Using the National Institute of Health Stroke Scale to Predict Dysphagia in Acute Ischemic Stroke

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Key Words

Stroke • Dysphagia • Dysarthria • Swallowing • Feeding route • National Institutes of Health Stroke Scale • Glasgow Coma Scale

Abstract

Background and Purpose: Oropharyngeal dysphagia is a common manifestation in acute stroke. Aspiration resulting from difficulties in swallowing is a symptom that should be considered due to the frequent occurrence of aspiration pneumonia that could influence the patient's recovery as it causes clinical complications and could even lead to the patient's death. The early clinical evaluation of swallowing disorders can help define approaches and avoid oral feeding, which may be detrimental to the patient. This study aimed to create an algorithm to identify patients at risk of developing dysphagia following acute ischemic stroke in order to be able to decide on the safest way of feeding and minimize the complications of stroke using the National Institutes of Health Stroke Scale (NIHSS). **Methods:** Clinical assessment of swallowing was performed in 50 patients admitted to the emergency unit of the University Hospital, Faculty of Medicine of Ribeirão Preto, São Paulo, Brazil, with a diagnosis of

ischemic stroke, within 48 h after the beginning of symptoms. Patients, 25 females and 25 males with a mean age of 64.90 years (range 26–91 years), were evaluated consecutively. An anamnesis was taken before the patient's participation in the study in order to exclude a prior history of deglutition difficulties. For the functional assessment of swallowing, three food consistencies were used, i.e. pasty, liquid and solid. After clinical evaluation, we concluded whether there was dysphagia. For statistical analysis we used the Fisher exact test, verifying the association between the variables. To assess whether the NIHSS score characterizes a risk factor for dysphagia, a receiver operational characteristics curve was constructed to obtain characteristics for sensitivity and specificity. **Results:** Dysphagia was present in 32% of the patients. The clinical evaluation is a reliable method of detection of swallowing difficulties. However, the predictors of risk for the swallowing function must be balanced, and the level of consciousness and the presence of preexisting comorbidities should be considered. Gender, age and cerebral hemisphere involved were not significantly associated with the presence of dysphagia. NIHSS, Glasgow Coma Scale, and speech and language changes had a statistically significant predictive value for the presence of dysphagia. **Conclusions:** The NIHSS is highly sensitive (88%) and specific (85%) in de-

tecting dysphagia; a score of 12 may be considered as the cutoff value. The creation of an algorithm to detect dysphagia in acute ischemic stroke appears to be useful in selecting the optimal feeding route while awaiting a specialized evaluation.

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Introduction

After heart disease, stroke is the main cause of mortality in the world [1]. Stroke causes about 5.7 million deaths, i.e. stroke is responsible for 10% of the total mortality, with more than 85% of deaths being due to stroke in countries of low and middle income [1, 2]. In Brazil, stroke is the main cause of death [3].

Dysphagia is a common manifestation among patients with stroke [4], affecting more than half the patients [5], and possibly represents an independent marker of worsening during recovery after a stroke [6]. It can cause complications such as malnutrition, dehydration, aspiration, choking, pneumonia and death [6–8]. The condition occurs in 30–42% of patients during acute stroke. About 50% of the affected patients spontaneously recover normal swallowing within 1 week after the beginning of the signs and symptoms [9, 10]. However, patients who continue to have swallowing difficulties after the first week show a recovery only very slowly from oropharyngeal dysphagia. The prevalence of a clinical diagnosis of dysphagia during the first month after a stroke is 2–21% and dysphagia may persist in 7% of the patients 3 months after a stroke [9–11].

The clinical evaluation of swallowing is complex and requires the presence of an experienced examiner. The detection of dysphagia during the acute phase is of fundamental importance for the adoption of appropriate measures for its compensation. For this purpose, a simple method of bedside evaluation is necessary in daily clinical practice [8].

The scale most frequently used for the assessment of neurological deficits during acute stroke is the National Institutes of Health Stroke Scale (NIHSS). It is a simple, validated, reproducible and safe scale which permits identification of neurological signals and clinical changes or a potential response to therapy [12, 13]. It is a quantitative measure of neurological deficits related to stroke with established reliability and validity for use in prospective clinical studies [14, 15]. Scales which measure the impact of stroke are important to implement preventive and treatment strategies tailored to a specific population

[16]. However, the NIHSS, specifically, does not include the assessment of swallowing.

