Audiology - Communication Research
ISSN: 2317-6431
Academia Brasileira de Audiologia

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Audiology - Communication Research, vol. 25, e2231, 2020
Academia Brasileira de Audiologia

DOI: 10.1590/2317-6431-2019-2231

Disponível em: http://www.redalyc.org/articulo.oa?id=391562666032

Original Article

https://doi.org/10.1590/2317-6431-2019-2231

Audiology Communication Research
ISSN 2317-6431

Oropharyngeal dysfunction and frequency of exacerbation in Chronic Obstructive Pulmonary Disease patients with exacerbating phenotype

Disfagia orofaríngea e a frequência de exacerbações em pacientes com Doença Pulmonar Obstrutiva Crônica com fenótipo exacerbador

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ABSTRACT

Purpose: To assess whether there is an association between the presence of oropharyngeal dysphagia and the frequency of exacerbations in patients with chronic obstructive pulmonary disease (COPD). **Methods:** This is a cross-sectional study. Patients with COPD (forced expiratory volume in the first second [FEV_1] / forced vital capacity [FVC] <0.7 after bronchodilator use) were recruited, with no exacerbation of symptoms in the last six weeks, who underwent outpatient follow-up and answered the questionnaire of self-assessment for risk of dysphagia. In addition, they underwent clinical and videofluoroscopic evaluation of swallowing. **Results:** Twenty-seven patients diagnosed with COPD answered the self-assessment questionnaire and underwent the clinical evaluation of swallowing. Eighteen (66.7%) underwent instrumental evaluation through the videofluoroscopy exam. The mean age was 62.7 years, with the majority of females (63%) and more than half of patients (70.4%) having an exacerbator phenotype. A significant association (p = 0.039) was observed between patients diagnosed with dysphagia and the number of exacerbations in the last year. **Conclusion:** The presence of oropharyngeal dysphagia should be considered in patients with COPD presenting an exacerbator phenotype.

Keywords: Deglutition; Deglutition disorders; COPD; Exacerbation; Speech, Language and hearing Science

RESUMO

Objetivo: Avaliar se existe associação entre a presença de disfagia orofaríngea e a frequência de exacerbações em pacientes com doença pulmonar obstrutiva crônica (DPOC). **Métodos:** Estudo transversal, para o qual foram recrutados pacientes com DPOC (Volume expiratório forçado no 1º segundo [VEF_1]/Capacidade vital forçada [CVF] <0,7 após uso de broncodilatador), sem exacerbação dos sintomas nas últimas seis semanas, que realizavam acompanhamento ambulatorial e responderam ao questionário de autoavaliação para risco de disfagia. Além disso, foram submetidos à avaliação clínica e videofluoroscópica da deglutição. **Resultados:** Vinte e sete pacientes com diagnóstico de DPOC responderam ao questionário de autoavaliação e realizaram a avaliação clínica da deglutição. Dezoito (66,7%) foram submetidos à avaliação instrumental por meio do exame de videofluoroscopia. A média de idade dos pacientes avaliados foi de 62,7 anos, sendo a maioria mulheres (63%), e mais da metade dos pacientes (70,4%) possuía fenótipo exacerbador. Observou-se associação significativa (p=0,039) entre os pacientes com diagnóstico de disfagia e o número de exacerbações no último ano. **Conclusão:** A presença da disfagia orofaríngea deve ser considerada nos pacientes portadores de DPOC que apresentam o fenótipo exacerbador.

Palavras-chave: Deglutição; Transtorno de deglutição; DPOC; Exacerbação; Fonoaudiologia

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Conflict of interests: No.
Authors' contribution: All authors participated directly in the planning, execution or analysis of the study, as well as in the reading and approval of the final version. SRF participated in the idealization of the study, execution, analysis and interpretation of data and writing of the article; PJZT co-supervisor, participated in the analysis and interpretation of data and writing of the article; MCAFC advisor, participated in the idealization of the study, analysis and interpretation of data and writing of the article.
Funding: None.
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Received: August 19, 2019; **Accepted:** January 27, 2020

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is characterized by progressive airflow obstruction, irreversible or partially reversible, which presents episodes of symptomatic worsening, of variable frequency and severity, called exacerbations. These exacerbations are related to worsening quality of life, rapid decline in lung function, hospital admissions, high use of health resources and increased risk of death[1-3].

