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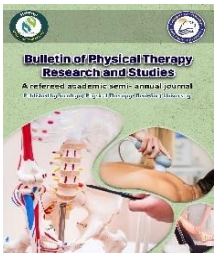

Prevalence of Dysphagia in Acute Stroke Patients: Cross Section Study

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Running Title: Prevalence of dysphagia in acute stroke patients

Abstract

Objective: To estimate prevalence of dysphagia in first time hemorrhagic or ischemic (both thrombotic and embolic) acute stroke patients also to determine the impact of (age, sex and severity of illness) on post stroke dysphagia.

Methods: Two hundred patients (152 ischemic, 48 hemorrhagic) with first ever acute stroke were recruited. Detailed history and neurological examination were done for each one of the patients. The National Institute of Health Stroke Scale (NIHSS) was used to determine the severity of stroke while swallowing was screened by Gugging swallowing screen (GUSS) which is the only screening tool for dysphagia which uses multiple consistencies for testing swallowing function.

Results: Fifty-four (27%) of hemorrhagic and ischemic stroke patients had post stroke dysphagia, 35 (23.03%) from group with ischemia, 19 (39.6%) from group with hemorrhage. Age of dysphagic patients was higher than non-dysphagic patients while it was higher in ischemic patients than hemorrhagic patients. The mean total NIHSS score was higher in dysphagic patients and was higher in hemorrhagic ones. Severity of dysphagia was significantly correlated with stroke severity and age of the patient.

Conclusion: The frequency of post-stroke dysphagia (27%) is near the results of the previous studies in literature. Severity of dysphagia is higher in ischemic stroke. Old age and severity of stroke were the main determinant of severity of dysphagia.

Keywords: post stroke dysphagia (PSD), acute stroke, Ischemic stroke, hemorrhagic stroke, Gugging swallowing scale (GUSS).

1. Introduction

Dysphagia after stroke is the most serious stroke complications [1]. It affects up to two thirds of patients with stroke in the first 72 hours after stroke occurrence leading to higher morbidity and longer hospital stay [2]. The most common cause of dysphagia among all neurological diseases is stroke. It causes disturbance in normal swallowing network, muscular incoordination and causes what's called "post stroke dysphagia" (PSD) [3].

Stroke usually affects the first three stages of swallowing causing what is called oropharyngeal dysphagia [4]. Dysphagia is characterized by incoordination of pharyngeal muscles due to cortical impairment. Factors that may increase the weakness are facial, oral and tongue weakness [5].

Cerebral lesions usually affect voluntary control of shewing. It affects cognitive functions as concentration and attention which in turn affects swallowing ability [6]. While brainstem lesions delay pharyngeal reflex [4]. Presence of multiple brain lesions affects the percentage of dysphagia. With higher incidence of (67%) in brain stem lesions, 56% in bilateral hemispheric strokes and nearly 40% in unilateral hemispheric strokes which happen in one place in one hemisphere only. It occurs in nearly 85% of combined lesions cases and persists in 50% of cases [7].

Prevalence of dysphagia varies widely in literature according to inclusion criteria and method of assessment [8]. Incidence rates ranged from 8.1 to 80%. This difference occurs according to definition of dysphagia, method of assessment and prescribed modified diet [9,10]. Many studies concluded that prevalence of post stroke dysphagia ranged from 40%-45% [8,10-13]. In another study the frequency was 34.4% [4]. While there was a systematic review which concluded that the frequency is 25.5 % [14].

Post stroke dysphagia has both physical and psychological consequences. It causes chest infection, malnutrition and decreased quality of life in addition to increases dependency, depression

and bad mood. [3,15]. It causes dehydration which in turn causes hemoconcentration, impaired cerebral perfusion and can lead to renal failure [7].

Dysphagia leads to aspiration pneumonia which considered the second cause of death in acute stroke. Nearly 20% of dysphagic stroke patients die during the first year from aspiration pneumonia [5]. Early systematic screening and detection of dysphagia following a stroke improves the prognosis and lowers the risk of aspiration pneumonia [16]. It helps to design the proper treatment program which decrease the risk of stroke associated pneumonia [17].

Objective of the study: To approximate the prevalence of dysphagia in first ever ischemic or hemorrhagic acute stroke patients and determine the impact of associated factors (age, sex and severity of illness) on Dysphagia after stroke.

