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Fiberoptic endoscopic findings of oropharyngeal swallowing of different food consistencies in Amyotrophic Lateral Sclerosis

Achados videoendoscópicos da deglutição em diferentes consistências de alimento na Esclerose Lateral Amiotrófica

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ABSTRACT

Purpose: This study aimed to compare the fiberoptic endoscopic findings of oropharyngeal swallowing of distinct food consistencies in Amyotrophic Lateral Sclerosis (ALS). **Methods:** This was a retrospective clinical study of a convenience sample of 20 individuals (13 males and seven females aged 34 to 78 years old) with a diagnosis of ALS and oropharyngeal dysphagia confirmed by clinical and objective evaluation of swallowing, regardless of the bulbar or skeletal type and of the time of neurological diagnosis. The fiberoptic endoscopic evaluation of swallowing (FEES) of the liquid (N = 18), thickened liquid (N = 19) and pureed samples (N = 20) in a volume of 5 ml were analyzed. Data related to posterior oral spillage, pharyngeal residues, laryngeal penetration and/or aspiration after swallowing the three food consistencies were analyzed statistically by the Friedman ANOVA test. **Results:** No impairment of laryngeal sensitivity was found in this population. There was no statistically significant difference in posterior oral spillage, penetration and/or aspiration between food consistencies. There was a statistically significant difference only related to pharyngeal residues of the thickened liquid and pureed consistency. **Conclusion:** Among the fiberoptic endoscopic findings of swallowing in ALS, only pharyngeal residues had a higher frequency depending on the consistency of food.

RESUMO

Objetivo: Este estudo teve por objetivo comparar os achados videoendoscópicos da deglutição orofaríngea em distintas consistências de alimento na Esclerose Lateral Amiotrófica (ELA). **Método:** Estudo clínico retrospectivo com amostra de conveniência. Foram incluídos 20 indivíduos com diagnóstico de LAS e disfagia orofaríngea confirmada por avaliação clínica e objetiva de deglutição, independentemente do tipo, bulbar ou esquelética, e tempo de diagnóstico neurológico, 13 do sexo masculino e sete do sexo feminino, faixa etária variando de 34 a 78 anos, média de 57 anos. Foram analisados os achados da videoendoscopia de deglutição (VED) nas consistências líquida (N=18), líquida espessada (N=19) e pastosa (N=20) no volume de cinco ml. Os achados sobre escape oral posterior, resíduos faríngeos, penetração laríngea e/ou aspiração foram comparados nas três consistências de alimento e a análise estatística utilizou o teste ANOVA de Friedman. **Resultados:** Não foi encontrada alteração na sensibilidade laríngea nessa população. Não houve diferença estatística significativa entre as consistências de alimento na presença de escape oral posterior, penetração e/ou aspiração. Houve diferença estatística significativa somente com resíduos faríngeos na consistência líquida espessada e pastosa na ELA. **Conclusão:** Dentre os achados videoendoscópicos da deglutição na ELA, somente o resíduo faríngeo teve maior frequência na dependência da consistência de alimento.

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INTRODUCTION

Oropharyngeal dysphagia is a swallowing disorder that may cause pneumonia, malnutrition and dehydration in different neurological diseases⁽¹⁻⁴⁾. In view of the presence of these complications due to dysphagia, it is extremely relevant for professionals in different health areas to screen for oropharyngeal dysphagia so that the patients may be referred to a specialist on a timely basis. In addition, the access to different methods for the assessment of oropharyngeal dysphagia has become a determinant factor for the understanding of the biomechanics of swallowing and for the definition of therapeutic strategies for dysphagic individuals⁽⁵⁾.

Neuromuscular diseases (NMD) are a group of disorders that can modify the swallowing pattern and that are characterized by impairment of the motor component and by a change of the cell body of superior or inferior motor neurons, or both⁽¹⁾. The diseases belonging to this group manifest in different clinical ways, causing muscle weakness, fasciculations, atrophy, and atonia among others impairments. Among NMD, amyotrophic lateral sclerosis (ALS) is one of the most frequent diseases, characterized by impairment of superior and/or inferior motor neurons. This disease is classified as a progressive degenerative neuromuscular disorder due to changes in motor neuron cells not only in the brainstem, but also in the medulla and in the corticospinal and bulbar pathways, which are responsible for the control of voluntary movements⁽⁶⁾. The different degrees of motor neuron degeneration provoke changes in the muscles controlled by them, causing damage to all phases of swallowing⁽⁷⁾.

Thus, oropharyngeal dysphagia is present in different stages of ALS, leading to impairment of the safety and efficiency of swallowing and compromising the offer of food by the oral feeding⁽⁸⁾.

