International Journal of Research in Medical Sciences
Achmad BF et al. Int J Res Med Sci. 2019 Jun;7(6):2192-2197
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012
DOI: http://dx.doi.org/10.18203/2320-6012.ijrms20192497

Original Research Article

Effect of swallowing therapy to avoid aspiration in patients with post-stroke dysphagia at the stroke unit of Harjono hospital, Indonesia

Bayu Fandhi Achmad[1]*, Muhammad Zafrullah Arifin[2], Aan Nuraeni[3]

[1]School of Nursing, Faculty of Medicine, Public Health and Nursing, Universitas Gadjah Mada, Yogyakarta, Indonesia
[2]Faculty of Medicine, [3]Faculty of Nursing, Universitas Padjadjaran, Bandung, Indonesia

Received: 19 March 2019
Accepted: 03 May 2019

***Correspondence:**
Dr. Bayu Fandhi Achmad,
E-mail: bayu.fandhi.a@ugm.ac.id

ABSTRACT

Background: Aspiration is common complication of dysphagia stroke due to cranial nerve damage, especially cranial nerves V, VII, IX, X and XII. Existing therapies to prevent aspiration is the compensation strategy therapy and semisolid nutritional therapy, but each of these therapies is still have a weakness, so it needs a new therapeutic method namely swallowing therapy which combine the advantages and reduce the weaknesses of each of the therapy. Aim of the study is to determine the effect of swallowing therapy on aspiration prevention in patients with dysphagia stroke.
Methods: This research was a quasi-experimental research involving 16 respondents in the intervention group and 16 respondents in the control group who obtained through consecutive sampling techniques. Data was collected from February-March 2016 at the Stroke Unit RSUD Dr. Harjono Ponorogo through observations using Gugging Swallowing Screen (GUSS) instruments. Data analysis used in this research was wilcoxon test to determine the difference of swallowing therapy effect before and after intervention. Mann-Whitney test was also used to determine the difference of swallowing therapy effect between intervention group and control group after intervention.
Results: There was a differences of swallowing therapy effect between pre-test and post-test in the intervention group ($p = 0.002$). In addition, there was no differences between pre-test and post-test in the control group ($p = 0.157$).
Conclusions: Swallowing therapy have a positive effect against aspiration prevention in patients with dysphagia stroke, so it can be recommended as an acute care intervention in stroke patients at stroke unit.

Keywords: Aspiration, Dysphagia, Stroke, Swallowing therapy

INTRODUCTION

The number of patients suffering from stroke keeps increasing every year. In the United States, there are 795,000 new cases of stroke every year, with death rate of 16.28% and it has been stated as the top four causes of death after heart attack, cancer, and chronic respiratory diseases.[1] Similarly in Indonesia, in 2007, the number of stroke patients was 1.9 million people. In 2013, the number increased to 2.8 million patients.[2] Stroke patients tend to have unstable blood pressure, intracranial pressure, hemiplegic, and cranial nerve disorders.[3] Cranial nerve disorders, especially at trigeminal cranial, facial, glossopharyngeal, vagus, and hypoglossal nerves that occur in stroke patients may result in post-stroke dysphagia. The incidence of post-stroke dysphagia is between 14 to 19%.[4] This high incidence rate effects on

increased cases of liquid and solid food aspiration in respiratory system.[5]

Aspiration that occurs in respiratory track may cause pneumonia aspiration. Data from the National Institute of Health Stroke Scale (NIIHSS) shows 43-50% of stroke patients suffer from aspiration pneumonia with mortality rate as high as 45%.[6] Moreover, it was stated that 30-50% of patients suffer from aspiration pneumonia at acute stroke phase. There is also hidden aspiration suffered by 38-48% patients 2-3 months after a stroke.[7]

Thus, immediate treatment is needed to improve the patients swallowing ability and to avoid aspiration in patients with post-stroke dysphagia.

