

ORIGINAL PAPER

SWALLOWING DISORDERS IN ELDERLY PATIENTS WITH NEUROLOGICAL DEFICITS

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Abstract

Aim: The study aimed to identify possible dysphagia in elderly patients with neurological deficits. **Design:** A cross-sectional study. **Methods:** A cross-sectional study was carried out using a standardized tool, the Brief Bedside Dysphagia Screening Test-Revised (BBDST-R). The study comprised 141 patients. Data were statistically processed; the sensitivity and specificity of the screening tool were calculated. The level of significance was set at 5%. **Results:** In the sample, the majority of screening results were positive (67.4%), that is, most patients had possible swallowing disorders. There was a statistically significant difference in the presence of possible dysphagia depending on cognitive functioning. As many as 77% of individuals with cognitive impairment had possible dysphagia. Analysis of the data suggested an increase in the proportion of individuals with possible dysphagia with increasing age. The sensitivity of the screening test with regard to speech pathology assessment was 100% (CI = 89.7–100.0%). The mean time needed to complete the BBDST-R in one person was 1.3 minutes. **Conclusion:** For its high sensitivity and short completion time, the BBDST-R is suitable for use in clinical practice to detect possible swallowing disorders in elderly patients with neurological deficits.

Keywords: dysphagia, elderly, neurological deficit, patient, screening.

Introduction

Dysphagia, or swallowing disorders, refers to difficulties swallowing saliva, liquids, foods of various consistencies or drugs. Dysphagia may develop due to either an impaired swallowing mechanism or neurological, gastrointestinal and other problems (Tedla, 2018). According to the European Society for Swallowing Disorders, dysphagia is a frequent and rather serious problem in the senior population (Baijens et al., 2016). As many as 70% to 90% of elderly patients, including those with no neurological disorders, experience some degree of dysphagia. Up to 50% of elderly patients have eating problems, resulting in a lack of nutrients associated with weight loss, an increased risk of falls, poor wound healing and a higher susceptibility to developing other diseases. Weight loss, longer meal times, depression and general complaints of tiredness are often seen in these patients even before dysphagia is diagnosed (Murry & Carrau, 2012). Neurological disorders causing dysphagia include, for instance, stroke, amyotrophic lateral sclerosis, multiple sclerosis, Parkinson's disease, neuromuscular disease, cerebral palsy, tumors, bulbar palsy and

cranial palsy (Kaufussová, 2007).

Dysphagia has a significant impact on an individual's life, potentially causing a range of serious complications. Therefore, dysphagia patients need to be thoroughly examined (Baijens et al., 2016; Kejkličková, 2011; Tedla, 2018). Although many methods and tools are used to detect dysphagia, no single one has been recommended as the most suitable for use in practice (Kertscher et al., 2014). The gold standards for diagnosing dysphagia are videofluoroscopic swallow study and fiberoptic endoscopic evaluation of swallowing (Černý et al., 2011; Kertscher et al., 2014).

However, it appears beneficial to initiate the diagnostic process with screening tools allowing rapid and non-invasive identification of patients requiring further assessment by a medical practitioner or clinical speech pathologist. Kertscher et al. (2014) published a review of screening methods for detecting possible dysphagia in patients with neurological disorders. However, most of the available screening tools are targeted at stroke patients only, namely the Acute Stroke Dysphagia Screen – SDS (Edmiston et al., 2010), Toronto Bedside Swallowing Screening Test – TOR-BSST (Martino et al., 2009), Gugging Swallowing Screen – GUSS (Trapl et al., 2007), etc.

In screening, an important role is played by a general nurse as she is present at the patient's bed for 24

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hours a day. General nurses are often aware of their patients' eating problems and are thus able to reveal dysphagia early (Groher & Crary, 2010). As part of the nursing process, nurses may use screening tools for diagnosing nursing problems such as dysphagia. However, it must be realized that screening alone is unable to provide definitive diagnosis but it is important for initializing the diagnostic and therapeutic processes (Steele et al., 2011).

