

Research Progress on the Prevention and Treatment of Metabolic Syndrome with Traditional Chinese Medicine Based on the "Preventive Treatment of Disease" Theory

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Abstract: Metabolic Syndrome (MS), characterized by central obesity, insulin resistance, hypertension, and dyslipidemia, has a global prevalence exceeding 25%, making it a significant risk factor for cardiovascular and cerebrovascular diseases. With the improvement in living standards and the trend of population aging in China, the prevalence of MS is continuously rising, severely impacting patients' quality of life and the public health system, potentially further exacerbating the socio-economic burden. The theory of "preventive treatment of disease" is one of the representative concepts of Traditional Chinese Medicine (TCM). As times evolve, this theory has been continuously enriched. This article systematically reviews relevant domestic and international research in recent years, summarizing the research progress in the application of the TCM "preventive treatment of disease" theory in the prevention and treatment of MS from the perspective of its three-level prevention system, aiming to provide new ideas and methods for TCM in preventing and treating this condition.

1. Introduction

Metabolic Syndrome (MS) is a cluster of metabolically interrelated risk factors, including abdominal obesity, dyslipidemia, elevated blood pressure, and elevated blood glucose, presenting as a clinical syndrome [1]. And the prevalence rate in China has reached 34% [2]. Each component of MS is closely related to the occurrence of cardiovascular and cerebrovascular diseases. Studies indicate that MS increases the population's risk of atherosclerotic cardiovascular disease (ASCVD) by threefold and the risk of type 2 diabetes mellitus (T2DM) by fivefold. And it is significantly associated with comorbidities such as chronic kidney disease [3-4], representing a severe global public health issue. Currently, modern medicine primarily focuses on improving obesity and insulin resistance (IR) for MS prevention and treatment, employing symptomatic management targeting the various components of MS. Specific and effective treatments are still lacking, and long-term medication may carry potential side effects such as liver and kidney damage. Given that the pathogenesis of MS involves multiple systems and targets, including endocrine and circulatory

systems, TCM emphasizes a holistic concept and stresses "preventing disease before it occurs, preventing deterioration after disease onset, and preventing decline after deterioration has occurred". It advocates understanding and managing diseases from a holistic and dynamic macroscopic perspective, thereby enabling early intervention, blocking MS progression, protecting target organs, and preventing complications, demonstrating distinct advantages in recognizing and managing MS.

2. Origin and Connotation of the TCM "Preventive Treatment of Disease" Theory

The TCM concept of "preventive treatment of disease" originated from the pre-Qin philosophers' philosophical idea of "taking precautions before problems arise." The term "health preservation" first appeared in the chapter "Essentials for Nurturing Life" in Zhuangzi [5]. Plain Question: On Regulating the Spirit in Accordance with the Four Seasons records: "To administer medicine after the disease has already formed, or to bring order after chaos has already arisen, is akin to digging a well when one is thirsty or forging weapons when the battle has already begun – is it not too late?" [6], emphasizing the importance of preparing in advance and taking preventive measures. It also states, "Hence, the sages did not treat already manifested diseases but treated those not yet manifest; they did not deal with already arisen chaos but dealt with chaos not yet arisen. This is the meaning thereof, "clearly defining the concept of "preventive treatment of disease." Later physicians continuously refined and developed the idea of preventive treatment based on their predecessors. Zhang Zhongjing of the Han Dynasty, in Essential Prescriptions from the Golden Chamber, stated: "In treating disease preventively, seeing liver disease, one knows it will transmit to the spleen, and should first fortify the spleen. When the spleen is robust throughout the four seasons, it cannot be affected by pathogenic factors" [7], emphasizing the idea of "preventing deterioration after disease onset." Zhang Zhongjing's theory of "preventive treatment of disease" is embodied in five aspects: health preservation to prevent disease, early treatment of disease, preventing deterioration after onset, preventing crisis in severe disease, and preventing recurrence after recovery [8]. Physician Ye Tianshi, in Discussion on Warm-Fever Diseases proposed the principle for disease prevention and treatment: "It is essential to first pacify areas not yet affected by pathogenic factors," further elaborating on the importance of the theory of preventing deterioration [9]. Through inheritance and development by physicians throughout history, the TCM theory of "preventive treatment of disease" has been continuously innovated and perfected, encompassing health preservation to prevent disease, early treatment of disease, preventing deterioration after onset, preventing crisis in severe disease, and preventing recurrence after recovery.

