DOI: 10.53469/jcmp.2026.08(01).12

Research Progress on Integrated Traditional Chinese and Western Medicine in the Diagnosis and Treatment of Hypertension

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Abstract: ***Hypertension is a cardiovascular syndrome characterized by persistent elevation of systemic arterial blood pressure, and it also serves as a crucial risk factor for severe cardio-cerebrovascular events such as stroke, coronary heart disease, and heart failure. In recent years, Western medicine has achieved numerous breakthroughs in pathogenic mechanisms analysis, targeted drug development and clinical intervention strategy optimization for hypertension. Guided by the holistic concept, Traditional Chinese Medicine (TCM) has exhibited unique advantages in the prevention and treatment of hypertension through syndrome differentiation-based treatment, standardized herbal prescriptions and diverse external therapies. This paper systematically collates the origin of TCM disease nomenclature, etiological and pathogenic interpretations, as well as multiple TCM therapeutic approaches for hypertension. Meanwhile, it elaborates on Western medical diagnostic criteria, pathogenic mechanism research and clinical treatment protocols. Additionally, this review thoroughly summarizes the current status and progress of clinical application of integrated TCM and Western medicine in the diagnosis and treatment of hypertension, aiming to provide a more comprehensive approach and practical reference for clinical prevention and management of this disease.***

Keywords: Hypertension, Integrated Traditional Chinese and Western Medicine, Syndrome Differentiation and Treatment, Clinical Therapeutics.

1. Introduction

Hypertension has evolved into a major public health challenge worldwide that demands urgent resolution. With the acceleration of population aging and the transformation of residents' lifestyles, its incidence rate has been on a steady upward trend year by year. Data from the 2023 Guidelines for the Prevention and Treatment of Hypertension in China indicates that the prevalence of hypertension among adults in China has reached as high as 29.9%, accompanied by a severe nationwide predicament of low awareness, treatment and control rates. Notably, the prevalence of hypertension in rural areas is growing faster than that in urban areas, with a year-on-year increase of 1.2% from 2021 to 2023, which is closely related to the lack of standardized health management in grassroots regions [1]. A cross-sectional survey covering 12 provinces in China further verified that the control rate of hypertension in patients receiving integrated TCM-Western medicine treatment was 18.3% higher than that in patients receiving Western medicine alone [2], and the incidence of target organ damage was reduced by 22.5% during the 2-year follow-up period [3], which directly reflects the long-term clinical value of the integrated treatment model. The core objective of Western medicine in treating hypertension is to achieve target blood pressure levels. Although Western medications can rapidly reduce blood pressure values, issues such as drug resistance emergence and frequent adverse reactions are prone to occur during long-term medication. Based on typical clinical manifestations of hypertension patients including dizziness, headache, cephalic distension and tinnitus, TCM categorizes this disease into the realms of Xuanniao (vertigo) and Toutong (headache). In the diagnostic and therapeutic process, TCM emphasizes the principle of "treating both the symptoms and root causes" and implements syndrome differentiation-based treatment. It possesses distinct advantages in alleviating patients' clinical discomfort, protecting target organs such as the heart, brain and kidneys, and improving patients' quality of life. The integrated TCM and Western medicine treatment model can organically integrate the strengths of both medical systems, achieve complementary synergies, and open up a novel direction for individualized and precision treatment of hypertension.

2. Research Status of TCM in Hypertension Treatment

2.1 Origin of TCM Disease Names

There is no modern medical term "hypertension" in ancient TCM literatures. According to its clinical manifestations, this disease is mostly categorized into the diagnostic domains of "Xuanniao (vertigo)" and "Toutong (headache)" for therapeutic intervention. Huangdi Neijing (Yellow Emperor's Internal Classic), the cornerstone of TCM theoretical system, first documented the relevant symptoms. The proposition of "All wind-induced dizziness and tremor pertain to the liver" recorded in Su Wen·Zhen Yao Da Lun (Plain Questions·Treatise on Prognosis and Treatment) laid the theoretical foundation for interpreting the TCM pathogenesis of hypertension. Zhang Zhongjing, a renowned physician in the Han Dynasty, put forward the viewpoint of "vertigo caused by phlegm-fluid retention" in Synopsis of the Golden Chamber, explicitly pointing out that "When there is retained fluid in the heart, the patient suffers from severe dizziness", thus establishing the correlation between phlegm-fluid retention and the onset of vertigo. Zhu Danxi in the Yuan Dynasty advocated the academic perspective of "No phlegm, no vertigo", while Zhang Jiebin in the Ming Dynasty proposed the theory of "No deficiency, no vertigo", further enriching and improving the etiological and pathogenic

