

Clinical Research Progress on Acupuncture Treatment for Post-stroke Swallowing Disorders

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Abstract: *Post-stroke dysphagia is a common complication of stroke, with a high incidence rate, and can easily lead to aspiration pneumonia, malnutrition, and other adverse outcomes, seriously affecting patients' quality of life. Modern rehabilitation methods have limited efficacy and poor patient compliance. As a distinctive TCM therapy, acupuncture is widely used in rehabilitation due to its safety and fewer adverse reactions. This article reviews recent clinical research on acupuncture for post-stroke swallowing disorder, summarizes TCM's understanding of the disease names, causes, and pathogenesis of post-stroke dysphagia, and summarizes the clinical application and research evidence of conventional acupuncture (body needle, scalp needle, eye needle, neck needle, throat needle, auricular needle, abdominal needle) and specialized acupuncture techniques (revitalizing the brain and opening orifices, passing the pass, regulating the orifices, regulating the mind and regulating the throat, and stimulating the throat). Current clinical studies confirm that various acupuncture therapies can improve swallowing function by regulating meridian qi and blood, promoting nerve repair, and reconstructing the swallowing reflex arc, with combined interventions often yielding better results. It is also pointed out that current research still needs to further explore the mechanisms of action, aiming to provide reference for clinical rehabilitation of post-stroke swallowing disorders and fully leverage the advantages of TCM treatment.*

Keywords: Stroke, Post-stroke swallowing disorders, Acupuncture, Acupuncture therapy, Rehabilitation.

1. Introduction

Stroke, also known as cerebral apoplexy, includes ischemic stroke and hemorrhagic stroke. It is an acute cerebrovascular disease characterized by brain tissue damage caused by cerebral blood supply disturbance, which further leads to severe neurological deficits [1]. Stroke is accompanied by numerous complications, among which post-stroke dysphagia (DAS) has an incidence of 51%-73% among stroke patients [2]. Patients with DAS suffer from dysphagia and choking during eating, which may induce aspiration pneumonia and malnutrition, causing considerable physical and mental sufferings to patients [3-4]. At present, non-pharmacological therapies constitute the main clinical treatments for DAS, including compensatory therapies (adjustment of eating utensils and postures, modification of food properties), swallowing function training (oral sensory training, swallowing muscle training), physical therapies (cold, heat, electrical and magnetic stimulation), and alternative therapies (acupuncture, transcranial magnetic stimulation, psychotherapy, balloon dilation) [5]. In recent years, numerous emerging therapies targeting swallowing disorders in stroke survivors have emerged, such as repetitive transcranial magnetic stimulation, transcranial direct-current stimulation, percutaneous and intralaryngeal electrical stimulation, as well as non-invasive brain-stimulation strategies. Nevertheless, these interventions have been reported to produce only transient and relatively limited therapeutic effects [6]. Moreover, the treatment process is painful, which tends to result in poor patient compliance and compromise therapeutic outcomes. As a well-recognized alternative therapy, acupuncture has been widely promoted. Acupuncture, a distinctive traditional Chinese medicine (TCM) therapy, can dredge meridians and collaterals and improve qi-blood circulation. Its advantages of safety, high efficacy and few side-effects have been verified in clinical practice. This paper reviews and summarizes recent clinical

studies on acupuncture for DAS, so as to provide references for rehabilitation treatment of DAS.