Among the various clinical phenotypes of the disease, the exacerbating phenotype is defined by the occurrence of two or more exacerbations in the last year, or one that has required hospitalization[4]. This phenotypic characteristic is so important that, currently, along with the intensity of dyspnea, defines the stage of the disease and guides the pharmacological treatment[1].

COPD patients have a high prevalence of gastroesophageal reflux disease (GERD) when compared to individuals without obstructive disease. Besides that, there is an association between GERD and exacerbations. The risk of patients with COPD having an episode of exacerbation increases sevenfold in patients with GERD[3].

The disturbance that occurs in the ventilatory dynamics of the COPD can impair the synchrony between breathing and swallowing processes, leading to a disturbance in the food bolus transportation, known as oropharyngeal dysphagia. When compared to normal individuals, in which swallowing occurs during the expiratory phase, patients with impaired respiratory mechanics are more likely to swallow the bolus during inspiration, increasing the risk of laryngotracheal aspiration and, consequently, contributing to accelerated deterioration of the ventilatory function[5,6].

Considering that GER is a risk factor for exacerbations and the few studies evaluating oropharyngeal dysphagia, the aim of the present study was to evaluate the occurrence of oropharyngeal dysphagia in patients with COPD and its association with the exacerbating phenotype.

METHODS

This is a cross-sectional study approved under registration No. 1,541,638 by the Human Research Ethics Committee of Irmandade Santa Casa de Misericórdia de Porto Alegre (ISCMPA). We recruited COPD patients who underwent outpatient follow-up at the Pulmonology Service of ISCMPA. All participants signed the Free and Informed Consent Form.

The inclusion criteria were: diagnosis of COPD confirmed by spirometry (forced expiratory volume in the first second [FEV_1]/forced vital capacity [FVC] <0.7 post-bronchodilator), in stable clinical conditions (without exacerbation of symptoms in the last six weeks), who were fed exclusively orally. Exclusion criteria were: Subjects with neurological disorders, other respiratory disorders, head and neck cancer and without clinical conditions to perform the speech-language assessment.

The participants answered a self-assessment questionnaire for risk of dysphagia[7], called *Eating Assessment Tool* (EAT-10). The EAT-10 is an instrument composed of ten questions of simple formulation, which provide information on functionality, emotional impact and physical symptoms that a swallowing problem can cause in an individual's life.

The speech-language evaluation was constituted by an anamnesis, which looked for signs and symptoms related to the difficulty of swallowing, followed by the functional evaluation of swallowing, through the ingestion of food in the pasty consistencies (petit suisse yogurt), liquid and solid, finishing with the classification of the swallowing disorder severity. For the pasty consistency, three offers of yogurt were made in 5 mL disposable plastic spoons; for the liquid, a free sip of 100 mL of water was used in a regular glass and; for the solid, a medium piece of bread.

All participants were positioned seated and monitored for oxygen saturation using pulse oximetry with a Morefitness® oximeter. Subsequently, patients were classified according to the Dysphagia Risk Evaluation Protocol (DREP)[8], which classifies dysphagia as mild, mild-moderate, moderate, moderate-severe and severe.

To assess the level of functionality, we used the Functional Oral Intake Scale (FOIS)[9], described in seven different levels of oral intake, classifying the level of functionality in: level 1 - No oral intake; level 2 - Tube-dependent with minimal attempts of food or liquids; level 3 - Tube-dependent with consistent oral intake of food or liquids; level 4 - Total oral diet of a single consistency; level 5 - Total oral diet with multiple consistencies but requiring special preparations or compensations; level 6 - Total oral diet with multiple consistencies without special preparation but with specific food limitations; level 7 - Total oral diet with no restrictions.

