

Effect of Swallowing Exercises on Swallowing Function for Patients with Neurogenic Dysphagia

Rasha Ali Ahmed Abdelmowla¹, Hanan Ali Ahmed Abdelmowla², Soher Ahmed Awad Abdel Aziz³, Eman Mawed Fahem⁴ & Sahra Zaki Azer⁵

¹. Assistant Professor of Medical-Surgical Nursing, Faculty of Nursing, Assiut University, Egypt

². Lecturer of Medical-Surgical Nursing, Faculty of Nursing, Assiut University, Egypt

³. Lecturer of Gerontological Nursing, Faculty of Nursing, Assiut University, Egypt

⁴. Lecturer of Medical-Surgical Nursing, Faculty of Nursing, Benisuef University, Egypt

⁵. Assistant Professor of Medical-Surgical Nursing, Faculty of Nursing, Assiut University, Egypt

Abstract

Background: Neurogenic dysphagia is one of the most common dangerous disorders for patients with neurological diseases. **Aim:** The aim of the study was to evaluate the effect of swallowing exercises on swallowing function for patients with neurogenic dysphagia. **Patients and Methods:** Research design: Quasi experimental (pre/post test) research design was used. **Sample and Setting:** A selected sample of 60 patients diagnosed with neurogenic dysphagia was recruited and also followed up for 2 months at neurology department and neurology outpatients clinic at neurology, psychiatry and neurosurgery Assiut University Hospital. Each patient was oriented and trained by the researchers to know the effect of practicing swallowing exercises and received brochure to be oriented about its effect on swallowing function. **Tools:** Patients assessment questionnaire, functional oral intake scale, Bazaz dysphagia score, eating assessment tool-10 and the 8-point penetration-aspiration scale. **Results:** The study finding revealed a highly statistical significant improvement ($p < 0.0001$) post application of the swallowing exercises as regard all outcome measures; functional oral intake scale, Bazaz dysphagia scale, aspiration and complications. **Conclusion:** Swallowing exercises significantly improve swallowing function and decrease severity of neurogenic dysphagia, aspiration and complications. **Recommendation:** The swallowing exercises (brochure) should be utilized in neurology hospitals as a teaching guide for patients with neurogenic dysphagia.

Keywords: Neurogenic dysphagia, Swallowing exercises & Swallowing function

Introduction

Swallowing is a complex neuromuscular process requires precise coordination of more than twenty-five muscle pairs, intact pharyngeal sensation and central control in the cortex and brainstem (Labeit et al., 2019). The variety of the different structures involved suggests that various pathophysiologic mechanisms can result in dysphagia rely on the underlying disease and associated functional and structural impairment (Labeit et al., 2020).

Neurogenic dysphagia is a swallowing disorder caused by diseases of the peripheral or central nervous system, muscles, or neuromuscular transmission. It is one of the most common and most dangerous disorders for different and many neurological diseases. Impaired deglutition is found in at least half of all patients with hemorrhagic or ischemic stroke. Affected patients have a four times increased risk of aspiration pneumonia, suffered from long lasting severe disability and discharged to nursing homes and show increased mortality (Joundi et al., 2017).

The incidence of neurogenic dysphasia worldwide is 400,000 to 800,000 patients per year. It is occurring in patients with various neurological diseases with different etiologies; stroke, multiple sclerosis, parkinson's disease, progressive supranuclear palsy, multiple system atrophy, spinocerebellar ataxia, myopathies, head injury, brain tumor or tardive dyskinesia and dystonia. An appropriate and early management of neurogenic dysphagia could be useful for improving swallowing function and may help to reduce complications. Stroke is considered the most frequent disease lead to disruption of swallowing thereby causing an impairment of deglutition (Maeshima et al., 2014; Alali et al., 2018 & Panebianco et al., 2020).

Neurogenic dysphagia is prominent across the continuum of cerebrovascular diseases recovery and its occurrence is likely to result in aspiration pneumonia, dehydration and poor nutrition as a result of disruption of swallowing safety and efficacy. It is estimated that fifty percent of cerebrovascular diseases survivors are present with neurogenic dysphagia (Dziewas et al., 2021).

Aspiration is the entry of materials into the airway under the level of the true vocal cords. Risk factors for aspiration post neurological diseases include: brainstem stroke, difficulty swallowing oral secretion, coughing/throat clearing or wet, gurgle voice quality following swallowing water, choking more than once while drinking (50 ml) water, weak voice and cough, wet-hoarse voice quality, recurrent lower respiratory infection, or immune-compromised patients (Han et al., 2020 & Kiran Kumar, 2016).

Swallowing exercises can help to improve swallowing function and maintain the ability to drink and eat safely and decrease swallowing problems that may arise from various neurological diseases. Swallowing dysfunction and its potential complications are common in patients with neurological diseases, thus the swallowing function should be assessed in all neurological patients (Banda et al., 2021).

Nurses have an important role in assessing and managing patients with swallowing problems with assistance and guidance from other health care team including speech pathologists to help reestablish safe oral intake to normal level as soon as possible, minimize complications and improve quality of life for patients with neurogenic dysphagia. Nurses should identify swallowing difficulty in patients with neurological diseases which is considered the first and important task in nursing care. Through patients assessment nurses can detect and assess signs and symptoms of dysphagia early and thus allow for early management. Also, they have role in managing patients` mealtime, teaching safe feeding practices, providing information about swallowing exercises and treatment plan, and documenting progress (Hines et al., 2016 & Kraaijenga et al., 2015).

Significance of the study

Based on various studies, neurogenic dysphagia found to be associated with excess morbidity and mortality rates for patients with neurological disorders. The presence of unsafe swallow remains a significant predictor of mortality. Also, dysphagia is an indicator of worse functional outcome. Dysphagia can lead to severe complications and cause malnutrition, dehydration, and increased risk of aspiration pneumonia. Therefore, efficient and effective management is so important (Warnecke et al., 2021). The current study was 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.

