

Review Article

Dysphagia screening tools for acute stroke patients available for nurses: A systematic review

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ABSTRACT

Background & Aim: There is a high incidence of dysphagia after stroke that, depending on the assessment, methodology and time elapsed, can range from 8.1% to 80%. Early and systemic dysphagia screening is associated with a decreased risk of aspiration pneumonia and prevents inadequate hydration/nutrition. The purpose of this systematic review was to identify dysphagia screening tools for acute stroke patients available for nurses validated against reference test. The research question was: which dysphagia screening tools for acute stroke patients available for nurses?

Methods & Materials: Three electronic databases were searched from January 2007 to November 2017: on PubMed, Scielo and CINAHL Plus. Two independent reviewers screened all titles and abstracts, assessed methodological quality and extracted data. The methodological quality analysis and evaluation was guided according to four domains: patient selection, index test, reference standard and flow and timing. Divergences between reviewers in data extraction were consensualized through discussion.

Results: From the 377 articles retrieved, only three articles met criteria for review: Barnes-Jewish Hospital-Stroke Dysphagia Screen; the Gugging Swallowing Screen and, The Toronto Bedside Swallowing Screening Test. None of the screening tools complies with all psychometric properties, which means that a still significant proportion of patients will be kept nil by mouth without being necessary or that some patients will “fall through the cracks” interrupting the diagnostic process. The tools identified are different from each other, making their comparison impracticable.

Conclusion: Due to psychometric proprieties and dietary recommendations adjusted to dysphagia severity, of all available tools, GUSS is a suitable screening tool for nurses in clinical practice.

Introduction

Dysphagia is the difficulty in swallowing (1), resulting from a delay in the duration of bolus flow, airway penetration/aspiration and/or the existence of post-swallowing residue in the pharyngeal cavity (2). It is common in different neurological diseases, particularly in Parkinson's disease,

multiple sclerosis, amyotrophic lateral sclerosis, Alzheimer's disease and, more prominently, in stroke. The affected phases correspond to the preparatory, oral and pharyngeal phases, therefore it is also referred to as oropharyngeal dysphagia (3). Stroke is characterized as a neurological deficit, attributed to a localized acute injury to the central nervous system, of vascular cause, including cerebral infarction, intracerebral hemorrhage and subarachnoid hemorrhage and is a major cause of disability and death throughout the world (4).

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There is a high incidence of dysphagia after stroke that varies between 8.1 and 80%, depending on the assessment technique (screening, clinical or instrumental testing) and time elapsed after stroke (5). In stroke patients, dysphagia increases the likelihood of death, disability, respiratory infection, and hospital length of stay (6).

Clinical guidelines for acute stroke patients' management identify screening for dysphagia as a priority, performed as early as possible after stroke onset, prior to the ingestion of any fluid, food or medication (1,7). Dysphagia screening is associated with a reduced risk of aspiration pneumonia (8,9,10). Even though there is no unanimity regarding the best tool for dysphagia screening in stroke patients, it does not mean that it should not be performed through the use of a validated one (11). Ideally, all patients should be evaluated with reference tests, ie, gold standards - instrumental evaluation of swallowing by video-fluoroscopic swallow study (VFSS) or fiberoptic endoscopic evaluation of swallowing (FEES) (6,12). However, there are a number of limitations in performing these tests: not all patients will be able to undergo an invasive test; not all hospitals have trained professionals available 24 hours *per* day to perform them, in addition to the fact that not all have the necessary equipment (6,13).

Therefore, it is essential to screen stroke patients as early as possible so that they are not kept nil by mouth for unnecessary time. Those with a failed dysphagia screening test must be subsequently referenced to qualified professionals to perform the reference tests, allowing the adequate definition of their therapeutic plan. In sum, dysphagia

screening is a quick non-invasive procedure for risk assessment, allowing to identify "healthy" individuals to whom oral feeding is safe and promptly pointing the ones that need further assessment – clinical and/or instrumental. It is a first but essential step in swallowing assessment and dysphagia treatment.