3. TCM Understanding of the Etiology and Pathogenesis of Metabolic Syndrome

Metabolic Syndrome is a modern disease name, and there is no exact corresponding disease name in TCM literature. Based on its typical clinical manifestations, it can be categorized under "obesity", "spleen wasting-thirst", "wasting-thirst", "dizziness", "chest impediment", etc. TCM believes that the etiology of MS is often related to congenital endowment insufficiency and acquired malnourishment. The core pathogenesis is dysfunction of the spleen and stomach in transportation and transformation. Spiritual Pivot states: "If all the five zang organs are weak and tender, the patient is prone to wasting-thirst disorder". This indicates that constitutional insufficiency can also enhance the body's susceptibility to certain diseases. Acquired malnourishment is mainly reflected in dietary irregularities, emotional imbalances, and improper balance of work and rest [10]. Overconsumption of rich, greasy foods and a sedentary lifestyle can lead to endogenous turbid pathogens accumulating in the vessels and obstructing the middle jiao, resulting in spleen failure in transportation, fluid retention generating dampness and phlegm. Emotional imbalance mainly manifests as liver damage due to external stimulating factors like social stress, leading to liver dysfunction in free coursing, qi

mechanism disharmony, and subsequent formation of phlegm and stasis, ultimately inducing MS. Improper balance of work and rest is reflected in sedentary habits, lack of physical exercise, leading to lipid accumulation and obesity, "prolonged lying damages qi, prolonged sitting damages the flesh." Most physicians believe the main pathogenesis of MS is internal obstruction of phlegm-dampness. A multicenter, large-sample TCM syndrome study of MS showed that "phlegm-dampness" runs through the entire course. The early and middle stages are mainly characterized by phlegm-heat intermingling and liver fire hyperactivity patterns, while the late stage is dominated by liver-kidney yin deficiency and spleen deficiency with dampness encumbrance patterns [11]. The disease locations primarily involve the liver, spleen, and kidney. The disease nature is primarily deficiency in origin and excess in manifestation. Dysfunction of the liver, spleen, and kidney organs, over time, leads to decline of visceral function [12].

4. Application of the "Preventive Treatment of Disease" Theory in MS Prevention and Treatment

4.1. Preventing Disease Before it Occurs: Taking Precautions, Constructing Risk Early Warning and Early Intervention Networks

4.1.1. TCM Constitution Theory and MS Prevention

TCM constitution theory is a theoretical system guided by TCM theory, studying the concept, formation, type characteristics of human constitution, and its relationship with the occurrence, development, and progression of diseases, thereby guiding disease diagnosis, prevention, and treatment. The "Classification and Determination Standards of TCM Constitutions" developed by Wang Qi's team categorizes constitutions into nine types: balanced constitution, qi-deficiency constitution, yin-deficiency constitution, yang-deficiency constitution, qi-stagnation constitution, phlegm-dampness constitution, dampness-heat constitution, blood-stasis constitution, and special diathesis constitution [13]. A clinical study involving 4222 subjects showed that individuals with phlegm-dampness constitution and combined constitutions were more prone to MS [11]. Wang Qi [14] believes that phlegm-dampness constitution is one of the formative factors of MS, and treatment and prevention can start by regulating the phlegm-dampness constitution. Ma Jianwei [15] used regression analysis, conducted a controlled study comparing MS patients and normal populations, and the results showed that phlegm-dampness and dampness-heat constitutions were risk factors for MS, with phlegm-dampness being the most significant. Luo Hui and Wang Qi [16], through Meta-analysis incorporating 13 cross-sectional studies and 2 case-control studies with a total sample size of 10, 318, found that phlegm-dampness, qi-deficiency, and dampness-heat constitutions were the main constitutional types in MS patients and were risk factors for MS incidence, with the phlegm-dampness constitution showing the closest relationship to MS [17]. TCM constitution theory also points out that human constitution is not fixed from birth but is adjustable postnatally. Through lifestyle interventions and TCM regulation, the constitution can be shifted from high-risk biased constitutions towards a balanced constitution. Thus, early identification of high-risk constitutions for MS like phlegm-dampness and qi-deficiency, and implementing lifestyle interventions and TCM regulation, may be fundamental methods for preventing MS occurrence and promoting health.

4.1.2. Lifestyle Management and MS Prevention

MS populations often exhibit characteristics such as irregular daily routine and high mental stress. This may lead to emotional dissatisfaction and liver qi stagnation causing impaired flow of qi and blood; or long-term improper diet, overconsumption of rich, sweet, and fatty foods, leading to spleen-

stomach transportation failure, affecting the generation of qi and blood, disrupting fluid metabolism, and resulting in internal phlegm-dampness obstruction; chronic illness, overexertion, aging, and physical weakness can damage the innate and acquired foundations, preventing the transformation of qi, blood, and body fluids, making it difficult to generate marrow, leading to marrow sea insufficiency and deficiency both above and below. As the Yellow Emperor's Inner Classic states: "When qi and blood are deficient, the hundred diseases arise; when qi and blood are replete, the hundred diseases are cured." This easily forms constitutions such as liver stagnation, phlegm-dampness, and dampness-heat, all of which can manifest as this disease. Plain Question: On the True Theory of the Ancients points out: "They modeled themselves upon yin and yang, harmonized [their practices] with the arts and divinations, ate and drank in moderation, arose and retired at regular hours, avoided strenuous activities; hence they were able to keep their bodies and spirits united" [6]. Therefore, one should follow the idea of "correspondence between human and nature, " meaning to adapt to the seasonal changes of cold and heat, avoid pathogenic factors, and prevent disease occurrence through regular Daily routine, dietary restraint, and appropriate balance of work and rest.

