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Research Article

Reliability and Validity of Barnes-Jewish Hospital Stroke Dysphagia Screen Test in Turkish Stroke Patients with the Fiberoptic Endoscopic Method

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- FEES

Abstract

Background: Early identification of dysphagia reduces morbidity and mortality in acute stroke patients. During the acute phase of stroke, the Barnes-Jewish Hospital Stroke Dysphagia Screen (BJH-SDS) is commonly recommended for such cases. In this study, our aim was to perform validity and reliability of the Turkish version of BJH-SDS with a different method.

Methods: The scale was administered to 140 acute stroke patients within the first 24 hours of the event. The procedures were scored by two blind independent expert observers. Cronbach's alpha and item-to-total correlations were used to assess internal consistency. Inter-rater reliability studies were also conducted. Endoscopic evaluations were performed within the first 24 hours following the application of the screening tests. The flexible fiberoptic endoscopic evaluation of swallow (FEES) method was used to describe the validity of measures.

Results: The mean age of 140 patients [58 (41.4 %) female, 82 (58.6 %) male] included in the study was 67.20 (SD 12.82) years. The internal consistency of the test was good with Chronbach's α values between 0.831 and 0.894, and there was a very good inter-rater agreement based on an intra-class correlation coefficient between 0.850 and 1.000. The item-to-total correlation for test items was between 0.493 and 0.712, exceeding the commonly accepted level of > 0.3. A significant positive association between total test scores of the raters and FEES levels (r: 0.733 p=0.001 and r=0.744, p=0.001).

Based on the total scores, the sensitivity and specificity for detecting the presence of dysphagia were 78.6% and 80 to 82.8%, respectively.

Conclusion: Our results suggest that the Turkish version of BJH-SDS that performed by using FEES method is a valid and reliable instrument when determining dysphagia in acute stroke patients.

INTRODUCTION

Dysphagia is a serious condition commonly observed in patients with acute stroke. The prevalence rate for dysphagia varies between 37% and 78%, depending on the time and method of assessment [1,2].

Generally, dysphagia resolves within the first two weeks in almost 90% of patients with stroke [3,4]. Thus early period represents the most significant period of time for these patients.

It does not only increase the risk of complications such as swallowing abnormality, dehydration, and malnutrition, but it is also associated with an increased short term mortality [4-6]. Aspiration-related pneumonia is the most important complication of dysphagia. Studies examining patients with dysphagia after acute stroke showed the presence of silent aspiration in 60% of these cases, which may lead to a mortality rate of up to 50% [3].

Early recognition of dysphagia results in reduced complication rate, shortened hospital stay, and decreased in healthcare costs [3,7,8].

American Stroke Association and the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) have described the importance of early diagnosis of dysphagia in acute stroke patients [9].

These organizations were commended that, this diagnosis should be include a bedside screening test protocol. Furtmore, this protocol should be consists of the check list and the water swallow test gave the best patient outcomes [10,11]. BJH-Stroke Dysphagia Screening (BJH-SDS) is recommended in accordance with these criteria [4].

Stroke represents an important heath problem both globally and nationally. Although nutritional management in stroke patients admitted to hospitals is based on an assessment of swallowing functions, no standardized dysphagia screening is utilized. Thus, we performed a reliability and validity testing of the Turkish version of Barnes Jewish Hospital Dysphagia Screen (BJH-SDS), which was originally developed in the stroke unit of Barnes Jewish Hospital and which was shown to be a reliable assessment tool in numerous previous studies [12].

MATERIALS AND METHODS

A total of 140 patients admitted to our neurology department with clinical and radiological diagnosis of acute stroke between February 2016 and February 2017 were included in this study.

All patients were informed regarding the study details; the study was approved by the Local Ethics Committee of the Diskapi Yildirim Beyazit Education and Research Hospital. All investigators confirmed the ethical standards as described in the Declaration of Helsinki.

The inclusion criteria were as follows: To have the diagnosis of acute stroke based on clinical and magnetic resonance imaging(MRI) results, to be at the age of > 18 years, and to have normal cognitive functions (Mini Mental Test Score >24 points).

The exclusion criteria included the presence of previous stroke, neurodegenerative or muscular disease histories which are potentially associated with swallowing disorder, having malignancy, history of surgery in the head and neck region, bilateral cranial infarction, and psychiatric disorders. Also, presence of infectious diseases such as HIV, hepatitis B, or hepatitis C, decompensated heart failure, and nasal obstruction were the exclusion criteria for FEES.