In the Czech Republic, there is no single approach to identification of patients with dysphagia. The issue has been addressed mainly by Mandysová et al. (2012, 2014, 2015). Mandysová et al. (2012, 2015) focused on developing a standardized tool for detecting potential swallowing disorders. In 2015, they published the Brief Bedside Dysphagia Screening Test-Revised (BBDST-R), a simple 8-item screening tool with high sensitivity (95.5%; CI = 84.9%–98.7%) and negative predictive value (88.9%; CI = 67.2%–96.9%). According to the authors, it is particularly useful for detecting possible dysphagia in patients with neurological deficits (Mandysová et al., 2015; Mandysová & Škvrňáková, 2016). Therefore, it was also used in the present study.

Aim

The study aimed to identify possible dysphagia in elderly patients with neurological deficits using the BBDST-R and to assess the impact of factors such as age, dementia or neurological disease type on the prevalence of dysphagia. Another objective was to determine the sensitivity, specificity and time to completion.

Methods

Design

A cross-sectional study was carried out.

Sample

The purposive sampling technique was used. The sample comprised 141 patients who met the following inclusion criteria: age 65 years or more, hospital stay in a neurology department, presence of selected neurological diseases (stroke, various types of dementia, multiple sclerosis, myasthenia gravis, Parkinson's disease or syndrome, various types of chorea, brain tumors, amyotrophic lateral sclerosis, acute inflammatory polyradiculoneuritis) and the patient's (legal representative's) consent to participate. The exclusion criteria were age under 65 years, absence of the above diseases and refusal to participate.

The study was conducted in normal wards of a neurology department. Each patient was individually informed about the purpose and significance of the study and assured of anonymity. The assessment itself was performed only after the participant's consent was obtained. All patients staying in the particular wards who met the above criteria were investigated.

Data collection

Data were collected using a special record sheet containing the BBDST-R and other necessary patient information, namely the diagnosis, age, gender, Mini Mental State Examination (MMSE) result (Folstein et al., 1975), speech pathology assessment of dysphagia and information on nasogastric tube (NGT) insertion.

The Czech version of the BBDST-R was used with the consent of its author. Data were collected by a nurse with a degree working at a neurology department who had received relevant training.

Brief Bedside Dysphagia Screening Test-Revised (BBDST-R)

The tool contains the following 8 instruments: 1) presence of voluntary cough; 2) ability to clench the teeth; 3) the tongue is symmetrical and strong; 4) the facial muscles are symmetrical and strong; 5) shoulder shrug is symmetrical and strong; 6) presence of dysarthria; 7) presence of aphasia; and 8) thick liquid: cough. The test is considered positive if one or more results are abnormal. Abnormal results are *no* responses to items 1–5 and *yes* responses to items 6–8 (1 point for each abnormal item) (Mandysová et al., 2015).

The items were assessed as follows:

To assess the presence of voluntary cough, the patient was asked to cough; cough was also assessed with regard to item 8 (thick liquid: cough). To assess the ability to clench the teeth, the patient was asked to clench and display their teeth. To assess tongue symmetry, the patient was asked to stick their tongue out. Tongue strength was assessed with a tongue blade. The symmetry and strength of the facial muscles was assessed by observing the patient's relaxed face; they were also asked to smile and frown. To assess shoulder shrug symmetry and strength, the shoulders were observed with the patient sitting (preferably unsupported); then they were asked to push the shoulders against the rater's hands. Dysarthria was assessed during an interview with the patient and also verified by checking the patient's medical records. Similarly, aphasia (sensory, motor and global, or mixed) was assessed during an interview with the patient as well as during previous tests when the rater observed the patient's

ability to understand instructions and follow them correctly. Swallowing was assessed by administration of thick liquid (pudding-like consistency, four teaspoons). The liquid was thickened with a commercially manufactured thickener (Nutilis Powder). Cognitive functions were tested using the MMSE. The patient's demographic data were also recorded. The record sheet included information concerning speech pathology assessment results, insertion of an NGT and diagnosis of the patient. The information was obtained from the patient's medical records.

As patients with dementia are at a higher risk for developing dysphagia, this issue was also investigated by including patients with cognitive deficits in the sample. In case of patients with cognitive deficits as confirmed by the MMSE, their family members or legal representatives were asked for consent to participate in the study.

Data analysis

Data were processed using Stata 13. Descriptive statistics (arithmetic mean, median, standard deviation, frequency tables with absolute and relative frequencies) were used to summarize the data. Hypotheses were tested with the chi-squared test and Fisher's exact test. In addition to sensitivity and specificity, 95% confidence interval was calculated. The level of significance was set at 5%.

