

A Preliminary Study on the Effect Evaluation of Electroacupuncture Combined with Balloon Dilation in the Treatment of Dysphagia after Cerebral Infarction

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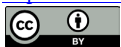
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Abstract

Objective: Dysphagia is a frequent symptom caused by cerebral infarction. This study investigated the effect evaluation and safety of electroacupuncture combined with balloon dilatation on dysphagia after cerebral infarction. **Methods:** Totally 100 patients with dysphagia after cerebral infarction were enrolled as study subjects and assigned into the control group (treated with balloon dilatation) and the observation group (treated with electroacupuncture and balloon dilatation), with 50 cases in each group. The general data of participants were recorded. Before or after treatment, swallowing function was assessed by water swallow test, standardized swallowing function assessment (SSA), videofluoroscopic swallow study (VFSS), and functional oral intake scale (FOIS). The cerebral hemodynamics, serological indicators, neurological impairment, quality of life (QOL) score were analyzed. Additionally, the occurrence of complications and adverse reactions after treatment was assessed. **Results:** There was no significant difference in gender, age, BMI, course of disease, and grade of dysphagia between the two groups. Balloon dilatation alone and electroacupuncture combined with balloon dilatation decreased the water swallow test, SSA, and VFSS scores, increased FOIS score, and improved the swallowing function, cerebral hemodynamic parameters, serological indicators, neurological function and QOL, with the better efficacy in the combined therapy. Moreover, combined therapy had lower incidences of complications and adverse reactions than balloon dilatation therapy alone. **Conclusion:** Electroacupuncture intervention combined with balloon dilatation therapy ameliorates swallowing function, cerebral hemody-

namics, serological indicators, neurological function and QOL, and reduces complications and adverse reactions in dysphagia after cerebral infarction.

Keywords

Electroacupuncture, Balloon Dilation, Dysphagia, Cerebral Infarction, Neurological Function, Quality of Life, Complications, Adverse Reactions

1. Preface

Cerebral Infarction is a common cerebrovascular disease in clinic, caused by local cerebral tissue hypoxia and ischemia after blood circulation interruption, with high mortality, high disability rate, high recurrence rate [1]. Once the disease occurs, it will pose a great threat to life, and at the same time bring serious economic and spiritual burden to the family and society [2]. Multiple complications can occur after treatment. The incidence of paralysis, the incidence of paralysis, hypoesthesia, aphasia, dysphagia and cognitive impairment caused by cerebral infarction is very high. Dysphagia is one of the most common symptoms, and about 50% of patients with cerebral infarction have dysphagia [3] [4] [5].

Deglutition disorder after cerebral infarction mainly occurs in oral cavity and pharynx. The main oral manifestations are salivation, accumulation of food residues in the mouth, nasal reflux caused by abnormal tongue and jaw movement; Pharynx is mainly manifested as aspiration caused by cough reflex and poor muscle coordination [3]. Dysphagia increases the risk of airway obstruction and chemical pneumonia, prolongs the recovery time of patients with cerebral infarction, and increases complications and mortality [6]. Dysphagia after cerebral infarction can lead to many complications, such as aspiration pneumonia. Studies have shown that dysphagia is associated with pneumonia after cerebral infarction, and patients with dysphagia have a 3-fold increased risk of pneumonia [7]. In addition, patients with dysphagia will have shortness of breath or dyspnea when eating, which will lead to malnutrition and dehydration, etc. [8] [9] [10]. Therefore, it is of great clinical significance to solve dysphagia after cerebral infarction. Swallowing is a complex cognitive and sensorimotor process. The nervous system controlling swallowing has mammalian brainstem and midbrain model control system, cortex and subcortical volitional area, and more than 30 muscles and several pairs of brain nerves are involved in swallowing function [3] [11]. Therefore, the complicated mechanism of deglutition disorder after cerebral infarction increases the difficulty of rehabilitation treatment. Currently, the treatment methods for dysphagia mainly include drug therapy, rehabilitation manipulation, balloon dilation and instrument therapy [12] [13]. In recent years, balloon dilation has been widely used in the treatment of primary annular pharyngeal disorders, which is cost-effective and minimally invasive. However, balloon expansion protocols have not been standardized across agencies, and the

