not only a decline in ovarian reserve, but also a systemic transition with individualized symptom trajectories. The STRAW+10 criteria stage reproductive aging by menstrual cycle patterns and endocrine features, yet women at the same stage may present different combinations of hot flashes, insomnia, anxiety, fatigue, weight gain, cognitive complaints, and urogenital symptoms [1]. Under the forum theme of digital empowerment and traditional renewal, perimenopausal care should move from symptom-centered observation to data-driven, mechanism-informed, and integrative management.

Purpose

This paper aims to summarize digital perimenopausomics as an emerging model for menopausal transition management, with emphasis on multimodal phenotyping, AI-assisted risk stratification, and modernization of traditional medicine.

Materials and Methods

A narrative review was conducted using representative staging criteria, clinical trials, systematic reviews, and multiomics studies related to reproductive aging, mobile health, wearable monitoring, microbiome-metabolomics, artificial intelligence, and traditional medicine. Priority was given to clinical relevance, innovation, limitations, and feasibility for integrated medical application.

Results and Discussion

Digital perimenopausomics is a multidimensional framework that links symptoms with continuous

physiological and biological data. Mobile applications can record menstrual irregularity, vasomotor symptoms, mood, sleep, diet, exercise, and medication use. Wearable devices can monitor heart rate variability, skin temperature, sleep rhythm, activity level, and possible vasomotor events. A randomized controlled trial of a mobile digital therapeutic showed potential benefits for vasomotor and behavioral health symptoms in midlife women, suggesting that digital tools may improve accessibility and self-management [2].

Multiomics extends assessment from clinical description to biological mechanism. Gut microbiome, metabolomics, inflammatory proteins, and cardiometabolic indicators may reflect estrogen fluctuation, metabolic remodeling, vascular risk, and chronic low-grade inflammation. Menopause-related microbial features have been associated with metabolites and inflammatory proteins, indicating that the menopausal transition involves systemic biological reprogramming rather than isolated ovarian decline [3].

AI is useful for integrating heterogeneous data. By combining menstrual history, endocrine markers, symptom scales, wearable signals, microbiome, metabolomics, imaging, and psychological data, interpretable models may identify subtypes such as vasomotor-dominant, insomnia-dominant, anxiety-depression-dominant, metabolic-risk-dominant, and urogenital-aging-dominant patterns. These models could support early warning, individualized intervention, and follow-up evaluation. However, multicenter validation, data privacy, fairness assessment, and clinician supervision are necessary to avoid black-box decision-making.

Traditional medicine offers a holistic framework for perimenopause, including kidney deficiency, liver constraint, heart-kidney disharmony, yin-yang imbalance, phlegm-dampness, and blood stasis. Its limitation lies in subjectivity and insufficient standardization. Digital perimenopausomics may renew traditional medicine by converting symptoms, tongue and pulse information, sleep data, endocrine markers, inflammatory factors, and omics features into auditable digital syndrome profiles.

Network pharmacology and omics validation can further link herbal formulas, acupuncture, and lifestyle regulation with neuroendocrine regulation, inflammation, oxidative stress, vascular function, sleep rhythm, and gut microbiota. A systematic review suggested that Chinese herbal medicine may improve sleep quality in perimenopausal insomnia, but larger high-quality randomized trials are still needed [4]. Therefore, future research should combine standardized outcomes, real-world evidence, safety monitoring, and mechanism verification.

Conclusion

Perimenopause should be regarded as a dynamic systemic transition. Digital perimenopausomics can reveal symptom trajectories, biological subtypes, and hidden risks through mobile health, wearable monitoring, multiomics, and AI. It also provides a practical pathway for renewing traditional medicine through digital syndrome profiling and mechanism-based validation. Future management may integrate precision medicine, evidence-based intervention, and digitally renewed traditional medicine to improve women's health.

References

[1] Harlow SD, Gass M, Hall JE, et al. Executive summary of the Stages of Reproductive Aging

Workshop +10. Menopause. 2012;19(4):387-395. doi:10.1097/gme.0b013e31824d8f40.

[2] Duffecy J, Rehman A, Gorman S, Huang YL, Klumpp H. Evaluating a mobile digital therapeutic for vasomotor and behavioral health symptoms among women in midlife: randomized controlled trial. JMIR Mhealth Uhealth. 2025;13:e58204. doi:10.2196/58204.

