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Post-stroke dysphagia in patients with acute ischemic stroke: single-center retrospective cohort study

Dysfagia poudarowa u pacjentów po przebytym udarze niedokrwiennym mózgu: jednoośrodkowe retrospektywne badanie kohortowe

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Abstract

Background. *Swallowing disorders (dysphagia) are a common phenomenon in patients after acute ischemic stroke (AIS). The most serious complications of post-stroke dysphagia (PSD) are related to aspiration and include aspiration pneumonia. Both the nasogastric tube (NGT) and percutaneous endoscopic gastrostomy (PEG) are recognized and used methods of nutritional support in patients with AIS.* **Objectives.** *The aim of the study was to analyze factors related to dysphagia in patients after ischemic stroke to assess possible complications of PSD and identify risk factors for PSD-related complications.* **Methods.** *867 patients after ischemic stroke staying in the Central Clinic Hospital of the Medical University of Silesia in Katowice in 2020-2022 were analyzed. Among other things, the relationship between swallowing disorders, pneumonia, and mortality was investigated.* **Results.** *The group of stroke patients with dysphagia was characterized by higher age (77.3 years vs 71.4; p=0.0000) and worse clinical condition on admission (15 vs 9 NIHSS points; p=0.00000). Dysphagia was associated with worse treatment outcomes (NIHSS at discharge 16 vs 6 points; p=0.0000) and a higher risk of death (29.5 vs 4, 1%, p=0.0000). During hospitalization, patients with swallowing disorders were much more likely to experience aspiration pneumonia (9.9% vs 0.6%). Gastrostomy feeding was a strong negative predictor of aspiration pneumonia (OR -12.33 (-14.72–9.95), p = 0.000).* **Conclusions.** *Dysphagia and related complications, including aspiration pneumonia, contribute to the deterioration of the functional status of patients with a history of ischemic stroke. (Gerontol Pol 2024; 32; 143-148) doi: 10.53139/GP.20243223*

Keywords: *dysphagia; ischemic stroke; pneumonia; percutaneous endoscopic gastrostomy (PEG)*

Introduction

Swallowing is a complex neuromuscular process in which the oral, pharyngeal, and esophageal phases are distinguished [1]. When swallowing disorders result in difficulty forming a piece of food and moving it from the mouth to the esophagus, it is called oropharyngeal dysphagia (upper dysphagia). Esophageal (lower) dysphagia is associated with food retention and retention as it moves into the stomach [2]. Stroke is the most common cause of neurogenic dysphagia [3]. According to available scientific reports, the incidence of dysphagia in patients after acute ischemic stroke (AIS) reaches up to 81% [4,5], and approximately 50% of patients struggle with this dysfunction in the sixth month after the onset of the disease [5]. Post-stroke dysphagia (PSD) leads to malnutrition, which in turn is associated with pressure ulcers, dehydration, electrolyte disturbances, and weight loss [4,6]. Most importantly, PSD leads to aspiration of secretions from the oropharynx or stomach, which is a predictor of aspiration pneumonia [7,8]. It should be emphasized that the occurrence of nosocomial infection – aspiration pneumonia – is one of the most important extra-cerebral factors increasing the risk of death. Patients

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with silent aspiration have an eleven-fold increased risk of pneumonia compared to those without swallowing disorders [9]. In some patients, PSD is often so serious that it requires the implantation of a percutaneous endoscopic gastrostomy (PEG), which prolongs the patient's hospitalization time, increases the risk of further complications, and is associated with high economic costs [10,11]. Swallowing disorders also increase patient's mortality rate in AIS [7,8].

Objectives

The aim of the study was to analyze factors related to dysphagia in patients after ischemic stroke to assess possible complications of PSD and identify risk factors for PSD-related complications.