Aims

General objective

The current study was aimed to evaluate the effect of swallowing exercises on swallowing function for patients with neurogenic dysphagia.

Specific objectives

1. Assess needs of patients with neurogenic dysphagia.
2. Design and implement swallowing exercises for patients with neurogenic dysphagia based on their assessed needs.
3. Avoid neurogenic dysphagia-related complications.
4. Maintain adequate nutritional intake and maximize airway protection.
5. Evaluate the effect of swallowing exercises on patients swallowing function.

Research Hypotheses

The following research hypotheses were included:

1. Swallowing exercises would improve swallowing function for patients with neurogenic dysphagia.
2. Application of swallowing exercises would reduce complications for patients with neurogenic dysphagia particularly aspiration pneumonia.
3. Application of swallowing exercises would permit adequate nutritional intake and maximize airway protection.

Patients and Methods

Research design

Quasi experimental (pre/post test) research design was utilized to conduct this study .

Setting

The study was conducted in the neurology department and neurology outpatients clinic at neurology, psychiatry and neurosurgery Assiut University Hospital.

Sample size

It was calculated using (G power software) as 60 cases. Calculated size of the sample for testing differences between two independent means two tailed. Used "power 95 %", "effect size 0.8", and "error 0.05".

Patients

A selected sample of "60" adult and old adult patients, male and female, with mean age 60.62 ± 5.58 years old, diagnosed with neurogenic dysphagia, conscious, cooperative, able to follow instructions and able to sit upright for 30 - 40 minutes.

Tools for data collection

Tool I: Patients assessment questionnaire:

It developed by the researchers to assess demographic and medical data and complications for patients with neurogenic dysphagia.

Part 1: Demographic data included age, sex, occupation, educational level and marital status.

Part 2: Medical data included medical diagnosis, onset and duration of dysphagia, and consistency of diet (swallowing difficulty).

Part 3: Complications of neurogenic dysphagia included aspiration pneumonia, malnutrition and dehydration.

Tool II: Functional oral intake scale (FOIS):

It developed by (Crary et al., 2005) to assess dysphagia and oral function in patients with neurological disorders, it used three times; at assessment, before discharge, and after 2 months after application of swallowing exercises. It includes 7- items, the first three items (no oral intake, tube dependent with minimal/inconsistent oral intake, and tube supplements with consistent oral intake); rating scale from (1 to 3 levels tube dependent). The remaining fourth items (total oral intake of a single consistency, total oral intake of multiple consistencies requiring special preparation, total oral intake with no special preparation, but must avoid specific foods or liquid items, and total oral intake with no restrictions); rating scale from (4 to 7 total oral intake). The total score calculated by adding all 7 scores. Higher scores reflect worse functions .

Tool III: Bazaz dysphagia scale:

It developed by (Bazaz et al, 2002) to assess symptoms of dysphagia. The measure includes items concerning severity of dysphagia (none, mild, moderate, or severe). It used three times; at assessment, before discharge, and after 2 months from the application of swallowing exercises. The dysphagia symptoms were graded as none [0], mild [1], moderate [2], or severe [3].

Tool IV: Eating assessment tool-10 (EAT-10):

It developed by (Belafsky et al., 2008). It includes 10-questions about swallowing difficulties. Rating scale range from "0 = no problem" to "4 = severe problem". It used three times; at assessment (before application of swallowing exercises) and before discharge and after 2 months from application of swallowing exercises. It calculated by adding up scores of each question, higher scores indicate a self-perception of high level of swallowing difficulties.

Tool V: The 8-point penetration-aspiration scale (PAS):

It developed by (Rosenbek et al., 1996), to assess presence or absence of aspiration. It includes 8-items; the first 5-items related to penetration and the last 3-items related to aspiration. Each behavior identified by scores "2" through "8" assumed to be more severe sign of neurogenic dysphagia than behavior identified in preceding score. Aspiration is more severe than penetration. Therefore, it scored 6, 7, or 8. Penetration, on the other hand, scored either 2 or 3 if residue remains above vocal folds and 4 or 5 if residue courses to level of vocal folds.

Tools validity and reliability

The study content was reviewed and approved by three experts (two medical-surgical nursing staff and one neurologist) to ensure validity of the content. Interrater reliability for tool (II) FOIS was high ranged from "0.86 to 0.91". Consensual validity was also high 0.90. Bazaz dysphagia scale (tool III) was valid and has perfect reliability (Cronbach $\alpha = 0.96$). The EAT-10 (tool IV) displayed excellent internal consistency (0.960), test-retest reproducibility (0.72 to 0.91), and criterion-based validity. The PAS (tool V) was valid and displayed higher inter-rater reliability "ICC = 0.67, CI 0.60 – 0.74".

Procedure The current study proceeded using the following phases:

Preparatory phase

An official permission was obtained from the head of neurology department and outpatients clinic at neurology, psychiatry and neurosurgery Assiut University Hospital to conduct the study.

Ethical considerations

All research ethics principles were fulfilled according to the World Medical Association Declaration of Helsinki by (Kong et al., 1997). Before the conduction of the pilot study as well as the actual study, official permission and consent were obtained from the dean of the Faculty of Nursing, as well as the director of the neurology department and outpatients clinic after explaining the nature and purpose of the study. The studied patients were entitled to refuse to participate and/or withdraw from the study at any time without any reason. Participants were assured of being highly confidential with all their data.

The aim of the study was explained to the patients before starting data collection. Patients will be informed about what will be done.

Oral consent was taken from patients who were agreeing to participate after reassured them about the confidentiality and the information will be used for the purposeful research.

Pilot study

It was done on 10% (6 patients) of the sample to test clarity and feasibility of the study tools. Also, it estimate time needed to fill out the study tools. There was no needs for modification, so patients in the pilot study sample added to the whole study sample.

