

Research Progress of Traditional Chinese and Western Medicine in Hyperthyroid Heart Disease

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Abstract: In recent years, hyperthyroid heart disease has become a condition with high incidence rate and high mortality rate. This paper discusses the pathogenesis, treatment, and influencing factors of hyperthyroid heart disease from two different angles – traditional Chinese medicine and western medicine – in hope to provide a reference basis for the treatment of hyperthyroid heart disease.

Keywords: Hyperthyroidism; Heart disease; Research progress; Traditional Chinese and western medicine

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1. Understanding hyperthyroid heart disease from the perspective of western medicine

Hyperthyroidism heart disease occurs when large amounts of thyroid hormones are secreted, causing a series of toxic effects on the heart. Although it has a slow onset, this condition is considered as a serious complication of hyperthyroidism, which can be referred to as hyperthyroid heart in short. A large amount of thyroid hormone increases the secretion of catecholamine, resulting in accelerated heart rate and increased myocardial contractility and systemic vascular resistance, thus further affecting the tissue structures as well as the systolic and diastolic functions of the heart ^[1]. Arrhythmias, particularly tachyarrhythmias, are the most common clinical manifestations, followed by cardiac insufficiency, which can lead to heart failure or even death in severe cases due to the production of cardiac enzymes that will increase the sensitivity of cardiac β -adrenergic receptors to catecholamine. Epidemiological studies have shown that the incidence rate of hyperthyroid heart disease is 10% to 20% of that in hyperthyroidism ^[2]. It is most often seen in patients with senile hyperthyroidism. If the condition is not treated promptly, it may lead to various complications or even death. Therefore, this study investigates the pathogenesis, influencing factors, and treatment of this condition from the perspective of traditional Chinese and western medicine, so as to provide a reference basis for the treatment of this disease.

1.1. Pathogenesis

Thyroxine is one of the most important hormones in the human body, and its function is different from that of the thyroid gland. The pathophysiology of hyperthyroid heart disease is related to several factors. First, the thyroid hormone can directly affect the stability of the cardiovascular system, drastically improve myocardial cells' glucose uptake, further strengthen myocardial contraction, and increase vascular expansion capacity. Second, the thyroid hormone can also increase the number of adrenergic receptors in myocardial cells, inhibit the liver function in the degradation of catechu phenolphthalein amine enzymatic

activity, improve heart rate, and increase myocardial contractility. Third, it can activate the renin-angiotensin-aldosterone system (RAAS), thus increasing the heart rate, blood pressure, and myocardial contractility. Several researchers found that when the level of thyroxine in blood exceeds the normal range, it will cause toxic effects on the heart and change the cardiac function and structure^[3], which is consistent with the results of another study that investigated the level of myocardial markers in hyperthyroid heart disease^[4]. Compared with patients with simple hyperthyroidism, the levels of cardiac troponin (cTnI), creatine kinase (CK), creatine kinase isozyme (CK-MB), and N-terminal-pro brain natriuretic peptide (NT-pro BNP) were all higher than normal. Studies have shown that hyperthyroidism can lead to pseudo-myocardial hypertrophy, which may be reversed with a normalized thyroid state. However, in late stages, it may progress to a pathological state, or even lead to heart failure. Even if thyroid function returns to normal, the cardiac function or structure may not^[5]. While exploring the risk factors of this condition, Hao Xiaodong and other researchers discovered that thyroxine can increase glucose uptake by cardiomyocytes, thus improving myocardial contractility and increasing myocardial oxygen consumption; in addition, they also found that thyroid hormone can activate the RAAS system, which might worsen the heart's condition^[6]. A study found that a high concentration of FT4 is one of the major risk factors of hyperthyroidism^[7]. According to several scholars, there is an increase in Na⁺-K⁺-ATPase activity in cardiomyocytes in cases of hyperthyroidism, resulting in cardiac electrophysiological activity imbalance. High levels of peripheral FT4 concentrations that cannot be explained by cardiomyocytes may lead to cardiomyocyte necrosis or fibrosis and arrhythmia^[8,9].