2.Patients and Methods

2.1. : Design and setting

This cross-section study was conducted between hemorrhagic and ischemic stroke patients. On 200 stroke patients to assess the frequency of dysphagia in first time ischemic and hemorrhagic acute stroke. The cross-sectional study design was employed using Gugging swallowing bedside screening test. Stroke severity assessment was done by using the national institute of health stroke scale (NIHSS). A signed consent was obtained from all of the patients. Ethical approval number is (NO:P.T.REC/012/002939) while clinical trial registration is (NCT06010940).

2.2. Patients:

Two—hundred patients with first time stroke within first 72 hours of stroke event onset were included. stroke diagnosis confirmed by magnetic resonance imaging (MRI) and/or computed tomography (CT). The exclusion criteria were: Patients below 18 years old, any history of earlier stroke or transient ischemic attack, disturbed conscious level, global or sensory aphasia, any history of swallowing disorder or neurological disease that cause swallowing disorder, mental retardation or patients who can't follow instructions were excluded. **(Figure 1**) shows the flowchart of the study.

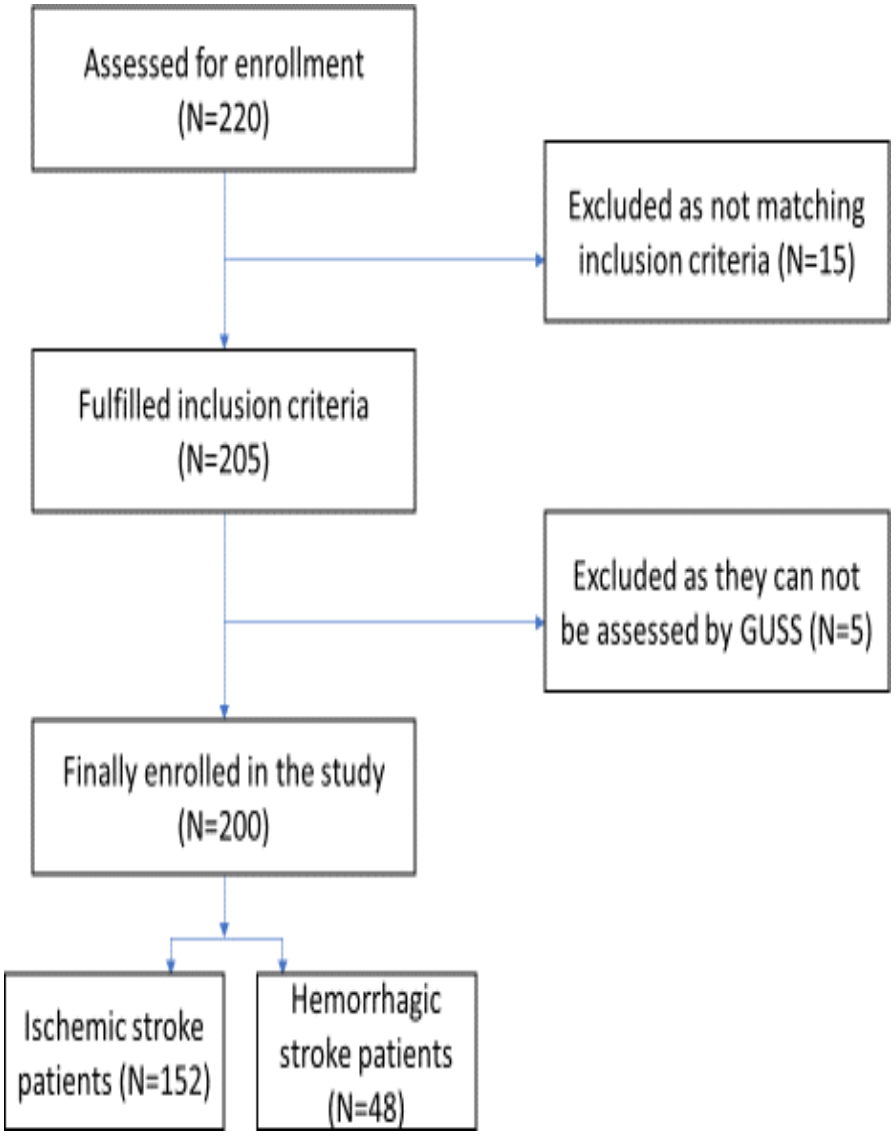

Fig.(1): A flow chart of study participants

The sample size estimation:

The sample size for this study was calculated using the G*power program 3.1.9 (G power program version 3.1, Heinrich-Heine-University, Düsseldorf, Germany). Sample size calculation based on T tests (Means: Difference from constant (one sample case)), Type I error (α) = 0.05, power (1-α error probability) = 0.80, SD σ = 0.5 and effect size d (V) = 0.2 with one independent group in comparison for 4 major variable outcomes. The appropriate minimum sample size for this study was 156 patients in each group as a minimum.

2.3. Assessment:

History and neurology examination were done for each one of the patients. Severity of stroke was assessed by using the National Institutes of Health Stroke Scale (NIHSS). It was created by the National institute of neurological disorders and stroke. It is the most used score to objectively quantify neurological impairments during acute stroke. It Includes these items: level of consciousness, best gaze, visual fields, facial palsy, arms motor function, legs motor function, limb ataxia, sensory stimulus responses, best language, dysarthria, extinction and inattention. Each item scores from 0 to 4. A score of 0 indicates a normal function, while a higher score is more impairment. Total score is from 0 to 42 (the higher the score, the more severe the stroke). It concluded 4 categories of stroke severity: very severe (more than 24 points), severe (15 to 24 points), moderate (5–14points), mild (1–5 points) [18-20] (Appendix I). Swallowing ability was screened by Gugging swallowing screen (GUSS). It's a valid and reliable bedside screening test [16]. Compared to endoscopic evaluation it has sensitivity of 100% and negative prediction value of 100 %. Its total score is 20, higher scores indicated better performance. while score less than 14 points predict risk of aspiration. Early systematic screening by GUSS can significantly reduce the incidence of SAP [21]. It is the only dysphagia screening test that uses different viscosities [22]. It began with a simple indirect swallow screen then if the total score was reached a direct swallowing test was done. It consists of three parts: semisolid, liquid and solid swallowing trials.

Test procedures: The patient sat in bed at least 60 degrees upright. The Patient has the ability to receive the examiner's face, the spoon and the bolus that would be tested. Criteria evaluated in the direct swallowing test were swallowing ability and detected by laryngeal elevation, involuntary cough, drooling and voice change. Indirect swallowing test: (GUSS part one) patient was asked to swallow saliva. When the test was completed successfully, the direct test was done. Direct swallowing test:

(GUSS part two) consisted of three sequentially subtests: semisolids, liquids then solids. First the semisolids: patient was given one half of teaspoon as the first bolus then five half teaspoons. Then the patient was observed closely after every bolus for any aspiration sign. The test was stopped if any signs of aspiration appeared (inability to swallow, drooling, cough and voice change). If no sign appeared, then the next subtest was performed. Liquid swallowing trial: began by three ml. water and the patient was screened if swallowing was completed successfully then amounts five, ten, twenty and fifty ml. of water was used to complete the test. Solid swallowing trial: a small piece of dry bread was used as first bolus then the test was repeated five times. Ten seconds was allowed for each bolus [23] (Appendix II).

3. Statistical Analysis:

The SPSS package program version 25 for Windows (SPSS, Inc., Chicago, IL– IBM) was used to analyze data. Continuous variables were expressed as mean ± standard deviation (SD) while qualitative data described in frequency and percentage (%). Chi-square test was used to compare qualitative variables and independent t test was used to compare continuous variables. Spearman correlation coefficients were used to assess the relation between degree of dysphagia and age, sex and severity of stroke. A value of $P < 0.05$ was considered statistically significant.

Data of NIHSS and GUSS score are ordinal data (as they are numerical but have no international unite of measurement), so we do Shapiro-Wilk test to assess the normality of data. As Shapiro-Wilk test results are significant so that these data are non- normally distributed so we use non- parametric

analysis (Mann-Whitney test) and data are expressed as median and interquartile range.

4. Results

General characteristics and the demographic data of patients:

Two - hundred patients diagnosed with stroke were participated in this study; results of GUSS test revealed that 54 patients had dysphagia (27%) while 146 were non dysphagic (73%). The mean age ± SD for dysphagic patients was 62.7± 2.846 years which is significantly higher than non-dysphagic patients (56.39±5.064 years) (P = 0.001).