pressure and timing of each expansion depends largely on the personal preferences and experience of the operator. Effectiveness of treatment in patients with neurological diseases may depend on upper esophageal sphincter function [14] [15]. Acupuncture is a traditional Chinese medicine treatment for various diseases, which can improve the neurological impairment of patients with brain injury [16] [17]. Traditional acupuncture combined with electrical stimulation of the electric needle therapy, refers to the neck of filiform needle acupuncture acupoints, pass by a narrow pulse current to treat a method of clinical disease [li hua, electrical item needle combined with the influence of comprehensive intervention on depression after cerebral apoplexy observe], keep the traditional acupuncture and the double effect of electrical stimulation, played a timing, quantitative, the advantage of fixed frequency stimulation [18]. The purpose of this study was to explore the effect of electroacupuncture combined with balloon rehabilitation training on swallowing function of patients with swallowing disorder after cerebral infarction, and to provide theoretical basis for clinical treatment of swallowing disorder after cerebral infarction.

2. Materials and Methods

2.1. Clinical Data

A total of 100 patients with dysphagia after cerebral infarction admitted to our hospital from April 2019 to April 2021 were selected as the research object. On the basis of conventional neurological treatment, patients were randomly divided into control group (balloon dilation treatment) and observation group (balloon dilation combined with electric needle treatment) according to the random number method, 50 cases in each group. The patients were diagnosed according to the diagnostic criteria of cerebral infarction in the National Cerebrovascular Conference and the swallowing dysfunction in the diagnostic and therapeutic criteria of TCM diseases and syndromes. Clinical baseline data including gender, age, BMI, course of disease, and dysphagia grade were recorded at enrollment. Inclusion criteria: 1) patients with related diseases that do not interfere with the course and outcome of treatment; 2) The patient's signs are stable and conscious, and can cooperate with clinical treatment; 3) Understand the treatment plan in detail and sign informed consent; 4) Participating in treatment for the first time. Exclusion criteria: 1) patients with severe diseases of vital organs; 2) dysphagia caused by other factors; 3) The patient suffers from severe mental illness or expression disorder; 4) Voluntarily withdraw from treatment; 5) Accidental discontinuation of treatment during treatment. This study was approved by the Medical Ethics Committee of our hospital. All patients participating in this study were fully informed of the purpose of this study and signed informed consent.

The sample size of most studies on influencing factors is at least 5 - 10 times the number of variables according to the stable requirements of statistical variable analysis model. Combined with the risk factors of dysphagia after cerebral

infarction and the influencing factors of acupuncture efficacy, it is predicted that there are about 8 - 10 variables in the regression model of this study, and the shedding rate is calculated as 10%. The sample size required for this study should be about 45 - 110 cases. According to the 10% shedding rate, a total of 100 subjects will be included in this study.

2.2. Treatment Methods

Control group: balloon dilation treatment. A no. 14 catheter was intubated through the nose, and the tube was passed through the annular pharyngeal muscle to the esophagus (5 - 6 neck level). 8 mL water was injected with a 10 ml syringe to dilate the balloon, and the needle plug of the syringe was supported. Slowly pull out the catheter, and pull out the syringe with appropriate amount of water repeatedly. Once the resistance is significantly reduced, pump quickly and repeat 5 - 10 times. Train once a day for 4 weeks. Observation group: on the basis of balloon dilation, electric needle treatment. 50 mm millineedle with 75% alcohol, and inserted 1 - 1.5 inches of needle tip inward and downward at the bilateral wind pool, Yming and blood supply point. Electric acupuncture therapy instrument (SDZ—II electronic needle multifunctional electric acupuncture instrument) was connected at the wind pool and blood supply point. The wind pool was the positive pole, and the blood supply was the negative pole. The patient sat up, sterilized 0.35. The intensity was determined by patient tolerance, and the electricity was energized for 30 min. Then take lianquan, Waijinjin and yuye in the neck, and stab 1 - 1.5 inches at the root of the tongue with a 60 mm long needle, and 0.3 inches with a 30 min straight needle for swallowing and choking, respectively. The needle should be quickly rotated for 10 seconds before the needle is released without needle retention. If there is a tendency to cough, take out the needle immediately and press the needle hole after taking out the needle. Once a day, 6d was a course of treatment. After 1 day of rest, the second course was carried out. The curative effect was determined after the longest 4 courses of treatment.