1.2. Treatment

In western medicine, this condition is controlled through surgery, drugs, and radiation. At the same time, some cardiovascular drugs are given to control complications, and other general measures are taken to improve the prognosis, such as diet and lifestyle modifications. Since surgical treatment has higher risk and incurs more cost, patients tend to opt for drug treatment. Drug treatment mainly includes antithyroid drugs and iodine-131 (¹³¹I). The clinical efficacy of ¹³¹I in 100 patients with hyperthyroid heart disease was investigated in the study^[10], and the study found that the levels of thyrotropin, free triiodothyronine, thyrotropin receptor antibody, and free thyroxine before and after six months of treatment had significant difference; in addition, LVEDD and BNP levels after treatment were lower than those before treatment, whereas LVEF was higher in the experimental group than in the control group, indicating that ¹³¹I has high feasibility in treating hyperthyroid heart disease and can effectively improve the disease effect as well as the prognosis of patients. Through clinical observation and research, Huang found that after radical treatment with ¹³¹I for hyperthyroidism, arrhythmia can be improved^[11]. Another study found that ¹³¹I combined with low-dose propranolol can effectively control the occurrence of this disease^[12].

1.3. Risk factors of hyperthyroid heart disease

Comparing the data of 112 hyperthyroid patients with 61 hyperthyroid heart disease patients and based on the values calculated according to the Logistic model, it was discovered that older age, a longer course of disease, and high concentrations of FT3 and FT4 were the major influencing factors^[6]. Ren Yanru and other researchers found that older age, a longer course of disease, decreased blood lipids, as well as increased FT4, NLR, LDH, and α -HBDH are all clinical risk factors of hyperthyroidism by comparing these clinical indicators in healthy subjects, patients with hyperthyroidism, and patients with hyperthyroid heart disease^[13]. Therefore, high-risk groups must be identified using ECG, echocardiography, and serological tests as soon as possible, so as to provide timely treatment.

2. Understanding hyperthyroid heart disease from the perspective of traditional Chinese medicine

2.1. Etiology and pathogenesis

Hyperthyroidism is classified as “gall disease” in ancient Chinese medicine. According to “Authentic Surgery: Discussion on Gall,” the pathological basis of this disease is the “mutual beating and knot of qi, phlegm, and blood stasis.” Qi stagnation leads to phlegm accumulation. Over time, blood circulation becomes unfavorable and blood stasis occurs, thus blocking channels and collaterals; this is known as gall disease. On the other hand, hyperthyroid heart disease is characterized by a series of heart yin deficiency symptoms, such as palpitation, irritability, sweating, and increased pulse. Therefore, hyperthyroid heart disease belongs to the categories of “palpitation” and “gall disease” in traditional Chinese medicine. Through systematic data analysis and a large number of clinical observations, modern researchers of traditional Chinese medicine attribute the etiology of hyperthyroid heart disease to the deficiency of the five internal organs of the human body and the flourishing fire of Yin deficiency^[14]. In the TCM clinical research classification of hyperthyroid heart disease, it has been proposed that blood stasis, qi deficiency, phlegm, yin deficiency, dampness, and heat are the main syndrome elements of hyperthyroid heart disease and various syndrome elements interact to produce a variety of TCM syndromes^[15]. The research also found that qi and yin deficiency, phlegm and blood stasis blocking collaterals, damp heat and blood stasis, as well as liver depression and spleen deficiency are the most common TCM syndromes in this disease.

2.2. Syndrome differentiation and treatment

The pathophysiology of hyperthyroid heart disease in traditional Chinese medicine is complex, and there are various etiologies. Modern TCM practitioners have their own traits in the syndrome differentiation and treatment of this disease. Professor Li Zhongnan Li divided the disease into four syndrome types according to their clinical manifestations^[16]: liver depression and fire, heart and kidney yin deficiency, heart and kidney yang deficiency, as well as heart and liver yin deficiency. Based on the syndrome types, corresponding treatment methods such as nourishing Yin, tonifying liver and kidney, clearing fire, and promoting blood circulation have been established. In response to the complications caused by this condition, addition and subtraction methods have been proposed. Shengmai powder can be used in those with atrial fibrillation; Chaihu Shugan powder can be used in those with anxiety; Bazhen decoction can be used in those with blood diseases; Danggui Liu Huang decoction can be used in those with sweating syndrome; Schisandra chinensis, Chaihu, and other liver-protecting traditional Chinese medicine can be used in those with liver damage. Zhong Xiaojun and several other researchers believe that the early stage of the disease is due to poor liver qi and the accumulation of phlegm and blood stasis in the heart and pulse over a long period of time^[17]; hence, Jianpi Jieyu prescription was formulated to strengthen the spleen and relieve qi as well as soothe the liver and relieve depression. Through clinical trials, it has been discovered that the use of this self-made prescription combined with western medicine can improve cardiac function and regulate the thyroid hormone levels, which provides a certain clinical basis for this prescription. In another study, several researchers investigated the cause of this disease and concluded that the disease is attributed to “gall disease”^[18]. In the early stage, it is affected by emotional factors, resulting in abnormal liver catharsis function, stagnation of liver qi and transformation of fire, long-term refining of liquid into phlegm, obstruction of phlegm and qi, poor operation of pulse channel, formation of blood stasis, as well as mind disturbance by virtual fire and palpitation. Therefore, Shugan Yiqi Yangying decoction was formulated and prescribed to several patients in a study. It was found that this prescription can improve heart function and reduce heart rate, and the effect is better than that of western medicine alone. Guoliang Du treated 41 patients with hyperthyroidism after adding and subtracting Xiaoyao powder, a well-known prescription for soothing the liver, relieving depression, and regulating emotions^[19]; the results showed that the patients’ thyroid function improved significantly with reduced risk of side effects. The curative