All subjects were referred for instrumental evaluation through swallowing videofluoroscopy. The swallowing videofluoroscopy examination was performed in the radiology sector of ISCMPA, according to its routine methodology, by the speech therapist hired by the service, blinded to the diagnosis of the clinical evaluation. The fluoroscopy equipment was an *Axiom Iconos r100*, *Siemens Medical Systems Forchheim*, *Germany,* interconnected with an image capture and recording system. The subjects were positioned at 90º, with the image captured in the profile position.

The oral, pharyngeal and esophageal swallowing phases were analyzed, offering the pasty, liquid and solid consistencies contrasted with barium sulfate. For each 20 mL of food, 20 mL of barium sulfate were inserted.

The examination conclusion was established by the *Dysphagia Outcome and Severity Scale* (DOSS), proposed by O'Neil et al.[10], which predicts the level of independence for feeding, classified in: level 7 - Normal swallowing; level 6 - Within functional limits/modified independence; level 5 - Mild dysphagia; level 4 - Mild/moderate dysphagia; level 3 - Moderate dysphagia; level 2 - Moderately severe dysphagia and level 1 - Severe dysphagia.

Clinical information was obtained from medical records regarding the frequency of exacerbations, severity of the disease, smoking index and the result of the spirometry test.

Quantitative variables were described as mean and standard deviation (symmetric distribution), or median and interquartile range (asymmetric distribution), depending on the data distribution. Categorical variables were described by absolute and relative frequencies.

To compare means, we used the Student's t test for independent samples. In case of asymmetry, the Mann-Whitney test was used. To compare proportions, Pearson's Chi-square or Fisher's Exact tests were applied. Associations between continuous and ordinal variables were assessed by Pearson or Spearman

correlation coefficients, respectively. The agreement between the evaluations was performed using the Kappa coefficient, being considered poor <0.20; reasonable from 0.20 to 0.39; moderate from 0.40 to 0.59; good from 0.60 to 0.79 and very good> 0.80. The level of significance adopted was 5% (p <0.05) and the analyzes were performed using the SPSS program, version 21.0.

RESULTS

Twenty-seven patients diagnosed with COPD by the criteria of the Global Initiative for Chronic Obstructive Lung Disease - GOLD (FEV_1/FVC <0.7 after bronchodilator use) responded to the dysphagia risk self-assessment questionnaire and underwent the clinical evaluation of swallowing. Eighteen (66.7%) participants underwent instrumental evaluation using the videofluoroscopy exam.

The sample consisted of a majority of women (63%), with a mean age of 62.7 ± 13.4 years. Information regarding the baseline characteristics of subjects, such as smoking index, functional impairment of the disease, episodes of exacerbations and spirometry tests are shown in Table 1. FEV_1 with a median of 29.2% pointed to the fact that most patients were in the very serious spirometric classification.

More than half of the patients (70.4%) had the exacerbating phenotype, that is, they had two or more exacerbations in the previous year. The EAT-10 showed that 48.1% of the patients had a score equal to or greater than 3, a score that suggested continuing with the complementary assessment.

In the clinical evaluation, 6 (22.2%) participants had mild dysphagia and only 1 (3.7%) had mild / moderate dysphagia. Two (7.4%) participants achieved level 5 on the FOIS scale, characterized by a diet with multiple consistencies that requires special preparation or compensation. Any result other than level 7 is considered as alteration. The results of the scales used in swallowing assessments are shown in Table 2.