2.3. Observation Indexes and Detection Methods

2.3.1. Swallowing Function

Drinking water experiment in the depression field: the patient sat and drank 30 mL warm water, and the swallowing function was divided into 5 grades according to the condition of choking and drinking time. When 30 mL warm water was swallowed at one time within 5 s and the process was smooth, the score of grade I was 0. If the patient swallowed warm water at least twice within 5 to 10 s and no cough was found, the score of grade II was 2; If the patient swallowed warm water at one time within 5 - 10 seconds but coughed, it was grade III and scored 4 points. Swallowing warm water at least twice within 5 to 10 s and coughing was grade IV and 6 points were scored; After swallowing 30 mL warm water in 10 seconds and choking, 8 points were scored as grade V. Standard swallowing

function Assessment Scale (SSA): clinical examination, including consciousness level, head and trunk control, throat function, respiratory function, soft palate motor regulation, degree of lips closure, active cough and pharyngeal reflex function, 8 to 23 points; The patient was observed to swallow 5 mL water, repeated 3 times, including throat movement, throat function after swallowing, flow in the mouth, wheezing during swallowing, and repeated swallowing, etc., 5 - 11 points; If the above examination shows no abnormal symptoms, increase the swallowing water volume to 60 mL, and observe the time when the patient can finish drinking, whether there is no abnormal aspiration, wheezing or coughing during swallowing, and throat function after swallowing, 5 - 12 minutes; The total score is 46.

Television fluorescent swallowing imaging (VFSS): X-ray simulation positioning machine (LX 40A, Toshiba Medical Systems Corporation) is used for lateral and orthographic swallowing imaging of patients, observe the process of food from the mouth to the throat, and record the occurrence of aspiration, choking and so on. Zero points were scored for normal swallowing function without aspiration and swallowing residue. 2 points for mild disorder if there is no mistake in swallowing residue; 4 points for moderate impairment with swallowing residue without error; The presence of aspiration and residual swallowing is considered as a major disorder with 6 points.

Functional oral ingestion grading (FOIS): Swallowing function is assessed indirectly by FOIS based on patient feeding test results. Grade 1 is rated as 1 point, grade 2 is rated as 2 points, and so on. The higher the score, the better the patient's swallowing function.

2.3.2. Cerebral Hemodynamics

Color Doppler ultrasonography (GE LOGIQ 7) was used to detect the maximum peak flow velocity (VS), average flow velocity (VM) and vascular resistance index (RI) of cerebral artery in 2 groups before and after treatment for 3 times, and the mean value of bilateral cerebral artery was used as the final value.

2.3.3. Serological Indicators

ELISA kit was used to detect the levels of BDNF, NGF and IGF-1 in serum before and after treatment. Follow the instructions for the ELISA kit to perform the experiment. Human BDNF ELISA Kit (AB212166, ABCAM), human NGF ELISA Kit (EH0242, Fine Test), human IGF1 ELISA kit (AB211651, ABCAM).

2.3.4. Neurological Deficits and Life Treatment Scores

The level of consciousness, speech, limb movement and quality of life were compared between the two groups by using the "clinical neurological deficit degree scoring standard of stroke patients" and the QOL quality of life table. The defect classification was mild defect (15 points or less), moderate defect (16 - 30 points), severe defect (31 - 45 points). QOL is divided into six aspects, including spiritual belief, independence, environment, society, psychology and physiology. The total score is 100, and the higher the score, the better.

2.4. Follow-Up

All patients were followed up by telephone every other week for 8 weeks after the end of the treatment endpoint. The incidence of complications (malnutrition, dehydration, aspiration pneumonia) and adverse reactions (swelling (swelling in the electrode or probe contact area), drowsiness (excessive daytime sleepiness), dizziness (the patient complained of dizziness) were recorded during follow-up.

2.5. Statistical Analysis

SPSS21.0 and GraphPad Prism 6.0 software were used for statistical analysis and mapping. The Shapiro-Wilk test was used to test the normal distribution. Counting data were expressed as case number/percentage (N/%), counting data were compared between groups using Chi-square test, measurement data were expressed as $\pm S$, independent sample T test was used for comparison between two groups, and chi-square test was used for comparative analysis of categorical variables. Kaplan-meier method was used to analyze the incidence of complications and adverse reactions in 2 groups.

