A meta-analysis of the effect of nape acupuncture combined with rehabilitation training in the treatment of dysphagia after stroke

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Abstract

Background: To systematically evaluate the general efficacy of nape acupuncture combined with rehabilitation training for the treatment of post-stroke dysphagia and in the recovery of swallowing function.

Methods: Three English databases (PubMed, Excerpta Medica Database, Cochrane Library) and three Chinese databases (China National Knowledge Infrastructure, Wanfang Data, CQVIP) were searched using the date range January 1, 2001–January 1, 2022. Study Selection: Randomized controlled trials (RCT) of nape acupuncture combined with rehabilitation for the treatment of dysphagia after stroke with appropriate evaluation methods were included in the study.

Results: The results indicated that nape acupuncture combined with rehabilitation training led to higher clinical effectiveness (odds ratio (OR) = 4.25 and 95% confidence interval (CI) = [2.94, 6.15]), higher videofluoroscopic swallowing study scores (VFSS) (weighted mean difference (WMD) = 1.33; 95% CI = [1.09, 1.58]), and lower Standardized Swallowing Assessment (SSA) scores (WMD = −2.57, 95% CI = [−3.51, −1.62]) in patients with post-stroke dysphagia compared with rehabilitation training alone.

Conclusions: This Meta-analysis suggested that nape acupuncture combined with rehabilitation training is more effective in the treatment of dysphagia after stroke than rehabilitation alone.

Abbreviations: CI = confidence interval, FEES = flexible endoscopic examination of swallowing, OR = odds ratio, RCT = randomized controlled trials, SSA = standardized swallowing assessment, VFSS = videofluoroscopic swallowing study scores, WMD = weighted mean difference.

Keywords: acupuncture, deglutition disorders, meta-analysis, rehabilitation, stroke

1. Introduction

The occurrence of motor, sensory, swallowing, and cognitive dysfunctions after stroke seriously affects the ability of patients to perform daily life activities and hinders their social reintegration.[1] It has been reported that 27% to 85% of stroke patients develop dysphagia, which makes them prone to suffocate and aspiration during food intake and aspiration pneumonia and may result in malnutrition and reduced appetite.[2–6] Nape acupuncture, a special acupuncture method that involves inserting needles into acupoints on the nape of the neck to treat head and neck diseases,[7] is often combined with rehabilitation training in clinical practice to treat dysphagia,[8] and the effectiveness and safety of acupuncture have also been confirmed in clinical trials.[9] The combination of acupuncture and rehabilitation provides a novel strategy for the clinical rehabilitation of stroke. In addition, some recent meta-analysis also provide a basis for acupuncture treatment of dysphagia after stroke.[10]

However, for the currently published studies, the evidence for acupuncture treatment of post-stroke dysphagia is not very complete. Nape acupuncture is a kind of acupuncture method with acupuncture point located on the neck, and it is currently widely used in the clinical treatment of dysphagia after stroke and has achieved good results.[11] Whereas, there is no high-quality evidence for nape acupuncture treatment of swallowing dysfunction after stroke. In this study, we performed a systematic evaluation and meta-analysis of randomized controlled trials...
performed literature screening, data extraction, and quality evaluation. The results were cross-checked between the evaluators. Disagreements were resolved through discussion and joint decision-making by the evaluators after an in-depth perusal of the full text or with the assistance of a third evaluator, when necessary. The data extracted from the literature included author names, publication dates, experimental design, sample information, treatment processes and methods, and outcome indicators.

2. Methods

2.1. Design

The work was reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines. The review was registered in the International Prospective Register of Systematic Reviews (PROSPERO) under registration number CRD42021230472.

