Fiberoptic nasopharyngoscopic evaluation of swallowing for the detection of dysphagia in patients with stroke: a integrative review

Nasofibrolaringoscopia da deglutição para detecção de disfagia em pacientes com acidente vascular cerebral: uma revisão integrativa

Nasofibrolaringoscopia de la deglución para la detección de disfagia en pacientes con accidente cerebrovascular: una revisión integradora

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ABSTRACT
Difficulty for swallowing, clinically defined as dysphagia, is a common manifestation in stroke patients and significantly increases the risk of clinical complications. The objective of this study was to perform an integrative review of the literature regarding the accuracy of Fiberoptic Endoscopic Evaluation of Swallowing (FEES) for detecting dysphagia in patients with stroke. Methods: We conducted a search for articles published from 2000 to 2021 in the PubMed, Scopus, Embase, and Bireme databases. The following keywords were used: "fiberoptic endoscopic evaluation of swallowing (FEES)" and "stroke". Results: It was identified 23 articles that utilized fiberoptic endoscopic evaluation of swallowing (FEES) to screen stroke patients for dysphagia. The overall sensitivity and specificity of fiberoptic endoscopic evaluation of swallowing (FEES) ranged from 55.9% to 100%. Conclusions: The standardization of specific protocols for the diagnosis of dysphagia in stroke patients is necessary, both in clinical tests and fiberoptic endoscopic evaluation of swallowing (FEES), as special care is essential for these patients given their unique clinical characteristics.

Keywords: dysphagia, stroke, Fiberoptic Endoscopic Evaluation of Swallowing (FEES), assessment.

RESUMO
A dificuldade de deglutição, clinicamente definida como disfagia, é uma manifestação comum em pacientes com AVC e aumenta significativamente o risco de complicações clínicas. O objetivo deste estudo foi realizar uma revisão integrativa da literatura sobre a acurácia da nasofibrolaringoscopia da deglutição na detecção de disfagia em pacientes com acidente vascular cerebral. Métodos: Foi realizada uma busca de artigos publicados de 2000 a 2021 nas bases de
RESUMEN
La dificultad de deglución, clínicamente definida como disfagia, es una manifestación común en pacientes con accidente cerebrovascular y aumenta significativamente el riesgo de complicaciones clínicas. El objetivo de este estudio fue realizar una revisión integradora de la literatura sobre la precisión de la nasofibrolaringoscopia de la deglución en la detección de disfagia en pacientes con ictus. Métodos: Se realizó una búsqueda de artículos publicados desde 2000 hasta 2021 en las bases de datos PubMed, Scopus, Embase y Bireme. Se utilizaron las siguientes palabras clave: “nasofibrolaringoscopia de deglución” y “accidente cerebrovascular”. Resultados: Se identificaron 23 artículos que utilizaron nasofibrolaringoscopia de la deglución para detectar disfagia en pacientes con accidente cerebrovascular. La sensibilidad y especificidad generales de la nasofibrolaringoscopia de deglución osciló entre el 55,9% y el 100%. Conclusiones: Es necesario estandarizar protocolos específicos para el diagnóstico de disfagia en pacientes con ictus, tanto en pruebas clínicas como en nasofibrolaringoscopia deglutoria, ya que es fundamental un cuidado especial con estos pacientes dadas sus características clínicas únicas.

Palabras clave: disfagia, ictus, nasofibrolaringoscopia deglutoria, evaluación.

1 INTRODUCTION

Difficulty for swallowing, clinically defined as dysphagia, is a common manifestation in stroke patients and significantly increases the risk of clinical complications\(^1\). Dysphagia following a stroke may develop, persist or recur during the course of the condition\(^2\). In this context, oropharyngeal dysphagia affects more than half the patients in the acute phase\(^3\), potentially representing an independent marker of worse prognosis for the recovery after a stroke\(^4\).

The most commonly used methods for the evaluation swallowing are clinical evaluation and instrumental exams, such as videofluoroscopy and fiberoptic endoscopic evaluation of
swallowing (FEES). Clinical evaluation of swallowing is usually the first step, but it is not accurate enough for detecting changes in the pharyngeal phase and, in particular, silent aspiration\(^5\). FEES is described as a simple, minimally invasive, and low-cost exam. It allows observation of the pharyngeal phase of swallowing and assessment of motricity and the sensitivity of the larynx, pharynx, and soft palate. Like videofluoroscopy, it permits the execution of maneuvers to protect the airway\(^6\).