3. Results

3.1. Analysis of General Patient Data

A total of 100 patients with first cerebral infarction complicated with dysphagia admitted to our hospital were included in this study and randomly divided into control group and observation group according to the random number method, 50 in each group. The control group ranged in age from 42 to 72 years, with an average age of 57 ± 8.43 , including 31 males and 19 females, with an average course of 19.24 ± 3.58 . There were 16 cases of grade II, 25 cases of grade III and 9 cases of grade IV dysphagia. The age range of the observation group was 42 - 70 years, with an average age of 56 ± 7.82 , including 34 males and 16 females, with an average course of disease of 18.84 ± 3.60 . There were 13 cases of grade II, 29 cases of grade III and 8 cases of grade IV dysphagia. There were no statistically significant differences in gender, age, BMI, course of disease and dysphagia grade between the two groups (**Table 1**, $P > 0.05$), indicating comparability.

3.2. Comparison of Swallowing Function between the Two Groups before and after Treatment

In order to explore the effect of electro-nailing combined with balloon dilation on swallowing function of patients, we analyzed the depression drinking water test, SSA, VFSS and FOIS scores of patients before and after treatment. The results showed that compared with before treatment, after balloon dilation treatment alone or electric needle intervention combined with balloon dilation treatment, the scores of depression drinking water test, SSA and VFSS were significantly decreased (**Figures 1(a)-(c)**, all $P < 0.05$), FOIS score was significantly increased (**Figure 1(d)**, $P < 0.05$), and dysphagia was significantly improved in 2 groups. Further comparative analysis of the efficacy of the two treatments on the

Table 1. General data analysis.

project	Control group (N = 50)	Observation group (N = 50)	t/ χ^2	P
Gender (example)			0.396	0.529
male	31 (62%)	34 (68%)		
female	19 (38%)	16 (32%)		
Age (years, $\bar{x} \pm s$)	57 \pm 8.43	56 \pm 7.82	0.615	0.540
BMI (kg/m ² , $\bar{x} \pm s$)	22.47 \pm 3.14	21.84 \pm 2.52	0.944	0.347
Course of disease (D, $\bar{x} \pm s$)	19.24 \pm 3.58	18.84 \pm 3.60	0.557	0.579
Dysphagia grade (example)			0.666	0.717
II2	16 (32%)	13 (26%)		
III4	25 (50%)	29 (58%)		
IV6	9 (18%)	8 (16%)		

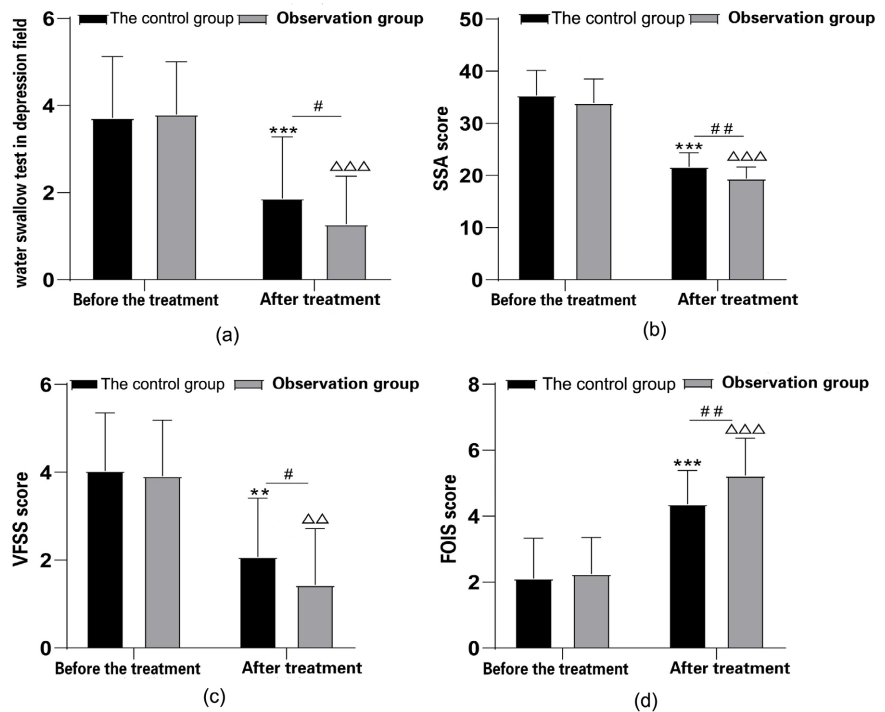


Figure 1. Comparative analysis of swallowing function of patients. (a) Scores of drinking water tests in the depression fields; (b) SSA score; (c) VFSS score; (d) FOIS score. N = 50, data were expressed as mean \pm standard deviation, data comparison between the two groups was performed by independent sample T test, # represents P < 0.05, ## represents P < 0.01, after treatment, comparison between the two groups; ** represented P < 0.01, *** represented P < 0.001, and comparison was made before and after treatment in the control group; △△ represented P < 0.01, △△△ represented P < 0.001, and the observation group was compared before and after treatment.

