





Swallowing Ability in Stroke Patients: A Case Study in Tasikmalaya Hospital, Indonesia

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Abstract

BACKGROUND: Dysphagia is one of the problems that stroke patients often experience. Stroke patients who experience dysphagia often do not get attention because of the lack of early screening, which will cause delays in treatment. To overcome this, nurses have an essential role from the initial screening phase to independent nursing interventions. In screening for dysphagia, nurses can use various methods: Gugging Swallowing Screen (GUSS).

AIM: The purpose of the study was to identify and explain association between respondent characteristics and the GUSS method of swallowing ability scores in stroke patients.

METHODS: This research was a descriptive study, with a total sample of 20 people. The sampling technique used was consecutive sampling.

RESULTS: The results showed that based on the results of the screening test for swallowing ability using the GUSS method, it was found that most of the respondents (75%) belonged to the category of severe dysphagia. Dysphagia was associated with age ($p < 0.001$), gender ($p = 0.000$), type of stroke ($p < 0.001$), comorbidities ($p < 0.001$), and the frequency of stroke attacks ($p < 0.001$).

CONCLUSION: This study concludes that there is association between respondent characteristics: Age, gender, type of stroke, comorbidities, and frequency of attacks with the score of swallowing ability of stroke patients.

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Introduction

Non-communicable disease (NCD) is one of the health problems that have become a national and global concern. Prevention and control of NCDs including stroke have become a top priority in every region. Stroke is one of the main causes of disability and is the second leading cause of death in the world; more than 6 million people die every year. So that all countries are trying to reduce the number of deaths caused by one of these types of NCD [1]. Indonesian Basic Health Research data [2] show an increase in the prevalence of stroke compared to 2013 from 7% to 10.9% and make it one of the highest ranks of NCD incidence. In West Java, it is estimated that 131,856 people are diagnosed as having the highest number of strokes, including 131,856 (11.4 percent). Based on the results of the author's preliminary study in the Mawar Room of the Ciamis District Hospital, the incidence of stroke reached 788 cases in 2019 and occupied the highest incidence of disease in the Mawar Room of the Ciamis District Hospital [3]. In line with the Ciamis District Hospital, stroke at RSU Dr. Soekardjo ranks first in most cases during 2019.

Stroke is a neurological disorder that is common and requires fast and precise handling. Delay in handling stroke cases can be fatal for patients [4]. Stroke is one of the main causes of disability or disability in adults. Stroke can cause limitations in motor skills, cognitive abilities, speech and language skills, and changes in swallowing abilities [5]. The report of World Stroke Organization shows that stroke is the leading cause of lost workdays and poor quality of life [1]. Dysphagia is a condition in which a person has difficulty swallowing liquids or food due to disturbances in the swallowing process. Stroke patients with dysphagia have a three-fold risk of developing pneumonia when compared to stroke patients without dysphagia [6]. Dysphagia is known to be one of the problems experienced by stroke patients. In America, 6.2 million stroke patients experience delays in post-stroke recovery because of this problem. Dysphagia not only increases morbidity and mortality after stroke but also significantly affects the quality of life [7]. Dysphagia affects more than 50% of stroke patients in the process of recovery. Most patients can improve their swallowing ability within 7 days, but about 10% of them only experience an improvement in swallowing function in the 6th month [7].

Dysphagia in stroke patients occurs because of changes in the oral, esophageal, and oropharyngeal

phases of the swallowing process. The most severe kind of dysphagia reported by stroke patients is oropharyngeal dysfunction, which is caused by neurological impairment. This condition will cause food aspiration, which will have an impact on the occurrence of pneumonia [5]. As many as, 30% of stroke cases with dysphagia die from this complication. In addition, another impact of dysphagia in stroke patients is the occurrence of malnutrition and dehydration, which of course will worsen the condition of stroke patients and increase the length of hospital stay.

Seeing the very threatening impact, a nurse is required to conduct initial screening for every stroke patient who enters the hospital. This screening is done so that patients avoid dysphagia which will exacerbate the stroke they are experiencing. Several instruments can be used to assess the swallowing ability of stroke patients, including Standardized Swallowing Assessment (SSA), Massey Bedside Swallowing Screen (MBSS), Dysphagia Screening Tool Nursing Dysphagia Screening Tool (DST-NDST), Acute Stroke Dysphagia Screen (ASDS), a Korean version of SSA (K-SSA), Yale Swallow Protocol and Nurse Dysphagia Screen Tool (NDST), and Gugging Swallowing Screen (GUSS). Swallowing ability screening is a safe and non-invasive procedure so it can be done as early as possible. This initial assessment provides an advantage in detecting the incidence of dysphagia and can guarantee the safe entry of nutrients through the oral route after screening is carried out [8].