The 140 patients included in the study were assessed within the first 24 hours. Demographic data, lesion side and stroke subtype according to Bamford classification were recorded [13]. The severity of the stroke was assessed using the National Institute Health Stroke Scale (NIHSS), while the functional disability was evaluated with the Modified Rankin scale [14,15] FEES was administered within the first 72 hours.

Barnes-Jewish Hospital Stroke Dysphagia Screen(BJH-SDS) Test

BJH-SDS is a bed-side assessment tool developed in 2006 in order to identify the presence of dysphagia in acute stroke patients. The tool is administered by the nurses (appendix) [12].

BJH-SDS consists of 5 items, each with two choices, i.e. present = yes, absent = no. The first four items assess the consciousness, and asymmetry or weakness in facial, tongue, and palatal muscles. The level of consciousness is assessed by using Glasgow Coma Scale, and the presence of dysarthria is identified together with the use of other items. The 5th item consists of the 3-oz water test, and the abnormality was defined as coughing , choking or breathlessness while swallowing, or wet/gurgly/ voice after swallowing.

Translation of BJH

As the initial step, permission was requested from the developer Edmiaston for conducting the validity and reliability studies of the Turkish version of BJH-SDS.

BJH-SDS was independently translated to Turkish by bilingual two physicians. Both translations were compared by five physicians (a neurologist, a specialist in physical medicine and rehabilitation (PMR), and three otolaryngologists) and formed scale. The pilot study for the initially prepared form was carried out in 15 patients, and using the feed-back obtained from these 15 patients, a re-assessment was performed to obtain the final document. It was translated into English by native English speaking, language expert .The final Turkish version's compliance with BJH-SDS accepted following a comparison of the meaning and format original English form.

Speech and language therapists are available in only a very limited number of centers in Turkey. The swallowing disorder is generally assessed by the treating physician. Thus, the term "SPL" was replaced by the term "clinician" in the first sentence of the tool.

Reliability

Cronbach's alpha coefficient and item-to-total correlations were used to assess internal consistency. Inter-rater reliability studies were also conducted. Agreement between two independent raters was analyzed using Intraclass Correlation Coefficient (ICC). One hour between the examinations was considered to be sufficient to prevent bias, because swallowing function may change over time.

Validity

The validity was assessed by the dysphagia level with FEES. Endoscopic evaluation was performed by an otolaryngologist blinded to the BJH-SDS test within the first 24 hours after performing the second BJH-SDS test.

The FEES was performed by the same otolaryngologist using a non-ducted fiberoptic nasopharyngoscope of 3.4 mm diameter, a light source, camera, monitor, and DVD recorder (Karl Storz GmbH & Co KG, Tuttlingen, Germany). The assessments were performed at the highest possible upright sitting position. Water was used for liquid, yoghurt for semisolid and a biscuit for solid food evaluations. Findings were recorded as video images. At the end of the examination, the dysphagia level was scored from 1 to 6 according to the protocol of assessment of dysphagia developed by Dziewas et al. [16] While 1 point was considered as "normal swallowing", 2-6 points were defined as "dysphagia

Statistical analysis

All statistical analyses were carried out using SPSS 22.0 statistical package (SPSS, Chicago, IL, USA). Descriptive statistics were demonstrated as mean ± standard deviations for continuous variables and as a percentage (%) for nominal

variables. Internal consistency was measured using Cronbach's alpha, >0.70 indicating an acceptable value. Item-to-total correlations were calculated by using Spearman rho correlation coefficients. Correlation coefficients above 0.3 were considered as acceptable [17] Inter-rater reliability was estimated using ICC. For ICC results, positive values ranging from 0 to 0.2 indicate poor agreement; 0.2 to 0.4, fair agreement; 0.4 to 0.6, moderate agreement; 0.6 to 0.8, good agreement; and 0.8 to 1, very good agreement [18]. For validity, the Spearman rho correlation test and ROC curve analysis were used to indicate the association between FEES and BJH. Correlation coefficient (r) was used to show the power of correlation. According to this; <0.30 indicated weak, 0.30 to 0.50 indicated moderate, 0.50 to 0.75 indicated good correlation, 0.75 to 1.0 indicated very good correlation between the variables . With ROC curve analysis, best diagnosis indices sensitivity, specificity, positive and negative predictive value (PV), were calculated. p <0.05 being accepted as statistically significant.