Nurses are at the front line within the caregiver team since they have the most prolonged contact with patients, 24 hours a day, urging the need to know all available instruments to fully assess their patient's needs. Therefore, it is important to know what tools are suitable for dysphagia screening in stroke patients, up to date with the best available practice. Evidence-based clinical practice recommendations of nursing care, for the first 72 hours of admission to hospital for acute stroke, define as a good practice point dysphagia screening using a valid and reliable tool (14). This raises one research question: which dysphagia screening tools for acute stroke patients available for nurses?

To address this question, a systematic review was conducted with the aim to identify which dysphagia screening tools for acute stroke patients are available for nurses validated against reference test, guided by the Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P) 2015 statement (15).

Methods

The review question, following the PICO strategy (16), was: (P) acute stroke patients; (I) dysphagia screening tool available for nurses; (C) dysphagia reference test and (O) dysphagia risk. The starting point of this review was the research question that outlined the

inclusion criteria: validation studies for dysphagia screening tools; acute stroke patients; tools validated against instrumental test and available for nurses. In addition, with the concern to look for the most updated evidence, all articles published from 2007 to 2017 and written in Portuguese, English, French and Spanish were included. All articles that did not fall under these criteria, including review articles, editorials, conference proceedings and opinion articles were rejected.

Two reviewers (IJO and LM) independently searched the databases PubMed, SciELO, CINAHL Plus in November 2017.

In order to identify the descriptors that best fit the objectives of the review, the Medical Subject Headings (MeSH Browser) were used, with the following descriptors, in conjunction with boolean operators: (*dysphagia OR deglutition OR deglutition disorders*) AND (*screen OR screening*) AND (*stroke*). This search returned 377 articles. However, most were excluded since they were not validation studies for dysphagia screening tools. Articles excluded were reviews, studies of the relationship between dysphagia and aspiration pneumonia or studies not related to screening, as shown in figure 1.