GUSS is one of the instruments used to detect the patient' swallowing ability. The use of the GUSS method in screening for swallowing ability aims to avoid the risk of aspiration when the test is being carried out, so this GUSS is widely recommended for use. According to research [9], GUSS can predict aspiration risk well and with good sensitivity. The results of this GUSS assessment will provide important information about the patient's swallowing ability status as a basis for intervention for nurses. This study aims to examine the swallowing ability of stroke patients assessed by the method GUSS and analyze association with the characteristics of the respondents.

Materials and Methods

Study design

This is a descriptive study that used a cross-sectional approach to describe the swallowing ability of stroke patients examined using the GUSS method. This study was carried out at Tasikmalaya's Dr Soekardjo Hospital from September to November 2021. The study began with the preparation of the proposal and continued until the collected data were completed.

Sample

The number of samples in this study was 20 people and the sampling was done by consecutive sampling. The inclusion criteria of this study were: Stroke patients with GCS 15, had swallowing disorders (dysphagia was willing to be respondents). The sample exclusion criteria were: Patients with a decreased level of consciousness.

Instruments

The GUSS swallowing ability screening format was employed in this study. The measurement results are expressed in scores. The respondent's characteristic variables are in the form of a questionnaire with the measurement results expressed in numerical and categorical forms.

Data collection

Data collection was carried out when the patient came to the hospital on the 1st day of admission to the inpatient room after the vital condition was stable. The researcher ensured that the patient is a stroke patient who meets the criteria. The researcher conveys the research objectives to the respondents, provides opportunities for respondents to ask questions, and signs the informed consent if they are willing to take part in the study.

Variables

The dependent variable in this study was the GUSS swallowing ability. There were five independent variables analyzed in this study that describe characteristics respondents including age, gender, type of stroke, comorbidities, and attack frequency.

Data analysis

The data were analyzed by univariate and bivariate. The research used paired t-test to determine association between swallowing ability and the independent variable. The entire analysis process uses SPSS 21 software.

Ethical approval

This research has permission from Ethics Commission Tasikmalaya Health Polytechnics, Ministry of Health Republic Indonesia Number 2021/KEPK/PE/VI/00108.

Results

Table 1 provides descriptive statistics swallowing ability and age variable of the respondents.

Table 1: Distribution of respondents by age and swallowing ability in Dr. Soekardjo Hospital year 2021

Variable	Mean	SD	Min–Max	95% CI
Age	58.55	11.63	38–86	53.11–63.99
Swallowing ability	8.60	4.21	4–18	6.63–10.57

The results showed that average score of respondents' swallowing ability was 8.6, with the lowest score of 4 and the highest score was 18.

Table 2 shows based on the results of the GUSS method, the average swallowing ability of the respondents was in the category of severe dysphagia (0-9), and this result indicates that the patient has a high risk of aspiration.

Table 2: Results of the GUSS method of swallowing ability assessment in Dr. Soekardjo Hospital year 2021

Score GUSS	Category	Number	Percent
20	No dysphagia	0	0
15–19	Mild dysphagia light	3	15
10–14	Moderate dysphagia	2	10
0–9	Severe dysphagia	15	75

GUSS: Gugging Swallowing Screen.

Table 3 shows that most of the respondents are male, as many as 12 people (60%), most of the respondents experienced an ischemic stroke 13 people (65%) and have comorbidities, as many as 13 people (65%). The results show that all of the respondents were patients with a first stroke. Bivariate analysis shows that all the independent variables (respondent's age, gender, type of stroke, comorbidities, and frequency of attack) there were showed significant correlation to the score of swallowing ability ($p < 0.005$).

Table 3: Bivariate analysis between respondents' characteristics and swallowing ability score at Dr. Soekardjo Hospital Tasikmalaya in 2021

Variable	Amount		p-value
	n	%	
Age (mean)	-	-	* <0.001
Gender			* <0.001
Male	12	60	
Female	8	40	
Types of strokes			* <0.001
Ischemic	13	65	
Hemorrhagic	7	35	
Comorbidities			* <0.001
Existing	13	65	
None	7	35	
Frequency of attack			* <0.001
First	20	100	
Second or more	0	0	

Discussion

The results showed that the average score of respondents' swallowing ability was 8.6, with the lowest score of 4 and the highest score was 18. Based on the results of the GUSS method, the average swallowing ability of the respondents was in the category of severe dysphagia (0-9). This result indicates that the patient has a high risk of aspiration. Swallowing tests should be done immediately when the patient enters the inpatient room and again when the patient is discharged. In

general, the things assessed are (1) sound quality before the test and after entering 50 ml of water; (2) the ability to swallow (in seconds); (3) the amount of fluid that enters; and (4) measurement of oxygen saturation 5 min before drinking and after [10].