2. Understanding of DAS in Traditional Chinese Medicine

There is no disease denomination of "dysphagia" in TCM. It is generally categorized under the syndromes of "throat obstruction" and "aphasia-apoplexy", whose etiology and pathogenesis are closely associated with pathological factors including wind, fire, phlegm, blood stasis and deficiency. The root cause lies in blocked brain orifices and disordered qi movement of the throat. Lingshu · Hai Lun (Spiritual Pivot · Treatise on the Seas) states: "The brain is the sea of marrow... insufficiency of the marrow sea leads to vertigo and tinnitus, soreness of shanks, dizziness and blurred vision, impaired vision, lassitude and desire to lie down." After stroke, obstruction of brain collaterals or disorder of qi-blood movement gives rise to dysfunction of "the mansion of primordial spirit", resulting in loss of higher-central regulation over swallowing movements and consequently dysphagia and choking. In addition, stroke induces qi-blood stagnation in meridians and collaterals. The throat serves as the convergence and crucial passage of meridians. Lingshu · Jingmai (Spiritual Pivot · Treatise on Meridians) records: "The Stomach Meridian of Foot-Yangming... runs along the throat and enters the supraclavicular fossa", "The Kidney Meridian of Foot-Shaoyin... runs along the throat and flanks the root of the tongue". According to Huangdi Neijing (Huangdi's Internal Classic), all the twelve regular meridians except the Bladder Meridian pass through the throat. Among the extraordinary meridians, the Conception Vessel and Governor Vessel are most closely connected with the throat. Therefore, obstruction of qi-blood in meridians and collaterals deprives the throat of nourishment and brings on dysphagia. Modern TCM physicians hold divergent views on the etiology and pathogenesis of post-stroke dysphagia. Academician Shi

Xuemin regards post-stroke dysphagia as a disorder of “orifices”, which is closely linked with “spirit”. Its pathogenesis is that pathogenic wind, fire, phlegm and blood stasis cloud the brain orifices, so that spirit cannot govern qi and the orifices become obstructed [7]. Professor Cheng Hongliang believes that the lesion site of post-stroke dysphagia resides in the brain and is closely related to the mouth and pharynx. Its pathogenesis consists of “dysfunction of the brain mansion and disorder of mental activities”, manifested as kidney-essence deficiency, disharmony of qi and blood, blocked orifices and impaired spirit, unsmooth meridian qi, together with obstructed qi-blood circulation in the pharynx as well as phlegm coagulation, qi stagnation and blood stasis in the pharyngeal region [8]. Zhang Yanwei et al. [9] propose that post-stroke dysphagia is fundamentally caused by liver-kidney deficiency and insufficiency of qi and blood, which leads to phlegm turbidity retention and collateral blood stasis, hence dysfunction of pharyngeal opening and closing.

3. Acupuncture Treatment for DAS

3.1 Conventional Acupuncture Therapy

3.1.1 Body Acupuncture

Body acupuncture refers to the traditional acupoint system of the fourteen meridians. As an important therapy for post-stroke dysphagia, it regulates meridians and collaterals, improves local muscle function and promotes nerve repair by stimulating specific acupoints. Zhai Chunmiao et al. [10] administered acupuncture therapy to the observation group on the basis of swallowing function training adopted in the control group. The observation group obtained superior Standardized Swallowing Assessment (SSA) scores, and both groups showed better Swallowing-Related Quality-of-Life (SWAL-QOL) scores than the control group, indicating significantly restored swallowing function and markedly improved quality of life in patients of the observation group.

3.1.2 Scalp Acupuncture

Scalp acupuncture represents a novel acupuncture modality for DAS. Scalp acupoints possess the effects of uplifting yang qi and regulating qi-blood of zang-fu organs throughout the body. Accordingly, acupuncture at specific scalp acupoints or scalp regions can reinforce healthy qi and eliminate pathogenic factors, dredge meridians and collaterals, and harmonize yin and yang [11]. Most researchers maintain that the therapeutic effect of scalp acupuncture at specific scalp regions for post-stroke dysphagia is based on the theory of cerebral cortical functional localization [12]. The lower 2/5 segment of the anterior parietotemporal oblique line corresponds to the functional projection areas of the face and throat in the brain, and exerts favorable therapeutic effects on symptoms such as salivation and dysarthria [13]. The lower 2/5 segment of the posterior parietotemporal oblique line also corresponds to pharyngeal sensation. Scalp acupuncture mainly promotes orifice-unblocking, collateral-dredging and blood-activating effects by stimulating specific acupoints so as to ameliorate dysphagia. Ling Shuiqiao et al. [14] hold that scalp acupuncture stimulation of the cerebral cortex can

significantly improve blood circulation, shorten cerebral tissue blood retention time, reduce mean transit time (MTT), and ameliorate swallowing function in DAS patients. Cao Xue et al. [15] find that the “three scalp-acupuncture zones” correspond to the superficial projections of cerebral cortical motor-sensory areas governing the mouth, tongue and pharynx. Acupuncture-induced activation of these regions is equivalent to stimulating relevant nerve centers, which enhances neuroplasticity of swallowing nerves, strengthens regulation over glossopharyngeal muscles and facilitates recovery of swallowing function.