[3] Wang Y, Sharma A, Weber KM, et al. The menopause-related gut microbiome: associations with metabolomics, inflammatory protein markers, and cardiometabolic health in women with HIV. Menopause. 2024;31(1):52-64. doi:10.1097/GME.0000000000002287.

[4] Cong J, Zhang H, Xing W. Effectiveness and safety of Chinese herbal medicine in treatment of perimenopausal insomnia: a systematic review and meta-analysis. Holist Nurs Pract. 2026;40(1):3-15. doi:10.1097/HNP.0000000000000743.

FROM EMPIRICAL PREGNANCY SUPPORT TO A DIGITAL TWIN MATERNAL–FETAL INTERFACE: ADVANCES IN DIGITAL PRECISION MEDICINE FOR RECURRENT PREGNANCY LOSS

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Abstract

Recurrent pregnancy loss (RPL) is a highly heterogeneous reproductive disorder characterized by complex interactions among embryonic genetic abnormalities, impaired endometrial receptivity, maternal–fetal immune dysregulation, and metabolic dysfunction. Conventional clinical management relies largely on empirical evaluation and limited biomarkers, resulting in inconsistent therapeutic outcomes. Recent advances in chromosomal microarray analysis, single-cell sequencing, spatial transcriptomics, radiomics, and artificial intelligence (AI) have enabled a shift toward data-driven and systems-level approaches. RPL is increasingly recognized as a computable systemic disease rather than a purely clinical syndrome. This article summarizes recent progress in multi-omics analysis, AI-based prediction, and proposes the concept of a "digital twin maternal–fetal interface" to enable dynamic stratification and precision intervention.

Keywords:recurrent pregnancy loss; digital medicine; multi-omics; artificial intelligence; digital twin; maternal–fetal interface

Introduction

Current clinical guidelines recommend multi-system screening; however, similar clinical phenotypes often arise from distinct molecular mechanisms, resulting in uniform empirical treatment strategies with inconsistent outcomes. This limitation highlights the need for a systems-level and data-driven diagnostic framework [1].

Digital Reconstruction of RPL Etiology

Chromosomal microarray and next-generation sequencing have improved detection of embryonic aneuploidy and copy number variations . Aneuploid losses are mainly embryo-derived, while euploid losses are more associated with maternal factors such as endometrial dysfunction or immune imbalance.

The endometrium is now recognized as an active regulatory tissue governing implantation through decidualization and immune modulation. Impaired decidualization may disrupt embryo selection and implantation processes [2].

Three-dimensional ultrasound and radiomics enable conversion of uterine morphology into digital biomarkers. Deep learning models achieve AUC values around 0.85, indicating meaningful predictive information in imaging data [3].

Overall, RPL etiology is shifting toward a multidimensional framework integrating genomic, structural, and functional features.

Multi-Omics Insights into the Maternal–Fetal Interface

Single-cell RNA sequencing shows that the maternal–fetal interface is a dynamic ecosystem of stromal, trophoblastic, and immune cells [4]. In RPL, pro-pregnancy immune cells decrease while inflammatory subsets increase.

Spatial transcriptomics reveals disrupted decidual spatial organization, suggesting that RPL involves both compositional and structural abnormalities [5].

Artificial Intelligence and Digital Twin Modeling**

RPL arises from complex multi-factor interactions. Machine learning enables integration of heterogeneous data for risk prediction, though limitations in interpretability and validation remain.

AI-based models achieve up to 87% predictive accuracy for high-risk cases [6].

The digital twin maternal–fetal interface integrates genomic, immune, and clinical data to simulate individualized reproductive dynamics, enabling prediction of implantation outcomes and therapeutic responses.

Conclusion

RPL research is transitioning from single-factor analysis to integrated systems modeling and from static diagnosis to dynamic simulation.

The digital twin framework provides a promising approach for precision risk assessment and personalized intervention, pending further validation and multi-center integration.

Conference:

[1] ESHRE Guideline Group on RPL. Recurrent pregnancy loss guideline update. Hum Reprod Open. 2023.

[2] Teklenburg G, et al. Decidualization and endometrial function in pregnancy outcome. Hum Reprod Update. 2020.

[3] Zhang Y, et al. Deep learning-based ultrasound radiomics for pregnancy outcome prediction. Ultrasound Obstet Gynecol. 2022.

[4] Vento-Tormo R, et al. Single-cell reconstruction of the early maternal–fetal interface. Nature. 2020.