effect of Chinese patent medicine on this disease was systematically analyzed in a study; the study found that the incidence of adverse events from using Chinese patent medicine in the treatment of this disease was lower than that of simple antiarrhythmic drugs ^[20]. For patients whose disease have not developed to the extent of needing long-term oral cardiovascular drugs, Chinese patent medicine may be a better choice. In addition, a large number of clinical researchers have confirmed through experimental research that traditional Chinese medicine combined with western medicine can better improve the prognosis of the disease. In a clinical study ^[21], 36 patients with hyperthyroidism were treated with Danzhi Xiaoyao powder on the basis of Saizhi. This prescription helps in soothing the liver, nourishing blood, strengthening the spleen, and clearing away heat. After four courses of treatment, the patients' thyroid functions returned to normal, and their ECGs had normal findings. Zhang Zhizhong and several researchers combined Shengmai Yin with western medicine to treat the disease. Shengmai Yin has the functions of nourishing Yin, nourishing heart, and supplementing qi ^[22]. It improves cardiac function and increases blood flow in the coronary arteries, thus resulting in a better prognosis. In a study ^[23], 86 cases of hyperthyroid heart patients were randomly divided into a control group and an observation group; the observation group was treated with nerve-calming pill and western medicine; the results showed that the combination of western medicine with is effective, in which the total effective rate of the combined prescription for arrhythmia was significantly higher than that of pure western medicine alone. In addition, the patients showed no obvious adverse drug reactions during the treatment. Therefore, the Anshen Dingji pill (nerve-calming pill) has an important value in the treatment of patients with hyperthyroid heart disease. The use of western medicine combined with TCM has a good therapeutic effect on this disease and can effectively improve the long-term prognosis of patients.

3. Problems and prospects

The pathophysiology of hyperthyroid heart disease is still poorly understood. For a long time, antithyroid and cardiovascular drugs have been used to treat this disease, which can control its progression. According to modern clinical researchers, the clinical efficacy of integrated traditional Chinese and western medicine in the treatment of hyperthyroid heart disease is more optimistic, as it can better improve the thyroid function and cardiac function of patients, along with their prognosis, quality of life, and mortality rate. However, finding a better treatment has become an issue that traditional Chinese and western medicine practitioners should actively deal with.

Disclosure statement

The authors declare no conflict of interest.

References

- [1] Poutasse CM, Herbstman JB, Peterson ME, et al., 2019, Silicone Pet Tags Associate Tris(1,3-dichloro-2-isopropyl) Phosphate Exposures with Feline Hyperthyroidism. *Environ Sci Technol*, 10(9): 23-24.
- [2] Sano M, Homma T, Ishige T, et al., 2017, An Autopsy Case of Hyperthyroid Cardiomyopathy Manifesting Lethal Congestive Heart Failure. *Pathology International*, 67(2): 110-112.
- [3] Qiang Z, Jin B, Lu Q, et al., 2019, Regulation of MicroRNA-146 in Hyperthyroid Heart Disease. *Chinese Journal of Clinical Anatomy*, 37(03): 273-277. DOI: 10.13418/j.issn.1001-165x.2019.03.007
- [4] Feng Y, 2020, Efficacy of Detection of cTnI, CK, CK-MB and NT-pro BNP Levels in the Diagnosis of Hyperthyroidism Heart Disease. *Medical Journal of Chinese People's Health*, 32(24): 110-112.