Fieldwork description

Swallowing exercises for patients with neurogenic dysphagia (brochure):

The researchers developed swallowing exercises (brochure) in Arabic language after reviewing the related literature, available resources, and patients assessed needs from the pretest. The swallowing exercises were helping strengthen and coordinate the muscles involved in swallowing. The researchers

educate and trained patients about swallowing exercises which improve swallowing function for neurogenic dysphagia. The number of exercises was "14" including: effortful swallow, isokinetic (dynamic) shaker, isometric (static) shaker, jaw thrust, lollipop swallowing, masako maneuver, mendelsohn maneuver, yawn, supraglottic maneuver, tongue strength exercise, tongue range of motion, tongue retraction, effortful pitch glide, and lip range of motion.

Data collection for this study was carried out from (December 2020 to December 2021), during morning and afternoon shifts. The researchers attended the neurology department and neurology outpatients clinic at neurology, psychiatry and neurosurgery Assiut University Hospital. Oral consent for participation in this study was obtained from every patient for ethical issues.

Implementation phase

Each patient was interviewed individually by the researchers. The average time taken for filling the study tools was around 20 - 30 minutes depending on the response of patients.

The researchers provide the selected patients with detailed explanation about the swallowing exercises through five sessions:

The first session: teach the patients swallowing exercises as effortful swallow, isokinetic (dynamic) shaker, and isometric (static) shaker. The time needed for the first session was 15 - 20 minutes.

The second session: teach the patients swallowing exercises as jaw thrust, lollipop swallowing, and masako maneuver. The time needed for the second session was 15 - 20 minutes.

The third session: teach the patients swallowing exercises as mendelsohn maneuver, yawn, and supraglottic maneuver. The time needed for the third session was 15 - 20 minutes.

The fourth session: teach the patients swallowing exercises as tongue strength exercise, tongue range of motion, and tongue retraction. The time needed for the third session was 15 - 20 minutes.

The fifth session: teach the patients swallowing exercises as effortful pitch glide, and lip range of motion. The time needed for the third session was 10 - 15 minutes.

The studied patients were given an educational colored brochure in clear Arabic language. The researchers used pictures, diagram, and role play to help them retain the learned material then gave them a copy of the illustrated brochure.

The patients were permitted to perform the learned exercises under the researchers` guidance to ensure that the patients gain the exact manner of applying the exercises correctly.

Patients are scheduled to perform the prescribed exercises under the researchers' guidance during hospitalization. Patients were encouraged to perform the swallowing exercises three times per day for 8 weeks or according to state of patient.

The researchers encouraged the patients to perform the learned exercises regularly without dropping the exercises sessions.

A scheduled follow up meeting (after 2 months) from starting the swallowing exercises was arranged by the researchers to evaluate the effect of the swallowing exercises.

Evaluation phase

In this phase, the studied patients were evaluated after 2 months using (tool I part 3, tool II, III, IV, and V) to evaluate the effect of the implementation of the swallowing exercises on swallowing function for patients with neurologic dysphagia.

Statistical analysis

The obtained data were reviewed, prepared for computer entry, coded, analyzed and tabulated. Descriptive statistics (Percentage, mean and standard deviation) were done using computer program SPSS version 22. Fisher exact test, one sample t-test and Chi-square test used for analysis of variance p.value < 0.05.

Results

Table (1): Distribution of demographic characteristics among studied patients (n=60)

Demographic data	No.	%
Age (years)		
< 60	28	46.6
≥ 60	32	53.4
Mean±SD	60.62±5.586	
Sex		
Male	41	68.3
Female	19	31.6
Marital status		
Married	52	86.7
Single	8	13.3
Occupation		
Manual work	16	26.7
Sedentary work	14	23.3
Heavy work	12	20.0
Not work	18	30.0
Level of education		
Illiterate	10	16.7
Read and write	8	13.3
Primary school	14	23.3
Preparatory school	20	33.3
Secondary school	3	5.0
University education	5	8.4

Frequency and percentage

Table (2): Distribution of medical data among the studied patients (n=60)

Medical data	No.	%
Diagnosis		
Cerebrovascular diseases	45	75.0
Parkinson's disease	4	6.7
Myasthenia gravis	2	3.3
Multiple sclerosis	9	15.0
Onset of dysphagia		
Sudden	11	18.3
Gradual	49	81.7
Duration of dysphagia		
1-2 weeks	35	58.3
More than 2 weeks	25	41.7
Consistency of diet (swallowing difficulty)		
Liquid	21	35.0
Solid	39	65.0

