Orotracheal intubation and dysphagia: comparison of patients with and without brain damage

Intubação orotraqueal e disfagia: comparação entre pacientes com e sem dano cerebral

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ABSTRACT

Objectives: To compare the swallowing and feeding abilities in extubated patients with and without brain injury. **Methods:** A retrospective study including 44 patients aged 20 to 50 years submitted to prolonged orotracheal intubation (> 48 hours). Two groups were analyzed: Group 1 composed of nontraumatic brain injury patients, and Group 2 composed of patients with traumatic brain injury. Two scales for characterization of functional swallowing and feeding abilities were used to compare both groups; the levels of alertness, awareness and patient collaboration were also assessed. **Results:** The groups were equal in age, number and time of orotracheal intubation and extubation on the date of the assessment. Regarding the speech and language diagnosis, Group 1 presented higher percentage of functional swallowing and mild dysphagia, while Group 2 showed higher rates of moderate to severe dysphagia and severe dysphagia. The Functional Oral Intake Scale average was higher in Group 1. In addition, the injured brain group was sleepier, less collaborative and had less contact in the first evaluation. **Conclusions:** In this study, patients who underwent prolonged orotracheal intubation had dysphagia in different degrees, but the patients with brain injury presented more frequent and severe disorder. Thus, this study suggested that orotracheal intubation cannot be considered as the single factor causing dysphagia, especially in neurological patients. Moreover, some cognitive factors may influence the possibility of providing oral feeding.

Keywords: Deglutition disorders; Intubation, intratracheal; Brain injuries

RESUMO

Objetivos: Comparar as habilidades de deglutição e alimentação entre pacientes extubados, com e sem dano cerebral. **Métodos:** Estudo retrospectivo, que incluiu 44 pacientes de 20 a 50 anos, submetidos à intubação orotraqueal (IOT) prolongada (> 48 horas). Foram analisados dois grupos, sendo o Grupo 1 composto por pacientes sem traumatismo crânio-encefálico (TCE) e o Grupo 2 de pacientes com TCE. Para a comparação, foram utilizadas duas escalas que caracterizaram as habilidades funcionais de deglutição e alimentação. Avaliou-se também o nível de alerta, consciência e colaboração dos pacientes. **Resultados:** Os grupos apresentaram-se equiparáveis quanto à idade, número e tempo de intubação e de extubação na data da avaliação. Em relação ao diagnóstico fonoaudiológico, o Grupo 1 apresentou maior porcentagem de deglutição funcional e disfagia leve, enquanto o Grupo 2 apresentou maior concentração das disfagias de grau moderado a grave e de grau grave. A média observada na Escala Funcional de Ingestão Oral na data da avaliação foi maior no Grupo 1. Além disso, o grupo de lesados cerebrais apresentou-se mais sonolento, menos contactuante e menos colaborativo na primeira avaliação. **Conclusões:** Neste estudo, os pacientes submetidos à IOT prolongada apresentaram disfagia em diferentes graus, porém os pacientes com dano cerebral tiveram maior freqüência e gravidade deste distúrbio. Desta forma, concluímos que a IOT não pode ser considerada como fator causador da disfagia isoladamente, principalmente nos pacientes neurológicos. Além disso, observou-se que alguns fatores cognitivos podem influenciar a possibilidade de ofertar dieta por via oral.

Descritores: Transtornos de deglutição; Intubação intratraqueal; Traumatismos encefálicos

INTRODUCTION

Literature frequently describes dysphagia resulting from lesions caused by orotracheal intubation (OI), a factor that can significantly contribute to the increased risk of

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aspiration after extubation. In general, prolonged time OI accounts for periods longer than 24 or 48 hours, with variations in some studies[1-6].

The reports of dysphagia associated with a neurological injury are also common[7-9]. It happens because several diseases of neurological origin can affect the neuronal structures controlling the complex mechanisms of oropharyngeal swallowing. According to León and Clavé[7], more than 30% of patients who suffered a stroke, 52 to 82% of patients with Parkinson disease, 100% of patients with amyotrophic lateral sclerosis, 44% of patients with multiple sclerosis, 84% of patients with Alzheimer's disease and more than 60% of institutionalized elderly patients present oropharyngeal dysphagia.