Several instruments can be used to assess the swallowing ability of stroke patients, including SSA, MBSS, DST-NDST, ASDS, the K-SSA, Yale Swallow Protocol, and NDST and GUSS. Swallowing ability screening is a safe and non-invasive procedure, so it can be done as early as possible. This initial assessment provides an advantage in detecting the incidence of dysphagia and can guarantee the safe entry of nutrients through the oral route after screening is carried out [8].

GUSS is one of the instruments used to detect the patient's swallowing ability. The GUSS method in screening for swallowing ability aims to avoid the risk of aspiration when the test is being carried out, so this GUSS is widely recommended for use. According to research [9], GUSS can predict aspiration risk well and with good sensitivity. The results of this GUSS assessment will provide important information about the patient's swallowing ability status as a basis for intervention for nurses. The study results found 75% of respondents in the category of severe dysphagia. The screening results on respondents with severe dysphagia showed that respondents could pass screening part 1, namely, having alertness (patients are awake for at least 15 min), cough or clear their throats, swallow saliva well, and no drooling, and no change in voice. However, the respondent could not pass the screening for part 2 of subtest one, namely, the swallowing test using semisolid nutrition [11]. This condition is dangerous because patients can experience coughing when food is semisolid form enters. This cough responds to food entering the lungs due to decreased ability to swallow. This is a risk factor for aspiration, which can threaten the patient's ability and respiratory function. In stroke patients, the incidence of dysphagia accompanied by aspiration is found in 40–70% of cases [12]. Aspiration was an important cause of serious illness and death in hospitalized patients.

Swallowing ability screening using the GUSS method can be applied in hospitals but needs to be adjusted to the hospital's conditions, facilities, and infrastructure. GUSS is a swallowing ability screening test developed by Trapl *et al.* Assessment of all phases of swallowing and determination of the need for further evaluation in patients with stroke need to be modified to reduce the risk of aspiration during the screening process. In the use of semisolid nutrition, drinking water, and food, care needs to be taken by continuously evaluating the patient's condition [13].

The results show that all the independent variables (respondent's age, gender, type of stroke, comorbidities, and frequency of attack) have significant correlation to the score of swallowing ability of stroke

patients. The results showed that the average age of the respondents is 58.55 years. Age is one of the non-modifiable factors for the occurrence of stroke. As increases age, the incidence of stroke also increases [14]. Aging is the strongest risk factor for stroke. After 55 years of age, the risk doubles for every 10 years of age. About three-quarters of all strokes occur in people 65 years of age. Because the number of people aged 65 years is predicted to continue to increase, the number of stroke cases is predicted to continue to increase [15]. Age has a role in the incidence of dysphagia experienced by stroke patients. Changes in the cerebrovascular system occur in old age, both microvascular and macrovascular. Microvascular changes are associated with endothelial dysfunction and impaired autoregulation in the cerebrovascular system. Endothelial dysfunction can lead to an increased risk of inflammation, while impaired autoregulation can increase the risk of neurovascular injury [15].

A study identified ten risk factors that lead to an increased incidence of stroke at all ages. The risk factors for stroke, including diabetes, hypertension, atrial fibrillation, and coronary artery disease, tend to increase with age. Other risk factors are obesity, high blood fat levels, hypertension, high blood sugar levels, and smoking habits. All of these can cause blockages in the brain's blood vessels, causing a reduced supply of oxygen in the blood to all tissues, including the brain, which can result in tissue death in the brain [14]. A cohort study in America involving 4038 samples for 8 years was found in the 0–60 year age group, which suffered from dysphagia as much as 30.7%, and this number increased in the >60 year age group, namely 37.7%. Likewise, with the research results of 15 determinant factors that affect the incidence of dysphagia, age is the main factor in the occurrence of dysphagia in stroke patients. This age factor also causes the slow recovery of dysphagia experienced by stroke patients. Therefore, in his research suggested screening for dysphagia as early as possible [16]. Increasing age will cause degeneration processes such as ossification of the laryngeal cartilage, atrophy muscles intrinsic larynx, dehydration of the laryngeal mucosa, reduced elasticity of the laryngeal ligaments, reduced teeth, and decreased sensory abilities in the pharyngeal and laryngeal areas [17]. Research Kumaresan *et al.* and Rofes *et al.* states that age plays an essential role in the incidence of dysphagia. Some studies show that the function of swallowing will be reduced even under normal circumstances in older people. This study showed a relationship significant between age and the severity of dysphagia. People with younger age (<50 years) had lower severity than its age [16], [18].