theories of hypertension-related diseases in TCM. In addition, for some hypertensive patients who develop severe complications such as limb numbness and hemiplegia in the advanced stage of the disease, treatment can be implemented with reference to the TCM category of "Zhongfeng (stroke)". Historical textual research has shown that the TCM understanding of hypertension-related symptoms can be traced back to the Qin and Han dynasties, and the treatment strategies recorded in Shen Nong Ben Cao Jing have laid a foundation for the modern application of herbal medicine in hypertension [4].

2.2 Etiology and Pathogenesis

TCM theory holds that the occurrence of hypertension is closely related to various factors such as emotional disorders, improper diet, imbalance between work and rest, and aging. The disease location is mainly in the liver and kidneys, involving the heart and spleen, and the disease nature mostly presents the characteristics of deficiency in origin and excess in superficiality, and intermingling of deficiency and excess.

Deficiency in origin: The core pathogenesis is liver-kidney yin deficiency, spleen-kidney qi deficiency, and yin-yang deficiency. Liver-kidney yin deficiency leads to loss of restraint of liver yang, wind-yang stirring upward to disturb the clear orifices, causing vertigo; spleen-kidney qi deficiency leads to disorder of transportation and transformation function, insufficient source of qi and blood production, and malnutrition of clear orifices resulting in dizziness; aging leads to kidney yin deficiency, failure of yin to control yang, and deficient yang floating upward, manifesting as vertigo and other symptoms. A clinical epidemiology study involving 896 hypertensive patients confirmed that liver-kidney yin deficiency is the most common syndrome type in hypertensive patients over 60 years old, accounting for 41.2% of the total cases, followed by phlegm-dampness internal obstruction (23.7%) [5], which provides epidemiological evidence for the TCM syndrome differentiation of hypertension.

Excess in superficiality: The main manifestations are hyperactivity of liver fire, internal obstruction of phlegm-dampness, and blood stasis obstruction. Emotional disorders lead to stagnation of liver qi, which turns into fire over time, and hyperactivity of liver fire disturbs the clear orifices; improper diet, such as excessive consumption of fatty, sweet and thick-flavored foods, damages the spleen and stomach function, leading to internal generation of phlegm-dampness, which clouds the clear orifices and causes heavy-headedness and vertigo; a prolonged illness enters the collaterals, resulting in poor circulation of qi and blood, blood stasis blocking the brain collaterals, and malnutrition of the brain leading to dizziness and headache.

Modern TCM physicians have also proposed many innovative interpretations of the pathogenesis of hypertension. Lei Zhongyi, a national TCM master, put forward that "intermingling of phlegm and blood stasis" is one of the core pathogenesis in the occurrence and development of hypertension. The intermingling of phlegm-turbidity and blood stasis in the collaterals disrupts the circulation of qi and blood, thereby causing an elevation in blood pressure. Meanwhile, some physicians have proposed pathogenic hypotheses such as "qi deficiency and blood stasis" and "liver yang transforming into wind" based on clinical practice, further enriching and expanding the TCM pathogenic theoretical system of hypertension.

2.3 TCM Treatment

2.3.1 Syndrome Differentiation and Treatment

Currently, there is no completely unified standard for the syndrome differentiation and classification of hypertension in TCM. TCM Internal Medicine [6], the national planning textbook for colleges and universities of traditional Chinese medicine, classifies hypertension into the following common syndrome types and formulates corresponding treatment protocols:

Hyperactivity of liver fire type: The main symptoms include dizziness with distending pain, flushed face and bloodshot eyes, irritability and easy anger, bitter taste and dry mouth, red tongue with yellow coating, and wiry and rapid pulse. The therapeutic principle is to calm the liver and purge fire, and Longdan Xiegan Decoction (Gentian Liver-Draining Decoction, composed of Gentianae Radix et Rhizoma, Scutellariae Radix, Gardeniae Fructus, etc.) is selected for modified treatment. Relevant clinical studies have confirmed that Longdan Xiegan Decoction can effectively alleviate the clinical symptoms of hypertensive patients with hyperactivity of liver fire type and reduce blood pressure levels. Its mechanism of action may be closely related to regulating sympathetic nerve excitability and inhibiting the body's inflammatory response.

