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*Original Article*

# The individualized rehabilitation interventions for dysphagia: a multidisciplinary case control study of acute stroke patients

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**Abstract:** Objective: To examine the effects of the individualized rehabilitation programs on the recovery of swallowing during acute stroke. Methods: A total of 88 stroke patients with dysphagia (within 2 weeks of acute stroke) were enrolled and classified into the experimental and control groups (n=44). The control group was treated with conventional rehabilitation program, while a multidisciplinary rehabilitation team was established to offer physical, social and psychological support to dysphagic patient in experimental group. All patients were assessed for their swallowing function by the water swallow test before and after the treatment. Results: After the treatment, the experimental group showed a significant improvement in the swallowing function than that of the control group ($p < 0.05$). Total effective rate improved significantly from 54.5% at control group to 88.6% at experimental group ($p < 0.01$), where 25 dysphagic patients were completely recovery after the individualized rehabilitation therapy. By contrast, only 12 patients were fully recovered from dysphagia when treatment with conventional rehabilitation training. Conclusion: The findings of present study showed evidence that the individualized rehabilitation interventions carried out by our multidisciplinary rehabilitation professionals provided effective therapeutic effects during the acute stroke dysphagia compared to the conventional rehabilitation interventions, which may shed light on a bright prospect of the individualized rehabilitation interventions in post-stroke dysphagic patients.

**Keywords:** Acute stroke, dysphagia, individualized interventions, neurologist, language therapist, psychologist, total effective rate

## Introduction

Current projections in the United States indicate that averagely one person experiences a stroke in every 40 seconds, and by 2030 there will be an additional 4 million people suffering from stroke due to the advancing age of the U.S. population, a 21.9% increase in prevalence from 2013 [1]. Stroke results in many complications, of which one of the most life-threatening may be dysfunctional swallowing or dysphagia. Dysphagia occurs frequently following stroke, and prevalence of dysphagia following stroke has been reported to range from 27% to 85% [2, 3].

Dysphagia may result in serious health consequences, some dysphagia patients would require long term feeding recovery [4, 5]. Complications of dysphagia include aspiration leading to pneumonia, malnutrition, inability to rehabilitate, prolonged length of stay in hospital, which significantly reduce patients' quality of life and even increase the risk of mortality [6, 7]. Prevention of these negative health outcomes requires early identification and treatment of dysphagia. Although it is known that swallowing may improve spontaneously within the acute phase for a subset of patients, it is critical that the patient be recognized and accept intervention as early as possible [8].

In the acute phase after stroke, when the stroke has ceased its evolution, early identification and intervention of dysphagia have been associated with reduced risk of aspiration pneumonia and improved cost effectiveness [9]. Therapies to improve swallowing were designed to accelerate recovery of swallowing function and reduce the risk of pneumonia. However, there were only a few therapy strategies or medications once dysphagia has developed. Early

rehabilitation therapies for these patients were, therefore, of major importance in preventing the progress of their symptoms. Although rehabilitation exercises were generally believed to be effective, there are few prospective randomized studies concerning this issue, and arguments may be made that patients could recover over time without rehabilitation. The aim of this multidisciplinary participant-centered case control study was to determine if individualized rehabilitation therapy could provide effective therapeutic effect over standard care for dysphagia in Chinese population.

## Materials and methods

### *Subjects*

This project was approved by an authorized human research review board at our institute. Patients included in this study were inpatients of our hospital from December 2011 to February 2013. Informed contents were obtained from all involved subjects. They were all suffered from primary acute stroke as diagnosed according to the criteria of the Chinese Medical Association in 1995 and the criteria amended in the fourth national cerebrovascular disease conference. Diagnoses were further confirmed by brain computerized tomography (CT) or magnetic resonance imaging (MRI). All the patients were definitely diagnosed as dysphagia with alertness, and ones with comprehension difficulty, such as Wernicke aphasia, that may affect training were excluded from this study. A total of 88 dysphagic patients within the first 2 weeks of acute stroke were recruited, of whom 56 were male and 32 were female. Twenty six patients (29.5%) suffered from cerebral hemorrhage and 62 patients (70.5%) suffered from cerebral infarction. Patients were randomly divided into the experimental group and control group, with 44 patients in each group.

### *Training preparation*

A multidisciplinary rehabilitation team, consisting of a neurologist, language therapist, psychologist, qualified primary nurse and two associate nurses, was established to offer physical, social and psychological support to dysphagia patient in experimental group. After admission to the hospital, all patients underwent systemic check-ups and specialized examinations of the nervous system performed by the neurologists. The neurologic deficits and consciousness were evaluated by National Institutes of Health Stroke Scale (NIHSS) and Glasgow Coma Scale (GCS) scores, and neuroimaging of stroke, location as well as outcomes were recorded in the process.