improvement of swallowing function showed that there were no significant differences in the scores of depression drinking water test, SSA, VFSS and FOIS between the two groups before treatment (Figures 1(a)-(d), ALL $P > 0.05$), while the scores of depression drinking water test, SSA and VFSS in the observation group were lower than those in the control group after treatment (Figures 1(a)-(c), ALL $P < 0.05$), FOIS score was higher than that of the control group (Figure 1(d), $P < 0.05$). These results indicate that the combined treatment of electric neck acupuncture has significantly better effect on the improvement of swallowing disorders than balloon dilation alone.

3.3. Comparison of Cerebral Hemodynamic Parameters and Serological Indexes between the Two Groups before and after Treatment

We further analyzed the changes of cerebral hemodynamic parameters and serological indexes in 2 groups before and after treatment. The results showed that compared with before treatment, VS, VM and serum BDNF, NGF and IGF-1 were significantly increased (Figure 2(a) and Figure 2(b) and Figure 2(d) and Figure 2(e) and Figure 2(f), all $P < 0.05$) and RI was significantly decreased (Figure 2(c), $P < 0.05$) after balloon dilation alone or electric needle intervention combined with balloon dilation. Cerebral hemodynamics and serum indexes

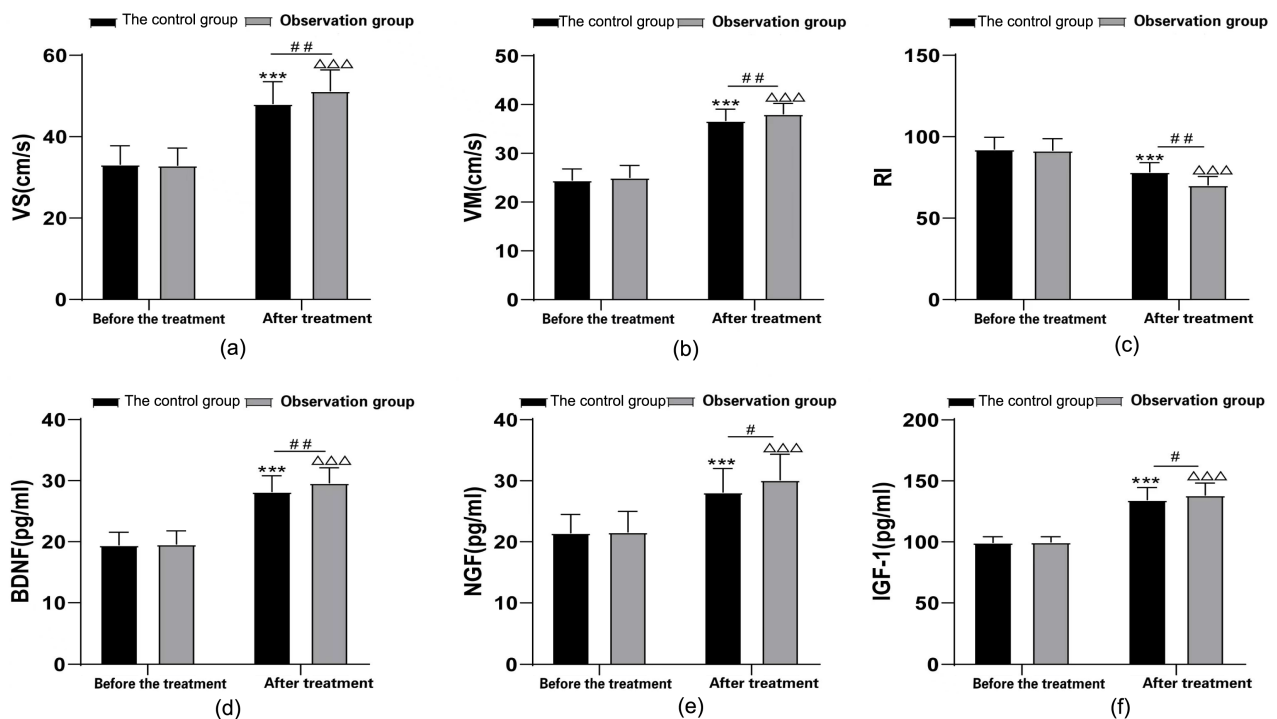


Figure 2. Cerebral hemodynamic parameters and serological indexes of patients. ((a)-(c)) VS, VM, RI detected by color Doppler ultrasonography; ((d)-(f)) ELISA detection of BDNF, NGF, IGF 1. $N = 50$, data were expressed as mean \pm standard deviation, data comparison between the two groups was performed by independent sample T test, # represents $P < 0.05$, ## represents $P < 0.01$, after treatment, comparison between the two groups; ***, $P < 0.001$, comparison of control group before and after treatment; $\Delta\Delta\Delta$ represents $P < 0.001$, and the observation group was compared before and after treatment.

were significantly improved. Further comparative analysis of the effects of the two treatment methods on cerebral hemodynamics and serum indexes showed that there were no significant differences in cerebral hemodynamics parameters and serum indexes between the two groups before treatment, while the VS, VM and serum BDNF, NGF and IGF-1 in the observation group were higher than those in the control group after treatment (**Figure 2(a)** and **Figure 2(b)** and **Figure 2(d)** and **Figure 2(e)** and **Figure 2(f)**, all $P < 0.05$). RI was lower than that of the control group (**Figure 2(c)**, $P < 0.05$). These results indicate that the combined treatment with electric neck acupuncture has significantly better effect on improving cerebral hemodynamics and serological indexes than balloon dilation alone.