Internal obstruction of phlegm-dampness type: The typical symptoms include dizziness with heavy-headedness, stuffy chest and epigastrium, nausea and vomiting, heavy limbs, white and greasy tongue coating, and soft and slippery pulse. The therapeutic principle is to resolve phlegm and dispel dampness, invigorate the spleen and harmonize the stomach, and Banxia Baizhu Tianma Decoction (Pinellia, Atractylodes and Gastrodia Decoction, composed of Pinelliae Rhizoma Preparatum, Atractylodis Macrocephalae Rhizoma, Gastrodiae Rhizoma, etc.) is selected for modified treatment. Some scholars have found through clinical studies that the total effective rate of patients with phlegm-dampness internal obstruction type hypertension treated with Banxia Baizhu Tianma Decoction combined with conventional Western medicine is significantly higher than that of the Western medicine monotherapy group, and this integrated regimen can effectively improve the patients' dyslipidemia. A randomized controlled trial (RCT) with 120 participants showed that the combination of Banxia Baizhu Tianma Decoction and amlodipine can reduce the levels of total cholesterol (TC) and triglycerides (TG) by 18.6% and 24.3% respectively in phlegm-dampness type hypertensive patients, which is significantly better than the amlodipine monotherapy group [7].

Liver-kidney yin deficiency type: Common symptoms include dizziness and tinnitus, soreness and weakness of the waist and knees, five-center heat (palms, soles and chest), insomnia with dreaminess, red tongue with little coating, and

thready and rapid pulse. The therapeutic principle is to nourish the liver and kidneys, replenish yin and calm the liver, and Qiju Dihuang Pill (Lycium, Chrysanthemum and Rehmannia Pill, composed of Lycii Fructus, Chrysanthemi Flos, Rehmanniae Radix Praeparata, etc.) is selected for modified treatment. Pharmacological studies have demonstrated that Qiju Dihuang Pill can regulate the renin-angiotensin-aldosterone system (RAAS) and protect vascular endothelial function, thereby delaying the progression of target organ damage caused by hypertension.

Yin-yang deficiency type: The main symptoms include dizziness and vertigo, aversion to cold with cold limbs, soreness and weakness of the waist and knees, frequent micturition at night, pale and swollen tongue, and deep and thready pulse. The therapeutic principle is to nourish yin and tonify yang, and harmonize yin and yang, and Jinkui Shenqi Pill (Golden Chamber Kidney-Qi Pill, composed of Rehmanniae Radix Praeparata, Cinnamomi Cortex, Aconiti Radix Lateralis Praeparata, etc.) is selected for modified treatment. Clinical practice has confirmed that this prescription can improve the yang deficiency symptoms of hypertensive patients with yin-yang deficiency type, stably control blood pressure fluctuations, and reduce adverse events caused by sudden elevation and decrease of blood pressure.

2.3.2 Therapeutic Methods and Prescriptions

Common TCM therapeutic methods for hypertension include calming the liver and suppressing yang, nourishing the kidney and yin, resolving phlegm and dispelling dampness, promoting blood circulation and removing blood stasis, etc. Clinical medication can be flexibly combined according to the patient's syndrome type. Commonly used herbs for calming the liver and suppressing yang include Gastrodia elata, Uncaria rhynchophylla, Concha Haliotidis, Oyster Shell, etc.; herbs for nourishing the kidney and yin include Radix Rehmanniae Preparata, Fructus Lycii, Fructus Ligustri Lucidi, Herba Ecliptae, etc.; herbs for resolving phlegm and dispelling dampness include Pinellia ternata, Atractylodes macrocephala, Poria cocos, Alisma orientale, etc.; herbs for promoting blood circulation and removing blood stasis include Salvia miltiorrhiza, Rhizoma Chuanxiong, Radix Paeoniae Rubra, Semen Persicae, etc. Deng Tietao, a master of TCM, emphasized "calming the liver and invigorating the spleen" in the treatment of hypertension. He often used Gastrodia elata and Uncaria rhynchophylla to calm the liver and dispel wind, Astragalus membranaceus and Atractylodes macrocephala to invigorate the spleen and replenish qi, with modifications according to clinical symptoms, achieving significant curative effect. Some physicians, based on the theory of "prolonged illness entering collaterals", add blood circulation-promoting and blood stasis-removing drugs to the syndrome differentiation prescriptions, which can improve microcirculation and protect target organs. Modern pharmacological studies have found that many TCM monomers such as gastrodin and rhynchophylline have the effects of dilating blood vessels and improving vascular elasticity, providing modern medical evidence for the treatment of hypertension with TCM. In vitro cell experiments have shown that rhynchophylline can inhibit the proliferation of vascular smooth muscle cells (VSMCs) induced by angiotensin II, with an inhibitory rate of 32.7% at a concentration of 10 μmol/L, which is related to the regulation of the MAPK signaling pathway [8].

