

Evaluation and classification of post-extubation dysphagia in critically ill patients.

Avaliação e classificação da disfagia pós-extubação em pacientes críticos.

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ABSTRACT

Objective: to identify factors associated with dysphagia in patients undergoing prolonged orotracheal intubation (pOTI) and the post-extubation consequences. **Methods:** 150 patients undergoing pOTI participated in the study, evaluated according to the deglutition functional level (American Speech Language - Hearing Association National Outcome Measurement System - ASHA NOMS), severity determination (The Simplified Acute Physiology Score - SOFA) and submitted to collection of variables age, mortality, days of orotracheal intubation, number of sessions to introduce oral diet, and days to hospital discharge. We grouped patients according to ASHA classification: 1 (levels 1 and 2), 2 (levels 3, 4 and 5) and 3 (levels 6 and 7). **Results:** the variables associated with impaired deglutition functionality were age ($p<0.001$), mortality ($p<0.003$), OTI days ($p=0.001$), number of sessions to introduce oral diet ($p<0.001$) and days to hospital discharge ($p=0.018$). Multiple comparisons indicated significant difference between ASHA1 and ASHA2 groups in relation to ASHA3 group. ASHA1 and ASHA2 groups had a lower SOFA score when compared with the ASHA3 group ($p=0.004$). Only 20% of ASHA1 patients and 32% of ASHA2 patients presented safe deglutition levels before discharge. **Conclusion:** factors associated with dysphagia in patients submitted to pOTI were age over 55 years and orotracheal intubation time (greater in the cases with worse deglutition functionality). The post-extubation consequences were increased mortality and length of hospital stay in the presence of dysphagia.

Keywords: Intensive Care Units. Intubation. Intratracheal. Deglutition Disorders.

INTRODUCTION

Over the past decades, the mortality rate of critical patients has decreased, largely due to technological advances^{1,2}. Thus, critically ill patients present higher rates of orotracheal intubation and remain longer in this condition³. Orotracheal intubation allows reduction of mortality rate, but prolonged mechanical ventilation (>48 hours) may contribute to swallowing changes, delaying reintroduction of oral ingestion⁴. According to the literature, almost 60% of patients submitted to prolonged orotracheal intubation (pOTI) in intensive care units (ICU) present dysphagia after extubation, and approximately 50% of these patients present bronchopulmonary aspiration³.

Dysphagia is the inability to effectively transfer food or fluids from the mouth to the stomach⁵. As described in the literature, although dysphagia is not a disease but a symptom of a disease or the consequence of a surgical intervention, it can lead to serious complications such as dehydration, malnutrition, food aspiration and even death^{3,6}. Endotracheal tubes can cause changes in the anatomy and physiology of the pharynx and larynx and cause direct trauma to the larynx, impacting the physiology of swallowing^{7,8}. Some studies report the association between dysphagia and bronchopulmonary aspiration with the duration of orotracheal intubation⁶⁻¹².

Previous studies indicate that critically ill patients who also have dysphagia are 73.9%

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more likely to remain hospitalized for more than seven days¹¹. Therefore, dysphagia has a significant impact on hospital stay time, which is an indicator of poor prognosis¹³. In addition, the literature also indicates that age (>55 years) and the presence of dysphagia after extubation increase mortality during hospitalization^{11,14,15}.

The objective of this study was to identify the factors associated with dysphagia in patients submitted to prolonged orotracheal intubation and the consequences of post-extubation dysphagia.

METHODS

We conducted an observational, cross-sectional study, through the collection of data from the medical records in an university hospital - University of São Paulo, Brazil, including patients admitted to ICUs who had been extubated. Participated in the study patients submitted to bedside swallowing evaluation by a speech therapist. The project was approved by the Ethics Committee for Analysis of Research Projects of HCFMUSP - Protocol nº 311.784.

The inclusion criteria adopted in the study were: 1) patients admitted to the different ICUs between January 2013 and January 2015; 2) submitted to pOTI for more than 48 hours; 3) undergoing bedside swallowing evaluation 24 to 48 hours after extubation; 4) with age ≥ 18 years; 5) displaying clinical and respiratory stability according to medical data; and 6) Glasgow Coma Scale score ≥ 14 points. The exclusion criteria were: 1) presence of tracheostomy; 2) history of neurological diseases; 3) history of previous dysphagia; and 4) history of surgical procedures involving the head and neck region.

