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Dysphagia and acute stroke, the influential factors and incidence.

Abstract

Background: Dysphasia is known as one of the common issues among patients experiencing an acute stroke. A stroke can bring about disorders in various organs such as the mouth, tongue, palate, pharynx, larynx, and upper esophagus, as well as bearing consequences due to dysfunction of those organs. One of the affected vital functions is swallowing, which will result in aspiration, Choking, Pulmonary infection, and even death. This study aims to evaluate the incidence of Dysphagia (swallowing disorder) and its related factors to identify the disorder and its complications.

Methods: In this Perspective study, 100 stroke patients were included. Swallowing disorder, type of stroke, National Institutes of Health Stroke Scale on arrival and time of discharge, gag reflex, and the 3 O.Z. Water Test results were studied, and data were analyzed using SPSS 24 software.

Results: The incidence of this disorder among these 100 patients is 45%, a significant percentage. Dysphagia in types of strokes was 100% in intracerebral hemorrhage and 39.6% in Ischemic (p-value< 0.001). As the severity of the stroke increases, the rate of dysphagia increases (minor stroke: 0%, moderate stroke: 29%, moderate to severe: 94%, severe:100%, p-value< 0.001). In 85.9% of the patients with normal GAG reflex, Dysphagia was incident, and 100% of those who aspirated in the 3OZ Water Test had Dysphagia.

Conclusion: Due to the high occurrence of swallowing disorders among stroke patients, immediate assessment and effective treatment of Dysphagia after any stroke can improve the quality of medical intervention and rehabilitation in the very first hours. Moreover, the steps above also decrease the rate of mortality owing to aspiration problems, prevent Pulmonary infection, shorten the hospitalization duration, and reduce hospital (treatment) costs.

Keywords: *Dysphagia, Acute stroke, Swallowing disorder, Aspiration, Incidence.*

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1. Introduction

Stroke is a comprehensive cause of disability, the second cause of death, and the third cause of death and disability in the world [1, 2]. More than 13 million new cases of stroke are diagnosed annually[3]. Ischemic stroke, the most common subgroup, accounts for 65% of all stroke cases worldwide and 87% of all stroke cases in high-income countries [4]. Stroke deaths account for 11.59% of global deaths. 87% of stroke-related deaths occur in low- and middle-income countries. In the Middle East and North Africa, stroke has risen from the fourth leading cause of death in 1990 to the second leading cause of death in 2019. Also, in Iran, stroke has increased from the sixth cause of death in 1990 to the second cause of death in 2019 [5]. Dysphagia is a common complication of stroke, and more than 50% of the surviving patients have this problem that is often undiagnosed and can cause aspiration [6, 7]. Dysphasia may affect a person's health and lead to dehydration، malnutrition, and pneumonia [8]. Aspiration pneumonia is the most common reason of mortality and morbidity in stroke patients with neurological disease, with a 70% mortality rate in in-hospital patients [9, 10]. Also, this accounts for approximately 35% of deaths after a stroke related to Dysphagia [11].

Disorder in the four stages: Swallowing is a swallowing disorder that causes difficulty moving food from the mouth to the stomach. In cortical stroke, with the involvement of the Frontal lobe, especially in the lower region, swallowing disorder occurs, and in subcortical strokes that result in a type of insurance Small or large vascular system, brainstem pathways, nucleus solitary, and nucleus ambiguous in the medulla as well as swallowing centers. If it is involved, oral-pharyngeal swallowing disorder occurs [12-14]. In addition to affecting the patient, Dysphagia also affects health costs, with an increase of 40.36% [15]. To identify patients after a stroke, swallowing evaluation is necessary in all stroke patients and

can reduce the various adverse effects and then mortality rate in stroke patients [16]. The ASA guidelines state that a swallowing assessment should be done since stroke patients are fed orally [17]. Evaluation of swallowing can be done with devices such as esophagogastroduodenoscopy (EDG), fiberoptic endoscopic evaluation of swallowing (FEES), International Dysphagia Diet Standardization Initiative (IDDSI), length of stay (LOS), neuromuscular electrical stimulation (NMES), pharyngeal electrical stimulation (PES), videofluoroscopic swallow study (VFSS) or using standard protocols such as the Gugging Swallowing Screen (GUSS) assessment test [18].