2.3.3 Combined Internal and External Treatment

In addition to oral medication, TCM external therapies also play an important role in the prevention and treatment of hypertension, with the advantages of simple operation and few side effects:

Acupuncture treatment: Commonly used acupoints include Baihui (GV20), Fengchi (GB20), Taichong (LR3), Quchi (LI11), Zusanli (ST36), etc. Baihui (GV20) is the confluence of all yang meridians, which can ascend lucid yang and descend turbid yin, calm the liver and dispel wind; Taichong (LR3) is the source acupoint of the liver meridian, which can calm the liver and purge fire, soothe the liver and regulate qi. Acupuncture at the above acupoints can exert an antihypertensive effect by regulating the circulation of qi and blood in the meridians. Studies have shown that acupuncture combined with western medicine in the treatment of hypertension can improve the blood pressure control rate and reduce the dosage of western medicine [9].

Acupoint application: Chinese herbal medicines with the effects of calming the liver and suppressing yang, promoting blood circulation and removing blood stasis, such as Gastrodia elata, Uncaria rhynchophylla, Rhizoma Chuanxiong, Radix Achyranthis Bidentatae, etc., are mostly selected, ground into powder and applied to acupoints such as Yongquan (KI1) and Shenque (CV8). The drugs are absorbed through the skin, which can avoid gastrointestinal irritation and achieve the purpose of stable blood pressure reduction.

Auricular point pressing: Auricular points such as Ear Apex, Antihypertensive Groove, Liver, Kidney are selected and pressed with Vaccaria seeds, which can regulate visceral functions and assist in lowering blood pressure by stimulating the acupoints through pressing [10].

3. Research Progress of Western Medicine in Hypertension Treatment

3.1 Clinical Symptoms and Diagnostic Criteria

Western medicine defines hypertension as follows: when antihypertensive drugs are not administered, systolic blood pressure (SBP) ≥140 mmHg and/or diastolic blood pressure (DBP) ≥90 mmHg measured on three non-consecutive days; patients with a history of hypertension who are currently taking antihypertensive drugs are also diagnosed with hypertension even if their blood pressure is lower than the above standard. Ambulatory blood pressure monitoring (ABPM) has become an important supplementary diagnostic method, with diagnostic criteria of 24-hour average blood pressure ≥130/80 mmHg, daytime average blood pressure ≥135/85 mmHg, and nighttime average blood pressure ≥120/70 mmHg. A meta-analysis involving 36 studies confirmed that ABPM can identify masked hypertension with an accuracy of 82.3%, which is significantly higher than office blood pressure measurement, and is of great significance for early intervention in high-risk patients [11]. Clinically, hypertension can be classified into essential

hypertension and secondary hypertension. Essential hypertension accounts for approximately 90%-95% of all hypertensive patients, with insidious onset and slow progression. Most patients have no obvious symptoms in the early stage, and only a few patients may present with non-specific symptoms such as dizziness, headache, neck stiffness, fatigue, and palpitations. Secondary hypertension is secondary to other diseases, such as renal parenchymal diseases, renovascular hypertension, endocrine diseases, etc.; its blood pressure is often significantly elevated, and it is difficult to control with conventional antihypertensive drugs.

3.2 Pathogenesis

The pathogenesis of hypertension in Western medicine is complex and multi-factorial, involving neurohumoral regulatory disorders, renal sodium and water retention, vascular endothelial dysfunction, genetic factors and other aspects:

Neural mechanism: Overactivation of the sympathetic nervous system leads to increased heart rate, enhanced myocardial contractility, and peripheral vasoconstriction, causing an increase in blood pressure [12].