[5]Suryawanshi H, et al. Spatial transcriptomics of human decidua. Cell. 2021.

[6] Cui Y, et al. Multi-omics integration for reproductive risk prediction. Front Immunol. 2022.

ARTIFICIAL INTELLIGENCE AND MULTI OMICS EMPOWERING TRADITIONAL CHINESE MEDICINE FORMULA RESEARCH: OPPORTUNITIES AND PATHWAYS FOR SINO RUSSIAN PHARMACEUTICAL INTEGRATION

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Abstract

TCM formula heory emphasizes multi-target advantages, yet research is constrained by compositional complexity. AI and multi-omics offer a novel paradigm to address these bottlenecks. Sino-Russian biomedical cooperation has deepened through expanded herbal trade, underscoring needs for standard mutual recognition. This review summarizes AI and multi-omics applications in formula research and proposes a digital twin-blockchain framework and joint cloud platform for cross-border quality management and collaborative R&D.

Keywords: artificial intelligence; multi-omics; TCM formula; sino-russian cooperation; industrial integration

Introduction

TCM formula science holds therapeutic value in chronic disease management, yet studies are hampered by compositional complexity and inefficient screening. Sino-Russian collaboration is advancing: in 2025, China authorized import of 24 botanical materials from Russia. The Fourth Sino-Russian Traditional Medicine Exchange Conference (2026) emphasized "technology-enabled" approaches. The convergence of AI and multi-omics—genomics, transcriptomics, proteomics, metabolomics, spatial omics, and single-cell omics—offers a new paradigm, driving formula research from "experience-driven" to "data-driven" approaches[1,2].

Objective

This review examines AI and multi-omics applications in TCM formula research—screening, compatibility, mechanism, and quality evaluation—and proposes pathways for Sino-Russian pharmaceutical integration.

Materials and methods

We searched PubMed using keywords including "artificial intelligence," "multi-omics," and "TCM formula." Studies with explicit experimental validation were included. Combined with Sino-Russian policy frameworks, we synthesized findings to assess integration prospects.

Results and discussion

AI enables efficient active-molecule identification via deep learning; Zhang et al. categorized AI

network pharmacology into relationship mining, target localization, and navigation[3].nerative AI optimizes structures; NLP extracts syndrome-formula-herb relationships; graph networks construct interactions.lti-omics—transcriptomics, metabolomics, microbiome—delineate formula-regulated networks; Zhou et al. identified 15 targets and four pathways for Buyang Huanwu Decoction[4]. Spatial and single-cell omics enable cell-type-specific insights. The AI-multi-omics synergy creates "data mining-validation": Yang et al. proposed a network pharmacology-AI-multi-omics framework[5]; Li et al. revealed Fuzhengkangfu Decoction's AGE-RAGE mechanism[6]; Casas et al. validated super-additive effects in stroke[7] .For Sino-Russian collaboration, we propose four pathways: (1) intelligent quality assessment via NIR-deep learning; (2) digital twin-blockchain traceability; (3) multi-omics geo-herbalism with a shared spectral library[8].

Conclusion

AI and multi-omics are driving TCM formula research toward validated paradigms. Their introduction into Sino-Russian cooperation promises breakthroughs in quality assessment, traceability, and joint innovation. Continued bilateral efforts will embody the forum's vision of "digital empowerment and tradition renewed."

References:

[1]Wang Z, Zhang T, Wang B, et al. TCM network pharmacology: new perspective integrating network target with artificial intelligence and multi-modal multi-omics technologies. Chin J Nat Med. 2025;23(11):1425-1434.

[2]Zhu X, Yao Q, Yang P, Zhao D, Yang R, Bai H, Ning K. Multi-omics approaches for in-depth understanding of therapeutic mechanism for Traditional Chinese Medicine. Front Pharmacol. 2022 Nov 25;13:1031051.

[3]Zhang P, Zhang D, Zhou W, et al. Network pharmacology: towards the artificial intelligence-based precision traditional Chinese medicine. Brief Bioinform. 2023;25(1):bbad518.

[4] Zhou H, Lin B, Yang J, et al. Analysis of the mechanism of Buyang Huanwu Decoction against cerebral ischemia-reperfusion by multi-omics. J Ethnopharmacol. 2023;305:116112.