Table 1. Baseline characteristics of subjects (n=27)

Characteristics	*Values*
Age (years) mean (min-max)	62.7(39-85)
Female (n,%)	17(63)
Smoke index (packs/year) - median (P25-P75)	34.5 (23.8 - 66.3)
***Pulmonary function* (mean±SD)**	
FVC (L)	2.08±0.79
FVC (% predicted)	62.58 (±21.39)
FEV_1 (L) - median (P25-P75)	0.76 (0.5-1.11)
FEV_1 (% predicted) - median (P25-P75)	29.2 (19.8-46.4)
Exacerbations	
Median per year (episodes) (P25-P75)	3 (1-4)
≥ 2 in the last year, n (%)	19(70.4)
<2 in the last year, n (%)	8 (29.6)
COPD spirometric classification (n=24)	
GOLD I	1
GOLD II	3
GOLD III	7
GOLD IV	13

Subtitle: min = minimal; max = maximal; n = number of subjects; % = percentage; P = percentile; SD = standard deviation; FVC = forced vital capacity; FEV_1 = forced expiratory volume in the first second; L = liters; COPD = chronic obstructive pulmonary disease; GOLD = *Global Initiative for Chronic Obstructive Lung Disease*

There was a moderate and statistically significant agreement between the classification of the FOIS and DREP scales (Kappa = 0.49; p <0.001) in the clinical evaluation, as shown in Table 3.

For analysis purposes, patients with normal and functional swallowing were grouped. As there was moderate and significant agreement between the scales of clinical swallowing assessment, the DREP classification was used to assess its performance, considering videofluoroscopy as the gold standard, to later verify the association with the number of exacerbations.

The number of exacerbations in the last year was related to the clinical evaluation. It was observed that patients with a greater number of exacerbations had a tendency towards a greater possibility of dysphagia (p = 0.081), as shown in Figure 1.

Among the 18 patients who underwent the videofluoroscopy exam, mild dysphagia was detected in 3 (16.7%). Also for analysis purposes, those with normal and functional swallowing were grouped. Patients diagnosed with dysphagia by videofluoroscopy had a greater number of exacerbations in the last year (p = 0.039;) median = 5), as seen in Figure 2.

The median number of exacerbations in the group of patients under the age of 60 was 3 (P25-P75: 2-4) and the median in the group aged 60 or over was 2 (P25-P75: 1-4), with no significant difference between age groups (p = 0.202). There was also no significant association between the age group and the clinical evaluation (p = 0.604), nor with the results of videofluoroscopy (p = 1,000).

DISCUSSION

The present study showed a significant association between oropharyngeal dysphagia detected by videofluoroscopy and the number of exacerbations. When the diagnosis of oropharyngeal dysphagia was only clinical, a tendency towards this association was observed. Exacerbations of COPD are an important part of the natural history of the disease[11], and when frequent, can worsen quality of life, accelerate the progression of the disease

Table 2. Swallowing assessments and videofluoroscopy (n=27)

Assessment	*Values*
EAT-10 (n,%)	
≥ 3	13 (48.1)
< 3	14 (51.9)
DREP (n,%)	
Normal	13 (48.1)
Functional	7 (25.9)
Mild dysphagia	6 (22.2)
Moderate dysphagia	1 (3.7)
FOIS (n, %)	
Level 7	19 (70.4)
Level 6	6 (22.2)
Level 5	2 (7.4)
Videofluoroscopy *(n=18) (n, %)*	
Level 7	1 (5.6)
Level 6	14 (77.8)
Level 5	3 (16.7)

Subtitle: *EAT-10 = Eating Assessment Tool*; n = number of subjects; % = percentage; DREP = Dysphagia Risk Evaluation Protocol; *FOIS = Functional Oral Intake Scale*

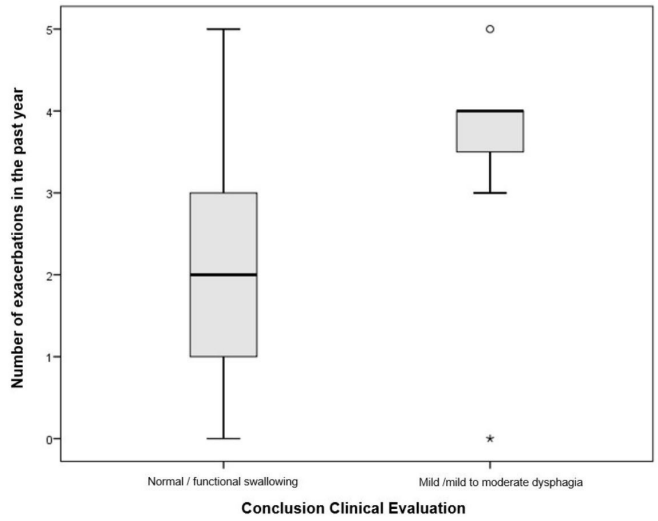

Figure 1. Association between the number of exacerbations and the clinical evaluation (*Dysphagia Risk Evaluation Protocol*); *approaching significance