Activation of renin-angiotensin-aldosterone system (RAAS): Increased renin secretion catalyzes the conversion of angiotensinogen to angiotensin I, which is then converted to angiotensin II. Angiotensin II can constrict blood vessels and promote aldosterone secretion, leading to sodium and water retention and increased blood pressure [13].

Vascular endothelial dysfunction: The decrease of vasodilator factors (such as nitric oxide) secreted by vascular endothelium and the increase of vasoconstrictor factors (such as endothelin) lead to imbalance of vascular vasomotor function and increased peripheral resistance [14].

Insulin resistance: Insulin resistance can lead to secondary hyperinsulinemia, promote sodium reabsorption in renal tubules, increase sympathetic nerve activity, and cause an increase in blood pressure [15].

In addition, genetic factors, obesity, high-salt diet, long-term alcohol consumption and other environmental factors are also closely related to the occurrence and development of hypertension.

3.3 Clinical Treatment Protocols

The treatment of hypertension in Western medicine adheres to the principles of individualized treatment, combined medication, and long-term adherence, with the ultimate goal of reducing the risk of cardio-cerebrovascular events.

Lifestyle intervention: It is the foundation of hypertension treatment, applicable to all hypertensive patients. Specific measures include weight control, salt intake reduction (daily salt intake < 5 g), smoking cessation and alcohol restriction, increased physical activity (such as brisk walking, jogging, swimming, etc.), and maintenance of a balanced diet (increasing the intake of fresh vegetables, fruits, whole grains, and low-fat dairy products). A cohort study with 10-year follow-up showed that hypertensive patients who adhere to 3 or more healthy lifestyle habits have a 40% lower risk of cardiovascular events than those who do not [16].

Pharmacological treatment: Commonly used antihypertensive drugs are mainly divided into five categories, namely calcium channel blockers (CCBs), angiotensin-converting enzyme inhibitors (ACEIs), angiotensin II receptor blockers (ARBs), diuretics, and β-receptor blockers.

CCBs: Such as amlodipine, nifedipine controlled-release tablets, etc. They block calcium channels in vascular smooth muscle cells, inhibit calcium ion influx, relax vascular smooth muscle, reduce peripheral vascular resistance, and lower blood pressure. They are suitable for most hypertensive patients, especially the elderly, patients with coronary heart disease, and patients with diabetes mellitus [17].

ACEIs: Such as captopril, enalapril, etc. They inhibit the activity of angiotensin-converting enzyme, reduce the production of angiotensin II, and exert antihypertensive effects. They are suitable for patients with hypertension complicated with heart failure, diabetic nephropathy, left ventricular hypertrophy, etc. The main adverse reaction is dry cough, and they are contraindicated in pregnant women and patients with bilateral renal artery stenosis [18].

ARBs: Such as losartan, valsartan, etc. They block the binding of angiotensin II to its receptors, and have similar antihypertensive effects and indications as ACEIs, but the incidence of dry cough is lower, which is suitable for patients who cannot tolerate ACEIs [19].

Diuretics: Divided into thiazide diuretics (such as hydrochlorothiazide), loop diuretics (such as furosemide), and potassium-sparing diuretics (such as spironolactone). They reduce blood volume by promoting sodium and water excretion, and are suitable for patients with mild to moderate hypertension, especially elderly patients, patients with heart failure, and patients with salt-sensitive hypertension. Electrolyte levels need to be monitored during long-term use [20].

β-receptor blockers: Such as metoprolol, bisoprolol, etc. They reduce heart rate and myocardial contractility by blocking β-receptors, decrease cardiac output, and lower blood pressure. They are suitable for patients with hypertension complicated with coronary heart disease, tachyarrhythmia, heart failure, etc., and are contraindicated in patients with bronchial asthma and severe bradycardia [21].

For patients with moderate to severe hypertension or single-drug treatment failure, combined medication is recommended. Common combination regimens include CCBs + ACEIs/ARBs, diuretics + ACEIs/ARBs, etc., which can exert synergistic antihypertensive effects and reduce the occurrence of adverse reactions. The 2023 Guidelines for the Prevention and Treatment of Hypertension in China recommends that for patients with grade 2 hypertension and above, combined medication can be initiated directly to achieve the target blood pressure faster [22].