The method used to avoid aspiration in patients with post-stroke dysphagia is compensatory strategy.[8] The advantage of this strategy is that it has effective techniques to improve stimulation transmitted from the maxilla branch of the trigeminal nerve, pharyngeal branch of the glossopharyngeal nerve, and two branches of the vagus nerve, and to increase effectivity of the superior larynx nerve, which eventually lead to faster closing of pharyngeal vestibule and opening of upper esophagus sphincter, as well as improved elevation of the larynx so that it lowers down the risk of aspiration.[9] Unfortunately, this method also has a disadvantage where it tends to be effective only to overcome pharyngeal dysphagia.[10]

Other method that has been developed to avoid post-stroke dysphagia is through the use of semisolid food. The advantage of semisolid food for patients with post-stroke dysphagia is that it can reduce the risk of aspiration since the texture is compact.[11] A study showed that pudding is a safe choice to avoid aspiration in patients with post-stroke dysphagia.[12]

Pudding has texture that is suitable to stimulate the coordination of sensorial and motor nerves on the tongue and upper respiratory tract during chewing and swallowing processes. However, this method also has a disadvantage, which is the lack of standard procedure unlike in the compensatory method.[9]

Based on several methods to overcome post-stroke dysphagia that have been discussed before, it can be concluded that those methods are essentially effective in reducing symptoms and increasing tolerance to swallow in patients with critical post-stroke dysphagia, however they also have disadvantages.

Therefore, a study is needed to develop a method that is able to combine those methods in order to improve the advantages and decrease the disadvantages; thus, swallowing therapy is developed. Swallowing therapy that was developed in this study was a therapy method that combined two methods mentioned before: compensatory strategy and semisolid food for patients with post-stroke dysphagia.

METHODS

This study was a quasi experimental study that was designed with pretest-posttest control group. The sample of the study was stroke patients undergoing treatment at the Stroke Unit in Dr. Harjono Hospital, Indonesia. The sampling method used was consecutive sampling. Data collection was started from 2nd February to 4th March 2016.

Swallowing therapy intervention was performed 60 min prior to meal time, each time for 30 min. For ischemic stroke patients, the therapy was started on Day 5, while for hemorrhagic stroke, it was started on Day 7.

Inclusion criteria

Inclusion criteria were applied for patients with V, VII, IX, X, and XII cranial nerve disorders that lead to dysphagia, patients with dysphagia due to hemorrhagic stroke (minimum treatment of 6 days) and ischemic stroke (minimum treatment of 4 days), patients with 3rd or 4th level of dysphagia, and patients with level of consciousness GCS ≥12.

Exclusion criteria

The exclusion criteria were patients with allergy towards the food used in the study, that was confirmed from their medical record and statement from the patients and/or the family. The drop out criteria was dead patients or patients with worsening condition, patients referred by other hospitals, patients leaving the hospital, and patients who did not consent to be respondents in the study. Total number of respondents was 32, which was divided into two groups: 16 patients in intervention group who received swallowing therapy and another 16 patients in control group who received standard intervention.

This study used an observation form as the instrument that was adopted from Gugging Swallowing Screen (GUSS) to select and assess aspiration risk in patients with post-stroke dysphagia. GUSS consisted of 2 parts. GUSS Part 1 was used to determine if the patients were ready for training (early assessment).

In GUSS Part 1, the indicators used to determine if patients were ready to receive training were if they could cough intentionally and if they could swallow their own saliva. GUSS part 2 was used to assess the swallowing therapy. In GUSS Part 2 (swallowing therapy), the respondents were observed based on four GUSS aspiration criteria including ability to swallow slowly (>2 s), involuntary coughing, dripping saliva, and hoarse voice. The lowest possible score was 0, while the highest possible score in GUSS Part 2 was 5.