3.4. Comparison of Neurological Deficits and Quality of Life Scores between the Two Groups before and after Treatment

Neurological deficits and quality of life scores were compared between the two groups before and after treatment. The results showed that, compared with before treatment, the neurological deficit score was significantly decreased and the quality of life score was significantly increased after balloon dilation alone and electric needle intervention combined with balloon dilation (**Figure 3(a)** and **Figure 3(b)**, both $P < 0.05$), and the neurological function and quality of life were significantly improved. Further comparative analysis of the effects of the two treatment methods on neurological function and quality of life showed that there was no significant difference in neurological function deficit and quality of life score between the two groups before treatment, while the neurological function deficit score in the observation group was lower than that in the control group, and the quality of life score was higher than that in the control group after treatment (**Figure 3(a)** and **Figure 3(b)**, both $P < 0.05$). These results indicate that the combined treatment with electric neck acupuncture has significantly better effect on the improvement of patients' neurological function and quality of life than balloon dilation alone.

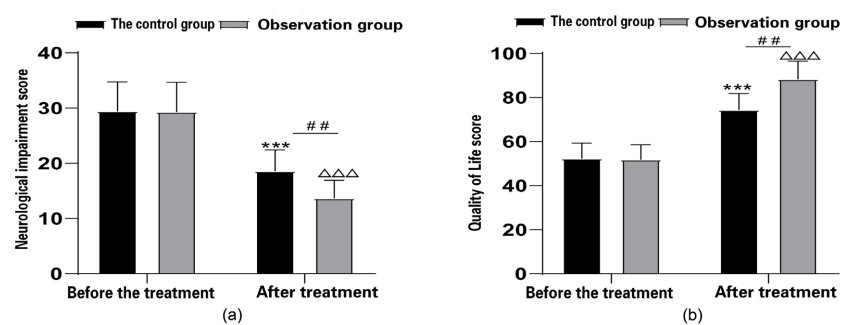


Figure 3. Neurological deficits and quality of life scores of the patients. (a) Neurological deficit score; (b) Quality of life score. $N = 50$, data was expressed as mean \pm standard deviation, data comparison between the two groups was performed by independent sample T test, ## means $P < 0.01$, after treatment, the two groups of patients were compared; ***, $P < 0.001$, comparison of control group before and after treatment; $\triangle\triangle\triangle$ represents $P < 0.001$, and the observation group was compared before and after treatment.

3.5. Comparison of Complications between the Two Groups after Treatment

We further evaluated the incidence of complications within 8 weeks after treatment in the two groups. The results showed that there were 17 complications in the control group, including 3 cases of malnutrition, 5 cases of dehydration and 9 cases of aspiration pneumonia, with a complication rate of 34%. There were 7 cases of complications in the observation group, including 3 cases of dehydration and 4 cases of aspiration pneumonia, and the complication rate was 14%, significantly lower than that in the control group ($\chi^2 = 5.482$, $P = 0.019$) (Table 2). Kaplan-Meier analysis also showed that the incidence of complications in the observation group was significantly lower than that in the control group (Figure 4, $P = 0.020$).