4. Integrated TCM and Western Medicine Treatment

Integrated TCM and western medicine treatment of hypertension can give full play to the advantages of both, achieve "treating both symptoms and root causes", and has significant effects in improving blood pressure control rate, relieving clinical symptoms, protecting target organs, and reducing adverse reactions. Gastrodia and Uncaria Decoction combined with amlodipine was used to treat hypertensive patients with liver yang hyperactivity type. The results showed that the blood pressure control rate of the combined treatment group was significantly higher than that of the amlodipine alone group, and the improvement of dizziness, headache and other symptoms in patients was more obvious without increasing the incidence of adverse reactions [23]. Banxia Baizhu Tianma Decoction combined with hydrochlorothiazide was used to treat hypertensive patients with phlegm-dampness internal obstruction type, which could effectively reduce blood pressure levels, improve patients' blood lipid and blood glucose metabolism indicators, and reduce the risk of target organ damage [24]. For hypertensive patients complicated with coronary heart disease, Salvia Miltiorrhiza and Ligustrazine Injection combined with metoprolol was used for treatment, which could stably lower blood pressure, improve myocardial blood supply, and relieve angina pectoris symptoms [25]. The mechanism of integrated TCM and western medicine in the treatment of hypertension may be related to regulating sympathetic nerve function, inhibiting RAAS activation, improving vascular endothelial function, and reducing inflammatory response [26]. In the future, it is necessary to carry out further large-sample, multi-center clinical studies to clarify the optimal plan and action target of integrated TCM and western medicine in the treatment of hypertension, so as to provide evidence-based medical evidence for clinical promotion and application.

5. Problems and Prospects

5.1 Existing Problems

Although the integrated treatment of TCM and Western medicine for hypertension has achieved certain results, there are still some problems to be solved:

Lack of unified syndrome differentiation standards: Currently, the syndrome differentiation standards of TCM for hypertension are not unified; different scholars and institutions adopt different classification methods, which leads to inconsistency in clinical research results and affects the popularization and application of integrated treatment [27].

Insufficient depth of mechanism research: The mechanism of TCM in the treatment of hypertension is mostly explained from the perspective of TCM theory, and the research on modern molecular biological mechanisms is not in-depth enough. It is necessary to further clarify the targets and pathways of TCM active ingredients in the treatment of hypertension [28].

Lack of high-quality clinical research: Most of the current clinical research on integrated treatment is small-sample, single-center studies, and there is a lack of large-sample, multi-center, long-term follow-up RCTs, which affects the credibility of research results. A systematic review of integrated TCM and Western medicine for hypertension showed that only 28% of the included studies are multi-center RCTs with a follow-up period of more than 1 year [29].

5.2 Development Prospects

With the continuous development of medical science and technology, the integrated treatment of TCM and Western medicine for hypertension has broad development prospects. Through multi-center collaborative research, combined with modern diagnostic techniques such as metabolomics, proteomics and medical imaging, unified TCM syndrome differentiation standards for hypertension will be formulated to standardize clinical practice [30]; Using modern molecular biology, genomics and other technologies to explore the mechanism of TCM in the treatment of hypertension, clarify the interaction between TCM active ingredients and Western antihypertensive drugs, and provide a scientific basis for the rational combination of TCM and Western medicine [31]; Developing personalized treatment plans: Combined with artificial intelligence (AI) and big data technology, establish a hypertension prediction model, and formulate personalized integrated treatment plans according to the patient's age, gender, blood pressure level, syndrome type, and complication status, so as to achieve precision treatment [32]; Promoting internationalization: Strengthen international exchanges and cooperation, promote the international recognition of TCM theory and clinical efficacy, and make the integrated treatment of TCM and Western medicine for hypertension benefit patients worldwide [33].

6. Conclusion

Hypertension is a complex chronic disease, and single treatment methods of either TCM or Western medicine have certain limitations. The integrated treatment of TCM and Western medicine combines the advantages of both medical systems, which can enhance antihypertensive efficacy, reduce adverse reactions, protect target organs, and improve the quality of life of patients. Although there are still some problems in current research and application, with the continuous deepening of research and the progress of technology, the integrated treatment of TCM and Western medicine will surely play a more important role in the prevention and treatment of hypertension.

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