Stroke patients were dominated by male, the incidence of stroke in men is higher than in women [14]. This is in line with the results of research showing that men have a higher incidence than women. Several studies have shown analysis that men who have had a stroke

have a lower mortality rate than women. Therefore, the incidence of stroke in men always increases every year. Meanwhile, in women, the mortality rate due to stroke tends to be higher, so that in terms of the incidence of stroke, women are lower than men [4]. The incidence of stroke in women is most often caused by hypertension, while it is more often caused by smoking in men. These two factors, coupled with age and other risk factors, lead to an increased risk of stroke [19]. The incidence of stroke in men occurs because of the hormone testosterone, which can increase low-density lipoprotein (LDL) levels. If LDL levels are high, it can increase blood cholesterol levels, a risk factor for degenerative diseases such as stroke [20]. Men have a greater tendency to have a stroke in adulthood than women, with a ratio of 2:1. Although men are more prone to stroke than women at younger age, in contrast with result study in United States that women have 55,000 more strokes than males per year, due to disparities in life expectancy and other contributing variables [21].

The results of the analysis show a difference in the average score of swallowing ability in male and female respondents in swallowing ability ($p = 0.005$). This is different from the research conducted by Rofes *et al.* [18] who showed that there was no relationship between gender and the incidence of dysphagia in stroke patients [18], [22]. Although some say that men experience dysphagia more because anatomically, they have a longer pharynx [23], [24]. The results showed that of the 20 respondents, 12 were men, with 11 of them in the category of severe dysphagia (score 0-9). Dysphagia, especially severe dysphagia, can increase the risk of aspiration. Aspiration that occurs in the respiratory tract can result in aspiration pneumonia. This is supported by data from the National Institute of Health Stroke Scale, which shows that as many as 43%–50% of stroke patients experience aspiration pneumonia with a mortality rate of 45%. During the acute phase of stroke, while 5% of patients experienced aspiration pneumonia during the chronic phase. In addition, there was a hidden aspiration that occurred in 38–48% of patients after 2–3 months after a stroke. Swallowing ability to reduce the risk of aspiration in stroke dysphagia patients [25].

Recent study revealed that ischemic stroke has a higher incidence than hemorrhagic stroke, this is related to the increased incidence of atherosclerosis vascular which causes blockages in blood vessels, this blockage then triggers stroke [6]. Ischemic stroke is the most common stroke case, but the hemorrhagic stroke has a higher mortality rate than ischemic stroke [26]. In America, the incidence of hemorrhagic stroke is between 15% and 30% and ischemic stroke is between 70% and 85%. However, for developing countries or Asia, the incidence of hemorrhagic stroke is around 30% and ischemic stroke is 70%. Ischemic stroke is caused, among others, by thrombosis cerebral (thickening of the artery walls) 60%, embolism 5% (sudden blockage),

and others 35%. Although the cases are fewer than ischemic strokes, hemorrhagic strokes often result in death. In general, about 50% of hemorrhagic stroke cases will lead to three deaths, while in ischemic stroke only 20% will result in death [4].

Comorbidities play an important role in stroke incidence, such as hypertension, diabetic results of the study in. Hypertension has a great effect on the structure of the blood vessels of the brain. Hypertension can be a precipitating factor for the development of atherosclerotic plaques in cerebral arteries and arterioles, which can lead to arterial occlusion and ischemic injury. The results of the study showed a decrease in cerebral blood flow (ADO) in hypertensive patients. This is due to decreased brain activation in hypertensive patients. Experimental and clinical studies have shown that hypertension predisposes to cerebral hypoperfusion and possibly ischemia. Increased blood cholesterol levels, especially LDL, are risk factors for atherosclerosis. In diabetic patients, high blood sugar levels at the time of stroke will increase the possibility of widespread infarction due to the formation of lactic acid due to anaerobic glucose metabolism which damages brain tissue. The results of the study by Sreedharan *et al.* [27] showed that stroke patients with diabetes complications experienced more dysphagia, especially in women. The healing process of dysphagia in women with DM is slower, with a prediction of 12 months after stroke.