[5]Yang L, Wang H, Zhu Z, et al. Network Pharmacology-Driven Sustainability: AI and Multi-Omics Synergy for Drug Discovery in Traditional Chinese Medicine. Pharmaceuticals (Basel). 2025;18(7):1074.

[6] M, Chen L, Liu X, et al. The investigation of potential mechanism of Fuzhengkangfu Decoction against Diabetic myocardial injury based on a combined strategy of network pharmacology, transcriptomics, and experimental verification. Biomed Pharmacother. 2024;177:117048.

[7]Casas AI, Nogales C, Szepanowski RD, et al. Synergistic Network Pharmacology: Preclinical Validation and Clinical Safety in Acute Ischemic Stroke. J Am Heart Assoc. 2025;14(10):e039098.

[8]Wang X, Wang Y, Yuan T, et al. Network pharmacology provides new insights into the mechanism of traditional Chinese medicine and natural products used to treat pulmonary hypertension. Phytomedicine. 2024;135:156062.

DIGITAL EMPOWERMENT AND TRADITIONAL REVITALIZATION: PATHWAYS FOR SINO-RUSSIAN SMART MEDICINE INNOVATION AND INDUSTRIAL INTEGRATION

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Abstract

Digital technologies are reshaping traditional medicine globally. This paper examines digital health applications in China and Russia, identifies opportunities for bilateral cooperation in smart traditional medicine, and proposes a practical framework for industrial integration. The discussion covers data sharing, AI-assisted research, and regulatory coordination. Practical pathways are suggested to advance innovation while preserving traditional knowledge.

Keywords: digital health, traditional medicine, Sino-Russian cooperation, industrial integration; digital transformation

Traditional medicine remains essential in both China and Russia. Digital technologies now offer new ways to document, validate, and apply traditional knowledge. The bilateral strategic partnership provides a favorable context for cooperation, yet barriers persist in infrastructure, regulation, and data standards. This paper reviews the current landscape and proposes actionable strategies.

Objective

To assess digital transformation in traditional medicine in both countries, identify collaborative opportunities, and propose a framework for industrial integration aligned with the forum theme.

Materials and Methods

This review draws on policy documents, official reports, and academic literature from 2015 to 2025, including national digital health strategies and bilateral agreements. Three dimensions are analyzed: digital infrastructure, regulatory environments, and existing cooperative mechanisms. No primary data were collected.

Results and Discussion

China has explored AI applications in TCM pattern recognition and herb recommendation, expanded telemedicine access in rural areas, and invested in digitizing ancient texts and systems pharmacology tools[1-2]. However, clinical translation remains uneven, and data sharing is constrained by proprietary issues and inconsistent standards.

Russia has developed digital health infrastructure integrating traditional phytotherapy and balneotherapy; Botanical databases and pharmacopoeia resources have been established, and telemedicine is growing in remote regions[3-4]. Yet similar challenges exist: fragmented data, limited interoperability, and weak international exchange mechanisms.

The two countries are complementary. China excels in large-scale data integration and AI, while Russia holds extensive botanical and ecological data on native medicinal plants. A joint platform could accelerate drug discovery, improve quality control, and support evidence-based validation, while also enabling joint training and clinical research.

Key challenges include differing data protection laws, intellectual property frameworks, language barriers, and divergent regulatory approval pathways for digital health products and traditional medicines[5]. These complicate cross-border cooperation and commercialization.

A phased approach is proposed. Short-term pilot projects on shared herbs (e.g., species used in both TCM and Russian phytotherapy) can test data exchange with clear agreements. Medium-term joint working groups should harmonize standards, develop bilingual terminologies, and align regulations. Long-term, a shared platform can expand to clinical data sharing, remote consultation, and co-developing digital therapeutics. Private sector engagement is essential. Public-private partnerships can fund infrastructure, while academic exchanges foster mutual understanding. Success depends on sustained political commitment, transparent governance, and adaptive regulation.

Conclusion

Digital empowerment can revitalize traditional medicine and enhance its global relevance. Bilateral cooperation between China and Russia in smart traditional medicine is both feasible and mutually beneficial. By leveraging complementary strengths and addressing legal, technical, and cultural challenges, a sustainable innovation framework can be built. The proposed phased approach offers a realistic starting point, with pilot projects serving as testbeds for broader collaboration. Future work should prioritize regulatory alignment, data security, and capacity building.