Materials and methods

A cross-sectional single-center retrospective study was employed to assess the clinical significance of the occurrence of dysphagia and the identification of risk factors associated with dysphagia complications. All patients diagnosed with AIS admitted to the Central Clinical Hospital of the Medical University of Silesia in Katowice, a tertiary stroke center from January 2020 to July 2022 were included in this study. The study group consisted of 867 patients – 480 females (55,4%) and 387 males (44,6%), mean age was 72,7±11,1 years (mean ± SD). In the study group, clinical data regarding the Gugging Swallowing Screen Scale (GUSS), Swallowing rating scale, the National Institutes of Health Stroke Scale (NIHSS) score, at admission and discharge were gathered. Data on the feeding route, nutritional parameters, and dysphagia complications were also included. In the next stage, an analysis of a group of patients with significant swallowing disorders (GUSS<15 points) was carried out to identify factors predicting the occurrence of dysphagia complications. The statistical analysis was performed with the Statistica 13.3 software system (TIBCO Software Inc. 2017. http://statistica.io). The quantitative variables are presented as an arithmetic mean and standard deviation (normally distributed variable) or median and interquartile range (variables with skewed distribution). The qualitative variables are presented as absolute values and percentages. The normality of distribution was assessed with the Shapiro-Wilk test.

Due to a lack of confirmation of the normal distribution in the analyzed groups, the intergroup differences for the quantitative variable were assessed with the Mann–Whitney U-test, Fisher's exact test or chi-square test. A p-value below or equal to 0.05 was considered statistically significant. Odds ratios (ORs) with a 95% confidence interval (CI) and *p* values were obtained using binary logistic regression. The variables that were significantly associated with the univariate logistic regression were then analyzed using multivariate logistic regression. The final predictive model for DM was fitted using the forward stepwise selection method. The significance level was set at $p < 0.05$ Due to the retrospective character of the work and data anonymization, the Medical University of Silesia Ethics Committee waived the requirement to obtain ethical approval for this study.

Results

Demographic and clinical data of AIS patients with and without significant swallowing problems.

The group of patients with dysphagia (GUSS <15 points) was characterized by higher age (77.3 years *vs* 71,4; p = 0,0000). The occurrence of swallowing disorders was also associated with a significantly worse clinical condition – higher NIHSS on admission (15 *vs* 9 points; p = 0,0000. No significant difference was observed in the use of reperfusion methods in patients without and with significant dysphagia. The group of patients with swallowing disorders more often had to be fed through an intestinal tube (51.8%*vs*0.6% and gastrostomy (10.1 *vs* 0%), aspiration pneumonia was more frequently observed in this group (9,9 *vs* 1,2%). Patients with GUSS< 15 points were also characterized by worse treatment outcomes – NIHSS on discharge (16 *vs* 6 points; p = 0,0000), and a higher risk of death 29,5 *vs* 4.1%; p = 0,0000.

The group of patients with significant swallowing disorders was characterized by higher total cholesterol, (216 mg/dL *vs* 204 mg/dL; p = 0.0399) higher white blood cell levels (8.92 $x10^9$/L *vs* 10.4 $x10^9$/L; p = 0.0000), and lower albumin levels (3.3 g/dL *vs* 3.7 g/dL; p = 0.0146). Detailed data are summarized in table I.

Risk factors for worse prognosis in patients with dysphagia.

Multivariable logistic regression analysis was performed based on the univariate logistic regression results to identify predictors of death in patients with swallowing disorders. A lower GUSS score and as-

Table I. Demographic and clinical data of AIS patients with and without significant swallowing problems. GUSS – The Gugging Swallowing Screen Scale; NIHSS - National Institutes of Health Stroke Scale; AIS – Acute Ischemic Stroke

	GUSS<15 points N=191 patients	GUSS>15 points N=676 patients	p
Age (years)	77.3±11.8	71.4±10.4	0.0000
Gender n (%)			0.2485
Male	81 (42,0)	305 (45.3)	
Female	110 (58,0)	370 (54.7)	
NIHSS on admission (points) [IQR]	15 [10-17]	9 [4-9]	0.0000
Swallowing rating scale (points) [IQR]	6 [5-6]	3 [1-5]	0.0000
GUSS (points) [IQR]	5[0-13]	19 [17-20]	0.0000
Thrombolysis n (%)	(18.7)	(19.5)	0.5948
Thrombectomy n (%)	(7,9)	(4.1)	0.1458
Route of feeding n (%)			0,0000
Orally	45 (23.7)	607 (89,9)	
Adjustment of food consistency	35 (18.7)	60 (8,9)	
Enteral tube	45 (51.8)	4 (0.6)	
Gastrostomy	19 (10.1)	0 (0.0)	
Aspiration pneumonia n (%)	19 (9,9)	6 (1.2)	0,0000
NIHSS on discharge (points) [IQR]	16 [5-18]	6 [1-7]	0.0000
Deaths n (%)	56 (29.5)	22 (4.1)	0.0000
Laboratory results Median (IQR)			
Total cholesterol mg/dL	216 [170.1-257.4]	204 [150.2-254.2]	0.0399
LDL mg/dL	109.1 [74.6-139.2]	108.9 [68.7-141.8]	0.7407
HDL mg/dL	48.6 [39.4-56.9]	47.2 [38-57]	0.3877
Triglycerides mg/dL	134.3 [85.5-164]	120.0 [82.3-147]	0.0677
Hemoglobin g/dL	13.9 [12.9-15.2]	13.6 [12.3-15]	0.0744
White blood cell count x109/L	8.92 [6.8-10.5]	10.4 [7.4-11.9]	0.0000
Albumin g/dL	3.3 [3.0-3.7]	3.7 [2.6-4.3]	0.0146
Calcium mmol/L	1.15 [1,12-1,19]	1.29 [1.11-1.32]	0.9378
Phosphorus mg/dL	3.70 [3.17-3.3.93]	3.35 [2.44-4.03]	0.0611

