

Effect of Implementing Swallowing Training Exercises on Neurogenic Dysphagia among Acute Stroke Patients

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Abstract

Background: Neurogenic dysphagia is one of the most dangerous consequences of stroke leading to pulmonary infections and even death in stroke survivors. **Aim:** Evaluate the effect of implementing swallowing training exercises on neurogenic dysphagia among acute stroke patients. **Design:** A quasi-experimental research design. **Setting:** This study was conducted at Neurological Intensive Care Units of Tanta Main University Hospital which affiliated to Ministry of Higher Education and Scientific Research. **Subjects:** A purposive sampling of 60 patients with acute stroke aged from 21 to 60 years old, both sexes. **Tools:** Four tools were used in this study **Tool I: Acute Stroke Patients' Assessment:** It included three parts as the following: **Part (1):** Patients' demographic characteristics, **Part (2):** Patients' medical data, and **Part (3):** Patients' swallowing reflexes examination, **Tool II:** Functional Oral Intake Scale (FOIS), **Tool (III):** The 8-Point Penetration-Aspiration Scale (PAS), and **Tool (IV):** Dysphagia Observational Checklist. **Results:** The study finding revealed a highly statistically significant difference was observed among control & study group at 5th day of admission with (p= 0.000) post application of the swallowing training exercises regarding penetration-aspiration scale. **Conclusions:** Neurogenic dysphagia is a common problem notified among acute stroke patients that need special intervention to improve patients' status and decreased its complications. **Recommendation:** Manual log book about care of dysphagia and stroke patients should be available to nurses at Neurological Intensive Care Units as a teaching guide for patients with neurogenic dysphagia and Continues health education programs for patients and relatives to increase practices and knowledge on swallowing exercises.

Keywords: Acute stroke patients, Neurogenic Dysphagia & Swallowing Training Exercises

Introduction

Neurogenic Dysphagia is an impairment of complex and integrated sensorimotor system. It is typically occurring in patients with neurological disease of different etiologies especially acute stroke. In fact, dysphagia is one of the most dangerous consequences of stroke leading to pulmonary infections and even death in stroke survivors. Therefore, a correct screening, evaluation, and treatment of dysphagia in acute stroke patients seem essential for improving patient's quality of life and may help to prevent or delay death **(Panebianco, et al., 2020, & Bakhtiyari, et al., 2022)**.

Globally, the incidence of neurogenic dysphagia is 400,000 to 800,000 patients per year. The prevalence of dysphagia varies according to etiology; 55% of stroke patients, 11%-81% in parkinson disease, 11%-93.5% in head and neck cancer, and more than 90% of patients with motor neuron disease. In Egypt, the prevalence of dysphagia is about 50% up to 80% of stroke patients **(Ansar, et al., 2022, & Benfield et al., 2019)**.

Swallowing process is a complicated neuromuscular activity whereby food is transferred from the mouth to the stomach. The act of swallowing requires the coordination of cranial nerves, the brain stem, cerebral cortex and 26 muscles of the mouth, pharynx and esophagus. The main cranial nerves that influence swallowing include the trigeminal, facial, glossopharyngeal, vagus and hypoglossal. Neural networks that are responsible for this automatic swallowing are coordinated in the medulla oblongata. The swallowing process can be divided into four phases; which include oral preparatory phase, oral phase, pharyngeal phase and esophageal phase **(Raj & Martina, 2022)**.

The most clinically relevant complications due to dysphagia in acute stroke patients are

malnutrition, dehydration, and aspiration pneumonia with inherent risk of respiratory insufficiency and even admission to the intensive care unit **(Spronk et al., 2022)**. The incidence of pneumonia caused by aspiration of pathogenic bacteria in patients who present with dysphagia, increases both the mortality and the need for acute care hospitalization **(Weimers & Pillay, 2021)**.

Nursing staff play an important role in preventing neurogenic dysphagia and its serious complications thought implementation of nursing measures to reduce hospital stay, improve patients' quality of life, and maintain care- effective cost-effective approach which improve the overall health. These measures include oral care which is extremely important, proper position of patient after eating a meal (30-degree position, up for 30 minutes after eating a meal) to prevent reflux. It is the nursing staff that monitors the amount and frequency of meals taken, which can prevent significant weight loss as well as malnutrition and dehydration of patients **(Śledzik & Szlendak, 2022)**.

Moreover, swallowing training exercises is essential to improve swallowing function for neurogenic dysphagia in acute stroke patients. These exercise approaches target specific muscles or groups of muscles active in deglutition or swallowing. These exercises include effortful swallow, Shaker's exercise, Masako maneuver, Mendelsohn maneuver and supraglottic maneuver. These Exercises probably constitute the most widespread treatment approach for patients with neurogenic dysphagia **(Krekeler et al., 2021, & Dziejew et al., 2021)**.