The dysphagic patients included 28 males (51.85%) and 26 females (48.15%) while the non-dysphagic patients included 76 males (52.05%) and 70 females (47.95%) with non-significant difference between the two groups (P value = 0.979). Severity of stroke (NIHSS score) was significantly higher in dysphagic patients than patients without dysphagia (P value = 0.0006) **Table (1).**

According to cause of stroke; the study included 152 ischemic stroke patients and 48 hemorrhagic stroke patients. From the total 54 dysphagic patients; 35 patients were ischemic (23.03%) and 19 patients were hemorrhagic (39.6%).

Comparison between ischemic and hemorrhagic patients with dysphagia revealed that dysphagia severity (GUSS score) was significantly higher in ischemic patients than hemorrhagic patients (P value = 0.0016).

Ischemic stroke patients included 6 patients with mild dysphagia (17.14%), 11 with moderate dysphagia (31.43%) and 18 patients with severe dysphagia (51.43%) while the hemorrhagic stroke patients included 10 patients with mild dysphagia (52.63 %), 4 with moderate dysphagia (21.05%) and 5 patients with severe dysphagia (26.32%).

The mean age ± SD for ischemic patients with dysphagia (63.71±2.15 years) was significantly higher than hemorrhagic patients with dysphagia (61.68± 2.81 years) (P = 0.0045).

The ischemic patients with dysphagia included 16 males (45.71%) and 19 females (54.29%) while hemorrhagic patients with dysphagia included 12 males (63.16%) and 7 females (36.84%) with non-significant difference (P value = 0.2635).

Severity of stroke (NIHSS score) was significantly higher in hemorrhagic than ischemic dysphagic patients (P value = 0.0001) **Table (2).**

Correlation between GUSS score and (age, NIHSS score and sex distribution) revealed a statistically significant inverse correlation between GUSS score with both age and NIHSS score (rs= -0.5800, P= 0.0001and rs= -0.3001, P= 0.0275 respectively) while there was a non-significant correlation between severity of dysphagia and sex distribution (r= 0.2249, P= 0.1020) indicating that dysphagia severity is related with increased age and severity of stroke **Table (3).**

5. Discussion:

Results of this study concluded that frequency of dysphagia in acute stroke is 27% (54 dysphagic patients from 200 acute stroke patients). These results are consistent with the systematic review by yang et al. [14] who concluded that the frequency of dysphagia in both ischemic and hemorrhagic acute stroke patients is 25.5%. The results are also in line with the results concluded by khedr et al. [13] who found that the frequency of dysphagia in acute stroke was 39.2%.

In our study, Ischemic dysphagic patients were 35 with percentage 23% and hemorrhagic dysphagic patients were 19 with percentage 29.6 %. This contradicted with the percentage found in khedr and colleagues [13] were the percentage of dysphagia in ischemic stroke was 31.7% and in hemorrhagic patients were 58.6%. This discrepancy may be due to the patients' selection criteria. the patients in our study were selected from intermediate care who had less sever hemorrhagic strokes. Higher dysphagia frequencies and more sever hemorrhagic strokes with intracranial hemorrhage and

interventricular extension had higher NIHSS and needs intensive care so they are not in the criteria of our study.

The findings of our study revealed that severity of dysphagia in ischemic stroke is more severe than that of hemorrhagic one. These results may be attributed to that sever dysphagia in hemorrhagic strokes usually was associated with ventilation and disturbed conscious level. Ventilated patients couldn't be assessed by GUSS. This limited the patients participation in this study so less severe cases were included. Pattern of hemorrhagic dysphagia is different than that of ischemic one. Hemorrhagic stroke patients are likely to be ventilated than ischemic ones due to cognition and concentration affection. Affection is due to extension of neural damage due to brain edema and intracranial mass. Entravision of blood caused by hemorrhage decrease cognition which affects swallowing and damage swallowing neural network [10,24,25].