- [5] Dillmann W, 2010, Cardiac Hypertrophy and Thyroid Hormone Signaling. *Heart Fail Rev*, 15(2): 125-132.
- [6] Hao X, Liu J, Cui Y, 2020, Analysis of Risk Factors of Hyperthyroidism Complicated with Hyperthyroid Heart Disease. *Electronic Journal of Practical Gynecologic Endocrinology*, 7(18): 151-152. DOI: 10.16484/j.cnki.issn2095-8803.2020.18.098
- [7] Wang W, Cheng Q, 2017, Analysis of Risk Factors of Hyperthyroidism Complicated with Hyperthyroid Heart Disease. *Modern Instruments & Medical Treatment*, 23(05): 43-44, 47.
- [8] Biondi B, Bartalena L, Cooper DS, et al., 2015, The 2015 European Thyroid Association Guidelines on Diagnosis and Treatment of Endogenous Subclinical Hyperthyroidism. *Eur Thyroid J*, 4(3): 149-163.
- [9] Klein I, Danzi S, 2016, Thyroid Disease and the Heart. *Curr Probl Cardiol*, 41(2): 65-92.
- [10] Xiang Q, 2020, Effect of (131)-Iodine in the Treatment of Hyperthyroidism Heart Disease. *Journal of Clinical Rational Drug Use*, 13(23): 43-45. DOI: 10.15887/j.cnki.13-1389/r.2020.23.019
- [11] Huang LK, 2017, Clinical Analysis and Efficacy of 131I Iodine in the Treatment of Hyperthyroidism Heart Disease. *Electronic Journal of Cardiovascular Diseases of Integrated Traditional Chinese and Western Medicine*, 5(26): 143-144. DOI: 10.16282/j.cnki.cn11-9336/r.2017.26.114
- [12] Tan X, 2020, (131) I Combined with Propranolol in the Treatment of Hyperthyroid Heart Disease. *Medical Diet and Health*, 18(20): 73, 76.
- [13] Ren Y, Ma J, Liu P, et al., 2020, Analysis of Risk Factors Associated with Hyperthyroidism of Heart Disease. *Ningxia Medical Journal*, 42(05): 406-408. DOI: 10.13621/j.1001-5949.2020.05.0406
- [14] Zhou Y, Zhang Z, 2017, Etiology and Pathogenesis of Hyperthyroidism. *Henan Traditional Chinese Medicine*, 37(10): 1771-1773.
- [15] Zhao X, Jiang Z, Fan G, 2019, Clinical Study and Analysis of Hyperthyroidism Heart Disease. *Clinical Journal of Chinese Medicine*, 11(25): 53-55.
- [16] Xing Y, Li Z, Zhou Y, et al., 2020, Li Zhongnan's Experience in Treating Hyperthyroid Heart Disease. *Henan Traditional Chinese Medicine*, 40(08): 1200-1203. DOI: 10.16367/j.issn.1003-5028.2020.08.0304
- [17] Zhong X, Wang Y, 2019, Observation on the Efficacy of Self-Made Jianpi Jieyu Prescription Assisted by Symptomatic Intervention of Western Medicine in the Treatment of Heart Disease Secondary to Hyperthyroidism. *Journal of Emergency in Traditional Chinese Medicine*, 28(11): 2032-2034.
- [18] Pan J, Zhang J, Li Y, et al., 2017, Clinical Study of Shugan Yiqi Yangying Decoction in the Treatment of Hyperthyroid Heart Disease. *Journal of Emergency in Traditional Chinese Medicine*, 26(07): 1278-1280.
- [19] Du G, 2017, Treatment of 41 Cases of Hyperthyroidism Heart Disease with Xiaoyao Powder. *China's Naturopathy*, 25(07): 57-58. DOI: 10.19621/j.cnki.11-3555/r.2017.07.045
- [20] Wang Q, 2018, Clinical Efficacy and Safety of Traditional Chinese Patent Medicine for Hyperthyroid Heart Disease: Study Protocol for A Systematic Review and Meta-Analysis. *Medicine (Baltimore)*, 97(45): e13076. DOI: 10.1097/MD.00000000000013076
- [21] Yu Q, Song Z, 2016, Saizhi Combined with Danzhi Xiaoyao Powder in the Treatment of Hyperthyroid Heart Disease. *Nei Mongol Journal of Traditional Chinese Medicine*, 35(16): 22. DOI: 10.16040/j.cnki.cn15-1101.2016.16.025
- [22] Zhang Z, 2016, Analysis of Curative Effect of Shengmai Yin Combined with Western Medicine in Treating Hyperthyroidism Heart Disease. *Cardiovascular Disease Journal of integrated traditional*

Chinese and Western Medicine, 4(16): 193-194. DOI: 10.16282/j.cnki.cn11-9336/r.2016.16.140

[23] Wang Z, Wang X, Yang Y, et al., 2018, Clinical Observation of Anshendingzhao Pill in the Treatment of 86 Cases of Hyperthyroidism Heart Disease. World Latest Medical Information Abstracts, 18(12): 89, 97. DOI: 10.19613/j.cnki.1671-3141.2018.12.060

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