RESULTS

Patient Characteristics

The mean age of 140 patients [58 (41.4 %) female, 82 (58.6 %) male] included in the study was 67.20 (SD 12.82) years. The disease characteristics of patients are presented in (Table 1).

An assessment of the swallowing functions showed the presence of oral phase disorder in 69 patients (49.3%). The mean PAS based on FEES assessment was 1.50 (1.0-6.0).

Reliability

Tests performed by 1st neurologist and the 2nd PMR specialist indicated that the internal consistency was "good" with a Cronbach's α values of 0.894 and 0.831, respectively.

Item-to-total correlation results according to both raters are shown in Table (2). According to the corrected item-total correlation, Spearman's rho correlation coefficients were ranged between 0.493 for "item 2 " to 0.712 for "item 5" for both raters and all of the subtests were above the acceptable standards.

Inter-rater reliability between inter-raters are presented in Table (3). In the measurements performed with ICC, the values varied from 0.850 to 1.000, suggesting satisfactory stability and very good reliability of the subtests. None of the items showed good, poor or fair agreement.

Validity

A strong positive significant correlation was found between FEES stage and the total scores of the raters (r: 0.733 p=0.001; r=0.744, p=0.001, respectively).

According to total score; sensitivity, specificity, PPV and NPV were established as follows respectively 78.6%, 80-82.8%, %75.6-72.3 and 79.4-78.8% (Figure 1). These results indicate that T-BJH is a very useful and accurate diagnostic tool in the prediction of the risk of dysphagia.

DISCUSSION

The pathophysiology of swallowing disorder not only involves peripheral, but also central mechanisms, which play a major part.

Table 1: The disease characteristics of patients.

	n=141 Median (min-max), n(%)
NIHSS score	3.00 (1.00-24.00)
Modified Rankin Score	3.00 (0.0-6.0)
Lezyon tarafı	
Sağ	56 (40)
Sol	84 (60)
Bamford classification (infarct area)	
Total anterior	21 (15.0)
Parsiyel anterior	62 (44.3)
Posterior	45 (32.1)
Lacunar	12 (8.6)

SD: Standard Deviation, NIHSS: National Institute Health Stroke Scale

Table 2: Corrected Item-total correlation results according to the two raters.

Subtests	**1st rater r**	**2nd rater r**
Item# 1	0.661	0.692
Item# 2	0.493	0.543
Item# 3	0.667	0.700
Item# 4	0.600	0.612
Item# 5	0.674	0.712

r: correlation coefficient

Table 3: Inter-rater reliability between inter-raters.

Items1-5	**ICC (95%CI)**	**p**
Item# 1	1.000 (1.00-1.00)	0.001
Item# 2	0.850 (0.940-1.159)	0.001
Item# 3	1.000 (1.00-1.00)	0.001
Item# 4	1.000 (1.00-1.00)	0.001
Item# 5	1.000 (1.00-1.00)	0.001
ICC: Intra	Class Correlation Coefficient, CI: Confidence Interval	ICC: Intra

It is a synchronous and persistent process with a certain pattern that is initiated by the brainstem. Although swallowing consists of a series of successive actions, the duration of laryngeal elevation, opening of the upper esophageal sphincter, and breath holding phases vary depending on the bolus volume and viscocity. Stroke has an impact on swallowing at multiple levels based on the interruption in the feedback loop. The recovery is dependent on the cortical healing [19,20].

Although dysphagia may rapidly improve following stroke, the swallowing function may exhibit variability in some patients [19]. Neurogenic oropharyngeal dysphagia is considered to represent a prognostic marker in stroke patients. In a study by Ickenstein et al., presence of aspiration within the first 72 hour period was found to predict severe swallowing disorder in the first 90 days following stroke [3] Identification and management of dysphagia should be promptly undertaken after stroke.