Mann–Whitney U-test, Fisher's exact test or chi-square test

Table II. The results of logistic regression for predictors of death in patients with dysphagia. OR—odds ratio; CI—confidence interval

	OR	95% CI		P
GUSS	-0,1905	-1,2798	-1,1011	0.0000
Aspiration pneumonia	1.0235	0,0745	1,97244	0.0345
Orally	2,9729	1,6872	4,25857	0.0000
Gastrostomy	-12,334	-14,7165	-9,95153	0.0000
Enteral tube	5,218			

Multivariable logistic regression analysis.

piration pneumonia were identified as predictors of death in this group of patients. The best predictive model identified for aspiration pneumonia in patients with dysphagia, oral nutrition (OR 2.97 (1.69-4.26), $p = 0.000$). Gastrostomy feeding was a strong negative predictor of aspiration pneumonia (OR 12.33 (-14.72-9.95), $p = 0.000$). The results of the logistic regression are summarized in table II.

Discussion

The study assessed the incidence of swallowing disorders in patients with AIS and possible complications related to dysphagia. We also assessed the clinical significance of swallowing disorders and analyzed the nutritional status of patients after acute ischemic stroke.

Due to the consequences of dysphagia, both the European Stroke Organization (ESO) and the National Insti-

tute for Health and Care Excellence (NICE) recommend screening for swallowing disorders in patients with AIS as soon as possible after the start of hospitalization [12].

A Cochrane review analyzed a total of 3,953 participants who underwent 37 screening tests, but no study achieved 100% sensitivity and specificity [12]. Instrumental methods for assessing swallowing disorders, including endoscopic assessment of swallowing disorders and videofluoroscopic assessment of the act of swallowing, allow for a detailed understanding of the mechanism of dysphagia [13,14], but they are not always used due to the lack of availability. The validated GUSS (The Gugging Swallowing Screen) test was used to screen for swallowing disorders in our study. A GUSS test result of 0-9 points indicates severe dysphagia with a high risk of aspiration, a result of 10-14 points indicates dysphagia of medium severity with a moderate risk of aspiration. Of the 867 patients we analyzed, swallowing disorders detected by the GUSS test were found in 22% of people whose average GUSS test result was 5 points. Known predictors of PSD include older patient age and a higher NIHSS score at admission [15,16]. Pereira included 311 patients with AIS in his study and showed using the Pearson correlation coefficient that the NIHSS score at admission was positively correlated with the degree of dysphagia ($r = 0.783$; $p < 0.001$), age (>70 years) was also associated with a higher risk of dysphagia ($p < 0.001$) [16].

These data are consistent with the results of our study. On admission, patients with dysphagia had a higher age (77.3 *vs* 71.4). The occurrence of swallowing disorders was also associated with a significantly worse clinical condition – higher NIHSS on admission (15 *vs* 9 points; $p = 0.0000$). Other consequences associated with dysphagia include malnutrition and dehydration [17]. Proteins are of the greatest importance in assessing nutritional status. It is assumed that the concentration of this protein below 3.5 g/dl indicates malnutrition. This is confirmed by the data obtained from our analysis, patients with dysphagia had lower albumin levels (3.3 g/dl *vs* 3.7 g/dl).