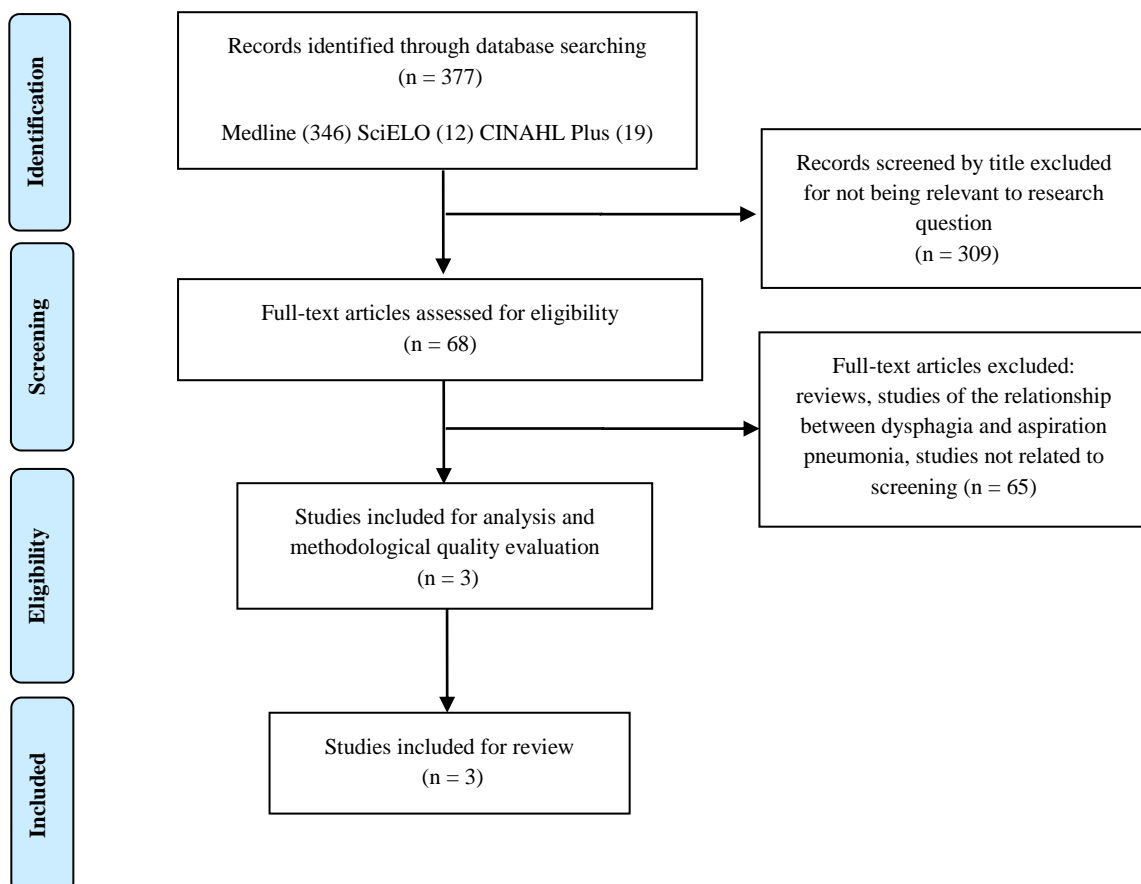


Figure 1. Flowchart detailing retrieval and selection of articles for review

For methodological quality analysis and evaluation, reviewers guided their appraisal according to four domains: patient selection, index test, reference standard and flow and timing (17). Two reviewers independently assessed the studies (IJO and LM) according to these four domains, quoting as complying or not complying with methodological standards in the different domains, based on the information reported and “unclear”, when there was insufficient information to make a judgement.

Results

A total of 377 articles were retrieved, of these, only three articles met the inclusion criteria: Barnes-Jewish Hospital-Stroke Dysphagia Screen (BJH-SDS), developed by Edmiaston, et al. (18); the Gugging Swallowing Screen (GUSS), by Trapl, et al. (19) and, Martino et al. (20), developed The Toronto Bedside Swallowing Screening Test (TOR-BSST).

In the analysis and evaluation of the methodological quality, the only divergence between reviewers was the appraisal of whether the whole sample or a random selection of the sample was submitted to the reference test, which one of the reviewers classified as "unclear" and the other as "complying", regarding the study of Edmiaston et al. (18), although it was not considered relevant in the overall methodological quality assessment. It was unclear for GUSS and TOR-BSST if the spectrum of patients included in the studies were representative of the patients who will receive the test in practice (exclusion criteria).

Thus, the three articles resulting from the systematic research show high compliance with the four domains, with the lowest compliance for Martino, et al. (20)

due to copyright that prevented sufficient detail of the index test description adding to the fact that only a random selection of the sample was submitted to the reference test.

Subsequently, two independent reviewers extracted the data according to the matrix presented in table 1. Divergences between reviewers in data extraction were consensualized through discussion. The summary of the main characteristics of the tools developed in these studies are described in table 1.

Study design and procedures

Regarding BJH-SDS, acute stroke patients were recruited consecutively for 17 months, and those with confirmed or suspected pregnancy, not eligible for VFSS, with decrease level of alertness (defined as no response to speech) and unable to sit upright were excluded. Screening was performed on admission to the stroke unit, but time between stroke onset and screening is unclear. Inter and intra rater reliability amongst hospital nurses was demonstrated in a previous study (21).

For GUSS, all patients admitted to the stroke unit on weekdays between Monday and Thursday, for 5 months, were included in the first and second groups and screened within 24 hours of stroke onset. In the first group screening was performed by two therapists and in the second group by trained nurses. Interrater reliability was measured in the first group by therapists, with a time span of two hours at most between assessments, and the second group was used for external validation, with nurses. Exclusion criteria were multiple brain infarctions, dysphagia attributed to another cause, and somnolence or coma in the first 24 hours.

Concerning TOR-BSST, all patients consecutively admitted to two acute stroke units and two rehabilitation units were included in the study for an unspecified

period of time. Patients with National Institutes of Health Stroke Scale (22) below 4, recurrent respiratory infection, non-oral feeding, and history of non-stroke related neurological disease, head and neck surgery, history of oropharyngeal dysphagia, dementia, or decreased level of consciousness were excluded.

