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REVIEW ARTICLE

**Functional magnetic resonance and swallowing:
critical literature review** ☆,☆☆



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KEYWORDS

Deglutition;
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Abstract

Introduction: Aspects of the neuroanatomical representation of swallowing have been investigated in humans through brain mapping techniques, such as functional magnetic resonance imaging (fMRI).

Objective: This critical qualitative review of the literature analyzed international scientific publications in the PubMed database that investigated the activation of the central nervous system in humans during the act of swallowing.

Methods: This investigation was limited to articles that investigated adults older than 18 years, published in English or Portuguese, between January 2002 and December 2013. Publications that did not have access to the full text, that were repeated by overlapping keywords, case studies, literature reviews, letters to the editor, and those not directly related to the topic of the investigation were excluded.

Results: A total of 649 articles were identified, of which 21 matched the inclusion criteria.

Conclusion: The main purpose of the manuscripts that investigate the swallowing process through fMRI were: to characterize swallowing in different pathologies; to compare swallowing in different age groups; to describe brain activation in different stimulation conditions. These

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PALAVRAS-CHAVE

Deglutição;
Transtornos de
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Imagem por
ressonância
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studies indicate multiple cortical regions involved in swallowing control. Overall, the studies indicate that fMRI is a non-invasive and quantitative method that allows the investigation of characteristics that are quite often not clinically visible.

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Ressonância magnética funcional e deglutição: revisão crítica da literatura

Resumo

Introdução: Aspectos da representação neuroanatômica do funcionamento cortical que controla a deglutição têm sido investigados e identificados em humanos, utilizando-se técnicas de mapeamento cerebral, como a Ressonância Magnética funcional (RNMf).

Objetivo: Esta revisão crítica qualitativa da literatura levantou publicações científicas sobre a funcionalidade do sistema nervoso central durante tarefas de deglutição, por meio da base de dados PubMed.

Método: O levantamento realizado limitou-se a seres humanos, com idade superior a 18 anos, nos idiomas inglês e português, entre janeiro de 2002 e dezembro de 2013. Publicações sem acesso completo, repetidas por sobreposição das palavras chave, estudos de caso, revisões de literatura, cartas ao editor e não relacionadas diretamente ao tema foram excluídas.

Resultado: Identificou-se 649 estudos, sendo que somente 21 se enquadraram aos critérios estabelecidos.

Conclusão: Foram encontrados artigos que objetivaram, por meio da RNMf, estudar a função de deglutição em patologias; comparar a deglutição em diferentes idades; descrever a ativação cerebral em diferentes situações de estimulação. Estes estudos apontam múltiplas regiões corticais que participam no controle da deglutição. Conclui-se que a RNMf é um método não invasivo, quantitativo, que demonstra respostas, muitas vezes, não visíveis clinicamente.

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Introduction

Swallowing is a complex sensory-motor process that involves several physiological stages.¹ The hypothesis has been proven that multiple brain areas are activated during swallowing, both in children and adults, reflecting regions that are responsible for different aspects of the swallowing process.²

It is known that the cerebral cortex plays an important functional role in the regulation of swallowing.³ The reflexive components of swallowing depend on the brainstem swallowing centers; the onset of swallowing is a voluntary action, which depends on the integrity of the motor areas of the cortex.⁴

Some aspects of the neuroanatomical representation of cortical function that controls swallowing have been investigated and identified in humans, using brain imaging techniques such as the functional magnetic resonance imaging (fMRI), considered one of the most recent and advanced methods of functional neuroimaging without the use of ionizing radiation.⁵

The advent of functional magnetic resonance imaging has facilitated or a better detection and quantification of organizational changes in cortical activation, with improved spatial and temporal resolution.⁵ fMRI is a safe and non-invasive

method to investigate the human brain, and has been indicated in the investigation of dysphagia after brain damage.⁶

The aim of this study was to perform a critical analytic summary of relevant articles on the fMRI findings during swallowing in different groups studied in the international literature.

Methods

Since this was a non-experimental study, there was no need for consent forms or institutional ethics committee approval. The Cochrane Handbook precepts were followed to establish the research method.⁷

The articles used in this study were selected through the PubMed database using the keywords: "deglutition", "deglutition disorders", "magnetic resonance", and "magnetic resonance spectroscopy", limited to studies performed in adult individuals, published in English and Portuguese, carried out from January 2002 to December 2013.

The search for publications in the database was independently conducted by the researchers to minimize possible citation losses. Each article recovered from the database was independently analyzed by the researchers to determine its relevance for selection and inclusion in the study. Articles in languages other than Portuguese and English were

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