Impairment of the swallowing phases in ALS has been reported in some studies conducted using different methods and regardless of food consistency⁽⁹⁾. In the initial phase of ALS, even with no complaint by affected individuals, oropharyngeal dysphagia is a frequent symptom characterized by difficulty in the oral propulsion of food, which is still safe even though it may compromise the level of food intake by the oral feeding. Progressive paralysis of the tongue is common in ALS and is much faster in bulbar ALS, affecting the preparatory oral phase and the oral phase. The result is severe impairment of food bolus propulsion, with difficulty in the choice of food consistency for a more efficient oral ingestion⁽¹⁾. Some studies have also emphasized that the pharyngeal phase is the most affected one, with the occurrence of laryngeal penetration or laryngotracheal aspiration⁽¹⁰⁾.

Even though current studies emphasize the presence of changes in the oral and pharyngeal phases of food intake in ALS, it is of fundamental importance for evidence-based practice to be aware of the frequency of these findings according to the consistency of ingested food in order to avoid the use of generalized conducts.

Some studies have pointed out the difficult management of pharyngeal residues in ALS because of difficulty in oral ejection and weak pharyngeal motility, with an increased risk of laryngeal penetration and/or aspiration⁽¹¹⁾. Another relevant aspect of the comparison of swallowing findings when using different food consistencies in ALS is the management of dysphagia, which requires constant modification of food consistency in order to permit oral intake as much as possible although without compromising the efficiency of oral ingestion and the safety of swallowing.

Thus, the objective of the present study was to compare the videoendoscopic findings of swallowing using different food consistencies in patients with ALS.

METHODS

The present study is part of a research project approved by the Research Ethics Committee of the institution (protocol no. 176/2009). All subjects or their legal representatives gave written informed consent to participate in the study.

This was a clinical study conducted on a convenience sample. Twenty Fiberoptic Endoscopic Evaluation of Swallowing (FEES) reports were analyzed. The procedures were performed by an otorhinolaryngologist and a speech pathologist at a reference service for the diagnosis and rehabilitation of oropharyngeal dysphagia. The study subjects, 13 males and 07 females ranging in age from 34 to 78 years (mean: 57 years), had a diagnosis of ALS, with no restrictions regarding type of disease or duration. FEES was performed by the same otorhinolaryngologist according to the protocol of the Outpatient Clinic of Otorhinolaryngology and Oropharyngeal Dysphagia of the Rehabilitation Center, São Paulo State University-UNESP, Marília Campus.

FEES was performed using a Pentax® nasofibroscope coupled to a Pentax® light source, model LH-150 PC. The images of the entire exam were visualized on the monitor using the image capture Zscan 6.0 software.

For the exam, the participant was instructed to remain seated while the device was introduced into the more pervious nasal fossa without the use of a topical anesthetic in order to avoid changes in local sensitivity. The nasal, pharyngeal and laryngeal cavities were evaluated by observing the vocal folds during the sound emission of the vowel /i/. Laryngeal sensitivity was tested by touching the bilateral aryepiglottic folds and the arythenoid folds with the distal tip of the nasofibroscope.

Foods of standardized consistencies, i.e., pureed, thickened liquid and liquid, were used in the videoendoscopic study of swallowing. Since 2015, the terminology used levels 2, 1 and 0, respectively, based on the International Dysphagia Diet Standardization Initiative (IDDSI)⁽¹²⁾.

Posterior oral spillage, pharyngeal residues and laryngotracheal penetration and/or aspiration were recorded for data collection. In the present study, posterior oral spillage was defined as the occurrence of anticipated oral spillage of the food bolus towards the hypopharynx beyond the region where the pharyngeal response should occur⁽¹³⁾. Pharyngeal residues were defined as the permanence of contrasted material in the valleculae and

pyriform sinuses after the second deglutition⁽¹⁴⁾. Laryngeal penetration was defined as the entire material being located above the vocal fold and laryngotracheal aspiration was defined as passage of the material below the level of the vocal fold⁽¹⁵⁾. For statistical analysis, the subjects were divided into three groups according to the consistencies tested in a 5 ml volume, i.e., pureed food (N=20), thickened liquid (N=19), and thin liquid (N=18). Data were analyzed statistically by Friedman ANOVA.

RESULTS

No impairment in laryngeal sensitivity was observed in the present study.

Table 1 compares the videoendoscopic findings regarding swallowing of the food consistencies in ALS. The swallowing findings studied were observed with the use of all food consistencies, although a significant difference was detected only for the presence of pharyngeal residues.