Effortful swallowing training (EST) increases the posterior motion of the tongue base toward the posterior pharyngeal wall. Recently, EST was reported as a remedial method for the treatment of oropharyngeal dysphagia. It

involves pushing the tongue firmly against the palate while swallowing as forcefully as possible. It is known to have a positive effect in functioning at the oral and pharyngeal phases (**Park et al., 2019**).

Additionally, Masako maneuver, was developed to improve base of tongue (BOT) to posterior pharyngeal wall (PPW) contact by targeting contraction of the superior pharyngeal constrictors and the Mendelsohn maneuver (MM) was originally developed to increase the duration and width of upper esophageal sphincter (UES) opening. The Shaker exercise, also referred to as the head lift exercise, was developed to target reduced UES opening through strengthening suprahyoid muscles that contribute to anterior movement of the hypo laryngeal complex (HLC) as well as shortening of the thyrohyoid muscle (**Félix-Lusterman et al., 2021**).

Likewise, the supraglottic maneuvers are used to close the airway before and during swallowing. These maneuvers strengthen the retraction of the base of the tongue and increase the pressure generated, as well as increase the clearance of the residue after swallowing. This maneuver is done in repeated swallows while the individual holds his or her breath. Each action is immediately followed by forced coughing and clearing of the throat (**Zavala-Solares et al., 2020**). Therefore, this study was done to evaluate the effect of implementing swallowing training exercises on neurogenic dysphagia among acute stroke patients.

Significance of study:

According to World Gastroenterology Organization data, Dysphagia symptoms develop between 42% and 67% of patients within three days of stroke and one third of patients experience complications in the form of aspiration pneumonia (**Śledzik & Szlendak, 2022**). Also, the incidence of pneumonia caused by aspiration of pathogenic bacteria in patients

who present with dysphagia, increases both the mortality and the need for acute care hospitalization (**Weimers & Pillay, 2021**)

Neurogenic dysphagia following stroke is prevalent, and associated with increased morbidities, and poorer outcome (**Carnaby et al., 2020**). From the clinical practice at Neurological Intensive Care Units, it was noticed that dysphagia can cause many complications such as aspiration pneumonia, dehydration and malnutrition that lead to increased mortality. There for, early assessment, texture modification, and effective swallowing training exercises can reduce these risks and improve quality of life (**Benfield et al., 2019**). Thus, the current study conducted in an attempt to design and implement certain types of swallowing exercises to improve swallowing function, maintain adequate nutritional intake and maximize airway protection to reduce potential complications for patients with neurogenic dysphagia.

Aim: Evaluate the effect of implementing swallowing training exercises on neurogenic dysphagia among acute stroke patients.

Research Hypothesis: The study group who are exposed to swallowing training exercises are expected to exhibit improvement of swallowing function and reduce complications of neurogenic dysphagia than the control group.

Research design: A quasi-experimental research design was utilized.

Setting: The study was conducted at Neurological Intensive Care Units of Tanta Main University Hospital which affiliated to Ministry of Higher Education and Scientific Research. It includes ICUs with 14 beds.

Subjects and methods:

A purposive sampling of 60 patients with acute stroke were collected from the previously mentioned setting.

The total sample size was (60) patients divided into two equal groups, 30 patients in each as the following:

Control group, consisted of 30 adult patients who received the routine nursing care as prescribed by the physician which included maintain the patient in proper position, oral care and care for feeding tube.

Study group, consisted of 30 adult patients who received the swallowing exercises as agreed by the training physician.

The subjects were selected according to the following criteria:

Inclusion criteria:

- Adult patients aged 21-60 years of both sex.
- Newly admitted conscious patient with neurogenic dysphagia.
- Able to communicate and follow instructions.
- Able to sit upright for 30 – 40 minutes.

Exclusion criteria:

- Language barriers such as aphasia.
- No oral intake was permitted due to medical reasons or oral intake was severely impaired.
- Patients experiencing old stroke.
- Sensory deficit.

Tools of data collection:

Four tools were utilized in the present study to collect pertinent data as the following:

Tool I: Acute Stroke Patients' Assessment:

It was developed by the researcher after reviewing of the relevant literatures (**Panebianco et al 2020, Benfield et al 2019, Wolf et al 2021, & Spronk et al 2020**) to assess demographic and medical data for patients with neurogenic dysphagia. It was comprised of three parts as the following:

Part (1): Patients' demographic characteristics such as age, sex, occupation, educational level and marital status.

Part (2): Patients' medical data; it consisted of past medical history, medications received, previous risk factors of stroke, comorbidities and history of medical problems, medical diagnosis, onset and duration of dysphagia,

swallowing difficulties, types of dysphagia, consistency of diet and vital signs.

Part (3): Patients' swallowing reflexes examination; it consisted of Trigeminal, Facial, Glossopharyngeal, Vagus and Hypoglossal Nerves examination.