Frequency and percentage

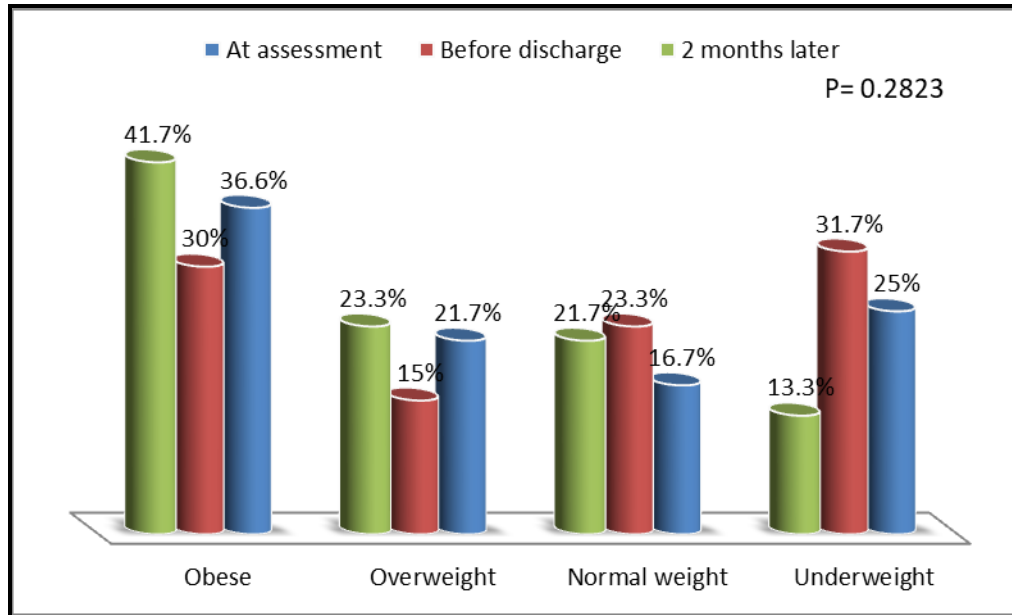


Figure (1): Body mass index among the studied patients before and after application of swallowing exercises (n=60)

Table (3): Functional oral intake scale before and after application of swallowing exercises

	Mean±SD	Mean different (95% confidence interval)	P. value
Functional oral intake scale			
Before	0.92 ± 1.47	2.030 (1.4788: 2.5812)	< 0.0001
After	1.95 ± 3.50		

One sample t-test

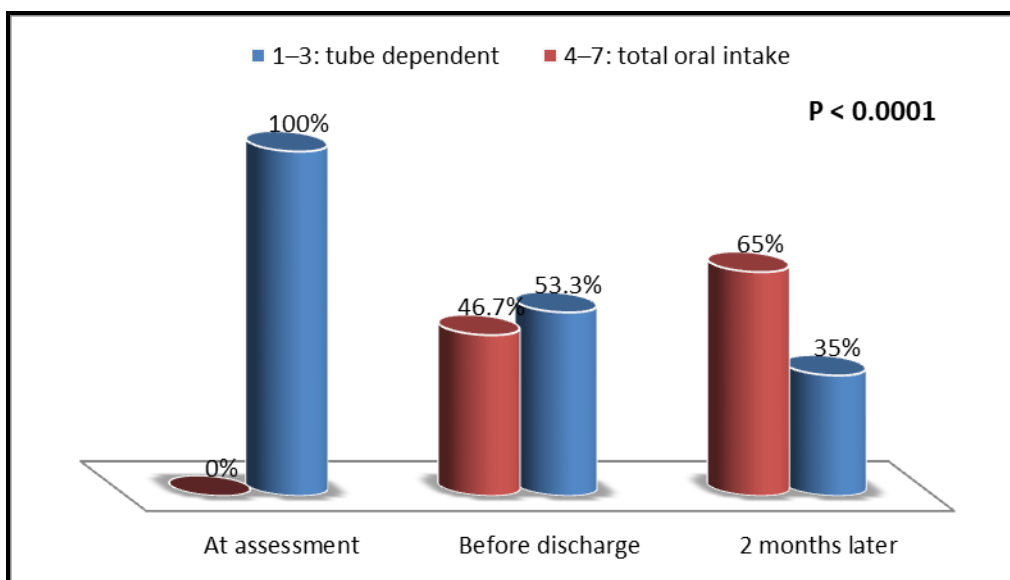


Figure (2): Functional oral intake scale score (1–3: tube dependent, 4–7: total oral intake) before and after application of swallowing exercises (n=60)

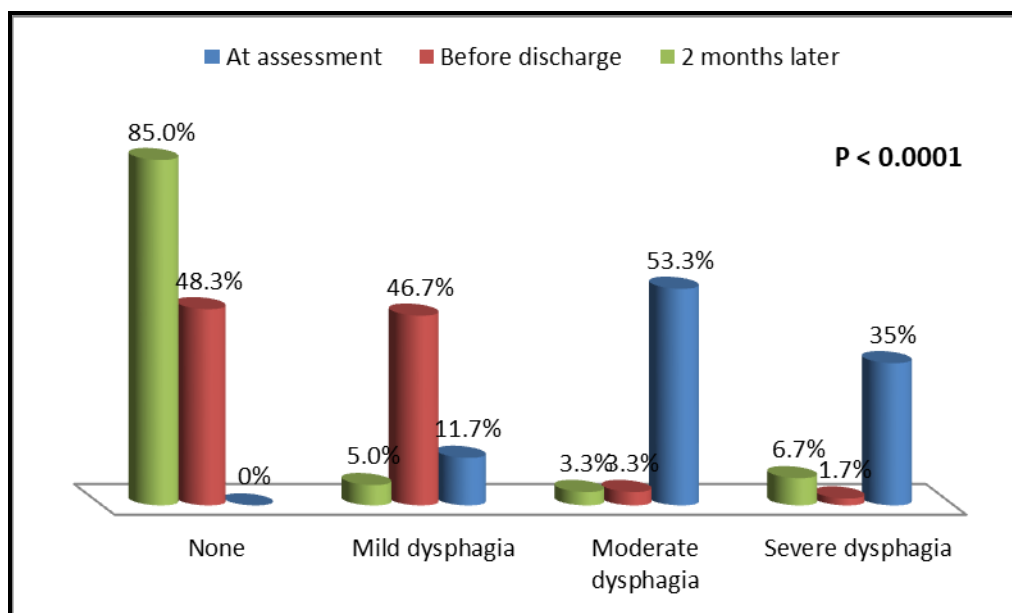


Figure (3): Bazaz dysphagia scale score at assessment, before discharge and after 2 months later after application of swallowing exercises (n=60)