Table 1. Comparison of the swallowing videoendoscopy results obtained with different food consistencies in ALS

Findings	Liquid (N=18)	Thickened Liquid (N=19)	Pureed (N=20)	P value
Posterior Oral Spillage	N=10 (55%)	N=10 (52.6%)	N= 10 (50%)	p= 0.47
Pharyngeal Residues	N=4 (22.2%)	N=8 (42.1%)*	N=8 (40%)*	p=0.018*
Laryngeal Penetration	N=7 (38.8%)	N=5 (26.3%)	N=6 (30%)	p=0.513
Laryngotracheal Aspiration	N=3 (16.6%)	N=1 (5.2%)	N=1 (5%)	p=0.36

*= Statistically significant value

Capiton: ALS: Amyotrophic Lateral Sclerosis

DISCUSSION

Although oropharyngeal dysphagia is a frequent symptom in ALS, the impairment of swallowing is worse in more advanced stages of the disease or according to disease type^(8,10). A recent study has shown that, the worse the motor performance in NMD, the higher the risk of penetration and aspiration⁽¹⁶⁻¹⁸⁾. Because this impairment of swallowing is more marked in the more advanced stages of the disease or according to NMD type, the changes in swallowing are less extensively investigated in the initial stage of the condition, with a consequent generalization of conducts. In addition, ALS patients are less studied than all other populations with oropharyngeal dysphagia and the literature reports detected did not compare impairments in oropharyngeal transit between different food consistencies⁽¹⁶⁾.

In the present study, no impairments in laryngeal sensitivity were detected in NMD. The absence of this finding was already expected in this population, in contrast to what has been reported regarding oropharyngeal dysphagia after a cerebrovascular accident (CVA)^(19,20), since the mechanisms of general sensitivity of the mucosa in the region of the larynx and hypopharynx are preserved in neuromuscular diseases. The laryngeal sensitivity impairment after a CVA, for example, compromises the mechanisms of protection of the lower airway and is correlated with penetration and tracheal aspiration, representing one of the aspects that explain the presence of aspiration in this population⁽²⁰⁾. Thus, the presence of penetration and aspiration in ALS should not be attributed to sensory questions, also because it is a muscular disease, but rather to the other aspects of the biomechanics of swallowing.

Posterior oral spillage also frequently occurred, with no significant difference between food consistencies. Previous

studies have also reported that posterior oral spillage of foods of any consistency is a frequent occurrence among ALS patients due to progressive paralysis of the tongue which compromises the oral propulsion of the food bolus and the consequent trigger of the pharyngeal response^(1,4,7).

The presence of laryngeal penetration and laryngotracheal aspiration also revealed no statistically significant difference between food consistencies in this population. Although some studies on ALS have reported a frequent presence of penetration and aspiration, in the present study this frequency was low compared to all other findings⁽²¹⁾. However, it should be pointed out that this was a convenience sample in which the type and stage of ALS were not identified. This limits the comparison to other studies since these two aspects of ALS greatly interfere with the biomechanics of swallowing. In addition, this finding was no frequent but was found with all food consistencies, whereas in some base diseases these findings are more frequent with liquid food^(22,23). On the other hand, although not frequent compared to the others swallowing findings, the presence of these signals represents a risk for pulmonary damage and should always be considered of importance within the context of manage and intervention.

The only significant result detected in this study when comparing the swallowing of the different food consistencies in ALS was a more significant presence of pharyngeal residues after the deglutition of thickened liquid and pureed food compared to thin liquid. The high frequency of pharyngeal residues in this population has been reported in previous studies and has been attributed to the serious impairment of the muscle component in this population, which reduces the strength of oropharyngeal contraction and pharyngeal clearance^(10,24). Thus, since ALS is progressive, we do know that oropharyngeal dysphagia is due

to the degeneration of the entire oropharyngeal musculature, causing progressive weakness of the structure involved in deglutition. This, in turn, causes changes in the dynamics of anteroposterior propulsion of the food bolus, reducing the elevation of the tongue base and laryngeal elevation. These pathophysiology involve a progressive impairment of the oral and pharyngeal phase of swallowing, causing residues after deglutition, laryngeal penetration and tracheal aspiration in this population^(25,26).

Thus, even though the pureed and thickened liquid food consistencies can be considered to be the safest ones for patients with some other neurological diseases, it is of fundamental importance to remember that the present sample of ALS patients was the one that most frequently produced pharyngeal residues, a fact that may potentiate the risk of aspiration⁽²⁷⁾.

An aspect of the present study to be considered and adjusted in future investigations is that it was conducted on a convenience sample. In this sample, the population with ALS was heterogeneous, involving both the bulbar and the skeletal forms, thus preventing better clarification about exactly which type or stage of ALS involved the highest prevalence of each swallowing finding. Thus, we suggest caution in clinical practice so that patients that would be able to oral feeding in an efficient manner regarding the nutrient component and safety will not receive a modified food consistency because some of these individuals showed risks during a determined disease stage and when receiving a determined food consistency.

CONCLUSION

Among the swallowing vidoendoscopy findings in ALS, only pharyngeal residues were more frequent according to food consistency.

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Author contributions

MMG: data collection, paper writing and editing; BNM: data collection; PCC: contribution to paper writing and editing and data collection; SMMO: data collection; RGS: study design, critical review and orientation.