

Advances in the Clinical Efficacy and Mechanism of Action of Acupuncture in the Treatment of Chronic Cough

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Abstract: ***Objective:** To systematically review the clinical research findings and mechanism exploration progress of acupuncture in the treatment of chronic cough in recent years, analyze its efficacy advantages and research deficiencies, and propose future research directions. **Methods:** Through literature review, the selection rules of acupoints, treatment methods, efficacy evaluation indicators, and application in different populations of acupuncture in chronic cough were summarized. Modern research was combined to summarize its mechanisms of neural regulation, immune inflammation regulation, and signaling pathway regulation. **Results:** Numerous clinical studies have shown that acupuncture has significant efficacy in relieving cough symptoms, improving lung function, and reducing recurrence rate, with high safety and good compliance. Mechanistic studies show that acupuncture exerts a comprehensive intervention effect by regulating the cough reflex arc, reducing the expression of inflammatory factors, improving airway hyperresponsiveness, and regulating multiple signaling pathways. **Conclusion:** Acupuncture, as a safe and effective non-pharmacological intervention, has broad application prospects in the treatment of chronic cough. Future research should focus on strengthening high-quality clinical trials and multi-dimensional mechanism studies to promote the standardization and scientific development of acupuncture therapy.*

Keywords: Acupuncture, Chronic cough, Clinical efficacy, Mechanism of action, Neuromodulation, Immune inflammation, Signaling pathways.

1. Introduction

Chronic cough is one of the most common respiratory symptoms in clinical practice. It usually refers to a persistent cough lasting more than 8 weeks. Its etiology is complex and its clinical manifestations are diverse, which seriously affects the quality of life and psychological state of patients. According to epidemiological surveys, the prevalence of chronic cough in the general population is increasing year by year, especially among urban residents, the elderly and people with allergies. Its main causes include cough variant asthma (CVA), upper airway cough syndrome (UACS), gastroesophageal reflux cough (GERC), and non-asthmatic eosinophilic bronchitis (NAEB), etc [1]. Although modern medicine has made significant progress in etiological identification and drug treatment, there are still problems such as long treatment cycle, high recurrence rate and obvious drug side effects. In particular, in some patients, the effect of conventional treatment is not ideal, and it is urgent to explore safer and more effective alternative or adjuvant treatment methods [2]. Acupuncture, as one of the traditional Chinese medicine treatment methods, has the functions of harmonizing Yin and Yang, unblocking meridians, and strengthening the body's resistance to pathogens. It has been widely used in the treatment of respiratory diseases. In recent years, with the acceleration of the modernization of traditional Chinese medicine, clinical research on acupuncture treatment for chronic cough has gradually increased, and its efficacy has gradually gained attention and recognition from scholars at home and abroad. A large number of clinical trials and systematic reviews have shown that acupuncture has significant advantages in relieving cough symptoms, improving lung function, and reducing recurrence. It is also safe, has good compliance, and is suitable for long-term

intervention [3,4]. Especially in children, the elderly, and people with chronic diseases, acupuncture therapy shows good application prospects due to its non-drug and low side effects. From the perspective of traditional Chinese medicine theory, chronic cough is mostly a "lung disease" and is closely related to the dysfunction of the lung, spleen, and kidney. The pathogenesis often involves wind-evil attacking the lung, phlegm-dampness obstructing the meridians, and qi deficiency causing chronic cough. Acupuncture treatment, by selecting acupoints such as Feishu, Lieque, Tiantu, and Tanzhong, can play the role of clearing the lungs and relieving cough, resolving phlegm and unblocking the meridians, and regulating the internal organs. Modern research has further revealed that acupuncture not only has significant clinical efficacy, but its mechanism of action is also gradually being elucidated. Related experimental studies have shown that acupuncture can regulate the nervous system, immune system, and endocrine system, affecting the cough reflex arc, expression of inflammatory factors, and airway hyperresponsiveness, thereby achieving comprehensive intervention for chronic cough [5,6]. With the development of biomedical technology, research on the mechanism of acupuncture in treating chronic cough has also gradually deepened. Currently, studies have explored the biological effects of acupuncture from multiple levels, including neural regulation, immune regulation, expression of inflammatory factors, and activation of signaling pathways. For example, acupuncture can regulate vagal nerve activity, affecting the central nervous system's control of the cough reflex [5]; it can also reduce the levels of inflammatory factors such as IL-6 and TNF- α , relieving airway inflammation [6]; some studies have also found that acupuncture can affect the activity of signaling pathways such as MAPK and NF- κ B, explaining its anti-inflammatory and antitussive effects at the molecular

level [7]. These studies not only provide a scientific basis for acupuncture therapy, but also lay the foundation for its further promotion and application. In summary, acupuncture treatment for chronic cough, as a safe and effective non-drug intervention, has important value in clinical practice. As research continues to deepen, its efficacy evidence and mechanism of action have gradually become clear, showing good development potential. This article aims to systematically review the clinical research results and mechanism exploration progress of acupuncture in the treatment of chronic cough in recent years, analyze its advantages and disadvantages, and propose future research directions, so as to provide a reference for the standardized application and mechanism research of acupuncture in chronic cough [8].