Compared with the control group, the curve moved right in the observation group, and the incidence of complications after treatment was lower in the observation group (log-rank test, $P = 0.020$).

3.6. Comparison of Adverse Reactions between the Two Groups after Treatment

We further evaluated the incidence of adverse reactions in the two groups within 8 weeks after the end of treatment. The results showed that there were 14 cases of adverse reactions in the control group, including 3 cases of swelling, 4 cases of drowsiness and 7 cases of dizziness, and the incidence of adverse reactions was 28%. There were 5 cases of adverse reactions in the observation group, including 1 case of swelling, 2 cases of drowsiness and 2 cases of dizziness, and the incidence of adverse reactions was 10%, significantly lower than that in the control group ($\chi^2 = 7.382$, $P = 0.007$) (Table 3). Kaplan-Meier analysis also showed that the incidence of adverse reactions in the observation group was significantly lower than that in the control group (Figure 5, $P = 0.025$).

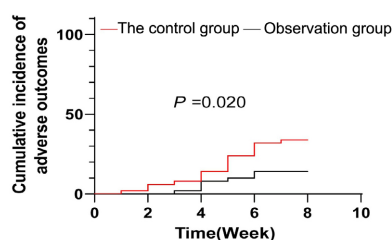


Figure 4. Kaplan-Meier method was used to analyze the incidence of complications in the two groups.

Table 2. Incidence of malnutrition, dehydration and aspiration pneumonia after treatment.

group	N	malnutrition	dehydration	Aspiration pneumonia	A combined
The control group	50	3	5	9	17
Observation group	50	0	3	4	7

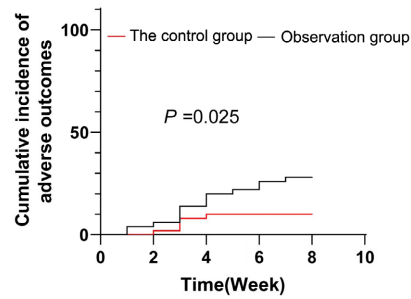


Figure 5. Kaplan-Meier analysis of the incidence of adverse reactions in the two groups.

Table 3. Comparison of adverse reactions between the two groups after treatment.

group	N	swelling	drowsiness	dizzy	A combined
The control group	50	3	4	7	14
Observation group	50	1	2	2	5

Compared with the control group, the curve moved right in the observation group, and the incidence of adverse reactions after treatment was lower in the observation group (log-rank, $P = 0.025$).

4. Discussion

Cerebrovascular diseases are a serious threat to human life, and cerebral infarction accounts for about 50% - 80% of elderly patients [19]. Cerebral infarction is one of the major neurological diseases worldwide [20]. The pathological process or injury of neurological dysfunction leads to local cerebral ischemia and dysfunction in brain tissue, which leads to dysfunction in brain and other parts of the body [21]. Swallowing dysfunction is one of the complications of cerebral infarction patients, and the incidence rate in China is 51% - 73% [22]. Dysphagia after cerebral infarction is mainly caused by pseudobulbar paralysis or bulbar paralysis [23], which can lead to malnutrition and dehydration, and increase the risk of complications such as asphyxia and aspiration pneumonia [24]. In addition, patients with dysphagia with cerebral infarction have different degrees of anxiety, depression and other negative emotions, which affect their quality of life [7]. In this study, we mainly explored the effect evaluation and safety of electro-nailing combined with balloon dilation in the treatment of dysphagia after cerebral infarction.

Balloon dilation has been widely used in primary diseases of circumpharynx, achalasia of cardia, and polymyositis with dysphagia [25] [26] [27]. Balloon dilation can improve FOIS score and swallowing function of patients with annular pharyngeal dysfunction [14]. Modified balloon dilation therapy has been proven to improve poststroke pharyngeal swallowing by increasing cortical projection excitability in patients with unilateral brainstem stroke [15]. It has been reported that traditional acupuncture can be used to treat dysphagia after stroke and dysphagia after cerebral infarction [28] [29]. Lu *et al.*'s study on the treatment of