In a study conducted in the USA ،the most common screening protocol reported was a volume-dependent water swallow test [19]. An investigation revealed that the three-ounce Water Swallow Test was initially validated for use in stroke patients in rehabilitation, and the GUSS was designed to identify Dysphagia in acute stroke patients [20]. Swallowing assessments are usually performed by speech and language pathologists. The primary role of speech therapy in swallowing disorder is related to the evaluation and diagnosis of neuromotor disability of mouth swallowing and also performing rehabilitation exercises in the form of sensory-motor therapeutic approaches for oral and pharyngeal areas [21]. Considering the importance of swallowing and its treatment in acute stroke patients, this study aimed to investigate the incidence of this disorder, the prevalence of the disease in patients with acute stroke, and whether it is effective for them.

2. Material and methods

2.1. Patients and Variables

This cross-sectional study is a single-center and open-label clinical trial that worked on 100 stroke patients admitted to the Vali-e-Asr Hospital stroke care unit (SCU) in Iran. In this study, all stroke patients were initially admitted to the SCU department of Valiasr Hospital. Upon arrival, they underwent a screening evaluation for swallowing disorders within 24 hours. Until the assessment of the patient by the NPO department remains, the stroke diagnosis is based on history, clinical examination, and necessary imaging (MRI and C.T. scan). The NIHSS and MRS charts are used. Speech and language pathologist with oral-motor evaluation, clinical assessment of organs, and utilizing relevant and functional tests. Lips, tongue, teeth, jaw, palate and soft palate, strength and range of muscles related to swallowing, ability, and quality of coughing, protection from the airway, the ability to control saliva, voice quality, the presence of some reflexes such as gag, and also evidence based on the existence Aspiration records the presence and severity of Dysphagia and this information. Also, demographic information, type of stroke, injection, Tissue-type plasminogen activator (TPA), NIHSS scores at admission and time of discharge, smoking, and age. GUSS to evaluate the patient's swallowing condition and predict the severity and risk of aspiration. Identify the type and severity of swallowing disorder and make recommendations regarding the type and texture of diet and further diagnostic evaluations.

This test consists of two direct and indirect evaluation stages, which must be performed in order. Scoring system, too. It is in this way that better performance has a higher score. The evaluations are conducted in the dinner's first (indirect) phase. It evaluates the state of consciousness, the ability to cough voluntarily, and the ability to successfully swallow (without coughing, drooling, and voice change). If the patient does not get the total score at this stage, the evaluation is stopped, and device evaluations such as Video fluoro are done [22]. The second stage, or direct assessment, includes the video fluoroscope and Fiberoptic Endoscopic Evaluation of Swallowing and the scope. Evaluation of involuntary cough, mouth-watering, change of voice, and larynx movement while swallowing liquids, solids, and semi-solids. The two stages' total scores determine the disorder's presence and severity. According to the protocol in this tool, there are separate recommendations for different ranges of scores, including the type of patient's diet, food texture, and the need to perform further device evaluations.

2.2. Inclusion and exclusion criteria

Inclusion criteria were patients who were hospitalized according to the history of clinical examination and medical imaging under the title of acute stroke. The neurologist has reached a diagnosis.

Exclusion criteria were failure to confirm stroke diagnosis by a neurologist, Patient dissatisfaction with evaluating swallowing or participation in the study, and Inability of the patient to cooperate in the examination, such as a decreased level of consciousness or intubation. The Zanjan University of Medical Sciences ethics committee registered and approved the study protocol, and all participants provided written informed consent.

2.3. Analysis and ethical considerations

The study data will be analyzed using SPSS 24 software. Descriptive data in the form of a number, percentage, mean, and standard deviation and the data between the study groups using chi-square tests, independent t-tests, analysis of variance, and, if needed, Parametric bread tests are employed. A statistically significant level of less than 0.05 will be assumed.

3. Results

The present was a cross-sectional study that aims to investigate Dysphagia and acute stroke, and the influential factors and incidence have been carried out. In this study, all acute stroke patients admitted to Valiasr Zanjan Hospital in 6 months of the year were included. During the first 24 hours, the patients underwent a swallowing examination by the therapist. Of the

100 patients surveyed in this study 54 patients (54%) were men. Also, the swallowing disorder was present in 45 patients (45%).

Based on the study variables, the frequency distribution of swallowing disorders in patients has been surveyed. The results obtained from the chi-square test demonstrated that the variables of stroke type and stroke severity, reflex GAG, 3 O.Z. water test, and receiving anti-coagulant drug (tPA) affected this disorder (*Table 2-6*).

Figure 1. The associated factors in the incidence of dysphagia are based on this study.