The term "gold standard" is often used for videofluoroscopy in the assessment of swallowing. However, several studies comparing the two tests, with different objectives and in patients with various diagnoses, have found major agreement between the examinations. Langmore\(^7\) emphasized that both tests can be considered the gold standard. He argued that the term "gold standard" would be appropriate when calculating the sensitivity, specificity, and predictive values of non-imaging tests, which are known to miss some findings, and comparing them to either of the instrumental examinations.

The objective of the present investigation was to survey studies that provide data about FEES in patients with stroke. To this end, we determined whether the studies surveyed (a) used an instrument for the classification of stroke, (b) used a protocol for the validation of their results, (c) compared the results to those for control patients, (d) compared the diagnostic accuracy (sensitivity/specificity) of clinical assessment of swallowing, and (e) reported the accuracy of the method.

2 METHODOLOGY

An electronic review of the literature was conducted to verify the use of Fiberoptic Endoscopic Evaluation of Swallowing (FEES) in patients with stroke. The review followed these steps: primary selection of all detected articles, selection of papers to be included in the review sample, analysis of the results of the included articles, and interpretation of the results. The following databases were surveyed: PubMed, Scopus, Embase and Bireme. Retrospective review studies, conference abstracts, and studies that did not assess swallowing in stroke patients using FEES were excluded. The selected studies were published from 2000 to 2021. The boolean operators used were “and” along with the keywords “fiberoptic endoscopic evaluation of swallowing (FEES)” and “stroke”, resulting in the detection of 125 articles. Of these, 23 articles
that rigorously used FEES to assess swallowing in stroke patients were selected and included in the study.

The selected studies used FEES to assess swallowing in stroke patients regardless of the type of stroke (ischemic or hemorrhagic). After selection, the studies were analyzed, and their data were summarized in tables according to: (a) the use of any instrument for stroke classification - determining how the study classified patients, either by using an instrument to classify severity or by localization of the injury, and whether the study followed a standardized instrument for FEES execution to establish a sequence for the exam steps; (b) the use of a protocol for the validation of results - verifying the use of a specific protocol for FEES evaluation as described in the study, whether it was a protocol developed by the study group (their own protocol) or protocols developed by other authors with individual modifications (others, with modifications); (c) comparison of results with non-stroke patients; (d) comparison of the diagnostic efficacy (sensitivity/specificity) of clinical swallowing assessment to FEES; and (e) the positive efficacy of the method - whether the application of FEES to stroke patients according to the proposed methodology was able to address the initial research questions of each study.

3 RESULTS

A brief description of the 23 studies that used FEES in stroke patients is presented in Table 1.

Most of the studies (74%) were conducted on patients with both ischemic and hemorrhagic stroke\cite{8-10,12,14-16,18,19,21,23-24,26-30}. The severity of stroke was classified according to the National Institutes of Health Stroke Scale (NIHSS)\cite{16,17,18,19,20,22,23,25,27}, and according to the Canadian Neurological Scale\cite{11,21}. A few studies provided information about the site of stroke injury\cite{12,19,22,26,27}, and others related the site and type of the injury to dysphagia as additional information\cite{21,23,24}.

For the assessment of swallowing by the FEES, 86% of the studies reported the use of a specific protocol for FEES\cite{8,10,11,14-30}. Only 13% of the studies did not mention the use of protocols. Most studies used as a basis the protocols of Langmore et al. (1988, 1991)\cite{11,12,16,17,18,19,24} and Dziewas et al. (2008 e 2008a)\cite{20,22,23,26}. In general, the studies followed the order of presentation of the food consistencies tested according to the safe swallowing
capacity of the patient, starting with foods of paste consistency (pudding or water with the use of a thickener), followed by liquid (varying from thin to thickened fluid), and finally by solid consistency (cookies or bread).

Many of the selected studies did not intended to compare the findings with control groups, only 30% of studies included control patients\textsuperscript{10,25-30}.

Sixty one percent of the studies compared the application of FEES to functional clinical evaluation of swallowing, demonstrating high sensitivity and specificity of the two tests for the detection of dysphagia\textsuperscript{9,11,12,14,17,20,23-30}.

In general, the studies found that both tests showed good agreement. Some studies highlighted that FEES is more sensitive and specific in detecting certain parameters of dysphagia. While other studies found no significant difference between the tests. FEES indicated aspiration in 60% of patients, and almost half of these aspirations had not been identified by the blue-dye test\textsuperscript{27}.
Table 1. Description of the selected studies that used FEES in stroke patients.

