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# Association between pharyngeal residue and posterior oral spillage with penetration and aspiration in Stroke

## *Associação entre presença de resíduos faríngeos e escape oral posterior e a ocorrência de penetração e aspiração no Acidente Vascular Encefálico*

### ABSTRACT

**Purpose:** This study aimed at showing association between the posterior oral spillage and pharyngeal residue with tracheal aspiration and/or laryngeal penetration in stroke. **Methods:** Clinical cross-sectional retrospective multicenter study. The study included 63 videofluoroscopic tests of post-ischemic stroke individuals and oropharyngeal dysphagia data of the three reference centers providing care for patients with dysphagia (43 men and 20 women; age range: from 40 to 90 years). These individuals were divided into two groups. Group I consisted of 35 participants with the presence of penetration and/or laryngotracheal aspiration, and Group II consisted of 28 individuals with no penetration and/or aspiration. Videofluoroscopic swallowing test results were analyzed to divide the groups, and the presence of posterior oral spillage and pharyngeal residue was observed. **Results:** No association was found between the groups with posterior oral spillage ( $\chi^2=1.65$ ;  $p=0.30$ ;  $\phi^2=0.02$ ), but there was statistical difference for the association between pharyngeal residue ( $\chi^2=12.86$ ;  $p=0.003$ ;  $\phi^2=0.20$ ) and the groups. **Conclusion:** There is an association between pharyngeal residue and penetration with tracheal aspiration in post-stroke individuals.

### RESUMO

**Objetivo:** Este estudo teve por objetivo verificar a associação entre a ocorrência de escape oral posterior e a presença de resíduos faríngeos com penetração laríngea e/ou aspiração laringotraqueal no acidente vascular encefálico (AVE). **Métodos:** Estudo clínico transversal, retrospectivo e multicêntrico. Foram incluídos neste estudo 63 exames videofluoroscópicos de indivíduos pós-AVE isquêmico e disfagia orofaríngea do banco de dados dos serviços de três centros públicos de referência no atendimento do indivíduo disfágico, sendo 43 do gênero masculino e 20 do gênero feminino, faixa etária variando de 40 a 90 anos. Estes foram divididos em dois grupos. O Grupo I foi composto por exames de 35 indivíduos com presença de penetração e/ou aspiração laringotraqueal e o Grupo II, por exames de 28 indivíduos com ausência de penetração e/ou aspiração. Foram analisados exames de videofluoroscopia da deglutição para dividir os grupos e observou-se a presença de escape posterior e resíduos faríngeos. **Resultados:** Não houve associação entre os grupos com o escape oral posterior ( $\chi^2=1,65$ ;  $p=0,30$ ;  $\phi^2=0,02$ ), porém houve associação entre resíduos faríngeos ( $\chi^2=12,86$ ;  $p=0,003$ ;  $\phi^2=0,20$ ) e os grupos. **Conclusão:** Diante dos resultados obtidos, concluiu-se que há associação entre a presença de resíduos faríngeos com a ocorrência de penetração com aspiração laringotraqueal em indivíduos pós-AVE.

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## INTRODUCTION

The presence of oropharyngeal dysphagia in stroke has been analyzed since the 1970s, and the occurrence described in these studies ranges from 19 to 90%, being probably related to the presence of heterogeneous samples and different methods of investigation<sup>(1-3)</sup>.

The identification of laryngeal penetration and laryngotracheal aspiration is a matter of constant concern for the screening and assessment instruments of oropharyngeal dysphagia, especially among post-stroke individuals<sup>(4-6)</sup>. Although some authors consider the laryngotracheal aspiration as being one of the most important targets of the dysphagia evaluation in this population, it is very important to analyze all the swallowing-related findings. Once the rehabilitation of these individuals confirms that we understand the reason for aspiration<sup>(7)</sup>, only then it will be possible to identify which aspects of the swallowing dynamics are causing these signals, and, therefore, we can properly plan the therapy for oropharyngeal dysphagia in cases of stroke.