Due to small numbers of participants with particular diseases, some clinical diagnoses were pooled into groups based on their etiology for better statistical analysis and interpretation of data. Four groups were created as follows: 1) stroke; 2) neurodegenerative diseases (various types of dementia, Parkinson's disease or syndrome, amyotrophic lateral sclerosis); 3) autoimmune inflammatory diseases (multiple sclerosis, myasthenia gravis, acute inflammatory polyradiculoneuritis) and 4) brain tumors.

Results

The study sample comprised 141 patients (58 males, 83 females). The youngest participants were 65 years old; the oldest patient was 94 years old. There were 100 stroke patients, 20 patients with neurodegenerative diseases, 13 patients with autoimmune inflammatory diseases and 8 patients with brain tumors. Nineteen patients with severe dysphagia had NGTs inserted. In that hospital, NGTs are placed depending on the severity of inpatients' condition; subsequently, these patients are examined to confirm or rule out dysphagia. The MMSE showed no cognitive deficits in 55 patients and borderline scores in another 14 individuals; the remaining 47

patients who could be tested had some degree of dementia (Table 1). The BBDST-R revealed possible dysphagia in 95 participants; the other patients were free from dysphagia (Table 1).

Table 1 Sample characteristics and BBDST-R results for the entire sample

Variables	Categories	n	%
Age	65–74 years	73	51.8
	75–84 years	51	36.2
	85 years and older	17	12.1
Gender	males	58	41.1
	females	83	58.9
NGT insertion	yes	19	13.5
	no	122	86.5
Neurological diagnosis	stroke	100	70.92
	neurodegenerative diseases	20	14.18
	autoimmune inflammatory diseases	13	9.23
	brain tumors	8	5.67
Neurological diagnosis (specific)	stroke	100	70.9
	dementia – various types	9	6.4
	multiple sclerosis	6	4.3
	myasthenia gravis	5	3.6
	parkinson's disease or syndrome	9	6.4
	brain tumors	8	5.7
	amyotrophic lateral sclerosis	2	1.4
	acute inflammatory polyradiculoneuritis	2	1.4
Cognitive function assessed with the MMSE	normal	55	39.0
	borderline	14	9.9
	dementia – mild to moderate	43	30.5
	dementia – moderate to severe	3	2.1
	dementia – severe	1	0.7
	not assessed	25	17.7
BBDST-R	positive	95	67.4
	negative	46	32.6

MMSE – Mini Mental State Examination, BBDST-R – Brief Bedside Dysphagia Screening Test–Revised

Out of 141 patients included in the study, 57 individuals suspected of having dysphagia were examined by a speech pathologist (consistently with the hospital's standards). The speech pathologist diagnosed 34 patients with dysphagia; the remaining 23 participants screened negative for dysphagia (Table 2).

The mean time to complete the BBDST-R in one person was 1.3 minutes; the shortest and longest times were 0.8 and 2.6 minutes, respectively (Table 3). There was a statistically significant difference in time needed to complete the BBDST-R depending on dysphagia and the presence of dementia (Table 4).

Table 5 lists factors investigated as to whether they potentially influence the development of dysphagia. Statistical tests (chi-squared test) failed to show a statistically significant difference in the prevalence of dysphagia ($p = 0.470$) depending on the patients' age. The Fisher's exact test and chi-squared test found no statistically significant difference ($p = 0.094$) in the distribution of dysphagia by groups of diagnoses.

Given the fact that some individuals ($n = 25$) were unable to undergo testing with the MMSE, only 116 patients were assessed using the MMSE.

Table 2 shows the comparison of the BBDST-R with speech pathology assessment. Only data from patients assessed by a speech pathologist ($n = 57$) were analyzed. The statistical tests showed that the sensitivity of the BBDST-R, as compared with speech pathology assessment, was $34/34 = 100\%$, with a confidence interval of $89.7\%–100.0\%$. For 34 tested patients also assessed by a speech pathologist, both the test yielded positive results and dysphagia was confirmed by speech pathology assessment. In 3 patients with negative screening results, dysphagia was ruled out by speech pathology assessment.