3.1.3 Eye Acupuncture

Eye acupuncture [16] is a novel micro-acupuncture therapy summarized and put forward by Professor Peng Jingshan from Liaoning University of Traditional Chinese Medicine. According to Suwen · Wuzang Shengcheng Pian (Plain Questions · Manifestations of the Five Zang-Organ), many of the twelve regular meridians and extraordinary meridians course through the eye. Stimulation of ocular meridians can regulate yin-yang and qi-blood of zang-fu organs and thereby improve swallowing function in DAS patients. Researches have verified [17] that eye acupuncture exerts therapeutic effects on dysphagia mainly by dredging meridians and collaterals, activating blood circulation to dissipate blood stasis, improving hemorheological properties after stroke, opening collateral microcirculation, and accelerating the repair of vascular-nerve injuries.

Wang Pengqin et al. [18] discover that eye acupuncture can decrease serum C-reactive protein levels in patients with ischemic stroke; it can also reduce plasma fibrinogen (FIB) levels in acute-phase cerebral infarction patients, mitigate acute-phase reactions triggered by tissue necrosis in infarcted foci, elevate anti-oxidative capacity of the organism, and promote recovery of neurological deficits in cerebral infarction patients [19].

3.1.4 Nape Acupuncture

Nape acupuncture mainly adopts acupoints below the occipital bone and beside cervical vertebrae. Blood supply to the neck influences cerebral cortical function. Nape acupuncture indirectly improves swallowing function by regulating vertebrobasilar arterial blood supply and relieving cervical muscular tension. Wang Yanhua et al. [20] conducted a study on 60 patients with post-stroke dysphagia. The control group received body acupuncture, while the treatment group was given nape acupuncture on the basis of conventional therapy. Results showed that the total effective rate of the treatment group was 93.33%, higher than 86.67% of the control group.

3.1.5 Pharyngoglossal Acupuncture

DAS is pathologically located in the tongue and pharynx. Acupuncture at these regions can unblock the throat, dredge qi-blood in pharyngoglossal meridians and collaterals, and relieve swallowing dysfunction in DAS patients, embodying the acupuncture acupoint-selection principle that “where the acupoint locates, where it treats”.

1) Pharyngeal Acupuncture

Literature review reveals that pharyngeal acupuncture mainly centers on Lianquan (CV23). Zhenjiu Zisheng Jing (Acupuncture-moxibustion Lifesaving Classic) records: "Lianquan treats sublingual swelling with aphasia, flaccid tongue, urgent retraction of tongue root and difficulty in swallowing food." Therefore, acupuncture at Lianquan (CV23) facilitates qi movement of glossopharyngeal meridians, unblocks the throat, stimulates parasympathetic nerves and superior laryngeal nerves, and alleviates dysphagia [21]. The Three Pharyngeal Acupoints consist of Lianquan (CV23), Zhiqiang and Tunyan. Cui Xunxian et al. [22] argue that acupuncture at Zhiqiang and Tunyan among the Three Pharyngeal Acupoints can stimulate branches of vagus nerve including recurrent laryngeal nerve and superior laryngeal nerve, promote functional repair of locally inactivated nerves, restore functions of medullary nerve nuclei via nerve conduction, ameliorate dysphagia and dysarthria, and facilitate reconstruction of swallowing movements. The Four Pharyngeal Acupoints refer to four intersection points formed by two vertical lines 2-cun lateral to the mid-pharyngeal line and two horizontal lines 1-cun above and below the highest point of thyroid cartilage. Gao Xuna et al. [23] clinically confirm that acupuncture at the Four Pharyngeal Acupoints yields markedly superior therapeutic effects over conventional acupuncture for pseudobulbar-paralysis-induced dysphagia after ischemic stroke. The Five Pharyngeal Acupoints include Zhiqiang, Tunyan, Fayin, Zhifanliu and Tiyan, which have proven clinically effective for DAS treatment. Chen Tao et al. [24] carried out a controlled trial, in which the observation group received Five Pharyngeal Acupoints therapy plus rehabilitation training. The observation group achieved greater improvement in swallowing-function-related indicators and higher total effective rate than the control group, demonstrating that combined Five Pharyngeal Acupoints and rehabilitation training produces better curative effects than rehabilitation training alone.

