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Research on the Treatment of Dysphagia Caused by True Bulbar Paralysis after Stroke with Electroacupuncture at Swallowing Points

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Abstract: Dysphagia caused by true bulbar paralysis after stroke is a common and serious complication that severely affects patients' eating ability and quality of life, and significantly increases the risk of complications such as pneumonia and malnutrition. Electroacupuncture at swallowing points stimulates Swallowing 1 and Swallowing 2 acupoints, acting on key areas such as the glossopharyngeal nerve and vagus nerve, stimulating the reconstruction of nerve reflex arcs and the recovery of swallowing function. Therefore, this article analyzes the mechanism and clinical efficacy of electroacupuncture at swallowing points for the treatment of dysphagia caused by true bulbar paralysis after stroke, aiming to provide theoretical support and practical basis for clinical application.

Keywords: Electroacupuncture at swallowing points; Stroke; Dysphagia caused by true bulbar paralysis; Clinical progress

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1. Introduction

Dysphagia after stroke is a common physiological dysfunction. According to research, about 50.4% of stroke patients experience swallowing difficulties [1]. True bulbar paralysis is a neurological disorder caused by lesions in the medulla oblongata or brain, commonly seen in the elderly population. Patients typically exhibit the disappearance of jaw and pharyngeal reflexes, accompanied by symptoms such as tongue muscle atrophy [2]. This disorder not only threatens the safety of patients' lives but also imposes a significant burden on families and society. Electroacupuncture, an innovative treatment method combining traditional acupuncture therapy with modern electrical stimulation technology, has been widely used in the treatment of various diseases. Stimulating the swallowing acupoints can prompt the pharyngeal levator muscles to elevate the throat and pharynx towards the dorsal side, facilitating the contraction and functional recovery of throat muscles, gradually establishing damaged reflex arcs, and thus promoting the smooth completion of swallowing function [3]. This

study aims to review the pathophysiological mechanism of dysphagia caused by true bulbar paralysis after stroke, focusing on analyzing the role and efficacy of electroacupuncture stimulation at swallowing acupoints in improving swallowing function and exploring more optimized treatment paths for patients' rehabilitation and quality of life improvement.

2. Understanding of dysphagia after stroke in traditional Chinese medicine

From the perspective of traditional Chinese medicine, dysphagia after stroke is classified under the categories of "tongue darkness," "aphasia and paralysis," and "throat obstruction." The root cause of these conditions is located in the brain, while the specific symptoms manifest in the throat area [4]. These disease names have been recorded in classical medical texts such as "Su Wen" and "Zhu Bing Yuan Hou Lun", with descriptions like "internal deprivation leading to collapse, resulting in aphasia and paralysis" and "the combination of Yin and Yang, known as throat obstruction."

Traditional Chinese medicine believes that the location of dysphagia primarily involves the tongue, throat, and brain, and it also relates to dysfunctions of the heart, liver, spleen, kidney, and other organs, as well as imbalances in the Ren and Du meridians. The etiology of dysphagia after stroke is attributed to imbalances in Yin and Yang of the organs, poor circulation of Qi and blood, and disturbances of pathogenic factors such as wind, fire, phlegm, and blood stasis that affect the brain, leading to blocked neural orifices, malnourishment of the tongue and throat, and obstruction of the tongue meridians [5]. Traditional Chinese medicine characterizes this type of dysphagia as "deficiency in origin and excess in manifestation," indicating weak organ function but the presence of obstructive factors like wind, phlegm, or blood stasis in the body. Therefore, the treatment emphasizes harmonizing the Qi, blood, Yin, and Yang of the organs, clearing meridians, and adopting therapies that awaken the brain, open orifices, benefit the throat, and relieve obstruction.

The main symptoms of true bulbar paralysis can be attributed to the categories of "stroke," "aphasia and paralysis," and "choking and gagging" in traditional Chinese medicine. Zhang Zhongjing, a medical expert from the Han Dynasty, pointed out in the "Jin Kui Yao Lue: Stroke and Arthralgia Disease Syndrome and Treatment" that "when pathogenic factors invade the organs, the tongue becomes difficult to speak, and saliva continuously flows out of the mouth." The ancient medical texts do not contain the term "bulbar paralysis." It is now often categorized under the scope of "similar choking and gagging." "Similar choking and gagging" is a modern clinical term based on the similar symptoms of dysphagia and choking when drinking water in bulbar paralysis, but the pathogenesis is not completely consistent with "choking and gagging," hence the name. "Choking" and "gagging" are actually two different conditions, but they are often referred to together because they frequently occur together or in succession. In "A Brief Description of Choking and Gagging" by He Ren, it is mentioned that the term "choking and gagging" did not appear in previous medical texts. The records in the "Inner Canon" refer to the current understanding of choking and gagging, and the term "choking and gagging" began to be recorded in the Song Dynasty's "Ji Sheng Fang."