References:

[1] Chaoyu, Wang,Guowei, Dai,Yue, Luo et al. Chinese Medicine in the Era of Artificial Intelligence: Challenges and Development Prospects.[J] .Am J Chin Med, 2025, 53: 353-384.

[2] Lu S, Zhou XQ, Wang XY, et al. Historical tracing and development trends of digital traditional Chinese medicine[J]. Journal of Nanjing University of Traditional Chinese Medicine, 2024, 40(12): 1308-1314. DOI: 10.14148/j.issn.1672-0482.2024.1308.

[3] Wang Q, Zhang WL, Zhou LH, et al. Analysis of registration barriers and pathways for Chinese herbal medicine "going global": a case study of Russia and Kazakhstan[J/OL]. Asia-Pacific Traditional Medicine, 1-7.

[4] Alexander N, Shikov,Igor A, Narkevich,Elena V, Flisyuk et al. Medicinal plants from the 14(th) edition of the Russian Pharmacopoeia, recent updates.[J] .J Ethnopharmacol, 2020, 268(0): 113685.

[5] Lan H, Xiong LX, Chen F. Current status, problems and countermeasures of traditional Chinese medicine culture dissemination in Russia under the Belt and Road Initiative[J]. World Chinese Medicine, 2023, 18(14): 2098-2102.

A DATA-DRIVEN COMPARATIVE ANALYSIS OF TCM BODY CONSTITUTIONS BETWEEN CHINESE AND RUSSIAN POPULATIONS AND ITS IMPLICATIONS FOR CROSS-BORDER PRECISION HERBAL MEDICINE

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Abstract

To investigate the distribution characteristics and differences of Traditional Chinese Medicine (TCM) body constitution types between Chinese and Russian populations, a systematic literature search was conducted in the China National Knowledge Infrastructure (CNKI) database using "China," "Russia," and "TCM body constitution" as search terms. Following manual screening and relevance assessment, four eligible studies were included for comparative data analysis. The results showed that Yang-deficiency constitution was the predominant type among Russian populations, while Balanced constitution was the dominant type among Chinese populations.

Keywords: Chinese and Russian populations, data-driven analysis, TCM body constitution

TCM body constitution is an objectively existing life phenomenon. It refers to a relatively stable, integrated trait encompassing morphological structure, physiological functions, and psychological states, shaped by both congenital inheritance and acquired factors. According to the "Classification and Judgment of TCM Body Constitutions" standard issued by the China Association of Chinese Medicine in 2009, TCM body constitutions are divided into nine basic types: Balanced Constitution, Qi-deficiency Constitution, Yang-deficiency Constitution, Yin-deficiency Constitution, Phlegm-Dampness Constitution, Dampness-Heat Constitution, Blood-stasis Constitution, Qi-stagnation Constitution, and Inherited Special Constitution. These constitutions determine an individual's susceptibility to pathogenic factors and predisposition to specific diseases, providing an important foundation for disease prevention and health maintenance.

The core concept of "correspondence between nature and human" in TCM holds that differences in geographical environment and climatic conditions inevitably shape region-specific constitutional characteristics. China has a relatively warm climate, while Russia has a relatively cold climate. These different geographical and climatic conditions necessarily lead to differences in body constitution distributions between the two populations.

Objective

This study aims to systematically compare the distribution characteristics of TCM body constitution types between Chinese and Russian populations through a structured review of epidemiological studies in the CNKI database, identify the predominant constitution types in each population, and further explore the clinical implications of these cross-population differences for TCM syndrome differentiation and prescription strategies in cross-border healthcare settings.

Materials and Methods

A systematic literature search was conducted in the CNKI database using "TCM body constitution," "China," and "Russia" as search terms. Studies on Chinese or Russian residents reporting the distribution of TCM body constitution types with the number or proportion of each type were included. Reviews, conference abstracts, case reports, animal studies, and studies with unclear constitution classification criteria or incomplete data were excluded. Descriptive analysis was employed to group the included studies by population source, summarize the proportion ranges and rank order of each constitution type, and compare the predominant constitution types and their cross-study consistency between the two populations.

Results and Discussion

Li Peng et al. conducted an epidemiological survey of TCM body constitutions among 549 Russian patients. The results showed that Yang-deficiency constitution had the highest proportion 21.5%, followed by Dampness-Heat 18.0% and Qi-stagnation 16.4% [1]. Li Peng et al. also studied 105 Russian patients with lumbar disc herniation and found that Yang-deficiency accounted for 26.7%, Balanced constitution 23.8%, and Dampness-Heat 12.4% [2]. Combined analysis of the two studies indicates that Yang-deficiency is the most prevalent TCM body constitution type among Russian populations.