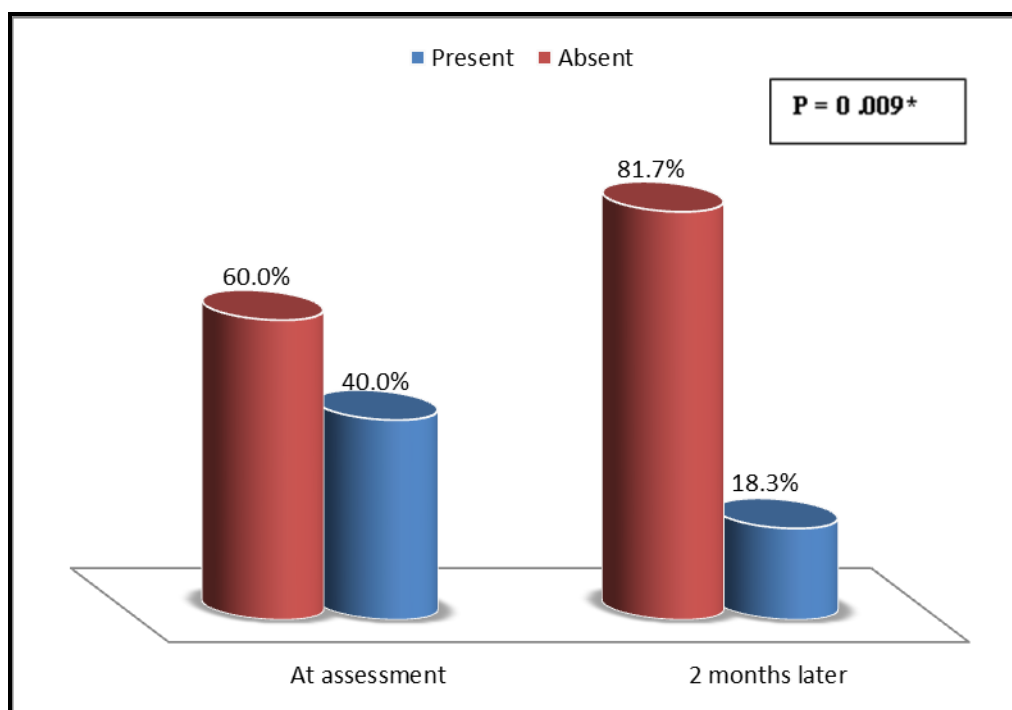


Figure (4): Aspiration among the studied patients at assessment and 2 months later after application of swallowing exercises (n=60)

Table (4): Correlation between eating assessment items, penetration aspiration scale and Bazaz dysphagia scalescore after application of swallowing exercises among the studied patients (n=60)

Scales	EAT-10 score				X ² test	P. value
	Less than 3 (n=17)		3 and higher (n=43)			
	No.	%	No.	%		
Penetration aspiration scale						
No risk of aspiration (1-2)	1	5.9	23	53.5	22.347	0.0001*
Risk of aspiration (3-5)	12	70.6	5	11.6		
Positive aspiration (6-8)	4	23.5	15	34.9		
Bazaz dysphagia scale score (Dysphagia severity)						
None (0)	3	17.6	26	60.5	8.623	0.0134*
Mild dysphagia (1)	13	76.5	16	37.2		
Moderate dysphagia (2)	1	5.9	1	2.3		
Severe dysphagia (3)	0	0.0	1	0.0		

*Chi-square test**Fisher exact test***Table (5): Relation between Bazaz dysphagia scale score and functional oral intake scale score after swallowing exercises among the studied patients (n=60)**

Bazaz dysphagia scale score (Dysphagia severity)	Functional oral intake scale				X ² test	P. value
	1-3: tube dependent (n=32)		4-7: total oral intake (n=28)			
	No.	%	No.	%		
None	9	31.0	20	69.0	12.293	0.006*
Mild dysphagia	21	75.0	7	25.0		
Moderate dysphagia	1	50.0	1	50.0		
Severe dysphagia	1	100	0	0.0		

*Fisher exact test***Table (6): Relation between age of the studied patients and Bazaz dysphagia scale score, functional oral intake scale, penetration-aspiration scale, and eating assessment tool -10 (n=60)**

Scales	Age (years)			
	< 60 (n=28)		≥ 60(n=32)	
	No.	%	No.	%
Bazaz dysphagia scale score (Dysphagia severity)				
None	7	25.0	21	65.6
Mild dysphagia	20	71.4	9	28.1
Moderate dysphagia	1	3.6	1	3.1
Severe dysphagia	0	0.0	1	3.1
X² test	11.0516			
P. value	0.011*			
Functional oral intake scale				
1-3: tube dependent	20	71.4	12	37.5
4-7: total oral intake	8	28.6	20	62.5
X² test	6.9069			
P. value	0.008*			
Penetration aspiration scale				
No risk of aspiration (1-2)	10	35.7	14	43.7
Risk of aspiration (3-5)	15	53.6	2	6.3
Positive aspiration (6-8)	3	10.7	16	50.0
X² test	19.321			
P. value	0.0001*			
Eating assessment tool -10 score				
Less than 3	9	32.1	8	25.0
3 and higher	19	67.9	24	75.0
X² test	0.3752			
P. value	0.008*			