2.2. Inclusion criteria

Our inclusion criteria were as follows: the study participants had post-stroke, diagnosed in accordance with relevant guidelines and supported by computed tomography or magnetic resonance imaging findings, with no restrictions on stroke duration, lesion location, and lesion type; the treatment method was nape acupuncture combined with rehabilitation training (namely, the experimental group) or rehabilitation training only (namely, the control group); the main acupoints used in nape acupuncture were limited to acupoints on the front and nape of the neck, whereas no restrictions were placed on the methods of rehabilitation training, timing and duration of treatment, and degree of dysphagia; for outcome indicators, the following had to be included in the assessment of treatment outcomes: “gold standard” assessments of VFSS or flexible endoscopic examination of swallowing (FEES) and the SSA; the study design was an RCT of nape acupuncture combined with rehabilitation training for the treatment of post-stroke dysphagia or bulbar/pseudobulbar palsy, with at least 30 participants in each group.

2.3. Exclusion criteria

Our exclusion criteria were as follows: nonclinical RCTs; studies investigating dysphagia not caused by stroke; studies involving non-nape acupuncture therapy; studies that also investigated the use of drugs and other forms of treatment; studies with experimental designs and outcome indicators that did not satisfy the inclusion criteria; studies with unclear treatment methods and procedures; studies that had unclear or non-extractable data.

2.4. Search strategies

By adopting the Population, Intervention, Comparison, Outcomes, and Study Design methodology, subject terms and free-text terms were searched on 6 databases: PubMed, Excerpta Medica Database, Cochrane Library, China National Knowledge Infrastructure, Wanfang Data, and Chongqing VIP database. Studies from January 1, 2001 to January 1, 2022, were searched, and no restrictions were placed on language. To avoid the omission of relevant literature, “RCT” and “randomized” were not used as limiters and the computer searches were supplemented by manual searches (Table 1).

2.5. Literature screening and data extraction

All retrieved literature was first subjected to duplicate removal using the reference management software EndNote X9 (Clarivate Analytics). Two evaluators thereafter independently

| Search | Search strategy |
|--------|----------------|
| #1     | “Stroke” [MeSH] |
| #2     | “Stroke” OR “Brain Infarction” OR “Cerebrovascular Accident” OR “Brain Ischemia” |
| #3     | #1 OR #2 |
| #4     | “Deglutition Disorders” [MeSH] |
| #5     | “Swallowing Disorder” OR “Pseudobulbar Palsy” OR “Bulbar Paralysis” OR “Dysphagia” |
| #6     | #4 OR #5 |
| #7     | “Neck Acupuncture” OR “Nape Acupuncture” OR “Neck Needle” OR “Nape Needle” |
| #8     | “Rehabilitation” [MeSH] |
| #9     | “Rehabilitation” OR “Swallowing Training” OR “Swallowing Exercise” |
| #10    | #8 OR #9 |
| #11    | #3 AND #6 AND #7 AND #10 |

MeSH = medical subject headings.
3. Results

3.1. Literature screening results

In total, 309 articles were retrieved from the literature search. After removing duplicates, 246 articles remained (227 articles in Chinese and 19 articles in English) and after primary screening by reading the titles and abstracts, 35 articles (31 articles in Chinese and 4 articles in English) remained. After a secondary screening, during which the full text of the articles was read, 11 articles (10 articles in Chinese and 1 article in English) that fulfilled the inclusion criteria were included in the study. All included articles were subjected to descriptive analysis. A meta-analysis was conducted on 11 articles. Figure 1 shows the details of the literature screening process.

3.2. Characteristics of the included literature

Eleven studies[12–22] were ultimately included in the meta-analysis, all of which were RCTs. The studies collectively included 1069 patients with 526 and 543 patients in the experimental and control groups, respectively. Interventions included nape acupuncture combined with rehabilitation training in the experimental group and rehabilitation alone in the control group. All included patients fulfilled the inclusion criteria and were comparable at baseline. The randomization method was not specified in 4 studies,[12,14,16,20] although the use of the random table number method was clearly stated in all articles. A meta-analysis was conducted on 11 articles. Figure 1 shows the details of the literature screening process.