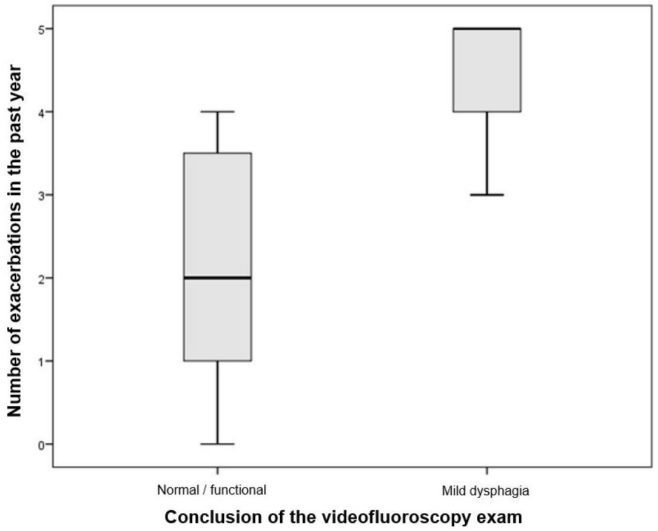

Figure 2. Association between the number of exacerbations and the videofluoroscopy

Table 3. Agreement between the Functional Oral Intake Scale (FOIS) and the Dysphagia Risk Evaluation Protocol (DREP) (n=27)

FOIS	*DREP*		
	7 (normal)	6 (functional)	4/5 (mild dysphagia)
7 (normal)	13 (68.4%)	5 (26.3%)	1 (5.3%)
6 (functional)	0 (0%)	2 (33.3%)	4 (66.7%)
5 (mild dysphagia)	0 (0%)	0 (0%)	2 (100%)

Subtitle: *FOIS = Functional Oral Intake Scale*; DREP = Dysphagia Risk Evaluation Protocol

and lead to early death. In addition, they represent a considerable economic burden[1,3]. Therefore, the recognition of all possible factors that contribute to the occurrence of exacerbations is of extreme importance.

Studies have reported that chronic obstructive pulmonary disease has the ability to alter the coordination between swallowing and breathing, due to dyspnea and dysfunctions in respiratory biomechanics. This fact negatively influences the normal swallowing process[6,12,13], since these patients do not adequately perform swallowing apnea, impairing the protective reflex of the upper airways, increasing the risk of aspiration[14,15].

The relationship between breathing and swallowing processes in COPD has been confirmed in the literature, with studies showing that the lack of coordination between these events can be a factor that causes the disease to worsen in some individuals[5,14,16]. The presence of dysphagia, with consequent laryngeal aspiration, can trigger the exacerbation of COPD[5,12,13]. A recent study showed that 78% of patients with stable COPD were clinically at risk of dysphagia[17], while another study pointed out that patients with the disease in an exacerbated state, with decompensated respiratory condition, had swallowing difficulties, with risk of aspiration and clinical worsening[18].

In our study, most patients (70.4%) had two or more exacerbations in the last year. Most of them also had a GOLD III and IV spirometric classification, constituting a group with greater disease severity. Furthermore, it was observed that patients under the age of 60 years had a greater number of exacerbations in the last year. However, it was not possible to observe a significant association between the age group and the frequency of exacerbations. Elderly patients experience loss of skeletal muscle mass as part of the natural aging process, which may be even more pronounced in those with COPD, as a result of poor nutrition, sarcopenia and cachexia[19]. In a study conducted with 31 patients with a mean age of 65 years, 35.5% had a prevalence of dysphagia and 29% were at risk of aspiration, requiring the use of a probe for nutrition[20]. A recent study revealed that 44% of COPD patients hospitalized for exacerbation had, clinically, risk of swallowing disorders and in 17% of these patients, presented videofluoroscopic evidence of aspiration[21].