3. Dysphagia caused by true bulbar paralysis after stroke

3.1. True bulbar paralysis caused by stroke and its pathophysiological mechanism

True bulbar paralysis after stroke is a complex neurological injury primarily manifested as severe dysphagia.

The occurrence of this condition is closely related to damage to the nerve nuclei and their pathways in the bulbar region, especially the vagus nerve nucleus, glossopharyngeal nerve nucleus, and hypoglossal nerve nucleus in the medulla oblongata. These nerve nuclei are involved in the coordination and control of swallowing [6]. Vascular blockage or hemorrhage from a stroke can disrupt the normal functioning of these nerve nuclei, directly affecting the coordination of the patient's swallowing reflex and related movements. The medulla oblongata, as the core region of the swallowing center, suffers damage that can impede nerve signal transmission, resulting in a loss of continuity in the patient's swallowing movements. This can lead to symptoms such as choking when drinking water, hoarseness, and in severe cases, aspiration pneumonia due to mis-swallowing.

The swallowing process is divided into five stages: pre-oral, oral preparatory, oral, pharyngeal, and esophageal phases. The anatomical structure and neural mechanism of this process are quite complex, consisting of a neural network system formed by the swallowing motor cortex and subcortical centers of both hemispheres. Signals are transmitted through descending fibers such as the corticospinal tract and corticobulbar tract. Among them, the corticobulbar tract transmits signals to the medulla oblongata, enhancing the excitability of the swallowing center in the medulla and regulating the pharyngeal phase of swallowing. The swallowing center in the medulla oblongata further issues neural commands to coordinate the activities of swallowing-related muscle groups, ensuring the smooth progress of swallowing movements [7].

Under normal circumstances, when food enters the mouth, it is transmitted to the pharynx via the base of the tongue, triggering the swallowing reflex and pushing food through the esophagus. However, nerve nucleus damage after a stroke can weaken the sensing and transmission capabilities of the glossopharyngeal and vagus nerves, causing a delay or complete loss of the swallowing reflex. The loss of coordination between the soft palate and pharyngeal muscles allows some food to flow back into the nasal cavity, further exacerbating the patient's difficulty in eating.

3.2. Common manifestations of dysphagia caused by true bulbar paralysis after stroke

Among stroke patients, the proportion of those with dysphagia sequelae is relatively high, accounting for approximately 51%–73%. Common symptoms include difficulty pronouncing, abnormal spontaneous coughing, uncontrolled saliva, and choking after swallowing [8]. Dysphagia caused by true bulbar paralysis after stroke often manifests as significant difficulties during eating and drinking. Due to nerve damage in the bulbar region, the multi-stage involvement symptoms of swallowing dysfunction are complex and diverse. Zhao *et al.* pointed out that patients with true bulbar paralysis may experience dysphagia, articulation disorders, speech impediments, choking when drinking water, and foamy sputum [9]. Dysfunction of the pharynx and cricopharyngeal muscle is particularly common. These muscles are responsible for pushing food down during normal swallowing and preventing food from entering the trachea. Hoarseness is related to poor coordination of pharyngeal and glottic movements, and this symptom is often the result of the cricopharyngeal muscle not being able to close properly. Patients often show food residue in the mouth or pharynx, especially when chewing and swallowing solid foods. This retention can increase fatigue during eating and require multiple attempts to completely swallow the food. If the swallowing reflex is severely impaired, it may be difficult to successfully complete eating even after multiple swallows, and such patients are prone to malnutrition and dehydration.

3.3. Commonly used assessment tools for dysphagia caused by true bulbar paralysis after stroke

Commonly used assessment tools for dysphagia play a crucial role in diagnosing and monitoring patients' swallowing function. The Water Swallow Test (WST) involves having the patient drink a specific volume of water in a short period and observing their swallowing process to determine the severity of dysphagia. The test focuses on whether the patient experiences choking, a sensation of throat blockage, and the smoothness of drinking water. The results are categorized into multiple levels to clarify the severity of swallowing difficulties.