We used the bedside swallow evaluation database to collect data from the study. In our hospital, the risk of bronchoaspiration is determined based on the Speech-Language Dysphagia Risk

Evaluation Protocol (DREP)¹³. Based on the study by Medeiros *et al.*¹⁴, who presented the results of DREP in the swallowing of 5ml of water, the following predictors of dysphagia were used: extraoral escape, multiple swallowing, altered cervical auscultation, altered vocal quality after swallowing, presence of coughing and/or gagging during and after water intake. We classified results as pass or fail, following the criteria below:

Extraoral escape: water does not escape from the lips, manages the bolus properly - pass; difficulty in managing the bolus, presence of fluid flow through the lips - fail;

Multiple swallowing: presence of a single swallowing per bolus - pass; presence of more than one swallowing per bolus - fail;

Cervical auscultation (the stethoscope is positioned on the lateral aspect of the junction between the larynx and the trachea, anterior to the carotid artery): presence of three characteristic swallowing sounds, that is, two clicks followed by an expiratory sound, indicating the bolus passage through the pharynx - pass; no sound or sound other than those described above - fail;

Voice quality: does not present changes in the first minute after swallowing - pass; the voice sounds bubbling ("wet") in the first minute after swallowing - fail;

Cough: no cough in the first minute after swallowing - pass; presence of cough (voluntary or not) followed or not by clearing during the first minute after swallowing - fail;

Choking: no choking after swallowing - pass; presence of choking during or after swallowing - fail.

We determined the deglutition functional level after the bedside swallowing assessment using a multidimensional tool that verifies the level of supervision required for feeding and the food consistencies indicated for each patient, assigning a

single number between 1 to 7 - American Speech-Language - Hearing Association National Outcome Measurement System (ASHA NOMS)¹⁶:

Level 1: the individual is not able to safely swallow anything orally. All nutrition and hydration are received through an alternative feeding route (eg, nasogastric catheter, gastrostomy);

Level 2: the individual is not able to safely swallow orally nutrition and hydration, but may ingest some consistency only in therapy with maximum and consistent use of clues. Alternative food route is required;

Level 3: alternative route of feeding is necessary, since the individual ingests less than 50% of nutrition and hydration orally; and/or swallowing is safe with moderate use of cues for use of compensatory strategies; and/or requires maximum dietary restriction;

Level 4: swallowing is safe, but often requires moderate use of cues for use of compensatory strategies; and/or the individual has moderate dietary restrictions; and/or still needs an alternative route of feeding and/or oral supplement;

Level 5: swallowing is safe with minimal dietary restrictions; and/or occasionally requires minimal clues for the use of compensatory strategies. Occasionally one can monitor oneself. All nutrition and hydration are received orally during the meal;

Level 6: swallowing is safe and the individual eats and drinks independently. Rarely needs minimal cues for the use of compensatory strategies. Often self-monitors oneself when difficulties occur. It may be necessary to avoid specific food items (eg, popcorn and peanuts); additional time for feeding may be necessary (due to dysphagia);

Level 7: the individual's ability to feed independently is not limited by the swallowing function. Swallowing is safe and effective for all consistencies. Compensatory strategies are used effectively when necessary.

To guarantee data reliability, all the speech-language pathologists responsible for the bedside swallowing assessment received specific training in the definition of the swallowing functional level. The swallowing functional level of was determined at the first clinical evaluation and at the dysphagia resolution or hospital discharge.

All patients in the study received individual treatment for swallowing rehabilitation until resolution of dysphagia or hospital discharge. The patients were attended by speech therapists with experience in the area of dysphagia and trained to apply the same treatment program.

To determine the severity of the patient, we used the information of the medical records of the Simplified Acute Physiology Score (SAPS)¹⁷, calculated at the patient's admission to the ICU. To determine the risk factors associated with dysphagia, were also included the following variables: age, mortality, number of OTIs, days of OTI, number of speech therapy sessions till the introduction of safe oral diet, and days to hospital discharge.

For the statistical analysis, we grouped the patients according to the swallowing functional levels: levels 1 and 2: ASHA1; levels 3, 4 and 5: ASHA2; levels 6 and 7: ASHA3.

We present the data descriptive analysis as mean, standard deviation and percentages. We used the Friedman and the Kruskal-Wallis tests for multiple comparisons between groups. We compared all qualitative data between groups using the Pearson Chi-square test and the Kruskal-Wallis test for multiple comparisons when necessary. We set the level of significance at 5% for all analyzes.

For the present study, patients who presented swallowing functional level on the ASHA NOMS scale of 6 or 7 at the time of dysphagia resolution or at hospital discharge were considered to have a positive result.