In contrast, Wang Qi et al. investigated 21,948 Chinese subjects and reported Balanced constitution as the predominant type 32.14%, followed by Qi-deficiency 13.42%and Dampness-Heat 9.08%[3]. Bai MH et al., in a large-scale study of 108,015 Chinese subjects, found that Balanced constitution was the dominant type 28.98%, followed by Yang-deficiency 16.41% and Qi-deficiency 13.18%[4]. Both studies consistently demonstrate that Balanced constitution is the predominant TCM body type in the Chinese population.

The constitution differences between the two populations have important implications for clinical TCM syndrome differentiation and herbal prescription strategies. For Russian patients, greater attention should be paid to the application of Yang-warming herbs in clinical practice. Treatment of Yang-deficiency syndrome should follow the principles of "supplementing deficiency and warming cold," with core herbs such as Prepared Common Monkshood Daughter Root, Cmnamomi Mmulus, and Dried Ginger as the foundation of prescriptions.

In the long term, developing specialized TCM formulas with warming and tonifying effects targeting the Yang-deficiency constitution characteristics of Russian populations would not only align with the TCM principle of "treatment according to individual characteristics" but also potentially enhance the clinical efficacy and acceptance of TCM in Russian healthcare services.

References

[1] Li P, Cao F, Chen D, et al. Disease and constitution characteristics in 549 Russian patients. China Journal of Traditional Chinese Medicine and Pharmacy, 2023, 38(12): 6061-6064.

[2] Li P, Cao F, Wang ZY, et al. TCM body constitution classification in 105 Russian patients with lumbar disc herniation. Guiding Journal of Traditional Chinese Medicine and Pharmacy, 2024, 30(4): 192-195.

[3] Wang Q, Zhu YB. Epidemiological investigation of TCM body constitutions in the general Chinese population—based on epidemiological survey data of 21,948 cases from 9 provinces and cities nationwide. China Journal of Traditional Chinese Medicine and Pharmacy, 2009, 24(1): 7-12.

[4] Bai MH, et al. Distribution characteristics of TCM body constitution types in Chinese population based on 108,015 cases. Journal of Beijing University of Traditional Chinese Medicine, 2020, 43(6): 498-507.

RAPID IDENTIFICATION OF ANTI-INFLAMMATORY SESQUITERPENOIDS IN ATRACTYLODES JAPONICA BY DIAGNOSTIC FRAGMENT IONS AND STRUCTURE-ACTIVITY RELATIONSHIP ANALYSIS

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Abstract

Atractylodes japonica Koidz. ex Kitam. is widely used as a medicinal herb, but the terpenoid constituents responsible for its anti-inflammatory effects remain unclear. In this study, activity-guided screening was combined with UHPLC-Q-TOF-MS/MS and diagnostic fragment ions to characterize metabolites enriched in the active fraction. The petroleum ether fraction produced the greatest inhibition of nitric oxide formation in LPS-stimulated RAW 264.7 macrophages and also lowered TNF-α and IL-6 release. MS/MS analysis led to the annotation of 30 sesquiterpenoid constituents, including five compounds recorded in this species for the first time. Recurrent product ions at m/z 105.0690 and 91.0528 served as useful markers for lactone-type analogues. Bioassay results suggested that lactone-bearing and highly oxygenated scaffolds were generally linked to stronger inhibition, whereas lactam substitution weakened the effect.

Keywords: Atractylodes japonica; sesquiterpenoids; anti-inflammatory activity; diagnostic ions; UHPLC-Q-TOF-MS; structure-activity relationship

Atractylodes japonica Koidz. ex Kitam. (Asteraceae) has long been used in East Asian medicine for gastrointestinal discomfort and inflammatory conditions. Atractylone, atractylodin, β-eudesmol and atractylenolides are among the major bioactive constituents of this plant. However, the most active solvent fraction and the chemical features associated with its inhibitory effect have not been clearly defined. UHPLC-MS/MS provides accurate-mass and fragmentation information, while diagnostic product ions facilitate dereplication of related skeletons in complex extracts. Accordingly, an activity-guided strategy combined with diagnostic-ion-based profiling was applied to clarify the chemical basis of A. japonica.