The selected statistical tests were used to calculate the specificity: $3/23 = 13\%$, with a confidence interval of $2.8\%–33.6\%$.

Table 2 Comparison of BBDST-R and speech pathology assessment results – sensitivity and specificity

BBDST-R	Dysphagia diagnosed by a speech pathologist		Total
	Yes (n)	No (n)	
positive	34	20	54
negative	0	3	3
total	34	23	57

BBDST-R – Brief Bedside Dysphagia Screening Test-Revised

Table 3 Time to complete the BBDST-R (minutes) for the entire sample

median	1.3
mean	1.3
SD	0.32
min.	0.8
max.	2.6

BBDST-R – Brief Bedside Dysphagia Screening Test-Revised; SD – standard deviation; min. – minimum; max. – maximum

Table 4 Time to complete the BBDST-R (minutes) depending on the presence of dysphagia and dementia

		n	median	mean	SD	min.	max.	p-value
BBDST-R	negative	46	1.0	1.1	0.23	0.78	1.97	< 0.001
	positive	95	1.4	1.4	0.33	0.85	2.63	
Dementia	no	69	1.1	1.2	0.29	0.78	2.63	< 0.001
	yes	47	10.8	11.0	1.75	7.00	15.0	

BBDST-R – Brief Bedside Dysphagia Screening Test-Revised; SD – standard deviation; min. – minimum; max. – maximum

Table 5 BBDST-R results by age, neurological disease type and the presence of dementia

Variables	Categories	Negative (n)	Positive (n)	
Age	65–74 years	27	46	$p = 0.470$
	75–84 years	15	36	
	85 years and older	4	13	
Neurological diagnosis	stroke	27	73	$p = 0.094$
	neurodegenerative diseases	8	12	
	autoimmune inflammatory diseases	6	7	
	brain tumors	5	3	
Neurological diagnosis (specific)	stroke	27	73	$p = 0.085$
	dementia – various types	5	4	
	multiple sclerosis	4	2	
	myasthenia gravis	1	4	
	parkinson's disease or syndrome	3	6	
	brain tumors	5	3	
	amyotrophic lateral sclerosis	0	2	
	acute inflammatory polyradiculoneuritis	1	1	
Dementia	no	34	35	$p = 0.005$
	yes	11	36	

BBDST-R – Brief Bedside Dysphagia Screening Test-Revised; p – p-value

Discussion

The study aimed to detect possible dysphagia in elderly patients with neurological deficits using the BBDST-R and to assess the impact of factors (age, dementia, neurological disease type) on the prevalence of dysphagia. Another objective was to determine the sensitivity, specificity and time to completion.

The BBDST-R (Mandysová et al., 2015) was selected for the study as its authors claim that it is particularly suitable for use in neurological patients. As the tool is able to detect the presence of possible dysphagia, it is essential that the screening is complemented by assessment to confirm or rule out dysphagia. The study comprised 141 elderly patients (mean age 75.6 years) staying in a neurology department.

The results showed a high prevalence of possible dysphagia in elderly patients with neurological deficits. As many as 67.4% of the tested patients had positive BBDST-R results, that is, were suspected of having dysphagia. The remaining 32.6% of patients with negative screening results were unlikely to suffer from dysphagia. The results were consistent with those in studies performed abroad which included more elderly patients. Lin et al. (2002) identified impaired swallowing in 51% of 1,221 patients with a mean age of 77.07 years. The participants, however, were institutionalized residents, not hospital inpatients. In another large study, Carrión et al. (2015) found oropharyngeal dysphagia in 47.4% of 1662 patients over 70 years of age. Oropharyngeal dysphagia is rather common in neurological patients, posing a serious health threat potentially leading to aspiration pneumonia and death (Kertscher et al., 2014). In the present study, statistical analysis showed no significant difference ($p = 0.470$) in the presence of possible dysphagia with regard to age. However, the results suggested an increase in the proportion of individuals with dysphagia with increasing age. This is consistent with results reported by Cabre et al. (2010). Out of 134 elderly participants in their study, 55.2% manifested dysphagia; for a subgroup of those over 85 years of age, the proportion rose to 60.8%. Similar results were reported by other authors. Tedla (2018) claimed that the prevalence of dysphagia increased with higher age. According to Kejklíčková (2011), dysphagia was present in 45% of persons aged 75 or more with age-related neurological, psychiatric or chronic comorbidities. In the literature on swallowing disorders, the prevalence of dysphagia increases with age and the condition results from a wide range of causes (Kubešová et al., 2006). According to other

authors, dysphagia is closely related to aging and neurological diseases (Murry & Carrau, 2012).