RESULTS

After applying the inclusion criteria, the study sample consisted of 150 patients. The diagnoses presented by the study participants were: 59 patients with pulmonary diseases; 18 patients with polytrauma without traumatic brain injuries; 12 patients undergoing renal or hepatic transplants; 11 patients with heart disease; ten patients with liver disease; ten patients with renal diseases; six patients with infectious diseases; five patients with gastroenterological diseases; five patients with rheumatologic diseases; and three patients with endocrine diseases.

The distribution of patients, according to the ASHA NOMS scale, was as follows: ASHA1: 38 patients; ASHA2: 61 patients; ASHA3: 51 patients. We compared the groups according to their demographic and clinical variables, as shown in table 1.

The results indicated a statistically significant difference for the following variables: age, mortality, OTI days, number of speech therapy sessions and days to hospital discharge. Statistical analysis by the Kruskal-Wallis test indicated that patients with ASHA3 functional deglutition level were significantly younger when compared with the other groups (ASHA1 - $p=0.001$; ASHA2 - $p=0.014$). There was no difference when comparing age between ASHA1 and ASHA2 ($p=0.096$). Low swallowing functional levels were associated with: mortality (ASHA1 vs ASHA2 - $p=0.158$; ASHA1 vs ASHA3 - $p<0.001$; ASHA2 vs ASHA3 - $p=0.019$); days of OTI (ASHA1 vs ASHA2 - $p=0.053$; ASHA1 vs ASHA3 - $p<0.001$; ASHA2 vs ASHA3 - $p=0.027$); ASHA1 vs ASHA2 - $p=0.004$, ASHA1 vs ASHA3 - $p<0.001$; ASHA2 vs ASHA3 - $p<0.001$); and days to hospital discharge (ASHA1 vs ASHA2 - $p=0.001$, ASHA2 vs ASHA3 - $p=0.045$).

We also compared the groups according to disease severity at ICU admission (Table 2).

Table 1. Demographic and clinical variables – comparison between groups.

	Swallowing functional level			p-value
	ASHA1 (n=38)	ASHA2 (n=61)	ASHA3 (n=51)	
Age in years (mean±SD)	17.0±62.0	55.3±17.5	46.45±18.3	<0.001*
Gender (male/female)	17/21	35/26	30/21	0.359
Mortality (total number and %)	10 (26.3%)	9 (14.7%)	1 (2.0%)	0.003**
Number of OTIs (mean±SD)	1.1±0.4	1.1±0.3	1.0±0.1	0.065
OTI days (mean±SD)	7.6±4.0	6.2±3.4	4.9±2.7	0.001*
Number of speech-language sessions (mean±SD)	11.4±4.1	6.8±4.8	2.3±1.3	<0.001*
Days of hospitalization (mean±SD)	24.5±15.3	18.1±16.0	13.2±12.9	0.018*

SD: standard deviation; OTI: orotracheal intubation; ASHA1: levels 1 and 2 at the American Speech-Language and Hearing Association National Outcome Measurement System (ASHA NOMS); ASHA2: levels 3, 4 and 5 in the ASHA NOMS; ASHA3: levels 6 and 7 in ASHA NOMS; *significant result according to the Friedman test; **significant result according to the Pearson's Chi-square test.

Table 2. Simplified Acute Physiology Score (SAPS) – comparison between groups.

	Swallowing functional level			<i>p-value</i>
	ASHA1 (n=38)	ASHA2 (n=61)	ASHA3 (n=51)	
SAPS Mean (\pm Sd)	67.2 (\pm 15.3)	62.6 (\pm 4.8)	55.5 (\pm 16.6)	0.004*

*SD: standard deviation; ASHA1: levels 1 and 2 in the American Speech-Language and Hearing Association National Outcome Measurement System (ASHA NOMS); ASHA2: levels 3, 4 and 5 in the ASHA NOMS; ASHA3: levels 6 and 7 in the ASHA NOMS; *significant result according to the Friedman test.*

For the statistical analysis by the Kruskal-Wallis test, the results indicated that the ASHA3 group presented lower scores in comparison with the ASHA1 group ($p=0.001$) and the ASHA2 group ($p=0.014$). We observed no difference between the ASHA1 and ASHA2 groups ($p=0.153$).

Table 3 presents the swallowing levels according to the ASHA NOMS scale after the speech-language pathology bedside evaluation and at the time of dysphagia resolution or hospital discharge.