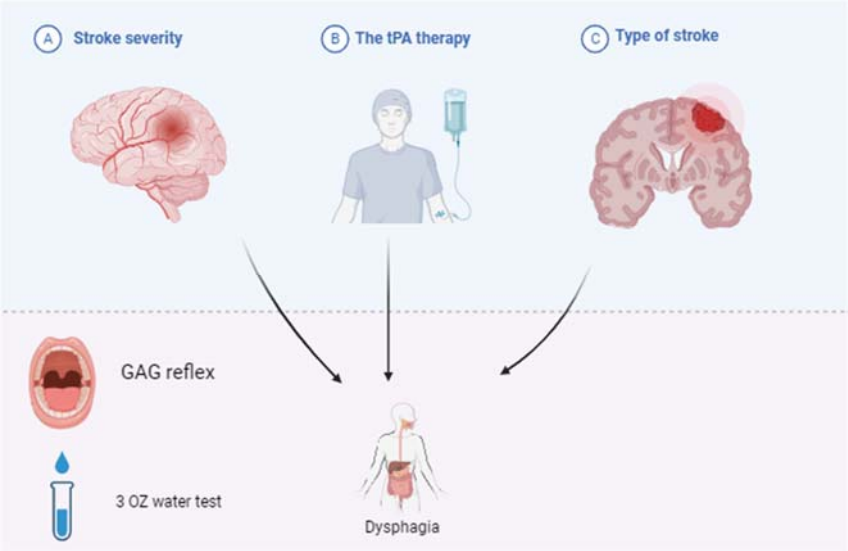

Table 1. The frequency of swallowing disorders in acute stroke patients is based on the study variables.

Variable		Swallowing disorder		Significance Level
		Yes	No	
Sex	Female	21	25	0.904
	Male	24	30	
Hypertension	No	12	22	0.161
	Yes	33	33	
D.M.	No	37	40	0.341
	Yes	8	15	
Smoking	Do not have	41	50	0.972
	Has it	4	5	
Hyperlipidemia	Do not have	45	54	0.550
	Has it	0	1	
Ischemic Heart Disease	No	32	45	0.206
	Yes	13	10	

Abbreviations: ICH: Intracerebral hemorrhage, IVH: Interventricular hemorrhage, D.M: Diabetes mellitus.

Table 2. The association between type of stroke and dysphagia relationship.

Variable		Patients number	Dysphagia		Significance level
			Yes	No	
Stroke type	Ischemic stroke	91	36 (39.5%)	55 (60.5%)	**Less than 0.001**
	ICH	8	8 (100%)	0	
	IVH	1	1 (100%)	0	

Table 3. The stroke intensity and dysphagia incident rate.

Variable		Dysphagia		Significance level
		Yes	No	
Stroke Intensity	Mild	0%	100%	P=0.001
	Moderate	41%	59%	
	Severe	94%	6%	
	Very Severe	100%	0%	

Table 4. Examined the relationship between stroke severity and GAG reflex.

Variable		Patients Numbers	Reflex GAG		Significance Level
			Normal	Abnormal	
Stroke Intensity	Minor	18	18 (100%)	0 (0%)	Less than 0.001
	Moderate	51	42 (83%)	9 (17%)	
	Moderate to severe	18	4 (33%)	14 (77%)	
	Severe	13	0 (0%)	13 (100%)	

Table 5. The effect of the tPA administration on the dysphagia prevalence.

Variable		Patients Numbers	Dysphagia		Significance Level
			Normal	Abnormal	
Thrombolysis therapy with tPA	tPA+	61	40 (66%)	21 (34%)	0.008
	tPA-	39	13 (39%)	24 (61%)	

Table 6. The test for evaluation of dysphagia in stroke patients. Both tests could diagnose dysphagia in stroke patients powerfully, but the normal results do not prove the absence of dysphagia.

Variable		Patients number	Dysphagia		Significance Level
			Abnormal	Normal	
GAG Reflex	Abnormal	36	36	0	Less than 0.001
	Normal	64	9	55	
3OZ Water Test	Aspiration	45	45	0	
	Normal	55	0	55	

The first related factor to the swallowing disorder is the type of stroke (*Table 2*), as the ischemic stroke affects this problem, and 36 of the 91 patients who had an ischemic stroke had swallowing disorders ($p \leq 0.001$). Ninety-one patients were hospitalized with ischemic stroke, of which 36 had dysphagia and 55 had no swallowing disorder, resulting in approximately 39.5% of ischemic stroke patients having dysphagia. Eight patients were hospitalized with ICH, all eight (100%) of which had dysphagia. Indeed, one patient was admitted with IVH, which was a patient with a swallowing disorder. So, the stroke type had a direct relationship with dysphagia incidence, and the IVH and ICH had absolute signs of dysphagia.