The present study showed a significant relationship between the presence of possible dysphagia and cognitive impairment ($p = 0.005$). As many as 77% of individuals with cognitive deficits confirmed by MMSE results were suspected of having dysphagia. Rösler et al. (2015) concluded that the prevalence of dysphagia is high in patients with dementia, particularly those with moderate to severe cognitive impairment. The present study failed to show a statistically significant difference in the prevalence of possible dysphagia with respect to the cause of the patients' neurological disease. However, 73% of stroke patients potentially developed dysphagia as suggested by the BBDST-R. In the literature, dysphagia is reported in as many as 80% of patients with stroke (Dziewas et al., 2008). In a study by Martino et al. (2009), the prevalence ranged from 19% to 81%. Other authors reported 35% to 78% prevalence, depending on the diagnostic approach used (Kumar et al., 2010).

As mentioned above, dysphagia is often associated with cognitive impairment. Among patients with various types of dementia, 44.4% of individuals were suspected of having dysphagia. According to Holmerová et al. (2007), dysphagia often accompanies dementia, particularly in advanced stages of the disease.

Two out of six patients with multiple sclerosis were positively screened for dysphagia; this may be due to the current stage of their disease or their current condition. In most cases, patients with multiple sclerosis are admitted to hospital for worsening of their condition due to a multiple sclerosis attack caused, for example, by acute infections (common cold, urinary tract infection, etc.). Dysphagia is experienced by 40%–50% of multiple sclerosis patients. However, bulbar symptoms of dysphagia, dysarthria and breathing difficulties only manifest in the most advanced stages of multiple sclerosis (Ehler, 2018). In their study on dysphagia in 309 patients with multiple sclerosis, De Pauw et al. (2002) found that 24% of the patients had permanent dysphagia and another 5% had a history of transient swallowing difficulties. According to the authors, permanent dysphagia may already develop in multiple sclerosis patients with mild impairment but it is relatively common in those with moderate to severe impairment. These findings were confirmed by another study showing dysphagia in 32% of multiple sclerosis patients (Poorjavad et al., 2010).

Out of five patients with myasthenia gravis, four had positive screening findings. This may be explained by worsening of the patients' condition requiring hospital admission associated with dysphagia. When the tongue muscles, soft palate, pharynx and esophagus are affected, dysphagia develops. While 15%–45% of individuals with generalized myasthenia gravis suffer from dysphagia, the condition is observed in only 6% of myasthenia gravis patients (Ehler, 2018). Typically, the intensity of symptoms fluctuates during the day, increasing in the evening and following exertion. Striated muscles easily become tired, including those resisting fatigue under physiological conditions (extraocular, masticatory, swallowing and speech muscles). After resting, their function is temporarily restored but gradually worsens again (Urbánek, 2000).

The screening test yielded positive and negative results in six and three patients with Parkinson's disease or syndrome, respectively. Dysphagia affects as many as 80% of Parkinson's patients, with many of them having no apparent clinical difficulties (so-called silent aspirations (Klempíř, 2013). In some cases, dysphagia may be one of the first symptoms of Parkinson's disease (Roth et al., 2009). As the condition progresses, however, the symptoms of dysphagia tend to develop and worsen (Kaniová et al., 2014). This is consistent with findings from foreign studies. In their meta-analysis, Kalf et al. (2012) found that while subjective dysphagia was reported in 35% of individuals with Parkinson's disease, objectively assessed dysphagia was much more prevalent (82%). Similarly, Miller et al. (2009) concluded that based on their own investigations, dysphagia is a rather common problem in Parkinson's patients.

Dysphagia is also frequently observed in association with both primary and secondary brain tumors (Ehler, 2018). In the present study, three out of eight patients with brain tumors were positively screened for dysphagia. There were only two patients with amyotrophic lateral sclerosis, both having positive screening results. In the literature, dysphagia is reported in as many as 59% of individuals with amyotrophic lateral sclerosis (Leder et al., 2004).