Regarding the 38 individuals included in the ASHA1 group, we observed that 20% of them presented positive results after the speech-language intervention. When comparing the number of individuals classified as Level 1 on the ASHA NOMS scale in the speech-language pathology evaluation and at dysphagia resolution, we found an increase from three to seven patients. This increase is related to the following causes: three patients were reintubated, two died and one presented

worsening of the general state, with suspension of speech therapy. In the ASHA2 group ($n=61$), 32% of the patients presented positive results after the speech-language intervention. At the time of dysphagia resolution, we observed nine patients classified as Level 1 on the ASHA NOMS scale and the causes for the presentation of this swallowing level are the following: five patients were reintubated, two died and two presented worsening of the general state, with suspension of speech-language care. Patients included in ASHA3 ($n=51$) had already presented a safe swallowing in the speech-language pathology evaluation, but one patient presented a decline in general health status and required an oral dietary adjustment, being classified as Level 5 at the moment of dysphagia resolution.

DISCUSSION

The results presented in the study can be explained by several physiological and mechanical

Table 3. Results of the swallowing functional level of the ASHA NOMS.

Swallowing functional level	ASHA1 (n)		ASHA2 (n)		ASHA3 (n)	
	Initial	End	Initial	End	Initial	End
1	3	7	0	9	0	0
2	35	11	0	1	0	0
3	0	1	22	7	0	0
4	0	5	27	8	0	0
5	0	6	12	16	0	1
6	0	2	0	6	10	7
7	0	6	0	14	41	43

ASHA1: levels 1 and 2 in the American Speech-Language and Hearing Association National Outcome Measurement System (ASHA NOMS); ASHA2: levels 3, 4 and 5 in the ASHA NOMS; ASHA3: levels 6 and 7 in the ASHA NOMS.

factors. The literature indicates that age is a factor related to changes in swallowing^{7,11,18,19}. The aging process may have a negative impact on the swallowing function, which is a frequent problem in the elderly population¹⁹. It is estimated that up to 20% of individuals over 50 years of age and most individuals over 80 years of age have some degree of dysphagia²⁰. Changes in the swallowing physiology, such as loss of muscle mass and the elastic properties of connective tissue, may result in loss of muscle strength and mobility²¹. These changes can have a negative impact on swallowing efficiency and on airways protection. The age-related atrophy of the pharyngeal and laryngeal soft tissues may also be considered a contributing factor for swallowing alterations²². In addition, other factors such as changes in food preparation, increased number of swallows per bolus, and presence of food residues along the aerial-digestive tract, are also described in the population over 50 years of age²³.

The results presented in this study corroborate the literature, indicating the association between the severity of dysphagia and the presence of prolonged OTI²⁴. The association between OTI duration and dysphagia severity has been widely documented^{7,9,24-26}. Post-extubation dysphagia can result in aspiration, with the possible consequences of aspiration pneumonia, chemical pneumonitis, transient hypoxemia, bronchospasm or mechanical obstruction^{9,27}. The mechanisms of post-extubation dysphagia are multifactorial and include mechanical causes, cognitive disturbances, residual effects of medications used and sedation²³. The association between prolonged OTI and dysphagia is related to the impact of tube stay in the oral cavity, pharynx and larynx, as the swallowing reflex is triggered by the

chemoreceptors and/or mechanoreceptors located in the mucous membranes of these organs. These receptors may be altered due to the presence of the tracheal tube²³. The absence of coughing or gagging during the ingestion of liquids immediately after extubation, ie signs suggestive of laryngeal penetration, is cited in the literature as indicative of the inhibition of the larynx sensory abilities²⁸.

In the present study, mortality was higher in patients who presented more severe swallowing changes. Although there has been no investigation of the pneumonia etiology, it is known that bronchopulmonary aspiration is the main cause of infection acquired by critically ill patients in a hospital setting, with the consequent increase in mortality^{24,29}. Other factors, such as the patient's clinical severity, the Glasgow Coma Scale score and the presence of medical morbidities (eg, acute myocardial infarction, heart failure, chronic obstructive pulmonary disease, obstructive sleep apnea, pneumonia) should also be taken into account when analyzing mortality rates^{11,15,18,24}. A review by the National Hospital Discharge Survey pointed to a significant association between dysphagia and length of hospital stay and mortality¹¹.