In recent years, numerous bedside swallowing screening

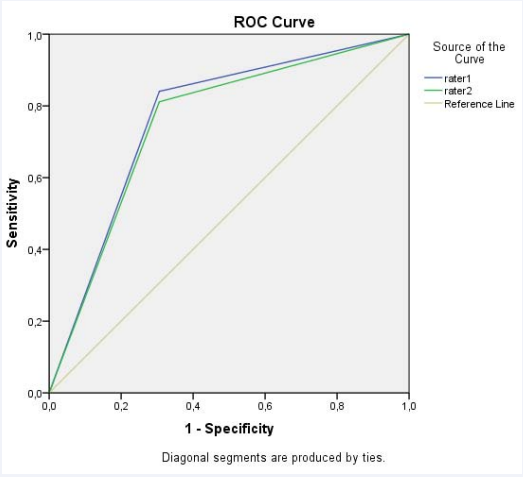

Figure 1 Roc curve analysis for prediction of dysphagia risk.

tests have been developed in order to assess dysphagia in stroke patients, each with varying degrees of validity and reliability [12,21-24]. Currently no consensus exists on a standard screening testing [25].

However, use of BJH-SDS is commonly endorsed based on its ability to meet a number of criteria such as its high sensitivity, high reliability, and quick and easy administration [4].

In the first study which Edmiaston et al. published in 2010, BJH-SDS was administered by nurses to a total of 300 acute stroke patients within the first 8 to 32 hour period after the incident, and the tool was validated against the Mann Assessment of Swallowing Ability Scale. The inter-test reliability was 94%, and the inter-rater reliability was 92.5% [12,26].

In the other study Edmiaston et al. conducted in 2013, BJH-SDS was administered to 225 patients with acute stroke, and the test results were compared with the video-fluoroscopy findings. The sensitivity and specificity for dysphagia were 94% and 66%, respectively, while the corresponding figures for aspiration were 95%, and 50 [27].

In this study, the tool was administered by a neurologist and a physical therapy and rehabilitation specialist. Routine assessment of the first 4 items within the context of the neurological examination provided convenience, and water swallowing test allowed a rapid assessment of the presence of dysphagia. The administration time of BJH took < 2 minutes. This is similar to the time required to complete the English version of the instrument.

In our study, a high inter-rater reliability was observed, although the correlation was only moderate for the 4th item. This may be due to the irritation experienced by the patient during examination, since the assessment of the palatal arch may pose certain challenges in patients who have a very strong gagging reflex. In other items of the test, the inter-rater correlation was high. This is consistent with the report of the Edmiaston evaluating the BJH in original language. Thus, it may be concluded that BJH also possesses reliability in repeated assessments, implying a high reproducibility.

The test was validated by using FEES. The severity of dysphagia was assessed with the Penetration Aspiration Scale developed by Dziewias, and a high correlation was identified [16]. Based on the total score the sensitivity was 78.6%, and the specificity was 80 to 82.8%. These results indicate that T-BJH is a very useful and accurate diagnostic tool in the prediction of the risk of dysphagia.

In the study by Edmiaston et al. the test was validated by using VF [21]. The current study confirmed the reliability of the test using both methods. Although VF is considered as the gold standard method for the detection of dysphagia, FEES currently represents the most frequently utilized assessment tool for the objective evaluation for dysphagia, as emphasized by the German Neurology and Stroke Associations and by Dziewas et al. [28] FEES allows effective and reliable assessment of swallowing as well as the determination of appropriate nutrition strategy and efficacy of different swallowing maneuvers. Furthermore, bedside utility and good tolerability provide additional advantages [29]. We also consider such benefits of FEES, which can be associated with time-savings with respect to nutrition management in vital stabilization and treatment planning stages during the acute period in the stroke unit (Appendix).

As a conclusion a reliability and validity study other than the original language of BJH-SDS was performed for the first time which confirmed the reliability and validity of the Turkish version in stroke patients. Moreover, effectiveness of this test has been shown by using FEES method which has easy application, radiation free and increased popularity in recent years more than VF. The test's reliability and validity have been updated. We believe that more extensive use of different language versions of this practical and rapid tool easily administrable by all healthcare professionals may assist in reaching a consensus for the dysphagia management during the acute phase of stroke.

Appendix

	Yes	No
1- Is the Glasgow Coma Scale less than 13?	1	0
2- Is there facial assymmetry/weakness?	1	0
3-Is there tongue assymmetry/weakness?	1	0
4- Is there palatal assymmetry/weakness?	1	0
5-Are there signs of aspiration during the 3 oz water test?	1	0
(throat cleaning, cough or change vocal quality within 1 minute)		

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