We observed that swallowing difficulties were directly related to higher total cholesterol levels and lower white blood cell counts. According to some sources, hyperlipidemia is less common in patients with dysphagia [18]. However, according to other reports, hyperlipidemia may not be directly related to the development of PSD. Banda et al. in their meta-analysis of over 26,000 participants from 42 studies, they found that biomedical risk factors for stroke, including hyperlipidemia, may not be directly related to the development of PSD [19]. The discrepancies in the results may be due to the fact that the analysis covered the acute period of the disease, when metabolic changes may not have been so pronounced. Data from the review show that dysphagia (not only post-stroke) lengthens hospitalization by 2.8 days, increases economic costs by 34 days and more than doubles patient mortality [13]. The relationship between dysphagia, increased mortality, unfavorable course of the disease is confirmed by numerous scientific reports [10,11]. On the day of discharge, the analyzed patients with dysphagia obtained a 10-point higher score on the NIHSS scale than those without swallowing disorders (16 *vs* 6 points; $p = 0.0000$). Moreover, swallowing disorders are also an independent predictor of patient death (29.5% (56) *vs* 4.1% (22); $p = 0.0000$). These reports are confirmed by numerous studies, e.g. Arnold et al. studied the association of dysphagia in 570 patients with AIS with pneumonia, hospitalization time, and compared 3-month mortality between patients with and without dysphagia. Dysphagia, as in our patients, was assessed using the GUSS screening test. Patients with dysphagia more often suffered from pneumonia (23.1% *vs* 1.1%, $p<0.001$), required longer hospitalization (4.4±2.8 *vs* 2.7±2.4 days; $p<0.001$) compared to those without dysphagia. After 3 months, patients with dysphagia were more likely to die (13.6% *vs* 1.6%; $p<0.001$) [20].

One of the main objectives of this study was to determine the factors influencing the incidence of aspiration pneumonia in stroke patients. An important factor causing aspiration pneumonia and death in stroke patients is dysphagia. Our analysis shows that of 191 patients with swallowing disorders, almost 10% developed aspiration pneumonia (9.9% *vs* 1.2%). It is worth mentioning that some patients may experience the so-called silent aspiration, which does not give any visible signs during the swallowing process [21]. Silent aspiration is associated with weakening of the throat muscles, impaired laryngeal and weakened cough reflex.

Screening tests are not applicable in the case of silent aspiration because they do not assess the pharyngeal phase of swallowing; this function is well fulfilled by instrumental methods [21].

The group of patients with swallowing disorders more often had to be fed through an intestinal tube (51.8% *vs* 0.6% and gastrostomy (10.1 *vs* 0%). A gastrostomy is planned to be placed for predictable long-term (4 weeks) support of the patient's enteral nutrition [22]. It has been shown that feeding patients with AIS and dysphagia through a gastrostomy tube is more effective than a nasogastric tube (NGT). Feeding through PEG leads to an increase in albumin, and a nasogastric tube decreases its level. The results of our logistic regression clearly indicate that PEG feeding is associated with a lower risk of

patient death. In the analysis of our patients, PEG feeding was a strongly negative predictor of aspiration pneumonia (OR -12.33 (-14.72–9.95), p = 0.000), which was found to be a predictor of death. Such data were not obtained when analyzing patients with NGT. The obtained results may result from the fact that patients in extremely poor clinical condition and with test results that made it impossible to perform a gastrostomy procedure were fed using NGT. Based on the results of our analysis, gastrostomy can be considered as a minimally invasive method that reduces mortality in the group of AIS patients with swallowing disorders. There are studies that show that gastrostomy as an invasive procedure is associated with a higher risk of mortality [23].

Limitations

One of the greatest limitations of our study is the use of only screening methods for diagnosing swallowing disorders. Therefore, it is important to proceed with caution when interpreting our findings.

Conclusions

Dysphagia is a common complication of cerebrovascular diseases. PSD is associated with a more severe clinical condition of patients, and its occurrence correlates with unfavorable prognosis and higher mortality among stroke patients. Aspiration pneumonia is one of the most important complications of dysphagia. Therefore, every effort should be made to reduce the risk of its occurrence. If dysphagia does not improve within the first few days, PEG placement should be considered as it minimizes the risk of aspiration pneumonia.

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Conflict of interest
None

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