<table>
<thead>
<tr>
<th>Authors</th>
<th>Research</th>
<th>Use of a protocol</th>
<th>Name of the protocol used</th>
<th>Comparison of the results to a control group</th>
<th>Comparison of the diagnostic efficiency (sensitivity/specify/cut-off to clinical value)</th>
<th>Stroke type</th>
<th>How the resulting test was carried out in FEES</th>
</tr>
</thead>
<tbody>
<tr>
<td>AYvu et al.</td>
<td>2006</td>
<td>263</td>
<td>ISS with assessment of the swallowing components</td>
<td>yes (flow rate)</td>
<td>ERBUST form</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>LD et al.</td>
<td>2002</td>
<td>50</td>
<td>Steady-state test in combination with measurement of oxygen saturation, compared to ISS</td>
<td>not mentioned</td>
<td>not mentioned</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>SMITH &amp; HAMMOND et al.</td>
<td>2002</td>
<td>63</td>
<td>ISS in combination for the assessment of solid and liquid consistencies, compared to ISS</td>
<td>yes (of others with modifications)</td>
<td>other: Langmore et al., 1991</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>LABAR et al.</td>
<td>2002</td>
<td>49</td>
<td>Clinical assessment compared to FEES</td>
<td>yes (of others with modifications)</td>
<td>other: Langmore et al., 1991; Langmore et al., 1992</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>CHONG et al.</td>
<td>2003</td>
<td>50</td>
<td>Validation of a score system in combination with measurement of oxygen saturation, compared to FEES</td>
<td>not mentioned</td>
<td>not mentioned</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>WARNICK &amp; KELLER</td>
<td>2004</td>
<td>20</td>
<td>Reported FEES during the evolution of clinical signs and symptoms</td>
<td>not mentioned</td>
<td>not mentioned</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>TRAPPI et al.</td>
<td>2004</td>
<td>62</td>
<td>Validation of a clinical test compared to GIS</td>
<td>yes</td>
<td>GIS</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>DEITCH &amp; BURTON et al.</td>
<td>2004</td>
<td>153</td>
<td>Validation of a score system for FEES</td>
<td>yes (of others with modifications)</td>
<td>other: Langmore et al., 1990;_Isdezer et al., 2002</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>BURTON &amp; DEITCH et al.</td>
<td>2004</td>
<td>153</td>
<td>FEES in patients with acute stroke</td>
<td>yes (of others with modifications)</td>
<td>other: Langmore et al., 1990;_Isdezer et al., 2002</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>WARNICK et al.</td>
<td>2005</td>
<td>166</td>
<td>Validation of a clinical test compared to GIS</td>
<td>yes (of others with modifications)</td>
<td>other: Langmore et al., 1990;_Isdezer et al., 2002</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>WARNICK et al.</td>
<td>2005</td>
<td>225</td>
<td>Validation of a clinical test compared to GIS</td>
<td>yes</td>
<td>GIS</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>WARNICK et al.</td>
<td>2005</td>
<td>17</td>
<td>Validation of a score system for FEES</td>
<td>yes (of others)</td>
<td>Robbins, 1999</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>SMITH &amp; HAMMOND et al.</td>
<td>2005</td>
<td>96</td>
<td>Determining whether objective voluntary cough measurements would improve the accuracy of clinical examination by clinical swallowing and FEES</td>
<td>yes (of others)</td>
<td>Robbins, 1999</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>WARNICK et al.</td>
<td>2005</td>
<td>131</td>
<td>Validation of a score system for FEES</td>
<td>yes (of others)</td>
<td>Robbins, 1999</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>SUNDE et al.</td>
<td>2005</td>
<td>30</td>
<td>Description of dysphagia in patients with hemiplegia stroke using FEES</td>
<td>yes (of others)</td>
<td>Robbins, 1999; Wiesbrock, 2000; Wiesbrock, 2000</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>NUNES et al.</td>
<td>2005</td>
<td>246</td>
<td>Correlation between basal swallowing and swallowing by clinical evaluation combined with FEES</td>
<td>yes (of others with modifications)</td>
<td>Langmore, 1990; Couty et al., 2005</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>RICKELEIN et al.</td>
<td>2005</td>
<td>114</td>
<td>Filling the exam and FEES of the patient should be clear to clinical swallowing</td>
<td>yes (of others)</td>
<td>Sheradin et al., 2010</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>UMIN et al.</td>
<td>2005</td>
<td>24</td>
<td>Assessment of dysphagia in stroke patients using FEES and electrophysiology</td>
<td>yes (of others)</td>
<td>Robbins, 2000; Wiesbrock, 2000</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>PENK et al.</td>
<td>2005</td>
<td>59</td>
<td>To characterize the swallowing function of patients with stroke in the documentation process through clinical assessment and maxillofacial magnetic resonance imaging</td>
<td>yes (of others)</td>
<td>not mentioned</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>MOKIN et al.</td>
<td>2005</td>
<td>50</td>
<td>Analysis of the consistency of oxygen saturation (SpO2) measurements in a randomized trial for aspirating risk in stroke patients</td>
<td>yes (of others)</td>
<td>not mentioned</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>UMIN et al.</td>
<td>2006</td>
<td>111</td>
<td>Identification of the Gugging Swallowing Screen (GUSS) test as a bedside screening test for detecting dysphagia in stroke early period after stroke, including Turkish translations, validity, and reliability</td>
<td>yes</td>
<td>Gugging Swallowing Screen (GUSS)</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>TOSCA et al.</td>
<td>2005</td>
<td>50</td>
<td>assessed the accuracy of the Ispochemisch Otofysicher Evaluatiesadhral Evaluation of Swallowing After Stroke (ISOLESAS) which combines the Toronto Bedside Swallowing Scoring Test (TBSS - 2005) with oxygen saturation and laryngeal elevation measurements during swallowing</td>
<td>yes (of others)</td>
<td>not mentioned</td>
<td>no</td>
<td>yes</td>
</tr>
</tbody>
</table>