3.3. Quality of the included studies

With the exception of the studies by Li et al[18] and Liu et al[22] (Jadad score = 4), all other studies were of low quality (Jadad score = 2–3). Selective reporting was not observed in any of the studies. Other biases in these studies were unknown. Biases were analyzed using RevMan 5.4. The detailed bias assessment results and percentages are shown in Figure 2.

3.4. Meta-analysis

The last treatment outcome was used as the assessment point for all studies. The FEES was used for outcome assessment in 1 study,[18] which made it incomparable; therefore, a meta-analysis was conducted on clinical effectiveness, VFSS, and SSA scores.

3.5. Clinical efficacy

Among the included studies, efficacy was assessed using clinical effectiveness in 9 studies, as follows: VFSS was used in 1 study,[13] a modified drinking test was used in 1 study,[21] and the Kubota drinking test was used in the remaining 7 studies.[14,17–20,22] In these studies, 417 and 420 participants were included in the experimental and control groups, respectively. Slight differences existed in the criteria for assessing outcome efficacy among the studies; therefore, all outcomes, except for ineffective outcomes (namely, cured, significantly effective, effective, and improved), were considered effective.

Figure 1. PRISMA flow chart. *Databases that were searched included PubMed (n = 10), Cochrane Library (n = 9), Embase (n = 1), CNKI (n = 102), Wanfang Data (n = 162), and Chongqing VIP database (n = 25). PRISMA = Preferred Reporting Items for Systematic Reviews and Meta-Analyses, RCT = randomized control trial.
When heterogeneity was assessed in the meta-analysis of the 11 articles, an \( P \) value of 0 was obtained, which indicated homogeneity among the various studies. Therefore, the fixed-effects model was used in the analysis. As shown in Figure 3, the experimental group treatment was significantly more effective than that of the control group (OR = 4.25, 95% CI = [2.94, 6.15], \( z = 7.66, P < .001 \)). This result did not change after excluding studies in which effectiveness was assessed using a VFSS and the modified drinking test (OR = 4.01, 95% CI = [2.53, 6.36], \( z = 5.91, P < .001 \)), which indicated that the clinical efficacy of nape acupuncture combined with rehabilitation training was better than that of rehabilitation alone for post-stroke dysphagia. On using Begg's test and Egger's test, the \( P \) values were 1.56 and 0.446, respectively, which were both > 0.05, indicating a low possibility of bias.

### 3.6. VFSS

VFSS scores were used in 4 studies\(^{[12,15,19,20]}\) to assess the treatment outcomes of 166 participants in each of the experimental and control groups. The random-effects model was used for the

### Table 2

Basic data of the included studies.