All the patients in this study were categorized have first stroke, that becomes an advantage. The danger that threatens stroke sufferers is repeated strokes which can be fatal and result in a worse quality of life than the first attack. There are even stroke sufferers who experience attacks as much as 6–7 times. This is partly because the patient does not control the existing factors risk [28]. Patients who have had a stroke have a high risk of having another stroke. Re-stroke attacks ranged from 30% to 43% within 5 years. After a transient brain attack, 20% of patients had a stroke within 90 days, and 50% of them had another stroke within 24–72 h. High blood pressure (systolic blood pressure >140 mmHg and diastolic blood pressure 90 mmHg) will increase the risk of recurrent stroke.

The study's limitations arise from the low number of samples used. This occurred because the study was conducted at the same time that the number of COVID-19 cases increased, resulting in a reduction in the number of stroke patients seeking treatment in hospitals and priority inpatient rooms for COVID-19 patients.

Conclusion

The results of the screening examination of swallowing ability using the GUSS method, it was found

that most of the respondents (75%) belonged to the category of severe dysphagia, there was a relationship between the characteristics of the respondents: Age, gender, type of stroke, comorbidities, and attack frequency with the score of swallowing ability of stroke patients.

References

1. World Health Organization. World Stroke Day 2019. Available from: <https://www.who.int> [Last accessed on 2022 Jan 20].
2. Kemenkes RI. Laporan Hasil Riset Kesehatan Dasar (RISKESDAS); 2018. Available form: <http://www.depkes.go.id> [Last accessed on 2020 Apr 14].
3. Rekam Medik RSUD Kabupaten Ciamis. Sepuluh Angka Kejadian Terbesar Kasus Sistem Persarafan di Ruang Mawar Tahun. Indonesia: Rekam Medik RSUD Kabupaten Ciamis; 2019.
4. Cahyati Y, Rosdiana I, Kartilah T. The influence of structured rom exercise and progressive muscle relaxation (PMR) exercise on the functional ability of stroke patients. *Malaysian J Nurs.* 2018;10(2):113-9. <https://doi.org/10.31674/mjn.2018.v10i02.014>
5. Barros AF, Fábio SR, Dantas RO. Risk factors for swallowing dysfunction in stroke patients. *Arq Gastroenterol.* 2012;49(2):118-24. <https://doi.org/10.1590/s0004-28032012000200005> PMID:22766998
6. Smeltzer SC, Bare BG, Hinkle JL, Cheever KH. Brunner and Suddarth's Textbook of Medical-Surgical Nursing. 11thed. Philadelphia, PA: Lippincott William & Wilkins; 2010.
7. Atanelov L, Christian AB. Dysphagia after stroke : An overview. *Curr Phys Med Rehabil Rep.* 2013;1(3):187-96. <https://doi.org/10.1007/s40141-013-0017-y> PMID:24977109
8. Jiang J, Fu S, Wang W, Ma Y. Validity and reliability of swallowing screening tools used by nurses for dysphagia : A systematic review. *Tzu Chi Med J* 2016;28(2):41-8. <https://doi.org/10.1016/j.tcmj.2016.04.006> PMID:28757720
9. Trapl M, Enderle P, Nowotny M, Teuschl Y, Matz K, Dachenhausen A, *et al.* Dysphagia bedside screening for acute-stroke patients the gugging swallowing screen. *Stroke.* 2007;38(1):2948-52. <https://doi.org/10.1161/STROKEAHA.107.483933> PMID:17885261
10. Krajczy E, Krajczy M, Luniewski J, Bogacz K, Szczegliński J. Assessment of the effects of dysphagia therapy in patients in the early post-stroke period: A randomised controlled trial. *Neurol Neurochir Pol.* 2019;53(6):428-34. <https://doi.org/10.5603/PJNNS.a2019.0053> PMID:31724147
11. El Said Bassiouny S. Assessment of dysphagia in acute stroke patients by the gugging swallowing screen. *Glob J Otolaryngol.* 2017;9(4):80-7. <https://doi.org/10.19080/GJO.2017.09.555766>
12. Nikhila KS, Gupta A, Jayavelu J, Sehgal J, Garg A. Functional outcome measurements in acute stroke patients with oropharyngeal dysphagia after swallowing rehabilitation therapy. *EC Neurol.* 2017;8:195-205.
13. Umay EK, Gürçay E, Bahçeci K, Öztürk E, Yılmaz V, Gündoğdu, *et al.* Validity and reliability of Turkish version of the gugging swallowing screen test in the early period of hemispheric stroke. *Neurol Sci Neurophysiol.* 2018;35(1):6-13. <https://doi.org/10.1007/s12275-018-0001-1>