The second related factor in dysphagia incidents was stroke intensity. Of the 100 patients studied in this survey, 18 patients had a mild stroke, 51 patients had a moderate stroke, 18

patients had a severe stroke, and 13 patients had a very severe stroke-based NIHSS score. (The NIHSS is composed of 11, The maximum possible score is 42 with the minimum score being (1-6) mild stroke, (7-12) moderate stroke, (13-19) moderate to severe stroke, and (20-42) very severe stroke). In the investigation about the relationship between stroke severity and swallowing disorder, 100% of the very severe strokes had swallowing disorders. Indeed, this number for the severe and moderate stroke severity was 94% and 41%, respectively (p=0.001). In the last, in the mild Stroke, any of the patients hadn't swallowing disorders (*Table 3*).

Also, we examined the relationship between stroke severity and GAG reflex (*Table 4*). The significance level obtained from the chi-square test showed a significant statistical relationship between these two variables. The GAG reflex was normal in all patients with mild stroke severity. The GAG reflex was abnormal in nine patients (17%) with moderate stroke severity. The GAG reflex is abnormal in 14 (77%) patients with severe stroke. All patients (100%) with very severe stroke had abnormal GAG reflexes.

Also, the investigation demonstrated the connection between thrombolysis and dysphagia. Sixty-one percent of the patients received tPA 21 patients (34%) had a swallowing disorder and others did not have swallowing disorders. On the other side, 39 patients did not receive tPA, 24 patients, (61%) had a swallowing disorder, and 15 patients (39%) did not have a swallowing disorder (*Table 6*). So, the tPA treatment in stroke patients could reduce the dysphagia prevalence significantly.

The other related factors to the swallowing disorder were the GAG reflex and 3O.Z. Water Test, as 100% of abnormal GAG and 100% of the 3O.Z. Water Test aspiration had dysphagia. Indeed, the 3O.Z. Water Test demonstrated the inverse results, too, which means that no patients with normal results of this test had experienced swallowing disorders. So, this test can strongly predict this disorder (p=0.001) (*Table 6*). However, it is worth mentioning that according to the obtained results, the normal result of these tests does not indicate the absence of dysphagia in a routine and definitive way, and it must be evaluated with other tests. The positive predictive value of these tests is very important. The other investigated factors, like sex, hypertension, D.M., smoking, hyperlipidemia, and ischemic heart diseases did not affect the incidence of swallowing disorder.

4. Discussion

The study aimed to determine the incidence of swallowing disorders in acute stroke patients in Valiasr Hospital, Zanjan. Dysphagia is seen as a complication in many of these patients who have suffered an acute stroke.

Deficiency in the function of the mouth, tongue, palate, larynx, pharynx, or the upper part of the esophagus causes problems in swallowing and swallowing disorders. It can lead to many issues, such as aspiration, suffocation, lung infection, and even death. Therefore, its evaluation and diagnosis in these patients in the early hours after the occurrence of stroke can interventions during treatment and cause rehabilitation, as well as the mortality rate due to aspiration and lung infections, hospital costs can reduce the duration of hospitalization and increase the quality of life of a person after a stroke. The rapid diagnosis of swallowing disorders in stroke patients can create a suitable intervention to reduce pneumonia or other side effects. Various interventions can be utilized in this manner, like rehabilitation, deviation of the alimentary canal by installation of percutaneous endoscopic gastrostomy (PEG) or nasogastric tube (N.G.), empirical antibiotic therapies in high-risk patients, and serial swallow assessment [23, 24]. This study aims to investigate the incidence of swallowing disorder in stroke patients and the factors affecting this disorder rather than swimming.

Many influencing factors can be identified, and their complications can be reduced. The occurrence of dysphagia disorder was present in a significant percentage. The results of the chi-score test showed that different types and severity of stroke, swallowing reflex, 3 O.Z. water test, and TPA are changes that affect swallowing disorders. All people who aspire to the 3 O.Z. water test have Dysphagia. The incidence of this disorder among these 100 patients is 45%, a significant percentage. In the study of Cui Yang (25.51%), patients had Dysphagia after a stroke, and There was no significant difference in the gender between Dysphagia and no dysphagia patients. That was in line with our study. In the study of Cui Yang, hypertension and diabetes were associated with Dysphagia in patients with ischemic stroke (all $P<0.05$). In our research, in Hypertension, P-value=0.161 and D.M. p-value =0.341 didn't align with our study. The difference can be due to differences in sample size [25] in the Arnold et al. Stroke severity rather than infarct location was associated with Dysphagia; in our study, there was a significant relationship between stroke severity and Dysphagia, which was in line with our study [26]. In the survey, Dysphagia was more frequent in older patients, and men didn't align with our study [27]. In this study, Dysphagia in the ischemic group was highly associated with diabetes mellitus (D.M.), and hypertension (HTN) didn't align with our research—Dysphagia with ICH with ventricular extension. Stroke severity and lesion size were the main determinants of dysphagia severity. That was in line with our study [28] in a 2020 study by Chiho and his colleagues.