*Chi-square test**Fisher exact test*

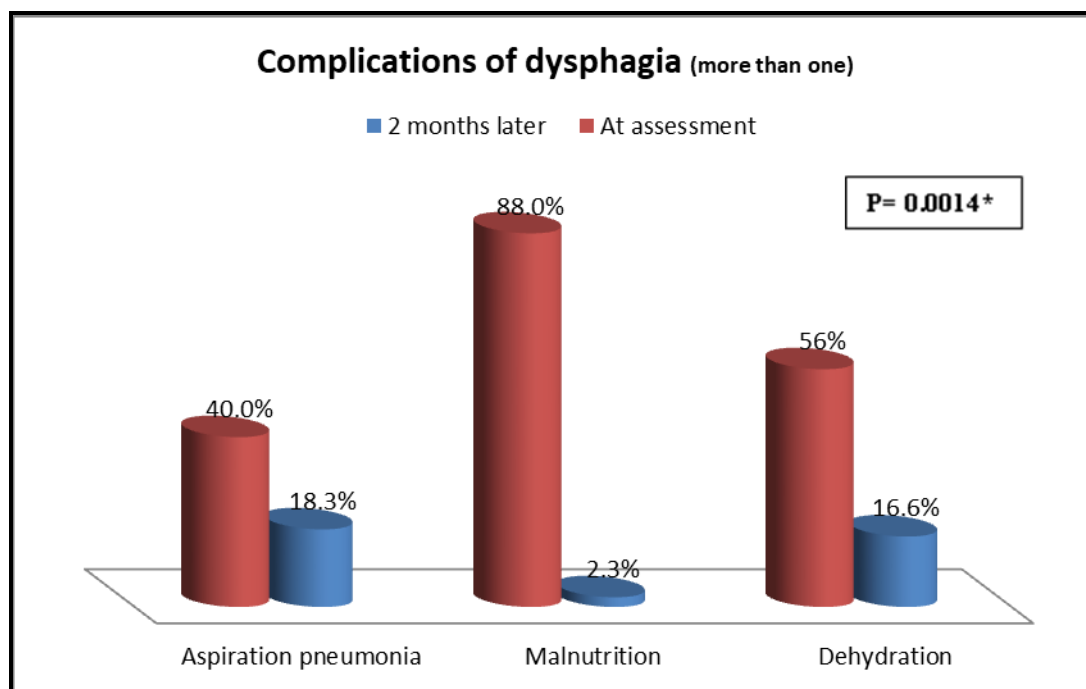


Figure (5): Complications of dysphagia among the studied patients at assessment and 2 months later after application of swallowing exercises (n=60)

Table (1): The majority of the studied patients were married 52 (86.7%), educated 50 (83.3%) and employed 42 (70%) with mean age 60.62 ± 5.586 years old. More than one-third of them 41 (68.3%) were males.

Table (2): The majority of patients were having gradual onset of dysphagia 49 (81.7%), more than half of them complained from dysphagia from 1 to 2 weeks ago. More than one-third of them 45 (75%) were having cerebrovascular diseases. More than two-third of them 39 (65%) were having difficulty swallowing with solid food.

Figure (1): Illustrated that no statistical significant difference among body mass index of the studied patients at assessment, before discharge and after 2 months ($P > 0.05$).

Table (3): Showed highly statistical significant difference before and after application of swallowing exercises among the studied patients regarding mean scores of functional oral intake ($p < 0.0001$, mean different [95% confidence interval of the difference] 2.030 [1.4788; 2.5812]).

Figure (2): Illustrated highly statistical significant difference before and after application of swallowing exercises among the studied patients regarding FOIS score ($p < 0.0001$). There was an improvement in FOIS before discharge after application of swallowing exercises and more significant improvement was observed 2 months later with continuous application for the swallowing exercises;

all patients were tube dependent at assessment while significant improvement was observed among the studied patients regarding oral food intake after application of swallowing exercises.

Figure (3): Demonstrated that highly statistical significant difference before and after application of swallowing exercises among the studied patients regarding Bazaz dysphagia scale score; severity of dysphagia ($p < 0.0001$). More than half of the studied patients were having moderate dysphagia at time of assessment. More than one-third of patients were having mild dysphagia before discharge after application of swallowing exercises. Absence of dysphagia was observed in the majority of patients after 2 months of practicing swallowing exercises.

Figure (4): Demonstrated highly statistical significant difference between studied patients before and after application of swallowing exercises as regard aspiration ($p = 0.001$). Absent of aspiration was significantly observed among the studied patients after application of swallowing exercises.

Table (4): Clarified that positive correlation was found between EAT-10 score and PAS score ($p = 0.0001$). The presence of swallowing problems increased the risk of aspiration. A positive correlation was found between EAT-10 score and Bazaz dysphagia scale score (dysphagia severity) with ($p = 0.01$). The presence of severe swallowing problems increased the severity of dysphagia.

Table (5): Showed that highly statistical significant relation was found between FOIS and Bazaz dysphagia scale score (dysphagia severity) with ($p = 0.001$). The severity of dysphagia limited the patients' functional level of oral intake.

Table (6): Clarified that age showed statistical significant relation with FOIS score ($p = 0.001$), Bazaz dysphagia scale score (dysphagia severity) with ($p = 0.01$), PAS score ($p = 0.0001$) and EAT-10 score ($p = 0.0001$).

Figure (5): Illustrated highly statistical significant difference between studied patients before and after application of swallowing exercises as regard complications of dysphagia ($p = 0.001$). Complications of dysphagia were significantly reduced among the studied patients after application of swallowing exercises.

Discussion

Swallowing dysfunction and its potential complications are common among patients with neurological diseases. A rehabilitation plan is decided after a comprehensive evaluation of cognitive, motor and sensory abilities and the effect of impaired abilities on recovery of swallowing function for patients with neurological diseases (Banda et al., 2021). In order to solve the impaired process, different methods of swallowing training are developed. These methods include strengthening exercises, biofeedback stimulation, temperature and taste stimulation (Kim et al., 2017).

In the current study, the majority of the studied patients were diagnosed with gradual onset of neurogenic dysphagia as a result of cerebrovascular diseases with mean age 60.62 ± 5.58 years old. More than half of them were having difficulty swallowing of solid food from one to two weeks ago. Other causes of neurogenic dysphagia in the present study included multiple sclerosis, parkinson's disease and myasthenia gravis.

A study finding of Krajczyk et al., (2019) is within the same line with the finding of the current study as they conducted study in sixty patients diagnosed with neurogenic dysphagia as a result of cerebrovascular diseases with age group ranged from fifty-five to sixty-five years old.