Similarly, only two patients with acute inflammatory polyradiculoneuritis were screened for dysphagia, one with positive and one with negative results. The condition is characterized by relatively rapidly and almost symmetrically developing muscle pain, paresthesia and hypoesthesia, with proximally spreading palsy. This palsy may spread to brain nerves, leading to dysarthria, dysphonia and dysphagia (Ehler, 2018).

Our data obtained with the BBDST-R were compared with assessments made by a speech pathologist. Out of 141 participants, only 57 patients suspected of having dysphagia underwent the assessment. The remaining 84 patients were not assessed by the speech pathologist as they were not likely to suffer from impaired swallowing (consistently with the hospital's standards). For this part of the study, sensitivity results were of key importance as they play a pivotal role in the assessment of a diagnostic tool. Statistical tests showed a sensitivity of the test of 100%, with a confidence interval (CI) of 89.7–100.0. This means that 100% of patients with suspected dysphagia may be identified with the test. Such high sensitivity is appreciated by the screening users and is consistent with sensitivity reported in neurological patients by the test's author (95.5%; CI = 84.9–98.7).

Furthermore, the specificity of the screening instrument was found to be 13% (CI = 2.8–33.6). This means that the test yielded many false-positive results as compared with speech pathology assessment. In 20 patients with positive screening results, dysphagia was ruled out by speech pathology assessment. Consistently with our results, the test's author reported a specificity of 25.8% (CI = 16.6–37.9) for patients with neurological diseases (Mandysová et al., 2012). Instead of speech therapy assessment, results obtained by Mandysová et al. (2012) were compared with FEES results. However, the specificity results (i.e. existence of false-positive cases) should not discourage using the test for screening. Since its sensitivity is excellent, the tool is suitable for detecting potential dysphagia in neurological patients. Subsequently, such patients should undergo a more detailed examination, for example, by a speech pathologist, to confirm suspected dysphagia and to plan their treatment and rehabilitation. Similarly, Mandysová et al. (2015) stated that the BBDST-R has high sensitivity and negative predictive value, recommending its use in neurology patients. At the same time, they stressed that it is not meant to replace the role of other healthcare providers who are more proficient in assessing dysphagia.

Another objective of the present study was to determine the time needed to complete the BBDST-R in one patient. The test's author herself recommended that further research focused on finding the mean time needed to test one patient with the dysphagia screening tool (Mandysová et al., 2012). The mean time required for testing one individual with the BBDST-R was 1.3 minutes. There was a statistically significant difference ($p < 0,001$) in screening time

depending on suspected dysphagia and cognitive function in the tested patients. In both patients with positive screening results and those with cognitive impairment, the time was longer than the time needed to test patients with negative screening results and no signs of cognitive impairment. The total time does not include time needed to prepare the screening. The results suggest that the test is not time-consuming and is therefore suitable for implementation into clinical practice. The test's author intended to develop a simple tool used by nurses to screen for dysphagia and to implement it into practice. The BBDST-R (Mandysová et al., 2015) is a screening tool for detecting possible dysphagia developed in the Czech Republic based on a thorough study.

Limitation of study

The presented results are limited by a relatively small sample of patients included in the study. Therefore, the study results cannot be generalized to the entire population of elderly patients with neurological deficits.

Conclusion

The study had found that the potential prevalence of dysphagia in elderly patients with neurological deficits is quite high, particularly in stroke sufferers. The BBDST-R is suitable for use in clinical practice for its high sensitivity and short completion time. This screening tool may help general nurses rapidly and easily identify patients with suspected dysphagia. Before using it in practice, however, general nurses should be informed about its role in preventing complications in patients with dysphagia and trained in its proper use.

Ethical aspects and conflict of interest

The study was approved by the hospital management. Subsequently, the neurology department management was informed about the study. All obtained data were handled in accordance with valid ethical norms and the participants' anonymity was protected. The authors are not aware of any conflict of interest.

Authors' contribution

Concept and design (JV, HL), data collection (JV), data analysis and interpretation (JV), preparation of the manuscript (HL), critical revision of the manuscript (HL, JV), final revision of the manuscript (HL).

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