Steps performed in swallowing therapy were divided into two parts

Part 1: Initial assessment

Initial assessment was used to determine if the patients were ready to undergo swallowing therapy. The assessment was useful to decide which patients that could be started with the therapy. Swallowing test was started by asking the patients to swallow their own saliva. For patients who were being medicated or for patients whose condition caused decreased production of saliva, drinking water was provided for 1 Ml. This amount of water given was equal to the amount of saliva normally swallowed. The aspects assessed were alertness, voluntary coughing, clearing of pharynx, and ability to swallow saliva.[13]

Part 2: Swallowing therapy

After passing the initial assessment, patients continued with the 2nd part, which was the swallowing therapy itself. Steps given in the therapy included: (1) creating calming condition around the patient prior to the therapy; (2) putting the patients in proper and comfortable sitting position (e.g. Fowler position); (3) helping the patient to perform oral hygiene before and after swallowing therapy; (4) for patients with hemiplegic, the head of the patient was faced aside in normal position and then turned it to the body side that suffered hemiplegic so that the patient could detect the food in his/her mouth while avoiding the extended position of the head; (5) putting a small piece of semisolid food at the tip of the patient's tongue to help the patient to chewing and swallow the food; (6) asking the patients to inhale, hold their breath and start the swallowing process, and soon after the swallowing process (before the patient took the next breath), the patient was requested to cough and re-swallow. The last step was performed to maintain pharyngeal clearance in order to decrease the risk of aspiration; (7) maintaining the patient's position at Fowler position for minimum 30 min after the therapy was performed; (8) evaluating the effectiveness of the swallowing therapy. In the control group, standard intervention was given. At Dr. Harjono Hospital, Indonesia, there was no specific procedure for the standard intervention, since it consisted only of swallowing test that was performed every morning for five days, before breakfast was served. Swallowing test was performed using gruel. Patients were sat at 45 degree angle and given gruel so that they could try to chew and swallow. There was no difference in position for patients with hemiplegic, especially in terms of where their faces facing at, which was similar for all: to the front. Next, patients were requested to swallow without any specific instruction/techniques.

Statistical analysis

Data analysis was performed with univariate and bivariate analysis. Univariate analysis was used to explain the characteristics of the respondents including their age, gender and type of stroke suffered, which were displayed in the form of frequency and percentage in order to assess the homogeneity of the study subjects between intervention group and control group. For items with numerical scale data such as age, Mann-Whitney test was used since the data distribution was not normal, and for characteristic items with categorical scale such as gender and type of stroke, chi-square test was used.

For the variable aspiration, data collected were in the form of scores and mean scores from the GUSS instrument. The data were displayed in the form of frequency and percentage of each criterion. Prior to selecting type of statistical analysis, normality of the data was checked with Shaphiro-Wilk test. To compare pretest and posttest results, Wilcoxon test was used since the data were not normally distributed. Moreover, post test data from intervention and control groups were also compared using Mann-Whitney test since the data were not normally distributed.

The study had been approved by the ethical committee of Faculty of Medicine, Padjadjaran University in their approval letter (013/UN6.C1.3.2/KEPK/PN/2016) dated 7th January 2016, and it also had been approved by the Nursing Collegiums as well as the district government of Ponorogo in their recommendation letter (072/114/405.19/2016). Moreover, the study had also been approved by the board of management of Dr. Sarjono Hospital in their approval letter (070/180/405.29/2016) on 27th January 2016. Respondents' participation was voluntary and respondents were not compensated for their participation.

RESULTS

Demographic data and results of homogeneity test are displayed in Table 1. Age of the respondents in the intervention and control groups were mostly in the range of 56-60 years old, with 7 respondents (21.87%) and 9 respondents (28.13%), respectively. Homogeneity test for age showed p value 0.690.

For gender category, most respondents in intervention group were female (9 respondents (28.13%)), while in control group, the respondents were mostly male (9 respondents (28.13%)). Homogeneity test resulted in p value = 0.480.

In the category of type of stroke, most respondents in both intervention and control groups had ischemic stroke, with 12 respondents (37.50%) and 10 respondents (31.25%), respectively. Homogeneity test provided p value of 0.446.