2. Clinical Research Progress of Acupuncture in the Treatment of Chronic Cough

Chronic cough is one of the common respiratory symptoms in clinical practice, usually referring to persistent cough lasting more than eight weeks. Its etiology is complex, often caused by cough variant asthma (CVA), upper airway cough syndrome (UACS), gastroesophageal reflux cough (GERC), etc. [9]. Due to the long treatment cycle and high recurrence rate, traditional Western medicine treatments such as antihistamines, glucocorticoids, and bronchodilators can relieve symptoms, but are often accompanied by side effects, and the efficacy is poor in some patients [10]. Therefore, acupuncture, as a safe and non-drug TCM treatment method, has gradually gained attention in the intervention of chronic cough. The selection of acupoints for acupuncture treatment of chronic cough is based on the principles of syndrome differentiation and treatment in traditional Chinese medicine, combined with the theories of the Lung Meridian, Ren Meridian, and Stomach Meridian of Foot Yangming, forming a relatively systematic acupoint selection pattern. Commonly used acupoints include Lieque, Feishu, Tiantu, Tanzhong, and Chize. Among them, Lieque is a Luo-connecting point of the Lung Meridian of Hand Taiyin, which has the effects of ventilating the lungs, relieving cough, and regulating Qi; Feishu is a Shu-point on the back, which can regulate lung Qi, relieve cough and asthma; Tiantu and Tanzhong are located in the chest and are mainly used to treat cough, asthma, chest tightness, etc.; Chize is a He-Sea point of the Lung Meridian, which has the effects of clearing lung heat, relieving cough and resolving phlegm [11]. Clinical acupoint combinations mostly follow the principles of dispelling wind and ventilating the lungs, regulating Qi and relieving cough, and harmonizing Qi, combined with syndrome differentiation and treatment based on etiology and pathogenesis. For example, for those with wind-cold cough, Fengmen and Lieque are appropriate to dispel wind and cold; for those with phlegm-dampness obstructing the lungs, Fenglong and Feishu can be added to resolve phlegm and promote diuresis; for those with Qi deficiency and chronic cough, Zusanli and Taiyuan are appropriate to tonify Qi and strengthen the spleen [12]. In terms of acupuncture methods, in addition to traditional body acupuncture, modern clinical practice often combines electroacupuncture, warm acupuncture and other methods. Electroacupuncture can enhance the antitussive effect by stimulating acupoints with low-frequency current; warm acupuncture is combined with moxibustion for warm

stimulation and is suitable for cold-damp cough; fire acupuncture is used for cough with phlegm and blood stasis obstructing the collaterals and has the effect of clearing the collaterals and resolving phlegm [13]. Some studies have also used combined therapies such as ear acupuncture, head acupuncture, acupoint embedding, and acupoint application to expand the application boundaries of acupuncture [14]. The efficacy evaluation of acupuncture in treating chronic cough mainly includes subjective symptom scores, cough frequency, pulmonary function indicators, and improvement in quality of life. Subjective evaluation often uses visual analog scale, cough symptom scoring scale, cough diary and other methods; objective evaluation includes pulmonary function tests such as FEV1 and FVC, serum inflammatory factor levels such as IL-6 and TNF- α , etc.; in terms of quality of life, cough-specific scale and SF-36 scale are often used for assessment [15].

Multiple clinical studies have shown that acupuncture has significant advantages in relieving cough symptoms, improving pulmonary function and reducing recurrence rate. A meta-analysis of 10 randomized controlled trials showed that acupuncture had an overall effective rate of 87.5% in treating chronic cough, significantly better than the Western medicine group (72.3%), and a significantly lower recurrence rate [16]. Another study found that acupuncture combined with traditional Chinese medicine in treating CVA patients was superior to Western medicine alone in terms of cough relief time, improvement in lung function, and decrease in serum IgE levels [17]. In addition, the incidence of adverse reactions to acupuncture in treating chronic cough was low, mainly mild local pain and swelling, with no serious adverse events, showing good safety and compliance [18]. Acupuncture also showed good efficacy in special populations. Children with chronic cough are not suitable for long-term use of Western medicine, and acupuncture, as a non-drug intervention, has good safety and compliance. Studies have shown that after receiving acupuncture treatment, children with CVA experienced a significant decrease in cough frequency, improvement in lung function, and a lower recurrence rate, with no obvious side effects [19]. Elderly patients with chronic cough often have multiple chronic diseases, and drug treatment carries a high risk. Acupuncture, as an adjunctive therapy, can effectively relieve cough symptoms, improve sleep quality and mood, reduce drug use, and reduce drug-related adverse reactions [20]. In addition, for subtypes such as cough variant asthma and gastroesophageal reflux cough, acupuncture can select acupoints according to the etiology to achieve individualized treatment and improve efficacy [21].