| Study     | Yr  | Experimental group | Control group | Treatment course | Interventional measure | Key outcome indicator * | Main acupoints | Rehabilitation method                                                                 | Jadad score |
|-----------|-----|--------------------|---------------|------------------|------------------------|------------------------|-----------------|-------------------------------------------------------------------------------------|-------------|
| Zhou et al\(^{[13]}\) | 2013 | 40                | 40            | Once daily, 6 times wkly for 4 wks | Nape acupuncture + rehabilitation/Rehabilitation | 1, 3, 4 | Fengchi (GB20), Yiming (EX-HN14), Gongoe, Zhiqiang | Cold stimulation, Mendelsohn maneuver, pushing exercise, vocal cord closure training, tongue muscle training | 3           |
| Chu et al\(^{[14]}\) | 2017 | 48                | 49            | Once daily, 5 times wkly for 8 wks | Nape acupuncture + rehabilitation/Rehabilitation | 3, 5, 7 | Fengchi (GB20), Yiming (EX-HN14), Gongoe, Zhiqiang | Mouth-lip training, breath-hold vocal training, vocal cord closure training, Mendelsohn maneuver, ice stimulation, tongue muscle training | 3           |
| Chen et al\(^{[15]}\) | 2018 | 50                | 50            | Once daily, 5 times wkly for 8 wks | Nape acupuncture + rehabilitation/Rehabilitation | 3, 4, 5 | Fengchi (GB20), Yiming (EX-HN14), Gongoe, Zhiqiang | Face-lip swallowing muscle training, breath holding, vocal cord closure, Mendelsohn maneuver, cold stimulation, tongue training | 3           |
| Liu et al\(^{[16]}\) | 2018 | 50                | 50            | Once daily, 5 times wkly for 8 wks | Nape acupuncture + rehabilitation/Rehabilitation | 3, 4, 5, 7 | Fengchi (GB20), Yiming (EX-HN14), Gongoe, Tunyan | Swallowing muscle training, breath-hold vocal training, Mendelsohn maneuver, ice stimulation, tongue muscle training, feeding training | 4           |
| Guo et al\(^{[17]}\) | 2019 | 50                | 50            | Once daily, 6 times wkly for 4 wks | Nape acupuncture + rehabilitation/Rehabilitation | 3, 4, 7, 8 | Yamen (GV15), Tianzhu (BL15), Zhiqiang, Fengfu (GV16) | Deep breathing exercises, lip-tongue muscle training, feeding training | 3           |
| Qin et al\(^{[18]}\) | 2019 | 50                | 50            | Once daily for 20 d | Nape acupuncture + rehabilitation/Rehabilitation | 1, 4 | Liangquan (CV23), Gongoe, Renying (ST9) | Cold stimulation, empty swallowing, gottol stop training, Mendelsohn maneuver, tongue muscle training, food intake training | 3           |
| Li et al\(^{[19]}\) | 2019 | 40                | 40            | Once daily, 6 times wkly for 4 wks | Nape acupuncture + rehabilitation/Rehabilitation | 2, 3, 4 | Fengchi (GB20), Yiming (EX-HN14), Gongoe, Zhiqiang | Oral sensory movement training, shaker maneuver, Masako maneuver, Mendelsohn maneuver | 4           |
| Wang et al\(^{[20]}\) | 2019 | 72                | 88            | Once daily, 6 times wkly for 8 wks | Electric nape acupuncture + rehabilitation/Rehabilitation | 3, 4 | Fengfu (GV16), Shuang Fengchi (GB20), Shuang Tianzhu (BL15), Shuang Yiming (EX-HN14) | Oral and facial movements, sensory training, feeding training, health education | 3           |
| Liu et al\(^{[21]}\) | 2019 | 50                | 50            | Once daily, 5 times wkly for 8 wks | Nape acupuncture + rehabilitation/Rehabilitation | 3, 5, 6, 7 | Shuang Fengchi (GB20), Yiming (EX-HN14), Gongoe, Tunyan | Face-lip swallowing muscle training, breath-hold vocal training, vocal cord closure training, Mendelsohn maneuver, cold stimulation, tongue muscle training, feeding training | 3           |
| Gao et al\(^{[22]}\) | 2020 | 30                | 30            | Once daily, 5 times wkly for 4 wks | Nape acupuncture + rehabilitation/Rehabilitation | 1, 3, 9 | Fengchi (GB20), Tianzhu (BL15), Wangu (GB12), bloodletting at Jinjin (EX-HN12) and Yuge (EX-HN13) | Breath-hold training, swallowing reflex facilitation technique, low-frequency neuromuscular electrical stimulation | 3           |
| Xu et al\(^{[23]}\) | 2020 | 46                | 46            | Once daily, 5 times wkly for 4 wks | Nape acupuncture + rehabilitation/Rehabilitation | 1, 3 | Tianzhu (BL15), Fengchi (GB20), Yiming (EX-HN14), Jiaji at the cervical segments | Mouth-lip training, ice stimulation, swallowing training, food intake training | 2           |