Also, in this regard study of Panebianco et al., (2020) reported that neurogenic dysphagia occurring in patients with neurological diseases of various causes. Cerebrovascular accident is considered the most common cause of neurogenic dysphagia. More than half of patients with cerebrovascular accident had neurogenic dysphagia. Half of patients with parkinson's disease had neurogenic dysphagia and less than one-third of patients with multiple sclerosis had neurogenic dysphagia.

In the current study finding, no significant difference was found among body mass index of the studied patients at assessment phase, before discharge and after 2 months. Also, no significant weight changes were observed as a result of neurogenic dysphagia or aspiration among the studied patients. Significant reduction in complications was observed after application of swallowing exercises (after 2 months) regarding aspiration pneumonia, malnutrition and dehydration.

In the contrary, study of Ottosson et al., (2014) stated that swallowing dysfunction and aspiration had significantly relation with the long-term loss of weight and reduced body mass index for patients.

From the researchers point of view, the current study showed no significant difference regarding body mass index because of significant weight loss and reduction in body mass index could be observed during long-term follow up but the present study followed patients for 2 months only. Also, starting swallowing exercises early (immediately after diagnosis) led to significant improvement in functional oral intake, reduce complications of dysphagia (aspiration pneumonia, malnutrition and dehydration).

According to the current study finding, a highly significant improvement was observed between before and after application of the swallowing exercises among the studied patients regarding functional oral intake. Also, the current study result showed absence of aspiration in the majority of patients after application of the swallowing exercises. In this regard, the study of Krajczyk et al., (2019) stated that education about safe management practices and application of rehabilitation swallowing exercises for patients depending on their dysfunction which showed significant improvement in swallowing reflex and reduce the risk of aspiration.

From the researchers point of view, application of swallowing exercises improved functional level of oral intake (total oral intake) in about more than two-third of patients after application of the swallowing exercises by 2 months. Also, absence of aspiration in the majority of patients after application of swallowing exercises could indicate improvement in swallowing function for patients and lack of choking.

The current study result revealed highly significant improvement before and after application of the swallowing exercises among the studied patients regarding Bazaz dysphagia scale score, regarding the severity of dysphagia. Absence of dysphagia was also observed among the majority of patients after 2 months of practicing swallowing exercises. Also, improving the functional oral intake and reduction in swallowing problems correlate significantly with the absence and reduction of severity of dysphagia.

A study finding done by **Balou et al., (2019)** was within the same line with the finding of the current study, they reported that after 8-week post the application of the swallowing exercises for older adults with dysphagia was associated with a positive effect on swallowing physiology was noticed which include improvement in swallowing initiation, laryngeal elevation, post swallowing residue and thus reduce PAS scores over the course of management.

From the researchers point of view, low level of dysphagia enhance patients' functional level of oral intake and thus reduce the risk of aspiration. This improvement could be due to the application of swallowing exercises over a period of 2 months. The swallowing exercises increased range of movement and muscle strength and activation of tongue, lips and jaw, improved laryngeal elevation, swallowing initiation and post swallowing residue which helped in improving swallowing function, dysphagia and reduce risk of aspiration.

The current study showed significant relation between age and FOIS score, Bazaz dysphagia scale score (dysphagia severity), PAS score and EAT-10 score. Also, swallowing problems, severity of dysphagia and risk of aspiration increased with advanced age and functional level of oral intake decreased.

A study finding of **Andrade et al., (2018)** is within the same line with the finding of the current study, they reported that age range of older adult was associated with high risk of dysphagia. As well as weak correlation was found between EAT-10 score and age.

From the researchers point of view, older adults are more susceptible to dysphagia, swallowing problems and aspiration because they often present with functional changes related to aging as loss of muscle tone and strength, decrease of propulsion, decrease of speed, coordination of movements and precision and esophagi-peristaltic reflexes and loss of tooth.

While hospitalization, nurses could provide instructions and direct supervision for the rehabilitation swallowing exercises. As the rehabilitation can continue to require upon discharge, it is essential to train patients and/or their caregivers on how to do and complete the exercises independently, especially as many required to perform daily. Performance can be monitored through outpatients sessions and/or through phone calls. A comprehensive management for neurogenic dysphagia is effective and can reduce serious complications of swallowing disorders in many clinical practices (**Johnson et al., 2014**).

Study limitations

1. The researchers did not track patients' adherence with swallowing exercises after they discharged

from hospital and therefore we do not know how many repetitions of swallowing exercises each patient completed.

2. The current study covered short observation period.

Conclusions

Swallowing exercises for patients with neurogenic dysphagia showed effective decrease in swallowing problems, severity of dysphagia and risk of aspiration. It also improved swallowing function and reduced complications of neurogenic dysphagia. Nurses play significant role in applying the swallowing exercises with assistance and guidance from the other health-care team to help in improving swallowing function for patients with neurogenic dysphagia.

Recommendations

The current study recommends the following:

1. Swallowing exercises educational brochure should be described for all patients with neurogenic dysphagia to improve swallowing function and reduce aspiration pneumonia, dehydration, and malnutrition.
2. Swallowing exercises educational brochure should be started as early as possible for patients with neurogenic dysphagia after admission.
3. Swallowing exercises educational brochure should be continued until swallowing judged returned and become safe.
4. The swallowing exercises educational brochure, which contained detailed explanation and illustrated photos should disseminating to all patients with neurogenic dysphagia.