The objective of the present study was to use the NIHSS to score items that may be relevant for the appropriate evaluation of swallowing and, on the basis of some risk factors detected by clinical examination of the patients, to propose an alternative feeding route using an algorithm during the acute phase in order to minimize the risks of complications while the patient is waiting for a more detailed assessment of swallowing.

Methods

Creation of the Algorithm

By analysis with the NIHSS we observed and scored items that might potentially interfere with the swallowing function. Thus, we considered the following items as risk factors for dysphagia: alteration of consciousness level (1 point), extent and location of the injury, scoring item 2 as 1 point, items 5a, 5b, 6a, 6b as 1 point each, 7 as 1 point, and 11 as 1 point; presence of facial paralysis as 2 points, alterations of language as 1 point, and alteration of speech as 1 point. We emphasize the fact that we considered the lowest value that would already predict alteration.

Then, a score <12 was used as reference for the absence of dysphagia and a score ≥ 12 as a score for the presence of dysphagia.

Subjects

The study was conducted on 50 patients admitted to the Emergency Unit of the University Hospital, Faculty of Medicine of Ribeirão Preto, University of São Paulo, Brazil, with a diagnosis of ischemic stroke, clinically confirmed by a neurologist within a maximum to 48 h of symptom onset. The patients, 25 males and 25 females with a mean age of 65 years (range: 26 to 91 years), were evaluated consecutively if they satisfied the inclusion criteria proposed.

Patients with hemorrhagic strokes, patients younger than 18 years and patients with a history of swallowing difficulties preceding the current symptoms were excluded from the study. All patients were carefully screened by anamnesis or by reviewing their medical records before being included in the study.

The study was approved by the Research Ethics Committee and all subjects gave their written informed consent to participate.

Clinical Evaluation of Swallowing

The structural evaluation of swallowing performed at the bedside was related to the observation and evaluation of nutritional aspects such as feeding route, presence or absence of complications, respiratory aspects, presence or absence of other affections, consciousness level, and communication ability by a directed conversation during the anamnesis or by previous evaluation of the NIHSS and oromyofunctional orofacial structures. Pasty, liquid and solid (when possible, depending on the patient's condition) food consistencies were used for the functional evaluation of swallowing. Pasty and liquid foods were offered in a controlled volume of 3, 5 and 7 ml, and in a free volume. Solid food consist-

Table 1. Association between NIHSS score and dysphagia

NIHSS	Dysphagia				Total
	presence		absence		
	fre- quency	relative frequency	fre- quency	relative frequency	
≥12 points	14	87.50%	5	14.71%	19
<12 points	2	12.50%	29	85.29%	31
Total	16	100.00%	34	100.00%	50
p value <0.01. Fisher exact test.					

ed of a cornstarch-type cookie, the liquid was water and the paste consisted of the dilution of 15 ml of Thick & Easy® thickener in 50 ml of water.

Analysis of the Topography of the Injury

The topography of the lesion was defined on the basis of the results of computed tomography or magnetic resonance imaging, and involvement of the carotid, cerebral or vertebrobasilar territory was determined.

Data Analysis

After data collection, the results regarding the following variables were tabulated: age, gender, NIHSS, Glasgow Coma Scale (GCS), communication disorder, topography of the injury, cerebral hemisphere involved and clinical evaluation of swallowing. In order to detect the groups at risk for the presence of dysphagia, each variable was correlated with the presence or absence of dysphagia, and finally the topography of the injury and the NIHSS score were correlated with dysphagia.

Statistical Analysis

The data regarding the association between the variables and the need to prescribe an alternative feeding route were analyzed by the Fisher exact test. To determine whether the NIHSS score represented a risk factor for dysphagia, a receiver operational characteristics curve was constructed in order to assess the sensitivity and specificity of the scale for this purpose. The level of significance was set at $p < 0.05$.

Results

Sixteen of the 50 patients studied (32%) had dysphagia. There was a higher frequency of dysphagia among patients older than 55 years (75%) although the difference was not statistically significant. There was no relation between gender and the presence or absence of dysphagia.