4.2. Preventing Deterioration after Disease Onset: Preventing Transmission, TCM Multi-Target Regulation and Precise Treatment

4.2.1. Internal TCM Therapies

Internal TCM therapies demonstrate certain advantages and characteristics in treating MS. Professor Bu Xianchun [18] emphasizes that this disease is clinically mainly divided into four patterns: liver-spleen disharmony, internal phlegm-turbidity obstruction, phlegm-stasis intermingling, and spleen-kidney yang deficiency. He advocates treatment based on pattern differentiation, using modified prescriptions of Major Bupleurum Decoction, Trichosanthes, Chinese Chive, and Cinnamon Twig Decoction, Coptis and Gallbladder-Warming Decoction, and Spleen-Restoring Decoction combined with Golden Coffer Kidney Qi Pill respectively. Through clinical observation, Lin Shaoqin [19] found that Poria and Alisma Decoction combined with lifestyle intervention positively regulated metabolism and inflammation-related indicators in individuals with MS of dampness pattern, helping to improve the level of dampness. In a study involving 110 MS patients where the control group received conventional symptomatic treatment and the observation group received Ginseng, Poria, and Spleen-Fortifying Dampness-Resolving Decoction, Shi Yan [20] found that postprandial 2-hour blood glucose, glycated hemoglobin, and fasting blood glucose (FPG) in the observation group were significantly lower compared to the control group. Ren Chang [21] demonstrated that Qingyu Huazhuo Decoction, which has phlegm-resolving and blood-activating effects, could significantly reduce blood glucose, blood pressure, blood lipid levels, and body weight, effectively preventing the occurrence of MS. Liu Jing [22] used Wenpi Fuzheng Decoction with spleen-fortifying and dampness-resolving effects to treat MS for 12 weeks. Then she found that compared to the control group (placebo), the treatment group (Wenpi Fuzheng Decoction) showed significant reductions in waist circumference, blood glucose, blood lipids, and blood pressure levels ($P<0.05$), and patients' clinical symptoms significantly improved. Professor Tong Xiaolin is skilled in using the "State-Target Combination" theory to treat MS. For MS with the state of "spleen deficiency and qi weakness as the root, phlegm-heat internal accumulation as the branch, " he often uses modified Pinellia Heart-Draining Decoction, regulating the middle jiao spleen and stomach through the pungent-dispersing and bitter-descending method to correct the "middle fullness and internal heat" state of multi-metabolic dysregulation, while simultaneously regulating indicators such as blood pressure, blood glucose, and blood lipids [23].

4.2.2. External TCM Therapies

External TCM therapies are an important component of Chinese medicine. Modern application of external therapies has shown characteristic efficacy in the prevention, treatment, and rehabilitation of MS, diabetes, obesity, hypertension, and other diseases. Commonly used external methods include: acupuncture, tuina, moxibustion, ear acupuncture, catgut embedding, etc. These methods can improve body mass index (BMI), blood lipids, blood glucose, and blood pressure levels, and delay the disease process of MS. Professor Wu Xu [24] used the "Dredging the Governor Vessel and Warming Yang Method" in acupuncture treatment for MS patients, effectively leveraging the bidirectional and holistic regulatory advantages of acupuncture to improve MS patients' blood lipids, blood glucose, and blood pressure levels. Chen Jie [25] used the "Warming and Unblocking the Triple Jiao acupuncture method to treat MS. The results showed that this method could synergistically alleviate the insulin resistance state in MS patients, enhance the correction of glycolipid metabolic disorders in MS, improve BMI, FPG, and fasting insulin in MS patients, reduce total cholesterol and triglycerides, improve the obese state of MS patients, reduce waist-to-hip ratio, thereby enhancing the regulation of the body's overall function. In a treatment study on MS patients with abdominal obesity, Wang Yi [26] found that abdominal acupuncture combined with ear acupoint pressing could effectively reduce BMI and had a certain interventional effect on FPG, blood pressure, blood lipids, and other indicators. Wang Yue [27] found that the "Seven Neck Points" therapy could effectively improve blood pressure levels and clinical symptoms in MS hypertensive patients, and also had a certain degree of improvement effect on patients' BMI, waist circumference, and blood lipid levels. Wang Yuqi [28] demonstrated that acupoint catgut embedding treatment for MS patients with phlegm-dampness encumbering the spleen pattern could significantly improve patients' blood pressure, blood glucose, blood lipid levels, and alleviate patients' clinical discomfort symptoms.