Comparative test in intervention group before and after receiving the intervention is provided in Table 2. In general, there was decrease in all criteria of the GUSS instrument after swallowing therapy was given. The

largest decrease was shown in the category of involuntary coughing, where before intervention, 15 out of 16 respondents (93.75%) had involuntary coughing, but after the therapy, the number dropped to 7 out of 16 respondents (43.75%) (p=0.002).

Table 1: Homogeneity test on characteristics of respondents in intervention and control groups in the Stroke Unit of Dr. Sarjono hospital in 2016 (n=32).

Characteristics of respondents	Intervention group		Control group		P
	f	(%)	f	(%)	
Age (years)					
50-55	7	21.87	5	15.61	0.690[a]
56-60	7	21.87	9	28.13	
> 60	2	6.26	2	6.26	
Sex					
Male	7	21.87	9	28.13	0.480[b]
Female	9	28.13	7	21.87	
Type of stroke					
Ischemic stroke	12	37.50	10	31.25	0.446[b]
Hemorrhagic stroke	4	12.50	6	18.75	

a. Man Whitney test; b. Chi square test

Table 2: Comparative test in intervention group before and after receiving swallowing therapy.

GUSS	Pre-test		Post-test		P
	f	(%)	f	(%)	
Swallow slowly	4	25	1	6.25	0.002
Involuntary coughing	15	93.75	7	43.75	
Dripping saliva	11	68.75	5	31.25	
Hoarse voice	3	18.75	1	6.25	

Table 3: Comparative test between pretest and posttest of standard intervention in control group.

GUSS	Pre-test		Post-test		P
	f	(%)	f	(%)	
Swallow slowly	4	25	2	12.5	0.157
Involuntary coughing	15	93.75	15	93.75	
Dripping saliva	8	50	9	56.25	
Hoarse voice	5	31.25	6	37.5	

Comparative test between pretest and posttest in control group that used standard intervention revealed that swallowing test with gruel did not have significant effect in avoiding aspiration in respondents (p=0.157). this result was also shown in the frequency data of the GUSS criteria that showed only time length for swallowing that was decreased from 4 out of 16 respondents (25%) who swallowed slowly in pretest to 2 out of 16 respondents (12.5%) in posttest (Table 3).

In Table 4, it can be seen that posttest in intervention group had lower incidences of slow swallowing (>2 s), involuntary coughing, dripping saliva, and hoarse voice compared to control group (p=0.000).

Table 4: Comparative test post intervention in control and intervention groups.

GUSS	Intervention group		Control group		P
	f	(%)	f	(%)	
Swallow slowly	1	6.25	2	12.5	0.000
Involuntary coughing	7	43.75	15	93.75	
Dripping saliva	5	31.25	9	56.25	
Hoarse voice	1	6.25	6	37.5	

DISCUSSION

Dysphagia in patients with ischemic stroke is mostly caused by damage to the brainstem. Brainstem is important as the source of the ten cranial nerves, especially the cranial nerve that affects chewing and swallowing activities such as V, VII, IX, X, and XII nerves. Specific symptoms in patients with damage to the brain stem is pharyngeal dysphagia.

Dysphagia in patients with hemorrhagic stroke is relatively low, however hemorrhagic stroke causes higher death rate up to 75%. Up to recently, there has not been much of knowledge collected in dysphagia symptoms related to hemorrhagic stroke, however, several studies previously have explained that dysphagia in patients with hemorrhagic stroke is mostly caused by hemorrhage in striato capsular area. This area is the most often to experience spontaneous intracerebral hemorrhage due to hypertension. Hemorrhage in this area is called basal ganglia hemorrhage. One of the functions of basal ganglia is as a connector between cerebral cortex and thalamus, which basically functions as the gate where sensorial input enters to the motor control center that governs the action of swallowing. Damage to the basal ganglia can cause oral phase dysphagia.[14]