The modified water swallow test and the repetitive saliva swallow test are commonly used as bedside screening methods for swallowing dysfunction. Participants were between August 1, 2016, and June 30, 2018. A videofluoroscopic swallowing study was carried out on all patients. Aspiration was observed in 9.3% of patients when swallowing 3 ml of water. These

aspirated patients showed significantly delayed swallowing reflex on videofluoroscopic; the results of this research were consistent with our study [29]. It was displayed in another research conducted in 2020 that Dysphagia is common in Asian post-stroke patients [30]. In a survey performed in 2019, 110 post-stroke patients were selected. Assess the common risk factors, namely the presence of diabetes mellitus, dyslipidemia, hypertension, alcohol usage, and smoking habits. Variables such as age, gender, type of lesion, side of lesion, and tobacco chewing were also evaluated using a structured interview method. Age type of lesion showed a significant association with the severity of Dysphagia following stroke. This study, in terms of the lack of influence of factors such as HTN, diabetes mellitus, and smoking, is consistent with our study [31]. Another study included 469 stroke patients whose severity independently predicted severe swallowing impairment in discharge. Also, Dysphagia after stroke continued to affect functional outcomes for up to 1 year; our results were consistent with this study [32].

A study conducted in 2021 showed Eighty-four patients were classified as Dysphagia. A higher volume of ICH and a higher degree of disability were associated with Dysphagia [33]. A 2023 study included 264 patients with acute ischemic stroke, with the incidence of severe swallowing disorder within 72 hours of admission at 19.3% [34]. Our results were consistent with this study. Out of 106 patients hospitalized for acute stroke, 60 had Dysphagia. Factors associated with Dysphagia include older age, stroke severity, and greater volume of the lesion, even though 68.80% of patients with temporal lobe lesions had Dysphagia. There was no difference in the location of the lesion in the studied areas. In this study, Dysphagia was not affected by the lateralization of the lesion or the type of stroke (ischemic/hemorrhagic), which was contrary to the results of our study. In this study, the severity of stroke was related to Dysphagia, which was consistent with the result of our study [35]. The only approved treatment option for the treatment of acute ischemic stroke prescribed (TPA) is angioedema, rarely a complication. The incidence of angioedema increases in patients receiving angiotensin–converting enzyme inhibitors (ACE). Angioedema with prominent topical edema is often found in the dermis. Angioedema can occur shortly after injection of TPA in about 1-5% of acute stroke patients [36]. The side effect of this drug is angioedema ،which causes difficulty swallowing, which is in line with our study.

5. Limitation

The limitation of the study was the patient's dissatisfaction with assessing swallowing or participation in the study. Therefore, investigating and monitoring the occurrence of Dysphagia in stroke patients in the Hospital, the incidence of swallowing disorders in stroke patients who have received TPA, and swallowing disorders based on comorbidities and cardiovascular risk factors in stroke patients.

6. Conclusion

The various factors related to the dysphagia incidence in the AIS patients like type of stroke, stroke intensity, and tPA therapy. Also, the evaluation GAG reflex and 3OZ Water Test can estimate the dysphagia that occurs. Considering the high prevalence of swallowing disorders in stroke patients, immediate evaluation and effective treatment of Dysphagia after each stroke can improve the quality of medical intervention and rehabilitation in the early hours. In addition, the steps above can also reduce mortality from aspiration problems, prevent lung infections, shorten hospital stays, and ultimately reduce hospital treatment costs.

7. Recommendation

Evaluation and diagnosis of swallowing disorders in stroke patients in the early hours after a stroke can lead to timely medical and rehabilitation interventions and also reduce the mortality rate due to aspiration and pulmonary infections, hospital costs, and hospitalization time and increase the quality of life of a person after a stroke.

- **Declarations**

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Conflict of interest

There was no conflict between the study results and the authors' interests.

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Author contribution

A.G. Conceptualization, Writing-review and editing, and Supervision. K.K. Methodology, Writing—original draft preparation, and Writing—review and editing. S.A. Conceptualization, Investigation, Writing—review and editing, and Project administration. K.H. and F.A. Investigation, Data curation, Resources, Writing—original draft preparation, and Writing—review and editing.

Ethics Code

This project achieved acceptance from the ethics committee of Zanjan University of Medical Sciences with a code IR.ZUMS.REC.1398.356.

Data availability statement

The data supporting this study's findings are available on request from the corresponding author.

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