**Note:**

- FEES = flexible endoscopic examination of swallowing, SSA = standardized swallowing assessment, VFSS = videofluoroscopic swallowing study.
- *The numbers correspond to the outcome indicators as follows: 1 = VFSS, 2 = FEES, 3 = SSA, 4 = Kubota drinking test, 5 = repetitive swallowing test, 6 = modified drinking test, 7 = swallowing quality-of-life questionnaire, 8 = dysphagia severity scale, and 9 = geniohyoid muscle movement time and displacement.*
meta-analysis because $I^2$ was 54.0%, which indicated moderate heterogeneity. The analysis results (Fig. 4) showed that the VFSS scores were higher in the experimental group than in the control group, as well as the combined effect size among studies (WMD = 1.33, 95% CI = [1.09, 1.58], $z = 10.82$, $P < .001$); the difference was statistically significant. Therefore, patients treated with nape acupuncture combined with rehabilitation had better swallowing function than patients treated with rehabilitation alone. Bias testing was conducted using Egger’s tests owing to the inadequate number of included studies, and the $P$ values were .041. The Egger’s test results indicated a possibility of bias ($P < .05$). The conclusion remained unchanged after using the trim and fill method, which proved that the result was steady. One study[12] reported that both groups of patients underwent basic Western medical treatment, which suggested that heterogeneity may have arisen from the use of different basic treatment methods or rehabilitation training methods among the included studies.

### 3.7. SSA

Treatment outcomes were assessed using the SSA in 10 studies.[12–14,16–22] The study by Wang et al.[16] was not included in the analysis owing to inconsistency between the research outcome data and the conclusion. In these studies, 397 and 400 participants were included in the experimental and control groups, respectively. The random-effects model was used because $I^2$ was 82.9%, which indicated a high degree of heterogeneity. As shown in Figure 5, the analysis results control group, as well as the combined effect size among studies (WMD = −2.57, 95% CI = [−3.51, −1.62], $z = 5.33$, $P < .001$); the difference was statistically significant. This finding indicated that the SSA scores for post-stroke dysphagia patients treated with nape acupuncture combined with rehabilitation training were lower than those of patients treated with rehabilitation alone. Therefore, patients treated with nape acupuncture combined with rehabilitation training had better swallowing function and could achieve safer swallowing than patients treated with rehabilitation alone. On using Begg’s test and Egger’s test, the $P$ values were .175 and .259, respectively. Both values were > .05, which indicated a low possibility of bias.

Analysis of heterogeneity using the Galbraith plot revealed that the study by Guo et al[14] was the main cause of heterogeneity. The outcome scores in this study were obtained by taking the mean of 3 scores after treatment, which lowered the possibility of assessment errors to some extent, compared to other studies. In addition, the large number of assessment items in the

![Figure 2. Summary of the risk of bias of the included studies.](image)

![Figure 3. Forest plot for effectiveness. CI = confidence interval, OR = odds ratio.](image)
scale used in the study may have led to the nonstandard use of the scale. Sensitivity analysis revealed that the results remained unchanged after 9 studies were excluded.

3.8. Adverse events

Adverse events were reported only by Wang et al. These events included bleeding (13 cases, 18%), hematoma (9 cases, 12.5%), and needle pain (12 cases, 20%).

3.9. Strength of evidence

Based on the Grading of Recommendations Assessment, Development and Evaluation tool, the overall strength of evidence for each outcome was evaluated as low. On account of the particularity of clinical acupuncture, using the blind method is difficult, which presents some limitations. High heterogeneity also reduces the quality of evidence. In addition, with regard to VFSS outcomes, the possibility of bias and imprecision is a serious problem because of the small number of inclusion studies (Table 3).

4. Discussion

In the present studies, relevant RCTs were retrieved through database searches, and studies with higher research quality were screened. Outcome indicators were objectively assessed, and a meta-analysis was performed based on indicators such as clinical efficiency and VFSS scores. The results showed that nape acupuncture combined with rehabilitation training was superior to rehabilitation alone for functional recovery in patients with post-stroke dysphagia, which provides evidence of higher accuracy for clinical applications of this treatment approach. With the development of rehabilitation medicine in China, the combination of acupuncture and rehabilitation has become the main strategy for the clinical rehabilitation of post-stroke functional disorders. In recent years, researchers have devoted increasing attention to this field, which has led to a rapid increase in the number of relevant literature articles. Dysphagia affects the food intake function of patients and leads to nutritional disorders, which affects stroke rehabilitation and prognosis. Therefore, it is a focal topic in stroke rehabilitation.