Tool II: Functional Oral Intake Scale (FOIS):

This tool was developed by **Crary et al (2005)** to evaluate the level of liquid and food oral intake for dysphagia in stroke patients. It included items related to, nothing by oral (NBO), tube dependency with minimal attempts of food or liquid, tube dependency with consistent oral intake of food or liquid, total oral diet of a single consistency, total oral diet with multiple consistencies but requiring special preparation or compensations, total oral diet with multiple consistencies without special preparation but with specific food limitations and total oral diet with no restrictions, ranged from NBO to total oral diet with no restrictions.

Scoring system:

The FIOS consisted of a 7 – point ordinal swallowing measures as the following:

- From level 1 to 3; indicated the tube dependent.
- From level 4 to 7; indicated total oral intake.

Tool III: The 8-Point Penetration-Aspiration Scale (PAS):

The 8-Point Penetration-Aspiration Scale was adopted from **Rosenbek et al (1996)** to assess presence or absence of aspiration. It included items related to: (1) material does not enter airway. (2) Material enters the airway, remains above the vocal folds and is ejected from the airway. (3) Material enters the airway, remains above the vocal folds, and is not ejected from the airway. (4) Material enters the airway, contacts the vocal folds and is ejected from the airway. (5) Material enters the airway, contacts the vocal folds and is not ejected from the airway. (6) Material enters the airway, passes below the vocal folds and is ejected into the

larynx or out of the airway. (7) Material enters the airway, passes below the vocal folds and is not ejected from the trachea despite effort and (8) Material enters the airway, passes below the vocal folds and no effort is made to eject.

Scoring system:

The PAS was consisted of 8- items as the following:

- The first 5-items related to penetration.
- The last 3-items related to aspiration.

Tool IV: Dysphagia Observational Checklist:

This tool was developed by the researcher, it consisted of six items to assess the signs of dysphagia and the patient's response during implementing of the swallowing exercises. It was included coughing, choking, aspiration, cyanosis, gag reflex, and vomiting during exercise.

Scoring system:

The dysphagia observational checklist consisted of 6 items and was scored as the following:

- Absence of sign scored (0).
- Presence of sign scored (1).

Methods

The study was accomplished through the following steps:

1. Administrative process:

- Official letters from the Faculty of Nursing, Tanta University to the director of the Neurological Intensive Care Units at Tanta University Hospitals.
- Permission to conduct the study was obtained from the directors of the selected setting.

2. Ethical and legal consideration:

- Ethical committee approval was obtained from the scientific research ethics committee of the Faculty of Nursing code (124/11/22). Additionally, the Faculty of Medicine code of ethics was (36105/11/22).
- An informed consent was obtained from every patient after explaining the aim, nature, and benefits of the study to participate in the study and including the right to withdrawal at any time without rationale.

- Confidentiality of the data and patient privacy were respected. A code number was used instead of name.

3. Tools Development:

- Tool I and IV of the study were developed by the researcher after reviewing recent related literature.
- Tool II was developed by **Crary et al (2005)** and tool III was adopted from **Rosenbek et al (1996)**.

4. Tools Validity:

All tools were tested for content validity for clarity and applicability by 5 experts of Critical Care and Emergency Nursing and Medical Biostatistics and modifications were done accordingly.

5. Reliability:

All tools were tested for reliability using Cronbach's alpha test. It was 0.90 for tool I, interrater reliability for tool (II) FOIS was high ranged from "0.86 to 0.91", The PAS (tool III) was valid and displayed higher inter-rater reliability = 0.67, and 0.88 for tool IV.

6. A pilot study:

It was conducted before the study, on 10% of the patients in order to test the clarity, feasibility, validity, and the applicability of the different items of the determinant tools and they were excluded from the total number of the study subjects.

7. Data was collected daily and the total mean scores were taken at three times: on admission, at the 3rd day and at the 5th day of implementing swallowing exercises. Data collection of the presented study was conducted within the period from the beginning of April 2023 to the end of the September 2023.

8. Data collection was done firstly for control group and then to study group to prevent data contamination.

The present study was conducted through the following phases:

I. Assessment phase:

Assessment of patient's baseline data for both group was carried out by using tool I to assess Patients' demographic characteristics and

swallowing reflexes examination, tool II used to evaluate the level of liquid and food oral intake for dysphagia in stroke patients. Tool III used to assess presence or absence of aspiration. Also, tool IV used to assess the signs of dysphagia and the patient's response during implementing of the swallowing exercises.

II. Planning phase:

- Based on the results of assessment phase as well as extensive literature review, the appropriate types of swallowing exercises performed to improve swallowing function and reduce neurogenic dysphagia.
- The booklet was formulated, prepared and distributed for patients and family for reinforcement of information. Educational aids and strategies were being used during the sessions which include; one to one instruction and demonstration were being used as a teaching method. Also, teaching aids such as a booklet and videos using lap top and smart phone. A booklet and videos were being prepared by the researcher based on literature review (Park et al., 2019, Zavala-Solares et al., 2020, & Carnaby et al 2020). The booklet and videos were being distributed to the patients participated in the study at the end of the sessions.