In the present study, it was found that dysphagia severity increases with the increase of the severity of the stroke. Stroke severity was assessed by national institute of health stroke scale (NIHSS) which considered an independent risk factor of post stroke dysphagia. This comes in agreement with khedr et al., yang et al., De Stefano et al. [13,14,25] whom revealed that stroke severity and NIHSS are strong predictors of post stroke dysphagia and the cutoff value is ≥ 12. Sever strokes usually characterized by decreased alertness and disturbed conscious level which in turn increase dysphagia symptoms [10,26,27].

our results concluded that dysphagia presence increases with increasing age of the patients. Age is considered risk factor for dysphagia. Normally there's age related swallowing disorders. There are normal changes in skeletal muscles strength which reduce mastication and swallowing functions that include chewing, mastication, vocalization and breathing. Those can't be compensated by the elderly stroke patient. Older ages also characterized by degeneration of cranial nerves functions and swallowing reflexes which affects swallowing process [6,14]. Insufficient breathing patterns decrease tidal volume which affects normal swallowing in old age [28]. Swallowing disorders, stroke dysphagia

and post stroke immunosuppression due to stroke increase risk of aspiration pneumonia and mortality. Organs aging happens in old age decrease the capability of the immune system to defense for the respiratory system [6,29,30].

Our study revealed that gender has no effect on dysphagia in stroke patients. This is consistent with Khedr et al., Yang et al., Kumaresan et al. [13,14,28] They all concluded that gender is not a risk factor for frequency of dysphagia in patients with acute stroke.

Our results concluded that there was a direct significant correlation between age, stroke severity and dysphagia severity in acute ischemic and hemorrhagic stroke patients while there was a non-significant correlation between sex distribution and severity of dysphagia in acute ischemic and hemorrhagic stroke patients. These results were consistent with the results of most of the studies in literature [8,10,13,14,28]. The study of Banda et al. [10] was the only study that contradicted all the studies and concluded that females are with a higher risk of post stroke dysphagia in comparison to males participants. He concluded that the only explanation of this result is that females had their first-time stroke at higher ages than that of males.

In our study, dysphagia screening was done by using GUSS screening test which is a valid and reliable screening tool to detect dysphagia and aspiration risk in stroke patients. This wide range of dysphagia percentage which ranges from 19 % to 81% in stroke patients in literature depends mainly on dysphagia screening [8]. Early dysphagia screening with a valid screening test helps in early dysphagia detection and successful treatment plan. This leads to decrease risk of associated aspiration pneumonia, decrease morbidity and hospital stay [9,10,17].

Conclusion: We concluded that the frequency of dysphagia in acute stroke is 27%. The mean total NIHSS score was higher in dysphagic than non-dysphagic patients and was higher in hemorrhagic than

ischemic patients with dysphagia. Severity of dysphagia was significantly correlated with stroke severity and age of the patient while sex has no effect on prevalence of dysphagia.

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Tables

Table [1]: **The general characteristics of study patients**

Variables		No dysphagia (n = 146)	Dysphagia (n = 54)	P-value
Age in Year (mean ±SD)		56.39±5.064	62.7± 2.846	**0.0001***
Sex distribution	Male (N (%))	76 (52.05%)	28 (51.85%)	**0.979**
	Female (N (%))	70 (47.95%)	26 (48.15%)	
NIHSS (median (IQR))		**14 (6)**	**16 (5)**	**0.0006***

N:Number, %: Percentage, SD: Standard deviation, IQR: interquartile range, * P≤0.05 is significant

Table [2]: Comparison between ischemic and hemorrhagic in dysphagic patients

Variables		Ischemic (n = 35)	Hemorrhagic (n = 19)	P-value
Age in Year (mean ±SD)		63.71±2.15	61.68± 2.81	0.0045*
Sex distribution	Male (N (%))	16 (45.71%)	12(63.16%)	0.2635
	Female (N (%))	19 (54.29%)	7 (36.84%)	
NIHSS (median (IQR))		15 (4)	20 (3)	0.0001*
Severity of dysphagia (GUSS score) median (IQR)		5 (7)	15 (2)	0.0016*

N: Number, %: Percentage, SD: Standard deviation, IQR: interquartile range, * P≤0.05 is significant.

Table [3]: Correlation between severity of dysphagia and (age, NIHSS, sex distribution)

	Severity of dysphagia (GUSS score)	
variable	rs	P-value
age	-0.5800	0.0001*
NIHSS	-0.3001	0.0275*
sex distribution	0.2249	0.1020

rs= Spearman's Rank Correlation Coefficient, * P≤0.05 is significant.