The results of this study show that the effective rate of nape acupuncture combined with rehabilitation training to

### Figure 4.
Forest plot for VFSS scores. CI = confidence interval, SD = standard deviation, VFSS = videofluoroscopic swallowing study, WMD = weighted mean difference.

### Figure 5.
Forest plot for SSA scores. SD = standard deviation, SSA = standardized swallowing assessment, WMD = weighted mean difference.
treat dysphagia after stroke is higher than that of rehabilitation training alone, and it has been confirmed in various evaluations. The improvement of patients’ symptoms after nape acupuncture treatment is manifested in the relief of many swallowing disorders. This study included 11 RCTs, and the results were consistent with each included RCT, which affirmed the efficacy of acupuncture. However, after careful analysis of each RCT, they all have different degrees of deficiencies and bias the results. Therefore, they reduce the quality of the results. The reason for the bias is mainly speculated to be due to the differences between the included studies. For a start, it may be caused by the difference in rehabilitation training methods adopted by different institutes. Besides, in some studies, there is a lack of reports on the mechanism of allocation concealment and the criteria for dropout, so the possible impact cannot be estimated and ruled out. Furthermore, few studies exist on the combination of nape acupuncture with rehabilitation training in China and other countries, and high-quality multicenter studies with large sample sizes are lacking, resulting in low-quality evidence. The standardization of nape acupuncture manipulations and rehabilitation training programs and the reporting of RCT results, based on standardized norms,[13,24] are recommended for future studies. In addition, the Kubota drinking test was used in most studies[11,14,17–20,22] for assessing treatment outcomes. This test is essentially a screening method for dysphagia and has a high screening reliability and validity,[22] however, it is not superior to other methods for assessing swallowing function and clinical efficacy in patients. Therefore, for future studies, we recommend using assessment methods with high accuracy, using assessment scales with higher reliability and validity, and using gold standard methods (namely, VFSS and FEES) for assessing outcome indicators. Sample size estimation should also be conducted to ensure the inclusion of a sufficient number of samples to enhance research quality and evidence accuracy.

To sum up, we have reason to believe that acupuncture can play a positive role in the treatment of dysphagia after stroke, but the low-level evidence strength of certain indicators prevents us from asserting that its application can significantly improve the swallowing function of patients. The results of clinical trials are inseparable from the situation of acupuncturists, rehabilitation practitioners and patients, thus, more rigorous, multi-center, large-sample RCTs for further verification are needed.

5. Conclusions
This meta-analysis and systematic review suggested that nape acupuncture combined with rehabilitation training is more effective in the treatment of dysphagia after stroke than rehabilitation alone. However, we only have the strength of the medium and low quality to confirm this conclusion. In order to increase the strength, it is necessary to conduct multi-center and large-sample RTCs and update the research in time so that improve the strength of evidence.

6. Limitations
The limitations of the current study are as follows. First, this study focused solely on evaluating the efficacy of nape acupuncture combined with rehabilitation training. Therefore, other traditional Chinese medicine and combined Chinese–Western medicine treatment methods such as acupuncture, moxibustion, and Chinese herbal medicine were excluded, which resulted in an inability to provide an accurate representation of actual clinical practice. Second, the acupoints of nape acupuncture and rehabilitation training methods were not standardized, and we were unable to determine whether the acupoints had been accurately positioned and whether the rehabilitation maneuvers had been standardized. Third, different forms of rehabilitation training and therapists may have affected the study results. Fourth, with the exception of VFSS, all other combined intervals in this study were relatively wide and the quality of evidence was low, presumably caused by heterogeneity arising from the aforementioned reasons. Finally, reports of adverse effects were limited, although this finding may not be indicative of the true clinical situation, owing to the small number of included studies.

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