The Videofluoroscopic Swallowing Study (VFSS) uses X-rays to record dynamic changes in the patient's swallowing process in real-time, particularly evaluating the openness of the cricopharyngeal muscle and food residue in the pharyngeal cavity. The examination covers the oral, pharyngeal, and esophageal phases, with key observation indicators including food retention in the valleculae and pyriform sinuses, initiation time and duration of the pharyngeal phase, presence and degree of leakage or aspiration, and laryngeal elevation.

The Gugging Swallowing Screen (GUSS) is used to classify patients' swallowing difficulties. Based on the assessment results, clinicians can develop tailored swallowing function rehabilitation programs for patients to promote their functional recovery.

The Standard Swallowing Function Rating Scale (SSA) is also widely used in the evaluation of dysphagia. It comprehensively assesses patients' performance during the oral, pharyngeal, and esophageal phases, including food propulsion, initiation of the swallowing reflex, and aspiration.

4. Mechanism and efficacy analysis of electroacupuncture at swallowing points for dysphagia caused by true bulbar paralysis

4.1. Swallowing points and their meridian localization and action principles

The setting of swallowing points mainly focuses on improving the function of the glossopharyngeal and vagus nerves, which are directly involved in controlling swallowing muscles and reflexes. Swallowing point 1 is located where the internal branch of the superior laryngeal nerve is distributed. Acupuncture at this point penetrates the skin, subcutaneous tissue, platysma, omohyoid muscle, and posterior margin of the thyrohyoid muscle, reaching the middle constrictor muscle of the pharynx. By penetrating these layers, acupuncture at this point stimulates the muscles responsible for swallowing, improving swallowing coordination. Swallowing point 2 is located anterior to the 3rd cervical vertebra. When acupunctured, it passes through the parotid gland and reaches the superior constrictor muscle of the pharynx. The role of this acupoint is to enhance the sensitivity of the glossopharyngeal reflex and restore nerve conduction ability by improving blood circulation.

4.2. Mechanism of action and clinical efficacy of electroacupuncture stimulation at swallowing points for dysphagia caused by true bulbar paralysis

The mechanism of electroacupuncture stimulation at swallowing points in the treatment of dysphagia caused by true bulbar paralysis is deeply rooted in the combination of traditional Chinese medicine meridian theory and modern neurophysiology. By precisely stimulating the swallowing points, electroacupuncture can promote the excitability of the glossopharyngeal and vagus nerves. These two nerve pathways are key control components of the swallowing reflex, involving coordinated movements of the soft palate, pharynx, and tongue muscles.

For example, Liu *et al.* implemented rehabilitation therapy for patients with post-stroke dysphagia in their

study, combining acupressure at three pharyngeal points with feeding-swallowing training for intervention [10]. During the treatment process, acupuncture at swallowing points was used to activate the glossopharyngeal nerve and hypoglossal nerve, aiming to restore the function of motor neurons. This method gradually restores the ability to control the glossopharyngeal muscle, parotid gland, and other nerves by transmitting repeated positive stimulation signals to the damaged bilateral corticobulbar tracts, thereby promoting tongue muscle activity, pharyngeal reflex repair, and enhancing the mobility of the laryngeal complex.

Both swallowing point 1 and swallowing point 2 are located on important nerve nodes. The weak pulses of electroacupuncture directly affect the glossopharyngeal and vagus nerve nuclei and their fibers through these two acupoints, enabling the gradual reconstruction of neural networks damaged by stroke. Clinical studies have shown that through persistent electroacupuncture stimulation, nerve conduction function is restored, and suppressed brain cells are reactivated, leading to gradual improvement in swallowing function and a reduction in the frequency of aspiration and choking. Besides improving nerve function, electroacupuncture also significantly enhances local blood circulation. Through electrical stimulation, it can promote blood flow in the pharyngeal and soft palate regions, accelerating tissue repair.

5. Conclusion

Dysphagia caused by true bulbar paralysis after stroke is a severe neurological injury that significantly affects patients' eating ability and quality of life and predisposes them to complications such as aspiration pneumonia and malnutrition. Addressing this complex issue, electroacupuncture at swallowing points therapy has demonstrated promising clinical efficacy as a rehabilitation method, leveraging its unique advantages in promoting nerve repair and improving pharyngeal muscle coordination. Future research can further explore the synergistic mechanisms of different treatment approaches and develop more standardized treatment protocols to provide patients with more precise and effective therapies.

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