Of the 16 patients with dysphagia, 14 (87.5%) had NIHSS scores ≥ 12 or more and 2 (12.5%) had scores

Table 2. Association between GCS score and dysphagia

GCS score	Dysphagia				Total
	presence		absence		
	fre- quency	relative frequency	fre- quency	relative frequency	
<14 points	11	68.75%	2	5.88%	13
≥14 points	5	31.25%	32	94.12%	37
Total	16	100.00%	34	100.00%	50
p value <0.01. Fisher exact test.					

of 10 and 11, with a significant correlation between NIHSS score and the presence of dysphagia (table 1).

Of the 34 patients without dysphagia, 29 (85.3%) had a score < 12 . The remaining 5 patients had cut-off points above or with 1 point more than hypothesized for the NIHSS (12 or 13 points) although they had the maximum score on the GCS, except for 1 patient who had 14 points.

Thirty-two (94.12%) patients without dysphagia had a GCS score ≥ 14 points. Regarding scores < 14 , only 2 patients did not present changes in swallowing, as expected, but they had NIHSS scores < 12 (scores of 9 and 10). Of the 12 patients with dysphagia with scores > 14 , only 2 had NIHSS scores < 12 , i.e. 10 and 11. Thus, there was a statistically significant correlation between the GCS score and the presence or absence of dysphagia (table 2).

There was a statistically significant difference between the presence of altered communication and dysphagia, so there is a correlation for the presence of dysphagia in patients with language disorders (11 patients, 68.75%). With a prevalence of 31.25% (5 patients) of patients with dysarthria who presented dysphagia, there was a complete association between them and the NIHSS score, with all of them having a score > 12 . Among those without dysphagia, only 2 had scores of 12 and 13 on the NIHSS and 15 and 14 on the GCS. None of the patients without altered communication presented dysphagia.

The topography of the lesion was significantly correlated with the presence or absence of dysphagia, with dysphagia being present in all patients (100%) with injuries in the carotid territory. No patients with injuries in the vertebrobasilar territory or with nonspecific lesions had dysphagia.

Twenty of the 34 patients without dysphagia (58.82%) presented involvement of a carotid territory, 10 (29.41%) presented involvement of a vertebrobasilar territory, and

Fig. 1. Algorithm for the detection of the presence of severe dysphagia in acute stroke.

in 4 (11.76%) it was not possible to identify the topography of the injury.

Of the 16 patients with dysphagia, 56.25% had injuries in the right hemisphere and the remaining 43.75% in the left; there was no correlation between the cerebral hemisphere affected and dysphagia.

In order to determine the presence of dysphagia by associating the topography of the injury and the NIHSS score, we calculated the association between these grouped variables. We observed that all patients (100%) with dysphagia had involvement of the carotid territory, with 14 of them (87.50%) presenting an NIHSS score ≥ 12 and only 2 (12.50%) presenting a score <12 (scores of 10 and 11).

Finally, the NIHSS cut-off score of 12 initially proposed presented 88% sensitivity and 85% specificity. Figure 1 presents the algorithm based on our study.

Discussion

Swallowing disorders are common symptoms after stroke, with impaired oral and pharyngeal phases of swallowing, called oropharyngeal dysphagia, and can be found in different intensities. A study conducted on patients with ischemic stroke within 5 days of the onset of the event demonstrated that dysphagia occurred in 65%

of the patients, with 36% having moderate to severe and severe dysphagia, 28% having moderate dysphagia and 36% mild dysphagia [17].

The main problem caused by the presence of dysphagia is aspiration, whose risk is higher within the first days after a stroke [10, 17]; however, many studies have exclusively focused on the determination of the presence of aspiration, forgetting that dysphagia can be demonstrated by the presence of other manifestations.

The objective of the present study was to detect difficulties in swallowing during acute stroke in order to plan the clinical approach in daily practice. To this end, we elaborated an algorithm for deciding on the safest feeding route during acute stroke with the use of the NIHSS while awaiting a more detailed evaluation by a speech-language pathologist. Based on items hypothesized to be relevant for the evaluation of swallowing, we proposed a score that would indicate a risk of dysphagia. A formal protocol for the detection of dysphagia reduces the incidence of pneumonia among patients hospitalized due to an ischemic stroke [18].

The evaluations of swallowing are usually divided into a clinical evaluation at the bedside and an instrumental investigation. Since each method provides different data with different accuracy, the incidence of dysphagia may vary according to the type of evaluation used [5]. Indeed,

each method has advantages and disadvantages, with more than one of them often having to be applied for diagnostic elucidation.