2) Tongue Three-Needle Therapy

Tongue acupuncture improves cerebral blood circulation and further promotes limb-function rehabilitation by unblocking pivot mechanisms, dredging meridians and collaterals, regulating qi-blood, modulating zang-fu organs, and refreshing the mind to open orifices. The "Jin's Three-Needle Therapy", pioneered by Professor Jin Rui from Guangzhou University of Chinese Medicine, follows the principle of "taking three main acupoints plus syndrome-differentiated supplementary acupoints". As an important component of Jin's Three-Needle Therapy, Tongue Three-Needle Therapy treats disorders based on acupoint indications, circulates meridian qi, clears heat and unblocks orifices, and achieves favorable therapeutic effects for post-stroke dysphagia [25].

Tongue Three-Needle Therapy consists of Shanglianquan and two acupoints 0.5-cun bilateral to it. Acupuncture at these acupoints effectively activates tongue meridian qi, dredges meridians and collaterals, and promotes swallowing-function recovery [26]. Situated between the hyoid bone and thyroid cartilage, this region is densely distributed with vagus nerve, recurrent laryngeal nerve and glossopharyngeal nerve [27].

Acupuncture at these acupoints stimulates motor nerve fibers, transmits impulse signals via neurons to the cerebral cortex or medullary swallowing center, excites the swallowing center, reconstructs the swallowing reflex arc and ameliorates swallowing function [28]. Improved swallowing function enables increased nutritional intake, which not only accelerates nutritional status recovery but also facilitates neuromuscular-function restoration, forming a virtuous cycle [29].

Xie Yaqing [30] holds that tongue acupuncture excites local lingual nerves, enhances afferent sensory impulses before swallowing and pharyngeal nerve responses, lowers the threshold for initiating swallowing movements, accelerates swallowing progression, heightens sensitivity of swallowing muscles, reduces muscular tension of swallowing-related muscles, restores swallowing reflex and relieves dysphagia. Yu Lan et al. [31] equally divided 62 DAS patients into control and observation groups. The control group received swallowing training, while the observation group was additionally administered Tongue Three-Needle Therapy. Both groups achieved symptom improvement after treatment.

3.1.6 Long-Needle Therapy

Long needles evolve from the "long needle" among the Nine Classical Needles. Characterized by considerable length, they can penetrate one or more acupoints and readily achieve qi arrival at the lesion site. Long-needle therapy effectively relieves clinical symptoms and improves quality of life in DAS patients [32]. Cheng Hongliang et al. [33] observed DAS patients treated with long-needle penetration at Tiantu (CV22) and Zusanli (ST36) through Sanyinjiao (SP6), plus filiform-needle acupuncture at Fengfu (GV16), Yifeng (SJ17), Lianquan (CV23) and Renying (ST9). This regimen effectively improved swallowing function and reduced adverse events. Li Jing et al. [34] found that curved long-needle acupuncture at Tiantu (CV22) yielded better improvement in dysphagia than rehabilitation training alone for post-stroke dysphagia.

3.1.7 Auricular Acupuncture

As an important branch of acupuncture, auricular acupuncture modulates central nervous-system functions by stimulating specific auricular reflex zones and exerts certain adjuvant therapeutic effects on post-stroke dysphagia. Guo Shanshan et al. [35] randomly divided 67 patients into treatment group (33 cases) and control group (34 cases). Both groups received routine western-medicine internal medical treatment and swallowing-function training. The control group received acupuncture therapy, whereas the treatment group received auricular acupuncture plus blood-letting therapy. The total effective rate reached 87.8% in the treatment group versus 73.5% in the control group, showing statistically significant inter-group difference ($P < 0.05$). Both groups obtained improved Kubota water-drinking test scores after treatment ($P < 0.05$).