III. The implementation phase:

Group II (control group)

- Control group received the routine nursing care as prescribed by the physician that provided by the nurse.

Group I (study group)

- During this phase, swallowing exercises were implemented by the study group during sessions.
- The patients were permitted to perform the learned swallowing exercises in front of the researcher to ensure that the patients gain the exact manner of applying the exercises correctly. The patients were scheduled to perform these exercises regularly without dropping any sessions three times per day for 5 consecutive days. Exercises were included effortful swallow, Shaker's exercise, Masako

maneuver, Mendelsohn maneuver and supraglottic maneuver.

- The acute stroke patients started swallowing exercises after admission. It includes five sessions and the duration of each session was 15 minutes, and continues for 5 consecutive days. As the following:

The first session:

Objective of the session:

In this session the patients were taught how to implement swallowing exercise as effortful swallow. It was being done as the following:

- Instruct the patient to swallow hard.
- Encourage the patient to keep the lips closed tight together.
- Ask the patient to push the tongue against the roof of the mouth when he swallows.
- Ask the patient to do this every time swallow food and drink.
- Tell the patient that he or she can apply that exercise without eating or drinking.
- Perform this exercise 3 times per day and repeat the same exercise 10 times per each one.

The second session:

Objective of the session:

- In this session the patients were taught how to implement swallowing exercise as Shaker's exercise. It was being done as the following:
- Instruct the patient to lie down flat.
- Encourage the patient to lift the head up until the patient can see her or his toes.
- Instruct the patient to hold for few seconds.
- Repeat 3 times, rest 1 minute between repetitions.

The third session:

Objective of the session:

In this session the patients were taught how to implement swallowing exercise as Masako maneuver. It was being done as the following:

- Ask the patient to protrude the tongue slightly and hold it between the teeth during swallowing.
- Tell the patient to repeat 5-10 times or until the patient's feel tired.

The fourth session:

Objective of the session:

In this session the patients were taught how to implement swallowing exercise as Mendelsohn maneuver. It was being done as the following:

- Tell the patient to put one hand on larynx and swallow.
- Ask the patient to feel larynx rise but do not let it drop down.
- Encourage the patient to hold it up with the patient muscles for two seconds.
- Release and let the larynx drop and repeat.
- Repeat this exercise 3 times per day.

The fifth session:

Objective of the session:

In this session the patients were taught how to implement swallowing exercise as supraglottic maneuver. It was being done as the following:

- Instruct the patient to inhale.
- Ask the patient to hold breath.
- Encourage the patient to swallow.
- Ask the patient to cough.
- Repeat 3 times, rest 5 minute between repetitions.

IV. Evaluation phase:

Evaluation was done for both study and control groups by using tool II to evaluate the level of liquid and food oral intake for dysphagia in stroke patients, tool III to assess presence or absence of aspiration and tool IV to assess the signs of dysphagia and the patient's response during implementing of the swallowing exercises. These tools were used three times (on admission, at the 3rd and at the 5th day).

- Comparison was done between both groups to evaluate the effect of implementing swallowing exercises on neurogenic dysphagia among acute stroke patients.

Results

Table (1) shows distribution of demographic characteristics among the studied groups.

- Concerning control group, more than half (56.67%) of them aged from (50 to 60) years old, with Mean \pm SD 49.63 \pm 8.36, Also about two thirds (66.67%) of them were married male, less than half of them had primary education and were employees (46.67% &

40%) respectively. Regarding study group, half (50%) of them aged from 50 to 60 years old, with Mean \pm SD 48.67 \pm 9.06, more than half (56.67%) of them were male, and the majority (93%) were married, less than one third (30%) of them had primary education and manual work.

- Also, this table illustrates that there were statistically significant differences between the study and control group regarding marital status and level of education at (P= .04 & .03) respectively.

Table (2) represents distribution of the studied acute stroke patients regarding their clinical data.

Regarding comorbidities and past medical history, 46.67% of control group and 50% of study group had hypertension and cardiac disease respectively. As well as, half (50 %) of the control group received antihypertensive medications compared with (46.67%) of study group. Concerning previous risk factors of stroke, two thirds (66.67%) of the control group had high stressful situations compared with (63.33%) of study group.

- No statistically significant differences were observed regarding all items to clinical data between control and study group.

Figure (1) shows distribution of the studied acute stroke patients regarding the onset of dysphagia and its type.

- Regarding onset of dysphagia, it was noticed that less than two thirds (63.33%) and half (50%) of the study and control group respectively had gradual dysphagia. Also, more than one third (36.67%) and half (50%) of study and control group had sudden onset of dysphagia respectively. Regarding type of dysphagia, it was observed that less than two thirds (63.33%) of control group and more than half (56.67%) of study group had oropharyngeal dysphagia.