Source: Prepared by the authors
4 DISCUSSION

The prevalence of dysphagia in individuals after a stroke in the acute phase of their disease is approximately 42%. However, studies that used instrumental gold-standard diagnostics estimated the prevalence to be about 75%, which is thus notably higher\textsuperscript{31}. Due to the complications associated with dysphagia, early detection is crucial to prevent these complications and improve patient outcomes\textsuperscript{32}. Awareness in stroke care regarding this issue has increased over the past 5–10 years\textsuperscript{31}.

All patients participating in the cited studies had a diagnosis of stroke established by physicians and confirmed by imaging exams. For the classification of stroke severity, most studies used the NIHSS. In addition to classifying stroke severity, some studies related the severity of dysphagia to other complications using these scales. Warnecke et al. (2006) correlated the NIHSS score with the severity of dysphagia, and Warnecke et al. (2009) related the NIHSS score to the occurrence of pneumonia and the need for endotracheal intubation. The NIHSS is a practical scale for monitoring the development of a patient's signs and symptoms and has high sensitivity (88%) and specificity (85%) for the detection of dysphagia\textsuperscript{2}.

Among the studies surveyed, 83% reported the use of a specific protocol for FEES\textsuperscript{8,10,11,14-30}. We noted a general tendency to measure clinical findings in a more judicious, planned and controlled manner. The use of protocols promptly satisfies these necessities. The assessment of swallowing guided by a protocol emphasizes the relevance of the steps to be followed in the exam and guarantees minimal discomfort for the patient\textsuperscript{33}.

Most of the selected studies did not intend to compare their findings to those of a control group, with only Smith-Hammond et al. (2001) and Umay et al. (2013) proposing this procedure. Studies involving the diagnosis of dysphagia usually do not involve control groups, with the non-pathological pattern of functionality acting as its own control.

Regarding the comparison of FEES to the functional clinical evaluation of swallowing, 61% of the studies determined the sensitivity and specificity of the tests\textsuperscript{9,11,12,14,17,20,23-30}. For the determination of the sensitivity and specificity of the tests, screening/diagnostic exams require high sensitivity so that patients with the alteration under study will not be falsely characterized as healthy\textsuperscript{34}.
All the studies analyzed demonstrated the positive efficacy of the chosen method, satisfying the initial objectives of the investigation. We also emphasize the detailed description of the findings regarding the swallowing process in the exams, both in the clinical evaluations and in the FEESs, favoring a better understanding of the study in question.

Though it is clear that endoscopy cannot reveal everything about oropharyngeal dysphagia, it is equally clear that it can reveal some aspects of the swallowing better than fluoroscopy. The temporal coordination of bolus flow into the hypopharynx and airway protection, for example, can only be fully appreciated from the endoscopic view of the entire hypopharynx. Spillage of material into the hypopharynx prior to the pharyngeal swallow response is a very common pattern in neurogenic patients and aspiration occurring before the swallow is the most frequent type of aspiration reported for stroke patients\(^{35}\).

We should consider the FEES as an effective option for the diagnosis of dysphagia in patients with stroke, especially when this method is applied in combination with functional clinical evaluation and is guided by a specific protocol for the evaluation of dysphagia in these patients.

5 CONCLUSION

Comprehensive care must be provided to stroke patients to identify changes in swallowing. It is necessary to standardize specific protocols for diagnosing dysphagia in stroke patients, encompassing both clinical tests and FEES, as special care is crucial for these patients due to cognitive impairments caused by their condition. Further research in this area is required to enhance and expedite the detection of swallowing dysfunction in this patient group.
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