The time elapsed between screening and stroke was, on average, of 6.1 days in acute units and 31.6 days in rehabilitation units. Interrater reliability by nurses was established with the first 50 screened patients, within 24 hours of each other.

Table 1. Main characteristics of the screening tools included for review

Authors	Screening tool	Sample	Validity and reliability	Reference test	Time lapse between screening and reference test	Description
Edmiaston, Connor, Steger-May, & Ford, 2014	Barnes-Jewish Hospital-Stroke Dysphagia Screen	225 acute stroke patients	Sensitivity/Specificity (dysphagia): 94%/66% Sensitivity/Specificity (aspiration): 95%/50% Positive predictive value/negative predictive value (dysphagia): 71%/93% Positive predictive value/negative predictive value (aspiration): 41%/96% Interrater reliability: k=0.94 Test-retest reliability: k=0.92	VFSS	mean 2 hours (range 0-8 hours)	consists in 4 items of indirect assessment (impairment of conscious level, face, tongue and palate symmetry) and 1 item of direct swallowing assessment (test with 90 ml of water); the failure of any of the items determines the interruption of the test.
Trapl et al., 2007	Gugging Swallowing Screen	50 acute stroke patients: 20 patients (group I); 30 patients (group II)	Sensitivity/Specificity: 100% (I) 100% (II) / 50% (I) 69% (II) Positive predictive value/negative predictive value: 81% (I) 74% (II) / 100% (I) 100% (I) Interrater reliability: k=0.835	FEES	group I: 2 hours at most group II: within 24 hours	Consists of 4 sequential subtests: first, indirect assessment of 5 items (consciousness, cough and / or throat clearing, successful swallowing of saliva, drooling and voice changes after swallowing of saliva), the following 3 are the direct assessment of swallowing of different consistencies (semi-solid, liquid and solid). Failure to obtain the maximum score in each of the subtests determines its interruption.
Martino et al., 2009	The Toronto Bedside Swallowing Screening Test	311 patients: 103 acute stroke patients 208 rehabilitation on stroke patients	Sensitivity/Specificity: 96% (acute) 80% (rehabilitation) /64% (acute) 68% (rehabilitation) Positive predictive value/negative predictive value: 76% (acute) 50% (rehabilitation) /93% (acute) 89% (rehabilitation) Interrater reliability: 0.92	VFSS 24 acute patients 35 rehab patients	less than 24 hours	Composed of four items that are assigned a "pass/fail" response: voice before, tongue movements, water swallow and voice after.

VFSS, video-fluoroscopic swallow study; FEES, fiber optic endoscopic evaluation of swallowing

Reference test

The presence of dysphagia and aspiration, for BJH-SDS, was investigated

using VFSS within 8 hours (mean 2 hours) of screening, which was blinded to

screening results. Aspiration was identified using the New Zealand Index of Multidisciplinary Evaluation of Swallowing and Dysphagia Outcomes Severity Scale was utilized as the functional scale for identifying dysphagia (18). For GUSS, FEES was performed blindly to the screening results, within 24 hours of stroke onset, and assessed the presence of aspiration, which was graded according to the Penetration Aspiration Scale (23).

In TOR-BSST, VFSS was performed within 24 hours of screening in 20% of patients included in the study due to the perceived risk of radiation exposure. It was performed blindly to screening results, assessing the presence of dysphagia and aspiration, using three measures: the Penetration Aspiration Scale, the Mann Assessment of Swallowing Ability (24) dysphagia subscore and the Mann Assessment of Swallowing Ability aspiration subscore (20).

Items

Comparing the items that compose the screening tools it is noted that the patients level of consciousness is common to all three tools, due to the understanding that patients must be alert and able to sit upright to be screened: Glasgow Coma Scale score equal or greater than 13 for the BJH-SDS; the need for patient to be alert for at least 15 minutes for GUSS; and the requirements for TOR-BSST determine that if patient is alert, can sit upright and follow simple instructions, the screen can be performed.