The laryngotracheal aspiration is detected in approximately 40% of the patients with acute stroke<sup>(8)</sup> along with high incidence of silent aspiration, ranging from 28 to 52%<sup>(9)</sup>. The presence or absence of laryngeal penetration and laryngotracheal aspiration should not be the only parameter to guide the management of partial or total alimentation by mouth. Even so, most studies analyzing the frequency of these signals did not show associations or correlations between these and other changes in the swallowing dynamics<sup>(10-13)</sup>.

The impact of the presence of pharyngeal residue and posterior oral spillage of food on oropharyngeal swallowing has been analyzed with different objectives, which may contribute to the reflection of the several approaches adopted for oropharyngeal dysphagia. The relationship between these findings and laryngotracheal aspiration may help us to understand more about dietary safety<sup>(14,15)</sup>. Therefore, this study aimed at verifying the association between posterior oral spillage and the presence of pharyngeal residue with the occurrence of laryngeal penetration and/or laryngotracheal aspiration in stroke.

## METHODS

### Sample

The material analyzed in this study consisted of videofluoroscopic swallowing images from the database of the participating centers, including 63 post-acute or chronic ischemic stroke participants (23 women and 43 men; age group: from 40 to 90 years). Only individuals with ischemic stroke confirmed by neuroimaging examinations (computed tomography or brain resonance) were included. According to the assessment of images, the material was divided in two groups. Group I (GI) comprised examinations of 35 individuals who presented laryngeal penetration and/or laryngotracheal aspiration, and Group II (GII) comprised examinations of 28 individuals who did not present laryngeal penetration and/or laryngotracheal aspiration as evidenced from the swallowing videofluoroscopy.

## Methodology

This is a cross-sectional, retrospective, multicenter study conducted with the database of a project approved by the research ethics committee of the institution (report no. 226/2008). All the individuals included in the study protocol, or their legal representatives, signed informed consent. It is worth to mentioning that all ethical guidelines were followed according to resolution 196/96.

The database was built by analyzing videofluoroscopic swallowing tests in patients with dysphagia after stroke in three reference centers of oropharyngeal dysphagia, conducted from 2008 to 2010. This study considered the presence or the absence of posterior oral spillage, pharyngeal residue, laryngotracheal penetration, and aspiration.

The videofluoroscopic swallowing assessment (VSA) was done in a specialized center that provide care for patients with oropharyngeal dysphagia, and, in this study, the data were analyzed by two speech language pathologists, with an average of 8 years of experience in the examinations and trained by the same center. Both agreed on the videofluoroscopic findings.

The analysis of VSA parameters is described later, and findings regarding both nectar and liquid consistency were selected; 5 mL were given to participants by a spoon.

### *Posterior oral escape*

The occurrence of premature food escape to the hypopharynx, surpassing the region in which pharyngeal response should take place<sup>(16)</sup>, was described as posterior oral spillage.

### *Presence of residue in pharyngeal recess*

The presence of contrasted material in the vallecula and piriform recess was analyzed after the second deglutition<sup>(17)</sup>.

### *Laryngotracheal penetration and aspiration*

During the swallowing process, all of the material located above the vocal fold was considered as laryngeal penetration, and the passage of material below the level of the vocal fold was considered as laryngotracheal aspiration<sup>(18)</sup>.

### *Statistical analysis*

The  $\chi^2$ -test was used for statistical analysis, considering that variables are nominal and qualitative. Besides, because these are nonparametric data, the  $\phi^2$  test was used for finding.

## RESULTS

Table 1 presents the evaluation of the association between groups and oral posterior escape; it can be concluded that there was no association between the presence of posterior oral spillage and the occurrence of laryngotracheal penetration and/or aspiration.

Results presented in Table 2 show statistical difference that confirm the association between the presence of pharyngeal residue and the occurrence of laryngotracheal penetration and/or aspiration.