3.1.8 Abdominal Acupuncture

Proposed by Professor Bo Zhiyun, abdominal acupuncture centers on the abdomen to regulate qi-blood and yin-yang of

zang-fu organs for diverse disease treatments. Bo Zhiyun [36] puts forward that there exists a high-level regulatory system in the human abdomen. This system can modulate abdominal qi-blood, balance zang-fu organs and meridians and collaterals, eventually improve cerebral function and cognitive capacity, which is known as Bo's Abdominal Acupuncture Therapy. Initiated from zang-fu-organ regulation, Bo's Abdominal Acupuncture Therapy has been applied to cardiovascular-cerebrovascular diseases, endocrine disorders and other illnesses [37]. Lv Kaiyue et al. [38] randomly divided 60 DAS patients into control and observation groups. On the basis of conventional symptomatic treatment and transcutaneous electrical acupoint stimulation for the control group, the observation group received additional abdominal acupuncture. After treatment, the observation group achieved superior Kubota water-drinking test grades, elevated SWAL-QOL scores and decreased Videofluoroscopic Dysphagia Scale (VDS) scores compared with the control group, confirming the efficacy of abdominal acupuncture.

3.2 Special Acupuncture Therapies

3.2.1 Mind-Refreshing and Orifice-Unblocking Acupuncture Therapy

Initiated by Professor Shi Xuemin, mind-refreshing and orifice-unblocking acupuncture therapy targets stroke and its sequelae. The pathogenesis of stroke is summarized as obstructed brain orifices and dysfunction of spirit. This therapy refreshes the mind, unblocks orifices, regulates spirit and relieves depression. Researches demonstrate that it elevates carotid and vertebral artery blood flow, increases cerebral blood perfusion, restores cerebral tissue's innervation over pharyngeal muscles and nerves, and further improves or recovers patients' swallowing function [39].

Li Hongrui et al. [40] treated 64 post-stroke dysphagia patients with combined mind-refreshing and orifice-unblocking acupuncture plus neuromuscular electrical stimulation. The observation group obtained better scores in all indicators, suggesting superior combined therapeutic efficacy. Lu Lanxiang et al. [41] adopted mind-refreshing and orifice-unblocking acupuncture combined with Vocastim swallowing therapeutic apparatus for post-stroke dysphagia patients. All therapeutic-evaluation indicators were better in the observation group than in the control group, indicating more favorable swallowing-function recovery in the observation group. Hao Youzhi et al. [42] observed the clinical efficacy of mind-refreshing and orifice-unblocking acupuncture combined with collateral blood-letting for post-stroke dysphagia. Combined therapy generated more significant swallowing-function improvement and higher clinical effective rate than blood-letting alone.

3.2.2 Orifice-Unblocking and Throat-Benefiting Acupuncture Therapy

Professor Shi Xuemin summarizes the pathogenesis of DAS as "orifice blockage, spirit concealment, spirit failing to govern qi and obstructed key orifices", and proposes orifice-unblocking and throat-benefiting acupuncture therapy guided by the principles of refreshing the mind, regulating

spirit, unblocking passes and benefiting orifices. Developed on the basis of mind-refreshing and orifice-unblocking acupuncture therapy, this specialized therapy for post-stroke dysphagia selects main acupoints including bilateral Neiguan (PC6), Renzhong (GV26), contralateral Sanyinjiao (SP6), bilateral Fengchi (GB20), bilateral Wanggu (GB12), bilateral Yifeng (SJ17), plus pharyngeal-posterior-wall pricking [43]. Shang Kai et al. [44] randomly divided DAS patients into two groups. The intervention group received additional orifice-unblocking and throat-benefiting acupuncture therapy on top of control-group interventions. Kubota water-drinking test grades declined in both groups after treatment, with lower grades in the intervention group (all $P < 0.05$). No statistically significant inter-group difference was found in Videofluoroscopic Swallow Study (VFSS) scores before treatment ($P > 0.05$); after treatment, VFSS scores were higher in the intervention group ($P < 0.05$). The clinical effective rate was higher in the intervention group ($P < 0.05$). Pre-treatment aspiration-risk grades showed no inter-group statistical differences (all $P > 0.05$); post-treatment aspiration-risk grades decreased in both groups, with lower grades in the intervention group (all $P < 0.05$). These findings verify the efficacy of orifice-unblocking and throat-benefiting acupuncture therapy for DAS.