Clinical evaluation has limitations regarding the definition of the presence of aspiration, which may be occult. Prediction of the risk of aspiration based on clinical evaluation has met with variable success [17, 19–21], and evidence of the benefits of this evaluation is limited [4, 19, 22]. Its main objective is to identify patients at risk for oropharyngeal dysphagia and to serve as an early initial reference for diagnosis and treatment in order to prevent the suffering caused by dysphagic symptoms and to minimize the risk of death [19]. Dysphagia detected at the bedside is an independent predictor of mortality and of the occurrence of pulmonary infection, and can identify patients at risk of receiving inadequate nutrition [6].

Several scales are used for the assessment of neurological involvement in cases of stroke, for the clinical monitoring of patients and for therapeutic decisions. However, few studies have calculated the correlation between these scales and dysphagia. The NIHSS, like all other scales, can be used in clinical studies and for the standardization of the diagnostic and prognostic evaluation of patients with stroke in Brazil [21].

Although it has been reported that the prevalence of dysphagia increases with stroke severity, the threshold score distinguishing between the presence and absence of dysphagia is not clear, with errors occurring regarding the methods employed. The agreement between different studies varies, a fact attributable in part to the diversity of evaluation methods used for the initial clinical examination and to the formal and informal classification of dysphagia [18].

Our intention was to correlate the findings obtained with the NIHSS and the possible presence of changes in swallowing. Despite evidence showing that dysphagia is part of the manifestations of acute stroke; its detection and management are inadequate in many hospitals.

The NIHSS reflects characteristics of the neurological picture. Values were attributed to the items that might negatively influence function.

As was also reported in the literature, we found a higher incidence of dysphagia in older (75%) than in younger (25%) patients although the difference was not statistically significant [6, 24]. In contrast, other authors considered age as a predictor of dysphagia [18, 25, 26], with an increased risk of aspiration with advancing age [27].

In agreement with previous studies [6, 24], we did not observe any significant gender differences regarding the presence of dysphagia in the present study. In contrast, in

another study [28], the presence of dysphagia was more frequent among women (62%).

We noted that the GCS score was significantly associated with the presence or absence of dysphagia. Since the GCS is used to evaluate the level of consciousness, patients with scores <13 are considered to be impaired [26]. The presence of somnolence, characterizing a lowering of consciousness, is a predictor of dysphagia [25].

Dysarthria and aphasia were significantly associated with the presence of dysphagia. The presence of dysphagia was preponderant in patients with language alterations (68.75%) [9].

Patients with injuries in the left hemisphere, which is dominant for language, will have higher NIHSS scores due to probable language impairment. The NIHSS may be more sensitive to injuries to the left hemisphere in view of the fact that 7 of the 42 possible points are directly related to the evaluation of language [29].

With a 31.25% prevalence of patients with dysarthria who presented dysphagia, there was a full correlation between this disorder and the NIHSS score. Dysarthria is considered to be a predictive factor for the risk of aspiration among the 6 factors identified in clinical evaluation [17, 30]. Involvement of the motor control of speech is observed in these patients, a fact that may lead to swallowing dysfunction, especially in the oral phase of deglutition, due to the participation of common structures. Speech symptoms may also be present in patients at risk of aspiration [31].

As concerns the association of the presence of dysphagia with the topography of the injury, dysphagia was found to be significantly related to lesions in the carotid territory.

Patients with lesions in the vertebrobasilar territory scored low on the NIHSS except for the 2 patients with scores of 13, but with 15 points on the GCS.

Finally, all patients (100%) in whom the topography of the lesion could not be defined showed NIHSS scores <11 points.

We also noted that 72% of our patients had lesions in the carotid territory and in 20% the lesion was located in the vertebrobasilar territory. Few patients had lesions in the internal carotid artery and/or posterior circulation, which precluded statistical analysis [32]. In a study proposing a severity scale of dysphagia based on fiberoptic endoscopic evaluation, 86.3% of the 153 patients studied, had ischemic stroke and 17.6% of these had lesions in the vertebrobasilar territory, and 5.2% had combined vertebrobasilar and hemispheric strokes [33]. Among 563 patients admitted to hospital, only 20 (3.6%) patients with

predominantly bulbar stroke were identified [24]. The presence of aspiration is not limited to lesions in the brainstem or bilateral lesions. Brainstem strokes are less common than other regions [34].