References

- **Alali, D., Ballard, K., & Bogaardt, H., (2018):** The frequency of dysphagia and its impact on adults with multiple sclerosis based on patient-reported questionnaires. *Multiple sclerosis and related disorders*, 25, 227-231.
- **Andrade, P., Santos, C., Firmino, H., & Rosa, C. (2018):** The importance of dysphagia screening and nutritional assessment in hospitalized patients. *Einstein (Sao Paulo)*, 16.
- **Balou, M., Herzberg, E., Kamelhar, D., & Molfenter, S. (2019):** An intensive swallowing exercise protocol for improving swallowing physiology in older adults with radiographically confirmed dysphagia. *Clinical interventions in aging*, 14, 283.
- **Banda, K., Chu, H., Kao, C., Voss, J., Chiu, H. L., Chang, P., & Chou, K. (2021):** Swallowing exercises for head and neck cancer patients: a systematic review and meta-analysis of randomized

- control trials. *International Journal of Nursing Studies*, 114, 103827.
- **Bazaz, R., Lee, M., & Yoo, J. (2002):** Incidence of dysphagia after anterior cervical spine surgery: a prospective study. *Spine*, 27(22), 2453-2458.
 - **Belafsky, P., Mouadeb, D., Rees, C., Pryor, J., Postma, G., Allen, J., & Leonard, R. (2008):** Validity and reliability of the Eating Assessment Tool (EAT-10). *Annals of Otolaryngology, Rhinology & Laryngology*, 117(12), 919-924.
 - **Crary, M.A., Carnaby-Mann, G.D., & Groher, M.E., (2005):** Initial psychometric assessment of a functional oral intake scale for dysphagia in stroke patients. *Arch Phys Med Rehabil* ;86:1516-1520.
 - **Dziewas, R., Michou, E., Trapl-Grundschober, M., Lal, A., Arsava, E. M., Bath, P., & Verin, E., (2021):** European Stroke Organisation and European Society for Swallowing Disorders guideline for the diagnosis and treatment of post-stroke dysphagia. *European stroke journal*, 6(3), LXXXIX-CXV.
 - **Han, Y., Jang, Y., Park, G., Joo, Y., & Im, S., (2020):** Role of injection laryngoplasty in preventing post-stroke aspiration pneumonia, case series report. *Medicine*, 99(7).
 - **Hines, S., Kynoch, K., & Munday, J., (2016):** Nursing interventions for identifying and managing acute dysphagia are effective for improving patient outcomes: a systematic review update. *Journal of neuroscience nursing*, 48(4), 215-223.
 - **Johnson, D., Herring, H., & Daniels, S., (2014):** Dysphagia management in stroke rehabilitation. *Current Physical Medicine and Rehabilitation Reports*, 2(4), 207-218.
 - **Joundi, R., Martino, R., Saposnik, G., Giannakeas, V., Fang, J., & Kapral, M., (2017):** Predictors and Outcomes of Dysphagia Screening After Acute Ischemic Stroke. *Stroke*, 48(4), 900–906.
 - **Kim H.D., Choi J.B., Yoo S.J., Chang M.Y., Lee S.W., & Park J.S., (2017):** Tongue-to-palate resistance training improves tongue strength and oropharyngeal swallowing function in subacute stroke survivors with dysphagia. *J Oral Rehabil.* ;44(1):59-64. DOI: 10.1111/joor.12461.
 - **Kiran K., (2016):** Incidence, risk factors and complications of dysphagia in stroke patients admitted to medical wards at a tertiary hospital in South India (Doctoral dissertation, Christian Medical College, Vellore).
 - **Kong, H., West, S., & Africa, S., (1997):** World medical association declaration of Helsinki. *Cardiovasc Res*, 35, 2-3.
 - **Kraaijenga, S., Van Der Molen, L., Stuiver, M., Teertstra, H., Hilgers, F., & van Den Brekel, M., (2015):** Effects of strengthening exercises on swallowing musculature and function in senior healthy subjects: a prospective effectiveness and feasibility study. *Dysphagia*, 30(4), 392-403.
 - **Krajczyk, E., Krajczyk, M., Luniewski, J., Bogacz, K., & Szczegielniak, J., (2019):** Assessment of the effects of dysphagia therapy in patients in the early post-stroke period: a randomised controlled trial. *Neurologia i neurochirurgia polska*, 53(6), 428-434.
 - **Labeit, B., Claus, I., Muhle, P., Suntrup-Krueger, S., Dziewas, R., & Warnecke, T., (2020):** Effect of intestinal levodopa-carbidopa infusion on pharyngeal dysphagia: results from a retrospective pilot study in patients with Parkinson's disease. *Parkinson's Disease*, 2020:4260501.
 - **Labeit, B., Muhle, P., Ogawa, M., Claus, I., Marian, T., Suntrup-Krueger, S., & Dziewas, R., (2019):** FEES-based assessment of pharyngeal hypesthesia—Proposal and validation of a new test procedure. *Neurogastroenterology & Motility*, 31(11), e13690.
 - **Maeshima, S., Osawa, A., Yamane, F., Ishihara, S., & Tanahashi, N., (2014):** Dysphagia following acute thalamic haemorrhage: clinical correlates and outcomes. *European neurology*, 71(3-4), 165-172.
 - **Ottosson, S., Lindblom, U., Wahlberg, P., Nilsson, P., Kjellén, E., Zackrisson, B., & Laurell, G., (2014):** Weight loss and body mass index in relation to aspiration in patients treated for head and neck cancer: a long-term follow-up. *Supportive Care in Cancer*, 22(9), 2361-2369.
 - **Panbianco, M., Marchese-Ragona, R., Masiero, S., & Restivo, D.,(2020):** Dysphagia in neurological diseases: a literature review. *Neurological Sciences*, 41(11), 3067-3073.
 - **Rosenbek, J., Robbins, J., Roecker, E., Coyle, J., & Wood, J., (1996):** A penetration-aspiration scale. *Dysphagia*, 11(2), 93-98.
 - **Warnecke, T., Labeit, B., Schroeder, J., Reckels, A., Ahring, S., Lapa, S., & Dziewas, R., (2021):** Neurogenic dysphagia: systematic review and proposal of a classification system. *Neurology*, 96(6), e876-e889.