Study on the Mechanism of TCM Treatment of Chronic Heart Failure Based on Signaling Pathway

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Abstract: To explore the mechanism of traditional Chinese medicine in treating chronic heart failure based on signaling pathways, and to reveal its regulatory effect. Studies have found that traditional Chinese medicine has advantages and potentials in regulating neuro-endocrine, inflammatory and immune response signaling pathways, such as RAAS, sympathetic-parasympathetic nerve, NF-κB and other pathways, reducing myocardial apoptosis, inhibiting inflammation, improving disorders, and promoting cardiac remodeling and normalization of related signaling pathways.
***Keywords*:** chronic heart failure; signal pathway; traditional Chinese medicine

1. Introduction

Chronic heart failure (CHF) is a common end-stage cardiovascular disease with complex pathophysiological mechanisms. In recent years, the role of signaling pathways in the mechanism of morbidity has been emphasized. Traditional Chinese medicine is an important part of traditional medicine, which has unique advantages in regulating signal pathways and improving the symptoms of heart failure. This study explored the mechanism of traditional Chinese medicine in the treatment of chronic heart failure, and provided the basis for the application of traditional Chinese medicine.

2. Definition of chronic heart failure

Chronic heart failure is a pathological state of insufficient blood pumping caused by abnormal heart, which will progress to shortness of breath, edema and other symptoms. The mechanism of morbidity is complex, involving abnormal activation of a variety of signaling pathways. Western medicine is needed to treat heart failure, and the role of traditional Chinese medicine should also be explored. Traditional Chinese medicine can act on pathological signaling pathways, improve symptoms, delay the course of disease and improve the quality of life.

3. Morbidity mechanism of traditional Chinese medicine in treatment of chronic heart failure based on signaling pathway

3.1 Cardiomyocyte apoptosis and injury

Cardiomyocytes are vulnerable to long-term stress, and signaling pathways are critical. Its apoptosis is related to oxidative stress, inflammation, calcium overload and pump failure, and interacts with multiple pathways, especially oxidative stress and inflammation pathways, which can activate proapoptotic factors, cause redox imbalance and increase the expression of apoptotic genes. In chronic heart failure, this apoptosis is the core of cardiac function deterioration and the activation of related pathways aggravates the disease.

3.2 Inflammatory response and immune activation

Inflammation and immune activation play an important role in the morbidity of chronic heart failure. Mild inflammation in patients leads to the deterioration of cardiac function, which is related to remodeling, and immune cells invade myocardium and vascular endothelial cells to produce inflammatory factors. NF-κB pathway is the core of inflammation, activating pro-inflammatory factors, long-term activation of myocardial damage, promoting fibrosis, abnormal activation of immunity also promotes heart failure, and the balance of regulation can be delayed.

3.3 Endocrine and metabolic disorder

Endocrine disorders in patients with chronic heart failure, RAAS activation leads to water and salt imbalance and fluid accumulation. Metabolic disorder is the main symptom, with abnormal glucose and lipid metabolism, changes in cardiac energy supply, myocardial cell metabolism and fatty acid oxidation damage aggravating failure. It involves many abnormal

activation pathways such as AMPK, which can be regulated to alleviate heart failure.

3.4 Cardiac remodeling and fibrosis

An overloaded or damaged heart undergoes remodeling, including hypertrophy, ventricular dilation, and hypofunction. Fibrosis is an important process that increases the rigidity of the heart and decreases its ability to pump blood. TGFβ pathway is the main regulatory network of fibrosis, which can promote the proliferation of fibroblasts and collagen synthesis. Regulation of TGF-β pathway can inhibit fibrosis and delay cardiac remodeling, which is closely related to the changes of cardiac structure and myocardial cell function.

4. Regulation of Traditional Chinese Medicine in Signaling Pathway

4.1 Regulation of Traditional Chinese Medicine on Neuroendocrine Signaling Pathway

4.1.1 The relationship between the method of supplementing qi and activating blood circulation and RAAS pathway

The method of replenishing qi and activating blood circulation in traditional Chinese medicine is used for chronic heart failure, which can regulate the nervous and endocrine pathways (RAAS). Excessive activation of RAAS aggravates heart failure. In this method, ginseng and Astragalus are used to regulate its activity, ginseng renin and Astragalus are used to increase adrenaline. It can directly regulate RAAS, strengthen heart, reduce swelling, improve microcirculation, balance RAAS, reduce the development of heart failure and improve the quality of life.