The presence of dysphagia is strongly associated with the subtype of stroke. Patients with injuries in the anterior cerebral circulation present a high incidence of dysphagia within 1 week after the event, representing 75% of the patients with dysphagia 2 days after the stroke and 90% of those with persistent dysphagia after 1 week [35]. Infarctions involving the anterior cerebral artery are primarily responsible for dysphagia because they affect important areas participating in swallowing [25]. There is a prevalence of injuries in the carotid territory, which is the most involved in 76% of dysphagic patients although without statistical significance [28].

In our study, there were no patients with dysphagia and vertebrobasilar lesions or nonspecific lesions (i.e. which could not be located). Studies have shown that patients with lacunar infarcts had no dysphagia in the days that followed the event, with only the need for a modification of food consistency [35]. Others have shown that the vertebrobasilar territory was more affected in patients with functional swallowing (43%), i.e. those without swallowing disorders or changes in the oral cavity not at risk of penetration and/or laryngotracheal aspiration [28].

Of the patients with dysphagia, 56.25% had injuries in the right hemisphere and the remaining 43.75% had injuries in the left hemisphere. There was no significant difference in stroke laterality in this sample [9, 25, 27, 36, 37].

Since the initial objective of the study was to create an algorithm based on the NIHSS for the detection of patients who would present dysphagia following acute stroke and in whom oral feeding would be contraindicated, we analyzed the sensitivity and specificity of the cut-off value determined. In the present study, the best value was considered to be the one that demonstrated high sensitivity in detecting dysphagia, i.e. the score of 12 initially proposed. This cut-off has 88% sensitivity and 85% specificity.

In a study on 236 patients with acute ischemic stroke admitted to an intensive care unit in order to determine independent clinical predictors of the development of pneumonia within 24 h of admission, it was concluded that the sensitivity of an NIHSS score ≥ 10 as an initial clinical predictor was 82% and the specificity was 71%; for an NIHSS score ≤ 5 , sensitivity was 96% and specificity 35% [26].

On this basis, by analyzing the above data, a score of 12 seems to be acceptable as a predictor of dysphagia. At

a cut-off of 10 points on the scale, sensitivity increases to 100% and specificity increases to 77%. However, we wish to point out that when sensitivity or specificity is close to 100% there is an increased chance of detecting false-positive or false-negative results, respectively. Thus, we felt that when the NIHSS did not show enough sensitivity for the detection of dysphagia, additional data could be obtained with the GCS score. Even though sensitivity without specificity, or the opposite, can be used in some situations depending on what is considered to be more important, this does not mean that isolated measurements would be sufficient to predict aspiration during the acute phase of stroke [31].

The objective of elaborating an algorithm based on scales and on basic clinical diagnostic criteria supports the necessity of resorting to a clinical evaluation even more. The algorithm is intended to help the clinician in selecting the feeding route in acute ischemic stroke. To avoid precipitated conducts that are often inadequate when the NIHSS score is between 10 and 13, the reference for the indication or not of an alternative feeding route proved to be better characterized by GCS scores of ≤ 13 . It should also be pointed out that this score should not be considered initially, but should only be seen as a differential criterion.

The intention is to minimize the occurrence of complications since the conclusion that swallowing function is altered in a given patient requires a series of practical reflections. The creation of a criterion for the detection of patients with dysphagia, however, does not exclude the assessment of deglutition by a specialized professional.

Conclusions

The present study permitted us to conclude that dysphagia is a frequent manifestation in acute ischemic stroke, being present in 32% of the patients studied here. The NIHSS and GCS scores, changes in speech and language and topography of the lesion are significant predictive factors of dysphagia while age, gender and brain hemisphere involved are not significantly associated with the presence of dysphagia. The NIHSS showed high sensitivity (88%) and specificity (85%) for the detection of dysphagia, with 12 being considered as the cut-off value. Patients with a score ≥ 14 should not receive oral nutrition and those with a score of 10–13 should be managed according to the GCS score. An algorithm for the detection of dysphagia in acute ischemic stroke may be of help for selecting the best feeding route while waiting for evaluation by a speech-language specialist.

Our data can also be interpreted as confirmation of the validity of the NIHSS that is designed to detect and measure the deficits in both cerebral hemispheres [12] and does not apply to brainstem lesions. We consider that

the sample size may have precluded further detailed analysis and believe that a larger number of patients should be studied in order for the results to be better correlated, explored and expanded to other groups of injury.

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