Change in voice quality is other of the common items, but the voice assessment is different in the three tools: a water test is performed in TOR-BSST with 50 ml and

voice quality is assessed before and after; in BJH-SDS, voice quality is assessed with 90 ml, along with throat clearing and cough; in GUSS, the first voice quality assessment is performed with the swallowing of saliva, the next swallowing test is performed with semisolid texture and, only if pass, the patient will be tested with water.

Duration of administration and need for prior training

Edmiaston, et al. (21) report that, for BJH-SDS, the mean time to perform the test is two minutes per patient, with a need of about 10 minutes of previous training to be able to administer it. As for GUSS, it is only stated that it is quick to apply, not estimating the time of application and adding that it is easy to use by stroke nurses and therapists. For TOR-BSST, Martino et al. (20) indicate that a four-hour didactic session was developed to train professionals in the administration and interpretation of the tool, including simulation training, and state a 10-minute application time.

Screening result

The administration of BJH-SDS is carried out by evaluating 5 sequential items, with a dichotomous answer, yes or no, and if any of the questions is answered "yes", screening must be stopped and patient referred to speech pathology. For TOR-BSST, a pass/fail answer is assigned to each item and failure in any item constitutes a positive screening. No other information is available in the paper about scoring or referral. GUSS scores resulted in four dysphagia severity categories: severe (<10), moderate (10 to 14), mild (15 to 19) and no dysphagia (20 points).

Aspiration risk was identified between the total scores of 14 and 15. As optional recommendation, from a score of 19 and lower, further functional swallowing assessments and referral to speech and language pathologist or speech and language therapists is suggested. GUSS also suggests nutritional recommendations in line with dysphagia severity.

Discussion

Considering the high incidence of stroke, associated with the high incidence of dysphagia and realizing its implications, there is an international consensus for the need for early screening for dysphagia, ideally before any food, liquids or medication is ingested. However, there is no consensus as to which tool to use. The lack of consensus results from the diversity of tools designed so far, and within these, the difficulty in agreeing on the most relevant parameters for dysphagia screening (25). Several reasons are pointed for the lack of consensus: the absence of replication studies that validate, in different settings, the screening tools with the best psychometric proprieties; the methodological quality of those studies (26, 27) and the lack of uniformity in study designs and validation criteria (25).

The similarities in the items that compose the tools in this review are few. Study design, reference test, sample size and criteria for dysphagia/aspiration determination were different in these three studies. An additional difficulty was the fact that TOR-BSST is copyrighted, therefore unavailable to be compared. Both BJH-SDS and TOR-BSST present a larger sample than GUSS: 225 and 103 acute patients respectively. However, for TOR-BSST, only 24 randomly selected patients were submitted to the reference test and

patients with a score less than 4 from the National Institute of Health Stroke Scale (22) were excluded because they were considered with no swallowing problems.

This could create a bias in the results, since more than one-third of patients with mild stroke fail screening, which is associated with respiratory complications (9). GUSS has a smaller sample, 55 acute stroke patients, in which all were submitted to the reference test.

The criteria used for validation, although all of the studies used instrumental testing, were different to determine dysphagia and aspiration in VFSS or FEES. For GUSS, it was not described how dysphagia scoring was determined, and for determination of aspiration the same scale was used that in TOR-BSST, the Penetration Aspiration Scale (23). In the BJH-SDS different scales were used to determine both dysphagia and aspiration on VFSS. Interrater reliability by nurses was determined for TOR-BSST and BJH-SDS, but not for GUSS and intra rater reliability by nurses was only determined for BJH-SDS. This makes it impractical to compare the results obtained in the validation of these tools.

The heterogeneity in the approach, definition and assessment of dysphagia has already been identified as one of the obstacles that makes it difficult to reach consensus at different levels: clinical, scientific and political (28). The sum of these factors has meant that, so far, no screening tool has been identified as superior in any clinical trial (11). However, the evidence suggests that patients who are screened for dysphagia early are less prone to the risk of developing pneumonia than unscreened patients (10,29,30,31). A

dysphagia screening tool should measure the risk of dysphagia and aspiration, the capacity for oral feeding and the need for referral to specialized professionals.