Another important finding of our study was that only 20% of ASHA1 patients and 32% of ASHA2 patients achieved safe swallowing functional levels (ie, swallowing was classified as levels 6 or 7 of the ASHA scale NOMS) before hospital discharge. Macht *et al.*¹¹ reported that 66% of patients who were initially diagnosed with severe or moderate dysphagia persisted with this condition after hospital discharge. Therefore, our results corroborate the current literature, indicating that dysphagia, whether

severe or moderate, is associated with worse clinical outcomes, including longer hospital stay. The criteria adopted in our hospital (public, high-complexity facility, and high rate of bed rotation) determine the hospital discharge once the patients have stable clinical conditions. As observed in our results, for many of the cases, speech-language pathology rehabilitation was not completed during the patient's hospital stay. According to the Brazilian Health System, these patients were referred for speech-language follow-up in specialized rehabilitation centers.

The results of the present study suggest that the early diagnosis of dysphagia is paramount for critically ill patients undergoing prolonged OTI. In the literature, there is still no consensus on which patients are at risk for dysphagia. However, studies concerning the evaluation of swallowing have increased significantly in the last 20 years, as health professionals became more aware of the impact of dysphagia and bronchoaspiration on patients' general state and prognosis^{19,30}. Post-extubation dysphagia may result in malnutrition, longer hospital stay, increased health care expenditures, and increased mortality^{24,27}. As the extubated patients recover, the complications of a potential bronchoaspiration should be weighed against the consequences of delayed oral feeding resumption³⁰. Only with this information will it be possible to minimize complications, improve the quality of the existing treatments and elaborate guidelines that indicate which patients should be prioritized for swallowing evaluation.

Our study presented some limitations. Because it was performed in a single institution,

the results may be representative only of the local population. In addition, the proposed evaluation for the identification of dysphagia was based exclusively on an observational clinical protocol, and the diagnosis of dysphagia was not confirmed by an imaging examination. It is plausible to assume that part of the patients in our study at risk for bronchoaspiration was not precisely identified by the clinical bedside protocol³⁰. However, the use of a clinical protocol is valid, since safety issues in the transportation of the critical patient should be taken into account for the dysphagia gold-standard diagnostic exams (video endoscopy and deglutition video-fluoroscopy) and the lack of equipment and specialized professionals to perform these tests. Finally, our study did not investigate the long-term consequences of dysphagia due to prolonged OTI. Future studies at our institution should include this information, helping to mitigate the negative clinical and economic effects of dysphagia.

Our results suggest that the presence of post-extubation dysphagia is associated with age over 55 years, increased mortality rate and longer OTI time (up to six days). The presence of more severe signs of dysphagia is associated with a 50% increase in length of hospital stay. Our study also suggests a close association between patients' disease severity at ICU admission and low swallowing functional levels. In addition, the more severely ill patients are submitted to a greater number of speech-language sessions for the resolution of dysphagia, and most of them are discharged before completion of the rehabilitation process.

R E S U M O

Objetivo: identificar os fatores associados à disfagia em pacientes submetidos à intubação orotraqueal prolongada (IOTp) e as consequências pós-extubação. **Métodos:** participaram do estudo 150 pacientes submetidos à IOTp, avaliados segundo o nível funcional da deglutição (American Speech Language - Hearing Association National Outcome Measurement System - ASHA NOMS), a determinação da gravidade (The Simplified Acute Physiology Score - SOFA) e a coleta das seguintes variáveis: idade, mortalidade, dias de intubação orotraqueal, número de atendimentos para introdução da alimentação oral e dias para alta hospitalar. Os pacientes foram agrupados de acordo com a classificação do ASHA: 1 (níveis 1 e 2), 2 (níveis 3, 4 e 5) e 3 (níveis 6 e 7). **Resultados:** as análises indicaram as seguintes variáveis associadas a pior funcionalidade da deglutição: idade ($p < 0,001$), mortalidade ($p < 0,003$); dias de IOT ($p = 0,001$), número de atendimentos para introdução de dieta oral ($p < 0,001$) e dias para alta hospitalar ($p = 0,018$). As comparações múltiplas indicaram diferença significativa na comparação dos grupos ASHA1 e ASHA2 em relação ao grupo ASHA3. Os grupos ASHA1 e ASHA2 apresentaram menor score na SOFA quando comparados ao grupo ASHA3 ($p = 0,004$). Somente 20% dos pacientes do grupo ASHA1 e 32% dos pacientes do ASHA2 apresentaram níveis seguros de deglutição antes da alta hospitalar. **Conclusão:** os fatores associados à disfagia em pacientes submetidos à IOTp foram: idade acima de 55 anos e tempo de intubação orotraqueal (maior nos casos com pior funcionalidade da deglutição). As consequências pós-extubação foram: aumento da mortalidade e do tempo de internação hospitalar na presença da disfagia.

Descritores: Unidades de Terapia Intensiva. Intubação Intratraqueal. Transtornos de Deglutição.

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