Table (3) shows comparison between study & control group regarding the functional oral intake scale (FOIS) throughout periods of intervention.

In relation to FOIS in control group, it was revealed that, the total sample were tube dependent on admission and it was 86.67% at the 3rd day and the percentage decreased to 73.33% at 5th day of intervention with $p = 0.010$. Moreover, in study group, all patients were tube dependent and it decreased to more than half (56.67%) at 3rd day and decreased to about one third (33.33%) after 5th day of admission with $p = 0.000$.

Table (4) illustrates comparison between study & control group regarding the penetration-aspiration scale (PAS) throughout periods of intervention.

- In relation to PAS in control group, it was revealed that, the majority (83.33%) of sample had aspiration on admission and the percentage decreased to (63.33%) at 5th day with $p = 0.000$. Moreover, in study group, (80%) of patients had aspiration on admission and it decreased to less than fifth (16.67%) after 5th day of intervention with $p = 0.000$. A statistically significant difference was observed among control & study group at 5th day of admission with $p = 0.000$.

Table (5) shows relationship between total functional oral intake (FOIS) score and total penetration-aspiration (PAS) score among studied stroke patients throughout periods of intervention.

In this table, concerning control group, the majority (83.33%), about two third (60%) and more than half (53.33%) of them had aspiration and tube dependent on admission, at the 3rd and at the 5th day respectively. Regarding study group, the majority (80.00%), less than third (26.67%) and no one (0.00%) of them had aspiration and tube dependent on admission, at the 3rd and at the 5th day respectively.

Table (1): Distribution of demographic characteristics among the studied groups (n=60).

Characteristics	The studied patients (n=60)				χ^2 P
	Control group (n=30)		Study group (n=30)		
	N	%	N	%	
Age (in years)					
(21-<30)	1	3.33	2	6.67	0.51 0.91
(30-<40)	4	13.33	4	13.33	
(40-<50)	8	26.67	9	30.00	
(50-60)	17	56.67	15	50.00	
Range	(29-60)		(28-60)		t=0.43
Mean \pm SD	49.63\pm8.36		48.67\pm9.06		P=0.67
Gender					
Male	20	66.67	17	56.67	FE
Female	10	33.33	13	43.33	0.59
Marital status					
Single	5	16.67	0	0.00	8.13 0.04*
Married	20	66.67	28	93.33	
Widowed	4	13.33	1	3.33	
Divorced	1	3.33	1	3.33	
Level of education					
Illiterate	1	3.33	7	23.33	8.77 0.03*
Primary education	14	46.67	9	30.00	
Secondary education	13	43.33	8	26.67	
University /Higher	2	6.67	6	20.00	
Occupation					
Manual work	9	30.00	9	30.00	5.61 0.13
Employee	12	40.00	6	20.00	
Housewife	7	23.33	7	23.33	
Farmer	2	6.67	8	26.67	

Table (2): Distribution of the studied acute stroke patients regarding their clinical data among the studied groups (n=60).

Clinical data	The studied patients (n=60)				χ^2 P
	Control group (n=30)		Study group (n=30)		
	N	%	N	%	
Comorbidities and past medical history					
Respiratory disorders.	2	6.67	2	6.67	1.06 0.31
Hypertension.	14	46.67	15	50.00	
Diabetic mellitus	10	33.33	7	23.33	
Atherosclerosis.	7	23.33	8	26.67	
Kidney disease.	4	13.33	6	20.00	
Cardiac disease.	14	46.67	15	50.00	
Endocrine disease.	4	13.33	7	23.33	
Medications received					
Anticoagulant therapy.	3	10.00	6	20.00	1.08 0.29
Antihypertensive drugs.	15	50.00	14	46.67	
Oral contraceptives.	2	6.67	2	6.67	
Antiarrhythmic medications.	14	46.67	14	46.67	
Oral hypoglycemic medications.	13	43.33	3	10.00	
Previous risk factors of stroke					
High blood pressure.	14	46.67	15	50.00	0.23 0.62
Heart disease.	14	46.67	15	50.00	
Diabetes mellitus.	10	33.33	9	30.00	
Smoking.	14	46.67	11	36.67	
Birth control pills.	2	6.67	2	6.67	
History of TIAs (transient ischemic attacks).	5	16.67	8	26.67	
High blood cholesterol and lipids.	6	20.00	12	40.00	
High stressful situations.	20	66.67	19	63.33	
Medical diagnosis					
Acute thrombotic stroke.	11	36.67	10	33.33	2.89
Acute embolic stroke.	7	23.33	9	30.00	
Acute intracerebral hemorrhage.	6	20.00	9	30.00	0.41
Acute subarachnoid hemorrhage	6	20.00	2	6.67	