Result study shows swallowing therapy prevent aspiration significanly. It caused by combination between compensation strategy with using semisolid food in swallowing therapy. Compensatory strategy contained in swallowing therapy is the postural technique and supraglottic swallow. Postural technique was first given

by setting the sitting position to Fowler position (45 degree angle). In this position, vertical phase of the swallowing process at the oropharyngeal area can be helped by the gravity force so that food moves down to the esophagus faster and it also helps to reduce the food residue that usually occurs when patients are in more horizontal position.[15]

The next step in postural technique is for respondents with hemiplagia, where therapist faced the head of the patient to the normal side and then moved it to face the side of the body that suffered hemiplegia. This action helped to make food bolus pass through piriform sinus on their stronger body side so that it lowers down the resistance of upper esophageal sphincter and concurrently also improved the opening time of the sphincter. As a consequence, food bolus passed through more smoothly from the oral cavity to the pharynx.[15] The opposite reaction suffered by the control group that received standard intervention where patients with post-stroke dysphagia and hemiplegia was not put in sideways position following the postural technique thus the food residue was left in the oral cavity on the weak side.

Moreover, by putting the head of the patient in sideways position, it helped them to control their saliva from uncontrolled dripping. A study previously had shown that respondents who were given postural technique could improve their ability to control position of food, move their tongue, and control tongue position on anterior position to the middle of the palatum durum during swallowing process, so that it clinically improved the bolus transfer mechanism from the oral cavity to the pharynx.[16]

Other than postural technique, there is also supraglottic swallow in swallowing therapy. This technique is performed by requesting the respondent to inhale once, hold it, and then start the process of swallowing. As soon as swallowing was done, before taking the next breath, the respondent was asked to cough and swallow again. This method was found to be effective in keeping the clarity of the pharynx, improving the opening response of the upper esophageal sphincter, and accelerating the closing of respiratory track on vocal folds, so that patient would not end up with hoarse voice since his/her vocal cord was kept clean.[17] The act of holding breath during swallowing process and immediate coughing post-swallowing was effective to minimize coughing and choking due to the invasion of the respiratory track9. A study previously had shown that supraglottic swallow applied in an intervention group could significantly improve the breathing-swallowing coordination, so that it protected the respiratory track better.[18]

Effectiveness of swallowing therapy is also affected by the structure of the semisolid food used in the intervention. A previous study revealed a decrease of pharyngeal residue in patients with post-stroke dysphagia who consumed semisolid food. Moreover, semisolid food could also reduce the incidence of aspiration significantly. It was further explained that it was due to the fact that semisolid food was easier to swallow by the patients.[11] This fact was seen in the study where respondents who received semisolid food had faster swallowing time (suitable with the GUSS criteria), so that the movement of food bolus from oral cavity to the esophagus was smoother. The opposite reaction was observed in control group who received swallowing test using gruel. Gruel has sticky texture and it does not melt in water immediately. Thus, it might increase the risk of aspiration. Moreover, the respondents also seemed to have difficulties to initiate swallowing, so they needed longer time and more energy as compared to those consuming semisolid food e.g. pudding. Table 4 also shows that in terms of slow swallowing (>2 s), swallowing therapy could reduce the incidence of slow swallowing more compared to the standard intervention.

CONCLUSION

Based on the results of the study, it can be concluded that there was significant effect of swallowing therapy to the avoidance of aspiration in patients with post-stroke dysphagia at the Stroke Unit of Dr. Sarjono Hospital. The therapy used in the study involved compensatory strategy (postural technique and supraglottic swallow), which was combined with the use of semisolid food.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee (013/UN6.C1.3.2/KEPK/PN/2016)

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Cite this article as: Achmad BF, Arifin MZ, Nuraeni A. Effect of swallowing therapy to avoid aspiration in patients with post-stroke dysphagia at the stroke unit of Harjono hospital, Indonesia. Int J Res Med Sci 2019;7:2192-7.