**Table 1.** Analysis of association between groups with and without penetration and/or aspiration and the presence of posterior oral spillage

Groups	Absence of posterior oral spillage	Presence of posterior oral spillage	Statistical analysis
I (penetration and/or aspiration – n=35)	2 (5.71%)	33 (94.29%)	$\chi^2=1.65$ ; $p=0.30$ $\phi^2=0.02$
II (no penetration and/or aspiration – n=28)	0 (0%)	28 (100%)	
Total (n=63)	2	61	

**Table 2.** Analysis of the association between groups with and without penetration and/or aspiration and the presence of pharyngeal residue

Groups	Absence of pharyngeal residue	Presence of pharyngeal residue	Statistical analysis
I (penetration and/or aspiration – n=35)	8 (22.86%)	27 (77.14%)	$\chi^2=12.86$ ; $p=0.003$ $\phi^2=0.20$
II (no penetration and/or aspiration – n=28)	19 (67.86%)	9 (32.14%)	
Total (n=63)	27	36	

## DISCUSSION

Several studies assessed the changes in the swallowing biomechanics of the patients with dysphagia after stroke; however, the association of these changes and the occurrence of penetration and/or aspiration were little studied. The reference to the presence of posterior oral spillage and pharyngeal residue is frequently found in studies with this population<sup>(14,15,19,20)</sup>. However, it is a matter of concern to understand which of these findings are associated with the occurrence of laryngotracheal penetration and/or aspiration, aiming to identify which would be the most predictive parameters of assessing risk for laryngotracheal aspiration, therefore determining the proper treatments.

Table 1 shows that although this is a common manifestation in this population with dysphagia, there was no association between the presence of posterior oral spillage and the groups. Different studies have shown that oral incoordination and decreased pharyngeal response are two of the most important factors in the occurrence of posterior oral spillage; even though they can cause laryngeal penetration and/or aspiration, it depends on the level of incoordination and time of pharyngeal response<sup>(21,22)</sup>, and these parameters are not analyzed in this study.

Another aspect of this study, presented in Table 2, showed a statistically significant association between the presence of pharyngeal residue and the groups<sup>(19,23-25)</sup>. It is considered that the presence of pharyngeal residue in post-stroke individuals would be related to different factors, such as increased time of oral and pharyngeal transit, reduced pharyngolaryngeal sensitivity, reduced pharyngeal response, reduced laryngeal elevation, and/or reduced pharyngeal peristalsis. The results of this study corroborate the scientific evidence that associated the pharyngeal residue and penetration and/or aspiration in the post-stroke individual with the time of pharyngeal response<sup>(26,27)</sup>.

Studies have been carried out to understand if there is an association between pharyngeal residue and the risk of laryngotracheal aspiration<sup>(27,28)</sup>. A recent study found that the residue present in the vallecula is significantly associated with the safety of swallowing, being considered as a relative risk of penetration and/or laryngotracheal aspiration, after subsequent deglutitions<sup>(13)</sup>.

One of the limitations of this study was the presence of variables regarding the consistency of food was not analyzed, so it is difficult to use this finding as a risk predictor or to generalize the conduct. In further studies, it is possible to explore this design. Literature presents studies related to consistencies and pharyngeal residue in healthy individuals, which shows there is no significant increase in pharyngeal residue after the intake of consistencies (thin liquid, thick liquid, and thick paste)<sup>(28)</sup>.

On the basis of the findings in this study and other scientific evidence<sup>(26-28)</sup>, it is suggested that professionals of the interdisciplinary team should consider the presence of pharyngeal residue when managing the oropharyngeal dysphagia as a risk marker for laryngotracheal aspiration, to contribute with the definition of the conduct related to the pulmonary security of the individual with dysphagia.

## CONCLUSION

In view of the obtained results, it is possible to conclude that there is an association between the presence of pharyngeal residue and the occurrence of penetration with laryngotracheal aspiration in post-stroke individuals.

*\*RRDS and AVMNS were in charge of data collection and tabulation; PWR, AGJ and FMP followed-up data collection and collaborated with data analysis; PCC, ROD and RGS were in charge of the project and study design, as well as general orientation of the stages of execution and elaboration of the manuscript.*

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