The risk of dysphagia and aspiration is given as a pass/fail result for TOR-BSST and BJH-SDS and referral to dysphagia experts if fail; for GUSS, a scoring that goes from 0 (severe dysphagia with high risk of aspiration) to 20 (slight/no dysphagia with no or minimal risk of aspiration) and the need of referral for further swallowing assessments for scores of 19 and down. As far as guidance for oral feeding, GUSS is the only screening tool that points out recommendations for nutrition, allowing dietary recommendations adjusted to dysphagia severity, which is of extremely use for clinical practice.

In addition, a screening tool must be reliable, i.e., that several professionals can use it with comparable results and that the same person in the same clinical condition, in a second use, obtains a result as valid as in the first observation (11). For these screening tools interrater reliability, reliability across multiple data collectors, was measured. The Kappa result for interrater reliability were between 0.835 (GUSS) and 0.94 (BJH-SDS), indicating the minimum acceptable interrater agreement among raters (32). Even if the minimum acceptable value was obtained (>0.80), careful training is required. Disagreements among raters can lead to recommendations based on faulty evidence.

The ideal screening tool should have high sensitivity, high specificity and high negative predictive value, to ensure that all dysphagic patients are correctly identified and that non-dysphagic patients can initiate oral feeding without delay. The tools identified in this review show a high

sensitivity for dysphagia, all over 94%, which means that very few stroke patients, or even none, will remain unidentified. This is particularly important given that the improper identification of dysphagic patients has serious immediate consequences, such as respiratory complications. This is emphasized by Martino et al., (20), pointing out that high sensitivity is of the utmost importance because failure to identify dysphagia can lead to pneumonia. A greater efficiency in the allocation of time and resources can be reached, which can be spent to carry out more complete and specific assessments. In fact, the high sensitivity of these tools foresees no increase in pneumonia rate (18). On the other hand, these tools have a relatively lower specificity ranging from 50% to 69%, making it essential to ensure that every patient that fail dysphagia screening has access to further instrumental evaluation. This means that a high percentage of patients will be kept nil by mouth and/or nasogastric tube for feeding, hydration and medication administration until further specialized assessment, without actually being dysphagic. This is acknowledged as a disadvantage by Edmiaston et al. (18) and Trapl et al. (19), but acceptable as safety margin for increased risk of aspiration. This result is also recognized in the revalidation study of GUSS, which states that GUSS over estimates the need for nasogastric tube feeding (33).

There is contradictory evidence regarding the use of nasogastric tubes and the development of aspiration pneumonia after stroke. In one hand, there is evidence that points out that the presence of nasogastric tubes is a significant predictor for respiratory infections (34). On the other hand, a study developed by Kalra, Hodsoll, Irshad, Smithard, and Manawadu (35)

suggests that the insertion of nasogastric tubes does not increase the incidence of post-stroke pneumonia, mortality, or worse functional outcomes, and can be used safely in acute stroke patients. Furthermore, another study concluded that a standardized care plan of intensified oral hygiene and early screening reduced the incidence of x-ray pneumonia (36). These findings suggest that aspiration pneumonia is multifactorial and that the clinical relevance of aspiration and the use of nasogastric tubes needs further investigation.

Although sensitivity and specificity are of interest, other measures can be of great use for clinical purpose. Sensitivity and specificity look backward and test results must also interpret those tested – look forward. Thus, the predictive values of the test need to be known: negative predictive values give the odds of not being affected given a negative result (37). Considering the aim of screening—identifying the individuals that are not dysphagia and therefore can safely initiate oral feeding— one can carefully consider GUSS a safe screening tool, since it has a 100% negative predictive value. This means that no patients will “fall through the cracks”. On the other hand, either TOR-BSST or BJH-SDS have negative predictive values lower than 100%, which represents a risk for this specific population. Any margin of falsely negative, i.e., patients that are not identified through the screening tool, means that the diagnostic process is stopped and the diagnostic “cascade” is not even initiated. Screening, detailed patient clinical examination and possibly further evaluation, including instrumental tests are ruled out at a very early stage of the diagnostic process, with serious implications on stroke patient’s outcomes

(respiratory complications, malnutrition and dehydration). Nurses’ role is extremely valuable here as they are the ones who can initiate/ or who fail to initiate this diagnostic cascade.