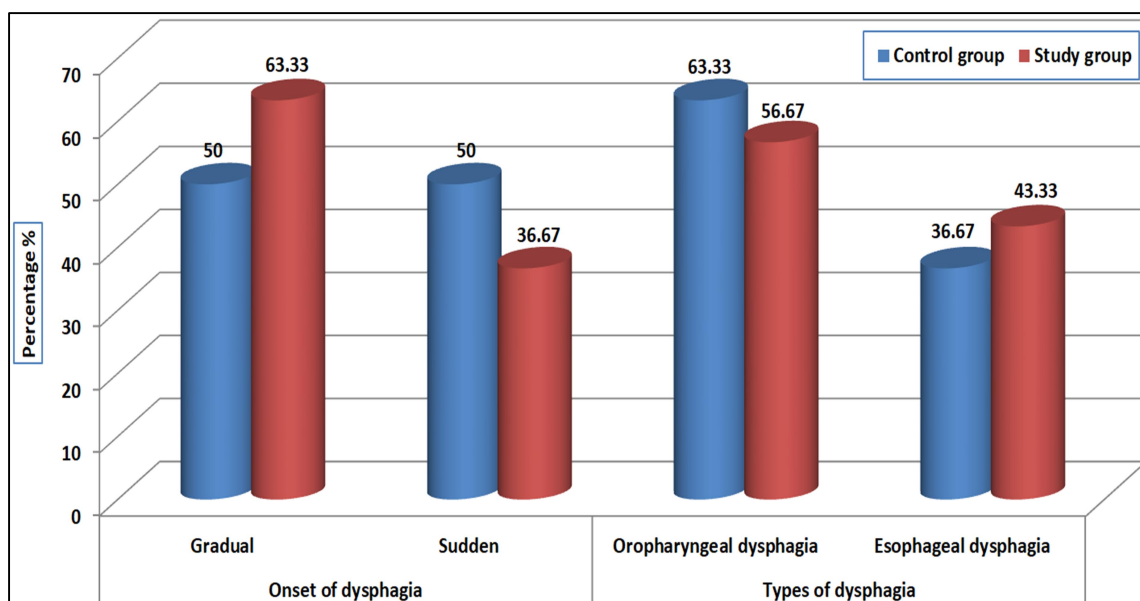


Figure (1): Distribution of the studied acute stroke patients regarding the onset of dysphagia and its type (n=60).

Table (3): Comparison between study & control group regarding the functional oral intake scale (FOIS) throughout periods of intervention (n=60).

FOIS level	The studied patients (n=60)												χ^2 P		
	Control group (n=30)						χ^2 P	Study group (n=30)						χ^2 P	
	On admission		At 3 rd day		At 5 th day			On admission		At 3 rd day		At 5 th day			
	N	%	N	%	N	%		N	%	N	%	N			%
▪ Tube dependent	30	100.00	26	86.67	22	73.33	30	100.00	17	56.67	10	33.33	29.56 0.000*		
▪ Total oral intake	0	0.00	4	13.33	8	26.67	0	0.00	13	43.33	20	66.67			
Range	(1-3)		(2-5)		(2-6)		(1-3)		(2-6)		(3-7)		F=60.45		
Mean ± SD	1.63±0.72		2.60±0.89		3.53±1.19		1.50±0.63		3.60±1.38		4.97±1.49		P=0.000*		
Gp1 Vs Gp2															
t	0.764		3.331		4.098										
P	0.448		0.002*		0.000*										

Table (4): Comparison between study & control group regarding the penetration-aspiration scale (PAS) throughout periods of intervention (N=60).

PAS level	The studied patients (n=60)													
	Control group (n=30)						χ^2 P	Study group (n=30)						χ^2 P
	On admission		At 3 rd day		At 5 th day			On admission		At 3 rd day		At 5 th day		
	N	%	N	%	N	%		N	%	N	%	N	%	
Penetration Aspiration	5	16.67	10	33.33	11	36.67	3.35	6	20.00	13	43.33	25	83.33	24.63
	25	83.33	20	66.67	19	63.33	0.19	24	80.00	17	56.67	5	16.67	0.000*
Range	(3-8)		(2-7)		(1-6)		F=7.33 P=0.000*	(3-8)		(1-7)		(1-6)		F=36.26 P=0.000*
Mean ± SD	6.30±1.37		5.37±1.54		4.73±1.84			6.40±1.33		4.53±1.96		2.60±1.83		
Gp1 Vs Gp2														
t	0.287		1.830		4.505									
P	0.775		0.072		0.000*									

Table (5): Relationship between total functional oral intake (FOIS) score and total penetration-aspiration (PAS) score among studied stroke patients throughout periods of intervention (n=60).