3.2.3 Governor-Vessel-Dredging and Spirit-Regulating Acupuncture Therapy

Created by nationally renowned TCM expert Professor Zhang Daozong, governor-vessel-dredging and spirit-regulating acupuncture therapy centers on the spirit-brain-heart-kidney-Governor-Vessel axis theory. In the TCM meridian-collateral system, all body meridians communicate directly or indirectly with the Governor Vessel. Regulating qi-blood of the Governor Vessel treats multiple disorders, and clinical practices have confirmed its definite curative effects on cerebrovascular diseases and their complications. Guided by the theories of "dredging the Governor Vessel, tonifying qi and rehabilitation", this therapy mainly selects Governor-Vessel acupoints to dredge the Governor Vessel and regulate primordial spirit, and has achieved sound clinical maturity. Clinical researches reveal that it excites the cerebral cortex, stimulates cerebral brain-derived neurotrophic factor (BDNF) secretion, markedly elevates neurotrophic-factor levels, promotes neuronal and neurological-function repair, and thus ameliorates swallowing function [45].

Hao Jiahuan [46] divided patients into two groups. The control group received swallowing training, whereas the observation group adopted combined governor-vessel-dredging and spirit-regulating acupuncture therapy. After treatment, both groups achieved improved swallowing-function scores (SSA, VFSS), neurotrophic-factor levels (BDNF, nerve growth factor [NGF]) and quality-of-life scores (SWAL-QOL). The observation group obtained superior outcomes compared with the control group, validating the efficacy of governor-vessel-dredging and spirit-regulating acupuncture therapy for DAS.

3.2.4 Spirit-Regulating and Throat-Relieving Acupuncture Therapy

Cai Yan [47] divided DAS patients into two groups in clinical

practice, and administered spirit-regulating and throat-relieving acupuncture therapy to the observation group. The clinical effective rate of the observation group reached 93.02%, basically consistent with the reported 95.0% clinical effective rate of spirit-regulating and throat-relieving acupuncture therapy for post-stroke dysphagia [48].

4. Summary

Acupuncture for dysphagia stimulates meridians and acupoints of the human body, enhances cerebral-cell functions, facilitates establishment and rehabilitation of swallowing reflex arcs, restores pharyngeal nerve innervation and coordinates swallowing movements. It represents a commonly-used and markedly-effective therapeutic modality. In terms of neuroregulation, acupuncture activates nerve reflex arcs, accelerates secretion of nerve-repair factors, and favors swallowing-reflex-arc reconstruction and nerve repair [49]. This paper systematically sorts out major acupuncture therapies for post-stroke dysphagia: conventional acupuncture modalities including body acupuncture, scalp acupuncture, eye acupuncture and nape acupuncture; special acupuncture therapies such as mind-refreshing and orifice-unblocking acupuncture, orifice-unblocking and throat-benefiting acupuncture, and governor-vessel-dredging and spirit-regulating acupuncture. Abundant clinical practices have verified their prominent curative effects on DAS. Clinical evidence indicates that combined application of multiple acupuncture modalities (e.g., scalp acupuncture combined with nape acupuncture) often generates better therapeutic outcomes. In future researches, we should further expand the application scope of acupuncture in stroke-sequelae treatment, deeply explore its action mechanisms, develop more optimized clinical treatment protocols, give full play to characteristic advantages of traditional medicine, and effectively mitigate adverse impacts of sequelae such as dysphagia on patients' quality of life.

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