The research on clinical consequences of dysphagia has been focused on its respiratory complications. The commitment in nutrition, dehydration and quality of life have not deserved the same attention (6), however, dysphagia has also a significant impact on the patients, beyond respiratory complications, who perceive it differently from the professionals. Patients consider the psychological consequences of dysphagia to be more relevant than pulmonary or nutritional ones (38). This reinforces the importance that, regardless the tool used, acute stroke patients should be screened for dysphagia, so that the therapeutic plan, appropriate to their clinical situation, is established as early as possible. There are currently several tools for dysphagia screening and multidisciplinary teams must use the best available evidence to make the informed decision for their choice (11).

The choice of a screening tool is dependent on the weighting of several factors: organizational, structural, clinical and the availability of professionals and resources. Therefore, a single dysphagia screening may not be appropriate for all clinical settings (11). The choice of the best tool for a specific clinical context can be performed using the Kepner-Tregoe Decision Matrix, which allows, in a simple way, to emphasize the combination of the features of several dysphagia screening tools and the factors considered most important for the institution, therefore allowing a clear and logical decision (39). For example, GUSS has been used in other

researches as reference tool for dysphagia screen (36,40).

As far as dysphagia screening tools development, concerns in research should focus on further study based on the ones already available. Different tools have already been developed without significant gains in psychometric proprieties; spending time and energy on research to develop other tools does not seem to bring better outcomes for patients. Other screening tools, not specific for stroke patients, have been developed, with overlapping results (41). This has been suggested in another systematic review, conducted by Jiang, Fu, Wang, & Ma (42), that assessed the validity and reliability of dysphagia screening tools for patients with neurological disorders, in order to identify a feasible tool that can be used by nurses. In this systematic review, screening tools compared with VFSS and FEES were excluded, retrieving eight studies for review.

Patients with stroke have a high probability of developing dysphagia during the acute phase. The complications range from aspiration pneumonia to psychological consequences. There is a lack of recognized evidence on the advantages of screening for dysphagia in these patients as well as a lack of screening tools with ideal psychometric proprieties. This has led that, so far, no international organization recommended, in its clinical guidelines, any specific tool, despite the recommendations pointing out the need to screen all acute stroke patients.

In this systematic review three dysphagia screening tools that could be used by nurses were identified. None of them complies with all psychometric properties for a screening tool, which means that a still significant proportion of patients will be kept nil by mouth, without

being necessary or that some patients will “fall through the cracks” interrupting the diagnostic process. The tools identified are different from each other, making their comparison impracticable. The choice of the most appropriate tool for each clinical context should rest on the multidisciplinary team, considering all the factors influencing the choice. Due to psychometric proprieties and dietary recommendations adjusted to dysphagia severity, of all available tools, GUSS is a suitable screening tool for nurses in clinical practice.

This study has limitations. There may have been disregarded some studies by limiting the search to three databases and, in addition, systematic reviews tend to bias in selection. The three studies included in this review had sufficient methodological quality. However, the fact that one of the dysphagia screening tools had strict constraints to obtain a free sample, prevented us to analyse and compare the tools as anticipated. Thus, the results of this review should be carefully considered.

Research in this area should be focused in consolidating the evidence already available, improving the tools developed with the highest methodological quality, in order to provide them robustness. More studies must be developed targeting the other consequences of dysphagia beside respiratory complications and evidence between dysphagia screening and improved patient’s outcomes must be strengthened.

Relevance to Clinical Practice

This review shows which tools are available for nurses use in stroke units, for dysphagia the early screening. Nurses must

incorporate the best available evidence into their practice and, depending on the experience, the patients and the organization in which they are located, choose the one that best suits their professional context. Nurses spend the most time with patients and are, often, the first in line of healthcare, playing an invaluable role in initial assessment and timely clinical intervention.

Conflict of interest

The authors declare no conflict of interest.

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