Total penetration- aspiration Level	The studied patients (n=60) Total FOIS level							
	Control group (n=30)				Study group (n=30)			
	Tube dependent		Total oral intake		Tube dependent		Total oral Intake	
	N	%	N	%	N	%	N	%
On admission Penetration Aspiration	5	16.67	0	0.00	6	20.00	0	0.00
	25	83.33	0	0.00	24	80.00	0	0.00
χ^2, P	-				-			
At 3rd day Penetration Aspiration	8	26.67	2	6.67	9	30.00	4	13.33
	18	60.00	2	6.67	8	26.67	9	30.00
χ^2, P	FE, 0.584				FE, 0.283			
At 5th day Penetration Aspiration	6	20.00	5	16.67	10	33.33	15	50.00
	16	53.33	3	10.00	0	0.00	5	16.67
χ^2, P	FE, 0.104				FE, 0.140			

Discussion

Dysphagia after stroke carries the risk of aspiration pneumonia, malnutrition, dehydration, and death. If associated with other risk symptoms such as drowsiness, disorientation or incontinence it may indicate an even worse prognosis. Thus, the importance of dysphagia management in acute stroke has become increasingly recognized with national and international guidelines. Direct exercises involve the action of swallowing and include the Mendelsohn maneuver and effortful swallow. Studies have shown the positive effects of rehabilitative exercises on reducing

the severity and symptoms of post-stroke dysphagia (Matos et al., 2022).

Discussion of the present study will focus on the findings related to demographic characteristics of the studied patients, assessment of medical data, patients' swallowing reflexes examination, assessment of functional oral intake among studied patients, Penetration-Aspiration, dysphagia among studied patients, the relation between FIOS scale and PAS scale, and finally the relation between demographic characteristics of the studied patients and their FIOS scale and PAS scale.

Concerning age of both groups, more than half of studied patients aged between 50 to 60 years old, from the researcher point of view, this may be due to increased incidence of chronic diseases and stroke with advanced age. This result was supported by the study performed by **Yousef et al., (2020)** who studied "Effect of swallowing training rehabilitation program on severity of dysphagia and swallowing trail among patients with cerebrovascular stroke" and mentioned that more than half in both groups were over 50 years old. Also, this result agreed with **Bahceci et al., (2017)**, who studied "The effect of swallowing rehabilitation on quality of life of the dysphagic patients with cortical ischemic stroke" and demonstrated that the studied patients' age ranged from 50 to 75 years.

In relation to gender and marital status of both groups, more than half of them were married males. From the researcher point of view, it may return to the fact that males are more risked for stroke than females due to recurrent work stressors, smoking and life style. This result was similar with **Hafez & Mohamed, (2023)**, they studied "Effect of swallowing exercise training on dysphagia and quality of life among patients following cerebrovascular stroke" and revealed that more than two thirds of both groups were males and almost all of them were married. Also, these results were in the same line with **Elsaid & Shabaan, (2019)** who studied "Effectiveness of exercises-based Dysphagia therapy on swallowing ability for patients with cerebrovascular accident" and reported that more than two third of study participants were married. Moreover, in same point with **Abo Elfetoh & Karaly, (2018)** who studied "Effect of swallowing training program on dysphagia following cerebrovascular stroke" and reported that the largest proportion of participants were males.

Regarding education and occupation of control and study groups, less than half of control group and less than one third of study group had primary education and were employees and had manual work. Moreover, that there was statistically significant difference between the study and control groups regarding marital status and level of education. While, there was no statistically significant difference between the study and control groups regarding gender and occupation. From the researcher point of view this may be due to patients' perception of the importance of education and their low-income levels that hinder the education completion and searching for manual work.

These results were supported by **Yousef et al., (2020)**, who found that above half of participants had work. On the other hand, these results were incongruent with the study performed by **Elsaid & Shabaan, (2019)**, who reported that above one third in control and study groups had secondary school had secondary school. These results were in the same line with **(Hafez & Mohamed, 2023); Yang et al., 2023)**, who studied "Community-based group rehabilitation program for stroke patients with dysphagia on quality of life, depression symptoms, and swallowing function" who and found that there was no statistically significant difference between the study group and control group regarding gender, occupation, marital status and level of education.

Regarding comorbidities and past medical history, less than half of control group and one half of study group had hypertension and cardiac disease. As well as, half of the control group received medications compared by less than half of study group. Concerning previous risk factors of stroke, two thirds of the control group had high stressful situations and less than two thirds of study group. From the researcher

point of view this may be due to that hypertension has a significant effect on the structure of the blood vessels of the brain which increases the risk for stroke.

These results were supported by **Bahceci et al., (2017)**, who showed that the majority of studied patients had hypertension and less than half of them had coronary artery disease. **Yanti et al., (2022)**, who studied "The effect of swallowing exercises in combination with Benson relaxation on swallowing ability in stroke patients", showed that less than two thirds of the respondents had comorbidities include hypertension.