Our results demonstrate that patients with a high number of exacerbations have dysphagia. However, this association was not significant, probably due to the small sample size.

Regarding the self-assessment of the risk of dysphagia, almost half of the sample had a score indicating the need for further investigation of swallowing[7]. Recent studies have shown good reliability and validity in the use of the EAT-10 screening test to identify swallowing disorders, observing that the complaints reported by patients are indicative of the possibility of dysphagia[22-24].

Clinical evaluation is a way of identifying dysphagia, with easy, fast and low cost applicability. It makes possible to identify patients who need instrumental evaluation to better diagnose a possible swallowing disorder[25,26]. As a complement to the clinical evaluation, the FOIS scale was used. It is an assessment that indicates which type of diet would be adequate orally, given the clinical signs of dysphagia, helping to clarify and characterize which patients have a worse prognosis[27].

The moderate, but significant agreement found between the clinical assessment and the FOIS scale, reinforces the importance and need to perform the clinical assessment for the diagnosis of dysphagia. However, sometimes, clinical evaluation is not able to reveal sufficiently basic information for the identification of dysphagia. For example, in the case of silent aspiration[25], that needs instrumental exams to clarify the diagnosis and confirm the degree of impairment of the swallowing disorder[28].

Considering the significant moderate agreement between the DREP scale and the FOIS scale, we tested its accuracy against videofluoroscopy, which allows the observation of anatomical

structures and the dynamic analysis, in real time, of the events related to the different phases of swallowing[27]. Videofluoroscopy is an objective examination and directly analyzes the phases of the swallowing process, and is therefore considered the gold standard in the diagnosis of dysphagia and aspiration risk[27,29].

Our results show that the majority of the sample presented functional swallowing, and some patients mild dysphagia. Patients with stable COPD can often have spontaneous protection favored by adaptations or adjustments in sequential events, in order to support the respiratory changes of the disease, remaining closer to normality[6], resulting in functional swallowing[21]. However, individuals with COPD with changes in the swallowing biomechanics may not have dysphagia, however, they are more susceptible to pulmonary complications[14]. Thus, the assessment and diagnosis of swallowing disorders should be performed as soon as possible, favoring strategies for safe eating[15,20].

In mild dysphagia, changes may occur, such as retention of food in the oral and pharyngeal cavities, penetration of a consistency with effective whitening, delay in triggering the swallowing reflex and slight reduction in laryngeal elevation[8-10]. These difficulties may require minor changes in consistencies and protective maneuvers, as they increase the risk of aspiration[30]. Our results show that patients diagnosed with mild dysphagia, as indicated by videofluoroscopy, exacerbated more than twice in the last year. Currently, it is known that patients with COPD who present dysphagia symptoms related to changes in the coordination between swallowing and breathing may be more likely to develop pneumonia[16].

This study had some limitations. The individuals who participated in the research came from the same outpatient service, linked to the researchers' educational institution. For this reason, individuals from other institutions were not recruited. This fact, added to the low sample size and the small number of individuals who underwent videofluoroscopy, may limit the power to generalize the results of the study to other contexts. However, to the best of our knowledge, this was the first study to investigate the relationship between dysphagia and the exacerbating phenotype of COPD.

Further studies, with a larger sample size, using the videofluoroscopy exam, should be performed in patients with an exacerbating phenotype. In addition, future studies should perform reliability analysis for the FOIS and DREP scales, in order to guarantee the reproducibility of the data.

CONCLUSION

It was possible to observe an association between oropharyngeal dysphagia and the number of exacerbations in patients with COPD.

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