



Brazilian Journal of  
OTORHINOLARYNGOLOGY

www.bjorl.org



REVIEW ARTICLE

**Diagnostic validity of methods for assessment of swallowing sounds: a systematic review**<sup>☆</sup>

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Received 26 September 2017; accepted 27 December 2017

**KEYWORDS**

Deglutition;  
Deglutition disorders;  
Diagnosis;  
Review

**Abstract**

*Introduction:* Oropharyngeal dysphagia is a highly prevalent comorbidity in neurological patients and presents a serious health threat, which may lead to outcomes of aspiration pneumonia, ranging from hospitalization to death. This assessment proposes a non-invasive, acoustic-based method to differentiate between individuals with and without signals of penetration and aspiration.

*Objective:* This systematic review evaluated the diagnostic validity of different methods for assessment of swallowing sounds, when compared to Videofluoroscopic of Swallowing Study (VFSS) to detect oropharyngeal dysphagia.

*Methods:* Articles in which the primary objective was to evaluate the accuracy of swallowing sounds were searched in five electronic databases with no language or time limitations. Accuracy measurements described in the studies were transformed to construct receiver operating characteristic curves and forest plots with the aid of Review Manager v. 5.2 (The Nordic Cochrane Centre, Copenhagen, Denmark). The methodology of the selected studies was evaluated using the Quality Assessment Tool for Diagnostic Accuracy Studies-2.

<sup>☆</sup> Please cite this article as: Taveira KV, Santos RS, Leão BL, Neto JS, Pernambuco L, Silva LK, et al. Diagnostic validity of methods for assessment of swallowing sounds: a systematic review. Braz J Otorhinolaryngol. 2018. <https://doi.org/10.1016/j.bjorl.2017.12.008>

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Peer Review under the responsibility of Associação Brasileira de Otorrinolaringologia e Cirurgia Cérvico-Facial.

<https://doi.org/10.1016/j.bjorl.2017.12.008>

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**PALAVRAS-CHAVE**

Deglutição;  
Distúrbios de  
deglutição;  
Diagnóstico;  
Revisão

**Results:** The final electronic search revealed 554 records, however only 3 studies met the inclusion criteria. The accuracy values (area under the curve) were 0.94 for microphone, 0.80 for Doppler, and 0.60 for stethoscope.

**Conclusion:** Based on limited evidence and low methodological quality because few studies were included, with a small sample size, from all index testes found for this systematic review, Doppler showed excellent diagnostic accuracy for the discrimination of swallowing sounds, whereas microphone-reported good accuracy discrimination of swallowing sounds of dysphagic patients and stethoscope showed best screening test.

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### Validade diagnóstica dos métodos de avaliação dos sons de deglutição: uma revisão sistemática

#### Resumo

**Introdução:** A disfagia orofaríngea é uma comorbidade altamente prevalente em pacientes neurológicos e representa uma séria ameaça à saúde, podendo levar a desfechos como pneumonia por aspiração, hospitalização, e até morte. A avaliação propõe um método não invasivo, acústico, para diferenciar entre indivíduos com e sem sinais de penetração e aspiração.

**Objetivo:** Esta revisão sistemática analisou a validade diagnóstica de diferentes métodos para avaliação dos sons de deglutição, quando comparados à Videofluoroscopia da Deglutição para detectar disfagia orofaríngea.

**Método:** Artigos nos quais o objetivo principal era avaliar a acurácia dos sons de deglutição foram pesquisados em cinco bancos de dados eletrônicos sem limitações de idioma ou tempo de publicação. As medidas de acurácia descritas nos estudos foram transformadas para construir curvas ROC (*Receiver Operating Characteristic*) e gráfico em floresta (*forest plot*) com o auxílio do software *Review Manager v. 5.2* (The Nordic Cochrane Centre, Copenhagen, Dinamarca). A metodologia dos estudos selecionados foi avaliada utilizando-se a ferramenta Avaliação da Qualidade de Estudos de Acurácia de Testes Diagnósticos-2.

**Resultados:** A busca eletrônica final resultou na identificação de 554 artigos; no entanto, apenas 3 estudos preencheram os critérios de inclusão. Os valores de acurácia (área abaixo da curva) foram 0,94 para microfone, 0,80 para Doppler e 0,60 para estetoscópio.

**Conclusão:** Baseado nas evidências limitadas e da baixa qualidade metodológica, pois foram poucos os estudos incluídos, e com pequeno tamanho amostral; de todos os testes diagnósticos (*index testes*) encontrados para essa revisão sistemática, o Doppler mostrou excelente acurácia diagnóstica na discriminação dos sons de deglutição, o microfone demonstrou uma boa acurácia na discriminação dos sons de pacientes disfágicos e o estetoscópio revelou o melhor teste de triagem.

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## Introduction

Swallowing is characterized by an intricate neuromuscular mechanism that requires a sequence of biomechanical activities, resulting in the passage of liquids and solids from mouth to stomach, avoiding the airway.<sup>1,2</sup> Dysphagia may bring serious and potentially fatal health consequences, which negatively impact the well-being, safety, quality of life, and safety of patients.<sup>3,4</sup> Aspiration is one of the most serious manifestations of oropharyngeal dysphagia, and may be the cause of undernourishment, chest infection, prolonged hospital stay and, lastly, mortality.<sup>5</sup> Prevalence measurements for dysphagia diverge, depending upon the

etiology and patient's age, but estimates as high as 38% for lifetime prevalence have been reported in those over 65-years-old.<sup>6</sup>

To avoid unfavorable health results, detecting dysphagia early is crucial as well as to initiate an early referral for diagnosis and treatment to minimize health threats. The test named Videofluoroscopic Swallowing Study (VFSS), which consists of asking a patient to swallow different foods and liquids that contain a radiopaque contrast agent while observed by a trained professional is often considered the standard reference to determine if dysphagia exists.<sup>7-11</sup> For this test, kinematic X-ray data for physiological swallow impairment and subsequent misdirection of swallowed

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