4.1.2 Regulation of Sympathic-Parasympathetic Nerve by Traditional Chinese Medicine

Sympathetic and parasympathetic nerve dysfunction seriously affects chronic heart failure. High sympathetic nerve activity increases the burden of the heart in heart failure, and parasympathetic nerve inhibition reduces the self-protection ability of the heart. It can be improved by traditional Chinese medicine, such as Salvia miltiorrhiza, Lycium barbarum and Glycyrrhiza. Salvia miltiorrhiza can resist oxidation, inhibit sympathetic excitation and reduce heart rate; Lycium barbarum can improve the activity of parasympathetic nerve and reduce the influence of sympathetic nerve; Glycyrrhiza uralensis is a "harmonizing drug", which can regulate in both directions, strengthen the activity of parasympathetic nerve, inhibit sympathetic excitation, improve the ability of heart repair and delay heart failure.

4.2 Regulation of Traditional Chinese Medicine on Inflammation and Immune Response Signal Pathway

4.2.1 Association between heat-clearing and detoxifying therapy and NF-κB pathway

TCM uses heat-clearing and detoxifying for chronic HF, regulating NF-κB etc. to cut heart inflam. Coptis & honeysuckle inhibit its activation, cut inflam. factors. Their alkaloids & effects help, treating HF by reducing factors, balancing immunity, slowing injury & delaying HF.

4.2.2 Discussion on the mechanism of Chinese herbal medicine in anti-inflammatory effect

Chinese herbal medicine can not only inhibit a single inflammatory factor, but also regulate multiple signaling pathways to cooperate with anti-inflammatory. For example, Salvia miltiorrhiza and Panax notoginseng inhibit NF-κB and reduce inflammatory factors, Tanshinone inhibits MAPK and reduces carditis, and Panax notoginseng regulates Nrf2 and reduces oxidative stress inflammation. Lycium barbarum and Astragalus membranaceus regulate the activity of T and B cells, improve immune regulation, and contain polysaccharides, which can reduce the inflammatory reaction of chronic heart failure.

4.3 Regulation of Traditional Chinese Medicine on Cardiac Remodeling and Apoptosis Signal Pathway

4.3.1 The relationship between the method of promoting blood circulation and removing blood stasis and TGF-β pathway

The method of promoting blood circulation and removing blood stasis in traditional Chinese medicine can increase blood circulation and reduce the burden on the heart, and is used to treat chronic heart failure. It is associated with cardiac structural remodeling and fibrosis progression, and regulation of TGF-β signaling is critical. TGF-β activation exacerbates fibrosis and remodeling. Radix Salviae Miltiorrhizae, Flos Carthami, and Radix Angelicae Sinensis can inhibit its excessive activation. Salvia miltiorrhiza can inhibit signal transduction pathways and reduce the proliferation of fibroblasts, and safflower can promote blood circulation, which can alleviate the symptoms of heart failure and improve the quality of life.

4.3.2 Relationship between anti-aging effect of traditional Chinese medicine and autophagy and apoptosis of myocardial cells

Traditional Chinese medicine treatment of chronic heart failure by promoting blood circulation and removing blood stasis can increase blood circulation and reduce the burden of the heart. Related to cardiac remodeling and fibrosis, the regulation of TGF-β pathway is the key, its activation will aggravate the disease, Salvia miltiorrhiza, safflower, angelica can inhibit its excessive activation, I Salvia miltiorrhiza block signal transduction, safflower promote circulation, this method can alleviate symptoms and improve quality of life.

5. Conclusion

In this study, we explored the regulatory effect of traditional Chinese medicine on signaling pathways in the treatment of chronic heart failure, revealed its potential mechanisms in improving cardiomyocyte apoptosis, inhibiting inflammation, regulating neuroendocrine system and promoting cardiac remodeling, and provided new ideas and methods for the treatment of chronic heart failure through multi-target and multi-way regulation.

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