The psychologist was designed to communicate with patients and families, perform mental state assessment and provide counseling to ease their anxiety and depression so as to assist in increasing compliance with therapeutic regimens and rehabilitation. Language therapist was responsible for address issues related to eating training program, matters needing special attention and cooperation of the patient and family members during the process. The primary care was performed by the nursing staffs responsible for implementing non-oral and oral feeding recommended by the physician and oral hygiene. All efforts were made to provide a pleasant environment for patients. According to the World health organization recombination, the clinical rehabilitation training was performed 48 h following the stabilization of vital signs and neurological symptoms [10].

Each patient received the individualized rehabilitation training and the corresponding plan was developed according to his or her condition. Weekly team conferences evaluated the patient's status and timely adjustments in rehabilitation program were made in appropriate.

### *Rehabilitation training maneuvers and regimen*

Swallow training: In the experimental group, oropharyngeal exercises deriving from speech-language pathology and including soft palate, tongue, and facial muscle exercises as well as stomatognathic function exercises were performed as described previously [11]. Pharynx and Larynx Exercises were also carried out to strengthen the swallowing musculature according to the method described by Tang et al. [12]. These rehabilitation training exercises were performed 2 times per day, and each exercise was repeatedly practiced for about 30 minutes. Eating training: The attending physician or nurse determined the type of diet, eating position and times after evaluating each patient's eating difficulties. (1) Eating position: Patients

**Table 1.** Demographic data and clinical characteristics of dysphagic patients

| Group | n | Age | Duration | NIHSS | GCS | Dysphagia scale | |
|---|---|---|---|---|---|---|---|
| | male/female | years | days | | | severe | moderate |
| Rehabilitation | 44 (29/15) | 65.0±3.0 | 8.4±2.8 | 11.8±3.5 | 15.0±0.0 | 10 | 34 |
| control | 44 (27/17) | 67.0±2.0 | 7.1±2.6 | 10.0±2.9 | 15.0±0.0 | 11 | 33 |

$P > 0.05$.

**Table 2.** Results of efficacy evaluation in two groups of dysphagic patients

| Group | n | Cure | Valid | Invalid | Total effective rate (%) |
|---|---|---|---|---|---|
| Rehabilitation | 44 | 25 | 14 | 5 | 88.6* |
| control | 44 | 12 | 12 | 20 | 54.5 |

*$P < 0.01$ when compared with the control group.

that can only stay in bed were putted at contralateral positions, the eating position was facing upwards at an angle of 30° and with the neck bent forwards. The hemiplegic ipsilateral was boosted with a pillow for food transit and to avoid the food leakage from the oral cavity. For patients that can sit by themselves, they were at the upright seated positions with the body leaned toward the contralateral sides. After the meal, they were asked to sit up for about 15 min to prevent food reflux and aspiration. (2) Type of Diet: The type of food was managed by using modified diet consistencies according to each patient's clinical condition, ranging from liquid diet to regular diet. A jelly medium such as steamed egg custard was generally administered for patients with serious swallowing disorders. (3) Volume and rate of food delivery: Small amount of meals should be given at short time intervals. Patients were advised to chew carefully and swallow slowly, and their daily food intake was selected after evaluating each patient's dysphagia, ranging from 1/2 to 1 soup spoon (1~4 mL) at the rate of consumption 70% food within the 30 min. After each swallowing movement, they were suggested to repeat empty swallowing act for at least 8 times.

*Conventional rehabilitation training*

The control group patients were treated according to the traditional neurology or internal medicine practices, and were assisted to feed in accordance with their will.

*Functional assessment of dysphagia*

The water swallow test was used to assess each patient's swallow function and effect of rehabilitation as follows [13]: patients were asked to drink 30 ml tepid water. A score of 1 was given to patients who were able to drink the 30 ml water within 5 seconds at one time without coughing or pausing. A score of 2 was given to patients who could finish drinking at one time, but in more than 5 seconds; the patient needed to drink twice, but without coughing or a pause. A score of 3 was given to patients who were able to drink the water in one drink, but with choking. A score of 4 was given to patients who were able to finish drinking in two drinks with choking. Finally a score of 5 was given to patients who choked and could not drink the water. The effect of treatment was interpreted as being: (1) ineffective, when there was no significant improvement in dysphagia and water test score was higher than 3; (2) effective, when dysphagia was obviously improved and water test scored 2; (3) excellent when symptom of dysphagia was disappeared completely and these patients all scored 1 in the water test. The efficacy rate was the percentage of patients with excellent and effective effects.

*Statistic analysis*

Statistical analyses were performed with SPSS, version 17.0 (SPSS Inc., Chicago, IL, USA). The data between groups were compared with $\chi^2$ test, $P < 0.05$ was considered to be statistically significant.