3. Research on the Mechanism of Acupuncture in Treating Chronic Cough

In recent years, preliminary progress has been made in the study of the mechanism of acupuncture in treating chronic cough, mainly focusing on neural regulation, immune inflammation regulation, improvement of airway hyperresponsiveness, and regulation of signal pathways. First, acupuncture can affect the sensitivity of the cough reflex arc by regulating the autonomic nervous system. Studies have found that acupuncture can enhance vagal nerve activity and inhibit sympathetic nerve excitation, thereby reducing airway

nerve sensitivity and alleviating cough symptoms [22]. At the same time, acupuncture also has a regulatory effect on the central nervous system, which can affect the excitability of the brainstem cough center and increase the cough reflex threshold [23]. Functional magnetic resonance imaging (fMRI) studies have shown that acupuncture can activate brain regions related to cough regulation, such as the prefrontal cortex and hypothalamus, suggesting that it has a central regulatory effect [24]. Secondly, acupuncture can exert an anti-inflammatory effect by regulating the immune system. Chronic cough is often accompanied by chronic airway inflammation. Acupuncture can reduce the expression of inflammatory factors such as IL-6, TNF- α , and IL-8, inhibit the inflammatory response, and improve the airway microenvironment [25]. At the same time, acupuncture can regulate the Th1/Th2 immune balance, enhance the body's immune regulation capacity, and reduce allergic inflammatory responses [26]. Animal experiments have shown that acupuncture can inhibit the infiltration of inflammatory cells in lung tissue, reduce the level of inflammatory factors, and improve the airway inflammatory state [27]. In addition, acupuncture can also improve the airway mucosal barrier function and reduce airway hyperresponsiveness. Studies have shown that acupuncture can increase the expression of tight junction proteins (such as ZO-1 and Occludin) in airway epithelial cells, reduce mucosal permeability, enhance barrier function, and thus alleviate cough stimulation [28]. Clinical studies have also found that acupuncture treatment reduces airway responsiveness and cough frequency in patients [29].

In terms of molecular mechanisms, acupuncture can affect multiple cell signaling pathways, such as MAPK, NF- κ B, and PI3K/Akt. These pathways play important roles in inflammatory responses, apoptosis, and immune regulation. Studies have found that acupuncture can inhibit NF- κ B pathway activation, reduce the release of inflammatory factors, and regulate the PI3K/Akt pathway, promoting cell repair and regeneration [30]. Animal models and cell experiments provide important support for the study of acupuncture mechanisms. In addition, acupuncture may also reduce airway nerve sensitivity by regulating nerve-sensitive factors such as TRPV1 and SP, further alleviating cough [31].

4. Current Status and Existing Problems

Although acupuncture treatment for chronic cough has made some progress, many problems still exist. First, most clinical studies are small-sample, single-center studies, lacking multi-center, large-sample, high-quality randomized controlled trials, which affects the reliability and generalizability of the evidence. Secondly, mechanistic research is still in its early stages, with studies mostly focusing on single pathways or factors, lacking systematic validation and multi-dimensional integration, making it difficult to fully reveal the mechanism of action of acupuncture.

Furthermore, the selection of acupoints and treatment protocols lack standardization. Significant differences exist between different studies in acupoint selection, acupuncture techniques, stimulation intensity, and treatment frequency, affecting the comparability and reproducibility of research

results. Finally, the long-term efficacy and safety assessment of acupuncture in treating chronic cough is insufficient, lacking systematic follow-up data and adverse event monitoring, making it difficult to comprehensively evaluate its clinical value.

5. Future Research Directions

To promote the scientific development of acupuncture in treating chronic cough, future research should focus on the following aspects: First, high-quality clinical trial design should be strengthened, employing multi-center, randomized, double-blind, and controlled methods to improve research quality and the level of evidence. Second, multi-omics and molecular biology techniques should be combined to deeply explore the mechanism of action of acupuncture, constructing a "acupoint-pathway-effect" mechanism map to achieve mechanism integration from macroscopic to microscopic levels.

Simultaneously, standardized acupuncture treatment protocols and operational guidelines should be established, clarifying the principles of acupoint selection, acupuncture parameters, and treatment course settings to enhance clinical replicability and promotional value. Fourth, the synergistic effects of acupuncture with other therapies such as traditional Chinese medicine, massage, and moxibustion should be explored to construct a comprehensive intervention system and improve treatment outcomes.

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