4.3. Preventing Decline after Deterioration: Target Organ Protection and Complication Prevention and Control

The pathological process of MS not only involves multiple metabolic disorders but also, due to its chronic inflammatory state, oxidative stress, and insulin resistance, leads to irreversible damage to target organs such as the heart, kidneys, and blood vessels, significantly increasing the risk of ASCVD, T2DM and its complications, and chronic kidney disease (CKD). The TCM "preventive treatment of disease" theory emphasizes "preventing decline after deterioration has occurred," meaning that at the stage of disease progression, multi-target interventions are used to protect organ function and delay the occurrence of complications. This section systematically elaborates on the characteristic advantages of TCM in target organ protection and complication prevention and control, combining clinical research evidence and molecular mechanisms.

4.3.1. TCM Protection of the Cardiovascular System, Delaying ASCVD Progression

Due to dyslipidemia, endothelial dysfunction, and chronic inflammation, MS patients have a significantly increased risk of ASCVD. TCM exerts cardiovascular protective effects by regulating lipid metabolism, improving vascular endothelial function, and inhibiting atherosclerotic plaque formation. Meng Xianglei [29] studied the use of Immature Bitter Orange, Chinese Chive, and Cinnamon Twig Decoction in treating coronary atherosclerotic heart disease (CHD) with phlegm-stasis obstruction pattern. The control group received conventional Western medicine treatment, while the observation group received Immature Bitter Orange, Chinese Chive, and Cinnamon Twig Decoction in addition to the control group's treatment. The results showed that all cardiac function indicators in the observation group were superior to those in the control group.

4.3.2. Regulating the Glycolipid Metabolic Network, Preventing T2DM Complications

During the progression from MS to T2DM, chronic hyperglycemia and oxidative stress accelerate microvascular and neuropathic complications. TCM employs the "State-Target Combination" strategy, targeting the improvement of insulin resistance and protecting microvessels while lowering blood sugar. Zhou Muna [30] found that the Liuwei Dihuang extract alleviated glycolipid metabolic disorders and insulin resistance in T2DM rats by regulating the Wnt/β-catenin signaling pathway, improving pancreatic damage in T2DM rats. Bao Peng [31] found that modified Yougui Pill combined with conventional diabetes treatment had good efficacy in patients with type 2 diabetic retinopathy, effectively improving the patients' fundus lesions and serum VEGF levels. Gao Huaiyun [32] observed the regulation of glucose metabolism by acupuncture in MS patients with TCM phlegm-dampness constitution. Compared to conventional Western medicine (antihypertensive, hypoglycemic, lipid-lowering, etc.) treatment, Western medicine combined with acupuncture treatment could effectively regulate glucose metabolism disorders in MS patients with TCM phlegm-dampness constitution.

4.3.3. Improving Renal Function, Delaying CKD Progression

MS patients often have comorbid hypertension and glycolipid metabolic disorders, leading to glomerular hyperfiltration and interstitial fibrosis. TCM protects renal function through multiple pathways. Wei Minggang [33] divided 60 patients with CKD stages 2-3 and spleen-kidney deficiency pattern into a control group receiving symptomatic Western medicine treatment and a treatment group receiving additional self-formulated Chinese medicine Qigui Yishen Formula. The results showed that after treatment, the treatment group was superior to the control group in improving renal function, urinary microprotein, and TCM syndrome scores, with statistically significant differences. Wu Hui [34] randomly divided 88 CKD patients into two groups. The control group received symptomatic treatment, while the treatment group received additional Chinese medicine and moxibustion treatment. After treatment, the total effective rate in the treatment group was 86. 36%, compared to 65. 90% in the control group. Furthermore, the treatment group was superior to the control group in improving various test indicators, with statistically significant differences.

5. Conclusion

The TCM theory of preventive treatment of disease shows promising prospects in the prevention and treatment of MS. Applying the TCM "preventive treatment of disease" concept to intervene in MS—namely, preventing disease before it occurs by identifying high-risk populations through constitution assessment, implementing early intervention, comprehensive post-illness regulation and treatment, controlling risk factors, integrating Chinese and Western medicine treatments, regular medication use, preventing further progression of MS and the occurrence of complications, and improving patients' quality of life—achieves the goal of "the superior physician treats disease before it occurs," which is of great significance for reducing societal and familial burdens. Simultaneously, research on the basic theories of TCM health management, exploration of diverse forms of TCM health management, as well as standardized and normalized research on constitution identification and constitution regulation in the pre-MS stage still have a long way to go.

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