## Results

*Participant demographics*

The demographic data and clinical characteristics of patients are given in **Table 1**. There was no significant difference in age, gender, course of disease and dysphagia scale between the two groups. In the experimental group, 24 dysphagic patients were male and 20 were female, the mean age was 65.0±3.0 years (range: 57-79 years), and the mean duration of dysphagia was 8.4±2.8 days (range: 2-13 days). Total NIHSS-score ranged from 4-14 with a mean

score of 11.8±3.5, and a higher score indicating more severe impairment. In the control group patients, there was an equal split of male and female, the mean age was 67.0±2.0 years (range: 58-81 years), and the mean duration of dysphagia was 7.1±2.6 days (range: 3-12 days). Their total NIHSS-score ranged from 4-12 with a mean score of 10.0±2.9 points. The GCS scores were 15 points in both the experimental group and control group

*Functional outcomes*

**Table 2** presents the results of efficacy evaluation in two groups of dysphagic patients. Significant improvements were demonstrated in experimental group. Total effective rate improved significantly from 54.5% in control group to 88.6% in experimental group ($p < 0.01$), where 25 dysphagic patients got complete recovery after the individualized rehabilitation therapy. By contrast, only 12 patients were fully recovered from dysphagia when treatment with conventional rehabilitation training.

## Discussion

Stroke is the leading neurologic cause of dysphagia, and is often complicated by problems with swallowing (dysphagia) and poor nutrition. Approximately 160,000 to 573,000 stroke patients were affected by dysphagia annually, representing 42% to 75% of all stroke patients [14]. Given these epidemiological data, it is not surprising that the evaluation and management of dysphagia in stroke patients is a major task for speech-language pathologists [15]. The emphasis on evidence-based practice fosters increasingly refined and accountable clinical practice. However, clinical challenges remained, and there were only a few treatment strategies or medications once dysphagia has developed. In this study, a multidisciplinary participant-centered rehabilitation program aimed at ameliorate the symptom of acute stroke dysphagia was tailored to each patients, and the intervention efficacy was comparatively studied using the conventional training program as a control.

Poststroke dysphagia is known to be best addressed through a systematic management plan [16], and the variety of related deficits requires a team for efficient management. The professional rehabilitation team was therefore established in this study to provide multidisciplinary specialist support according to each patient. The findings of the present study showed that the individualized rehabilitation program developed by our multidisciplinary rehabilitation team significantly improved the performance of dysphagic patients, and the intervention efficacy went up significantly from 54.5% in control group to 88.6% in experimental group.

The goals of swallow therapy are to help minimize the risk of aspiration and to optimize oral delivery of nutrition. Interventions for treating dysphagia often involve the modification of fluid and food consistencies, postural techniques, swallowing exercises, and stimulation of oral and pharyngeal structures [17]. Options for swallowing intervention in clinical practice can be divided into three categories: compensatory strategies, indirect rehabilitation strategies, and direct rehabilitation strategies [18].

Compensatory strategies helped eliminate symptoms but did not change the swallowing dysfunctions. Direct method was associated with the use of foods and achieves treatment through diet adjustments, and diverse posture changes, while indirect method was associated with the stimulation or behavioral swallowing techniques without the direct use of food [19]. In addition, there is growing evidence that the neural networks for swallowing were capable of experience-dependent neural plasticity that may be possible to induce through nonbehavioral and behavioral swallowing interventions [20, 21]. In this study, the patients in the experimental group were treated with the swallow training, with the psychologist responsible for easing their anxiety and depression so as to assist in increasing compliance with therapeutic regimens and rehabilitation. Meanwhile, eating training program was implemented individually to facilitate safe and effective swallow. The food viscosity, body position at meal, the volume and rate of food delivery were adjusted by language therapist and nursing staffs, according to the personal conditions of each patient, as recommended by McCullough, et al. [22].

The contribution of swallowing exercises in dysphagia patients has been historically questioned. Exercise involving the action of swallow has been suggested to be most effective training for patients with dysphagia [21], while evidence also showed that swallowing musculature may be strengthened with non-swallow

exercise [23]. Perlman et al. showed evidence supporting the perspective that one should treat at a task level, such as therapeutic swallowing, maneuvers that incorporate swallowing [24], consistent with the exercise physiology principle of specificity [25, 26]. In some circumstances, however, treatment at a task level may be inappropriate, as in the case of individuals with recurrent pneumonia, flagrant aspiration, and risk factors known to predispose one to aspiration pneumonia [27]. The swallowing training employed in this study was under the supervision of our multidisciplinary rehabilitation team, and depended upon the each patient's condition. Overall, the individulized training seemed to exert a positive impact on poststroke dysphagia.

Although swallowing may improve spontaneously within the acute phase for a subset of patients, early identification and intervention for dysphagia following stroke is critical. The findings of the present study showed evidence that the individualized rehabilitation interventions carried out by our multidisciplinary rehabilitation professionals was much more effective strategy and implied a better outcome for post-stroke dysphagic patients compared to the conventional rehabilitation interventions.

## Disclosure of conflict of interest

None.

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