dysphagia after stroke by acupuncture showed that acupuncture treatment can reduce the swallowing function score of patients, improve their quality of life and significantly improve their swallowing function [30]. Wang *et al.* reduced SSA score of cerebral infarction patients with dysphagia, improved their dysphagia function and improved their quality of life by acupuncture at Tiantu point or fengchi point, Shanglian Quan point, Jinjin point, Yuye point, pharyngeal posterior wall point, Shugou point and Tongli point [31]. In addition, neuromuscular electrical stimulation combined with conventional treatment can reduce anxiety, depression and other negative emotions in swallowing disorders after cerebral infarction [7]. With the development of medical technology, the combination of traditional acupuncture and electrical stimulation has formed the electric nail-acupuncture therapy. “Gao’s nail-acupuncture” combined with electrical stimulation can reduce the score of patients’ Weitian drinking water test, improve the score of SWAL-QOL scale and improve dysphagia after stroke [32]. Our study further confirmed the improvement effect of balloon dilation on swallowing disorders after cerebral infarction, and found that the improvement effect of electric needle combined with balloon dilation on swallowing disorders was significantly better than that of balloon dilation alone, and the clinical effect was more significant.

Dysphagia after stroke is closely related to cerebral blood flow microcirculation and brain nerve function, and the improvement of hemorheological indexes can promote the recovery of impaired nerve function [33]. Surface emG bio-feedback therapy can enhance conduction sensory stimulation, promote the establishment of a new connection between the motor neurons of the swallowing center of the brainstem and the contralateral center, promote nerve regeneration and reorganization of the cortical nuclear bundle, and realize the reorganization and reconstruction of brain functions, thus improving the swallowing function of patients with central pontine myelolysis [34]. Electric acupuncture can through stimulating the skin, muscles, blood vessels and nerves, activate the related nerve nuclei, excited the brain network, make the neck rhythmic contraction of the muscles to promote blood running, improve blood circulation and restore nerve conduction, and promote brain circulation, improve the supply, repair of central nervous system function [18]. Both BDNF and NGF have been reported to have cerebral neurotrophic effects, which can protect nerve cells under hypoxia, repair damaged nerve tissues and promote nerve cell growth [35]. IGF 1, also known as growth promoting factor, can promote the proliferation and differentiation of nerve cells and play a protective role in apoptosis when cerebral cortex neurons are ischemic and hypoxic [36]. Qi *et al.* applied cervical band acupuncture at Fengchi point, Tianzhu point, Wanggu point, Lianquan point and Panglianquan point in patients with dysphagia after stroke, and the results showed that cervical band acupuncture could improve the bilateral cerebral artery VS, VM and serum BDNF, NGF and IGF-1 levels, reduce the bilateral cerebral artery RI level and improve dysphagia [37]. The results of this study suggest that compared with the control group, cerebral hemodynamic param-

ters VS, VM and RI were improved more significantly in the observation group after treatment, and serological indicators DNF, NGF and IGF-1 levels were higher, and neurological deficit score was lower and quality of life score was higher in the observation group. The results showed that electro-nailing combined with balloon dilation could improve cerebral blood microcirculation and increase the level of nerve factors in stroke patients, thus enhancing the curative effect. In addition, this study found that the incidence of complications (malnutrition, dehydration, aspiration pneumonia) and adverse reactions (swelling, lethargy, dizziness) in the observation group was significantly lower than that in the control group after treatment, indicating that electric needle intervention combined with balloon dilation can significantly improve the quality of life of patients with higher safety.

5. Conclusion

In conclusion, electro-nailing combined with balloon dilation therapy can effectively enhance swallowing function, improve cerebral hemodynamic parameters, increase serum BDNF, NGF and IGF-1 levels in patients with dysphagia after cerebral infarction, and reduce the incidence of neurological impairment, complications and adverse reactions, thus improving the quality of life of patients. However, although the treatment of patients with dysphagia after cerebral infarction showed good efficacy in this study, there were still some problems: First, the sample size included in this study was small, and there was insufficient evidence of Randomized Controlled Trial. Secondly, there is a lack of unified standards for the quantitative methods of electroacupuncture intervention and balloon dilation therapy and rehabilitation training techniques, and relevant scales and other evaluation methods need to be further developed. Therefore, in the follow-up study, it is necessary to further expand the sample size for multi-center randomized controlled experiments, strengthen the TCM syndrome differentiation and classification of dysphagia, screen effective acupoints, and establish a clinical efficacy evaluation system. According to the characteristics of dysphagia, suitable and effective combination of Traditional Chinese and western medicine was selected to improve the overall level of dysphagia in patients with cerebral infarction after treatment.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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