Regarding onset of dysphagia, less than two thirds of the study group and half of the control group had gradual dysphagia. Also, more than one third of study group and half of control group had sudden onset of dysphagia. Regarding type of dysphagia, it was observed that less than two thirds of control group and more than half of study group had oropharyngeal dysphagia. From the researcher point of view this may be because dysphagia is developed gradually post stroke and developed primarily from oropharyngeal stage.

These results were in harmony with the study performed by **Abdelmowla et al., (2022)**, entitled "Effect of Swallowing Exercises on Swallowing Function for Patients with Neurogenic Dysphagia" and showed that the majority of studied patients had gradual dysphagia. On the other hand these results disagreed with the study conducted by **Kusumaningsih et al., (2019)**, entitled "The effectivity of pharyngeal strengthening exercise, hyolaryngeal complex range of motion exercise, and swallowing practice in swallowing function of ischemic stroke patients with neurogenic dysphagia" and showed that all subjects experienced dysphagia since the onset of stroke occurred.

In relation to FOIS in control group, it was revealed that, the total sample were tube dependent on admission and it was the majority of them at the 3rd day and the percentage decreased to less than three quarters at 5th day. Moreover, in study group, all patients were tube dependent and it decreased to more than half at 3rd day and decreased to about one third after 5th day of admission with. Also, statistically significant difference was observed among control & study group at 3rd, 5th day of admission. From the researcher point of view, this may be explained by the effectiveness of swallowing exercises that implemented by the researcher in improving patients' functional oral intake.

These results were supported by the study carried out by **Jongprasitkul & Kitisomprayoonkul, (2020)**, who revealed that patients admitted at the FOIS score 1–3 (NG tube dependent), less than half improved to the FOIS score 4–6 (no NG tube dependent) before discharge. These results were compatible with **Hafez & Mohamed, (2023)**, who found that a significant difference in functional oral intake between patients in study and control groups after implementing swallowing exercise training was found. Also, these results were consistent with **Kang et al., (2012)**, who illustrated that there was an improvement in FIOS for interventional group after implementing swallowing exercises.

Concerning penetration-aspiration scale (PAS) throughout periods of intervention, the majority of sample had aspiration on admission and decreased to less than two thirds at 5th day. Moreover, in study group, the majority of patients had aspiration on admission and it decreased to less than one fifth after 5th day of admission. From the researcher point of view this may be due to weak or absent Gag reflex and overall swallowing reflexes.

These results were similar with **Choi et al., (2017)**, they studied "Effects of Shaker exercise in stroke survivors with oropharyngeal dysphagia" and revealed that the experimental group showed greater improvement on the PAS compared with the control group. Also, these results were compatible with **Kim et al., (2017)** found that effortful swallowing has a positive effect on aspiration in patients with dysphagia after stroke.

Concerning the relation between total functional oral intake (FOIS) score and their total penetration-aspiration (PAS) score the current study illustrated that the majority of studied patients had aspiration and tube dependent on admission, more than half of them had aspiration and tube dependent at the 3rd and at the 5th day. Regarding the study group, the majority studied patients had aspiration and tube dependent on admission, and decreased to be more than one quarter at the 3rd and no one of them had aspiration or tube dependent at the 5th day. Also, there was no statistically significant difference between the total functional oral intake (FOIS) and their total penetration-aspiration (PAS) was observed in control and study group at 3rd day and 5th day. From the researcher point of view this may be due to comorbidities that affecting patient responses to swallowing exercises.

These results were different with **Pekacka-Egli et al., 2021)**, they revealed statistically significant differences between PAS scores for FOIS on admission and before discharge. These results were similar with the study performed by **Kumar et al., (2022)**, who revealed that primary efficacy outcome was a change in PAS scores at day-5 of intervention.

Conclusion

Based on the finding of the present study, it can be concluded that, statistically significant differences were observed among control & study group regarding functional oral intake at

3rd, 5th day of admission. Also, statistically significant differences were observed among control & study group regarding penetration-aspiration at 5th day of admission with and there was statistically significant difference among control & study group regarding dysphagia assessment throughout periods of intervention.

Recommendations:

Based on the finding of the current study, it can be recommended that:

For administration:

- Nurses should be educated and trained on swallowing exercises to be able to use it to manage dysphagia
- Enrollment of swallowing exercise training into treatment plan for stroke patients
- Manual log book about care of dysphagia and stroke patient should be available to nurses at Neurological Intensive Care Units as a teaching guide for patients with neurogenic dysphagia.

For nurses:

- Swallowing exercise should be accomplished by patients who have swallowing problems to improve swallowing and eating capability.
- Continues health education programs for patients and relatives to increase practices and knowledge on swallowing exercises.
- Fixed poster on the about swallowing exercises for patients and relatives.

For further researchers:

- Replicate the study on a greater group; selected from different geographical areas in Egypt to gain more generalized findings in relation to present study.
- Assess different factors contributing in increased incidence of dysphagia on stroke patients.

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