- org/10.5152/NSN.2018.10436
14. Black JM, Hawks J. *Medical Surgical Nursing Clinical Management for Positive Outcomes*. 2nd ed. St Louis, Missouri: Elsevier, Saunders; 2014.
 15. Yousufuddin M, Young N. Aging and ischemic stroke. *Aging (Albany NY)*. 2019;11(9):2542-44. <https://doi.org/10.18632/aging.101931>
PMid:31043575
 16. Kumaresan A, Alagesan J, Vijayaraghavan R, Ramachandran A, Abraham MM, Geetha M. Determinants of dysphagia following stroke. *Ethiop J Health Dev*. 2019;33(3):147-52. <https://doi.org/10.1159/000077663>
PMid:15073441
 17. Leung M, Ball LJ, Advisor T, Ambrosi D. *Quantifying Swallowing Function for Healthy Adults in Different Age Groups using Acoustic Analysis*. Boston, MA: MGH Institute of Health Professions; 2015.
 18. Rofes L, Muriana D, Palomeras E, Vilardell N, Palomera E, Alvarez-Berdugo D, *et al*. Prevalence, risk factors and complications of oropharyngeal dysphagia in stroke patients: A cohort study. *Neurogastroenterol Motil*. 2018;30(8):e13338. <https://doi.org/10.1111/nmo.13338>
PMid:29573064
 19. Park TH, Ko Y, Lee SJ, Lee KB, Lee J, Han MK, *et al*. Identifying target risk factors using population attributable risks of ischemic stroke by age and sex. *J Stroke*. 2015;17(3):302-11. <https://doi.org/10.5853/jos.2015.17.3.302>
PMid:26437995
 20. Watila MM, Balarabe B. Factors predicting post-stroke aphasia recovery. *J Neurol Sci*. 2015;352(1-2):12-8. <https://doi.org/10.1016/j.jns.2015.03.020>
PMid:25888529
 21. Benjamin EJ, Blaha MJ, Chiuve SE, Cushman M, Das SR, Blaha, MJ, *et al*. Heart disease and stroke statistics-2017 update: A report from the American heart association. *Circulation*. 2017;135(10):e146-603. <https://doi.org/10.1161/CIR.0000000000000485>
 22. Khedr EM, Abbass MA, Soliman RK, Zaki AF, Gamea A. Post-stroke dysphagia: Frequency, risk factors, and topographic representation: Hospital-based study. *Egypt J Neurol Psychiatry Neurosurg*. 2021;57(1):23.
 23. Chaidir R, Busral K. Pengaruh latihan menelan terhadap kemampuan menelan pasien stroke dengan disfagia. *Prosiding Seminar Kesehatan Perintis*. 2020;3(2):2018-21.
 24. Ehsaan F, Khan MS, Malik SN, Kanwal S. Frequency of post-stroke dysphagia in Pakistan: A hospital based study. *J Pak Med Assoc*. 2016;66(10):1281-5.
PMid:27686304
 25. Sultradewi Kesuma NMT, Krismashogi Dharmawan D, Fatmawati H, Mutiarasari D, Achmad BF, Nuraeni A, *et al*. Perbedaan efektivitas terapi menelan berdasarkan karakteristik demografi pasien disfagia stroke. *J Keperawatan Klin dan Komunitas*. 2019;1(0274):36-44. <https://doi.org/10.22146/jkkk.35295>
 26. Katan M, Luft A. Global Burden of Stroke. *Semin Neurol*. 2018;38(2):208-11. <https://doi.org/10.1055/s-0038-1649503>
PMid:29791947
 27. Sreedharan SE, Sayed JV, Vipina VP, Mohan MP, Paul R, Sylaja PN. Dysphagia and disability in minor strokes-an institutional study. *J Stroke Cerebrovasc Dis*. 2020;29(9):105070. <https://doi.org/10.1016/j.jstrokecerebrovasdis.2020.105070>
 28. Cahyati Y, Rosdiana I. Faktor yang Berkontribusi terhadap kejadian stroke ulang. *Media Inf*. 2017;13(1):75. <https://doi.org/10.37160/bmi.v13i1.75>