Objective

This study aimed to develop a diagnostic-ion-guided UHPLC-Q-TOF-MS/MS method for identifying sesquiterpenoids from A. japonica, identify the principal bioactive fraction, and outline preliminary structure-activity relationships in LPS-stimulated RAW 264.7 macrophages.

Materials and methods

Authenticated rhizomes of A. japonica were extracted with methanol by ultrasonic-assisted extraction. The crude extract was suspended in water and successively partitioned with petroleum ether, ethyl acetate and n-butanol. RAW 264.7 macrophages were used for cytotoxicity and bioactivity evaluation. Cell viability was assessed by the MTT assay. Nitric oxide formation

was determined by the Griess reaction, and TNF-α and IL-6 levels were quantified by ELISA. UHPLC separation was carried out on a BEH C18 column with water and acetonitrile containing 0.1% formic acid. MS data were collected in positive-ion mode on a high-resolution Q-TOF mass spectrometer with a collision energy ramp of 30-50 eV. A literature-based database of A. japonica constituents was built, and atractylenolides I-III and cryptomeridiol were used as reference standards.

Results and discussion

At 20 μg/mL, none of the solvent fractions reduced RAW 264.7 cell viability below 85%. The petroleum ether fraction showed the strongest inhibition of NO production (59.6 ± 1.1%), followed by the n-butanol, ethyl acetate and aqueous fractions. This lipophilic fraction also suppressed TNF-α and IL-6 release by 35.6 ± 1.3% and 28.9 ± 2.0%, respectively. It was therefore chosen for MS-based chemical profiling.

Using accurate mass, retention behavior, literature data and diagnostic product ions, 30 sesquiterpenoid compounds were annotated from the petroleum ether fraction. Five constituents, including isolanceolide A, beishulenolide, taenialactam A, 8β-ethoxyasterolid and 6β-hydroxyatractylenolide I, were recorded from A. japonica for the first time. Reference standards verified the characteristic fragmentation of atractylenolides. Atractylenolide I gave m/z 231.1401 $[M+H]^+$ and product ions at m/z 203.1077 and 185.1308; atractylenolide II showed m/z 233.1551 $[M+H]^+$ with fragments at m/z 187.1494 and 145.0990; and atractylenolide III generated a prominent dehydration ion at m/z 231.1401. The shared ions at m/z 105.0690 and 91.0528 appeared repeatedly in lactone-type metabolites and were used as practical markers for rapid screening.

The 30 authenticated compounds were further tested for inhibition of LPS-induced NO production. Their IC_{50} values ranged from 12.3 to 90.2 μM, and seven compounds showed relatively strong potency, with IC_{50} values between 12.3 and 17.9 μM. Comparison of related structures suggested that lactone-containing and more oxygenated scaffolds were favorable for the effect, whereas lactam substitution clearly reduced potency. Dimerization did not improve inhibition compared with monomeric lactones.

Conclusions

This work established a diagnostic-ion-guided UHPLC-Q-TOF-MS/MS approach for profiling anti-inflammatory constituents in A. japonica. The petroleum ether fraction was confirmed as the main active portion, and 30 sesquiterpenoid compounds were annotated. These findings indicate that lactone-bearing and highly oxygenated sesquiterpenoids contribute substantially to the anti-inflammatory properties of A. japonica and may support its quality control and further pharmacological study.

References:

1. Jang M.H., Shin M.C., Kim Y.J., et al. Atractylodes japonica suppresses lipopolysaccharide-stimulated expressions of inducible nitric oxide synthase and cyclooxygenase-2 in RAW 264.7 macrophages. Biol Pharm Bull. 2004;27(3):324-327.

2. Chen L.G., Jan Y.S., Tsai P.W., et al. Anti-inflammatory and antinociceptive constituents of

Atractylodes japonica Koidzumi. J Agric Food Chem. 2016;64(11):2254-2262.

3. Bailly C. Atractylenolides, essential components of Atractylodes-based traditional herbal medicines: antioxidant, anti-inflammatory and anticancer properties. Eur J Pharmacol. 2021;891:173735.

4. Li C.Q., He L.C., Jin J.Q. Atractylenolide I and atractylenolide III inhibit lipopolysaccharide-induced TNF-α and NO production in macrophages. Phytother Res. 2007;21(4):347-353.