The patient with head trauma (HT), more specifically, may still present abnormalities of swallowing dynamics associated with cognitive and behavioral *deficits*, which may lead to a more difficult diagnosis and rehabilitation[10,11]. Other previous studies indicate that some factors, such as injury severity, cognitive and ventilation status can predict the functional results of swallowing in patients with HT[12].

Disregarding these findings and evaluating OI as an isolated factor for the development of dysphagia, some authors[3,13,14] include neurological patients in their studies, correlating the presence of dysphagia resulting from the use of endotracheal tubes and disregarding the consequences that may be related to the patient's own neurological picture.

Aiming to clarify and demystify this point of view, our purpose was to compare the abilities of swallowing and feeding in extubated patients with and without brain damage.

METHODS

A total of 44 patients were included in this study, according to the inclusion and exclusion criteria. Of those, 23 were classified in Group 1 (with nontraumatic brain injury) and 21 patients in Group 2 with traumatic brain injury (TBI). In Group 1, 43.5% of patients were female and 56.6% were male, while in Group 2, 14.3% of patients were female and 85.7% were male.

A retrospective study was carried out by means of analysis of medical records, evaluations performed by the speech therapy team at the intensive care and stepdown units at Instituto Central do Hospital das Clínicas da Faculdade de Medicina da Universidade de São Paulo (HC-FMUSP), from May 2007 to May 2008.

The inclusion criteria were patients aged 20 to 50 years who underwent OI for a period longer than 48 hours and whose assessment was performed between the first and fifth day after extubation.

Patients who met the inclusion criteria were divided into two groups, with Group 1 composed of patients without TBI and Group 2 composed of patients with TBI.

Patients with previous or current history of neurological abnormality were excluded from Group 1 and patients who presented other previous or current neurological disorders, not related to trauma, were excluded from Group 2.

The exclusion criteria for both groups comprised patients whose medical records did not provide enough data for the variables established; those whose initial assessment was inconclusive due to lack of data; who were assessed after the fifth day of extubation; who underwent more than three intubation procedures and patients with a previous or current history of tracheostomy, orofacial trauma and/or head and neck neoplasms.

Aiming to assess the sample homogeneity, the groups were compared in terms of age, number and duration of OI and duration of extubation on the date of assessment.

The Dysphagia Severity Scale (DSS), see Chart 1[15] and the Functional Oral Intake Scale (FOIS), see Chart 2[16] were used to compare the functional results of feeding.

We also analyzed the cognitive-behavioral screening which comprised the level of alertness, consciousness and collaboration of patients in the initial assessment, with the purpose of analyzing the possible influences of these factors in the results of the speech pathology assessment of deglutition.

The level of alertness was considered adequate when the patient presented awaken and alert, able to participate and decreased in the observation of description of the need of auditory and tactile stimulation to remain awaken, somnolence, eye closing or fluctuation of alertness during the assessment. The consciousness status was considered according to the oral and non-oral responses described; the patient was considered as able to contact when presenting satisfactory verbal or nonverbal communication with the investigator; with reduced ability to contact when engaging into some form of verbal or nonverbal communication with the investigator but with reduced frequency; unable to establish a contact when patient did not present any type of verbal or nonverbal communication with the investigator; and confused, when patient presented incoherent and confused talk and/or talked incessantly without focusing the attention[17,18]. The collaboration data were obtained directly from description of the speech pathology assessment in the medical record, and they were classified as collaborative, not much collaborative and non-collaborative[18].

Chart 1. Dysphagia Severity Scale (DSS)[15]

Level I: normal swallowing	Normal for both consistencies and in all items assessed. No strategy or extra time is required. Complete oral feeding is recommended.
Level II. Functional swallowing	It may be abnormal or altered, but it does not result in aspiration or reduced efficiency of deglutition, and it is possible to maintain appropriate nutrition and hydration via oral route. Thus, spontaneous compensation of mild difficulty is expected in at least one consistency, with no signs of risk of aspiration. Complete oral feeding is recommended, but it may be necessary to spend extra time for this task.
Level III: mild oropharyngeal dysphagia	Swallowing disorder is present, and speech therapists have to provide specific orientations during deglutition. Little changes in diet are required; spontaneous and efficient cough and/or throat clearing; mild oral alterations with adequate compensations.
Level IV: mild to moderate oropharyngeal dysphagia	Risk of aspiration, but reduced risk using therapeutic maneuvers and techniques. Need of sporadic supervision to perform therapeutic measures; signs of aspiration and restriction of one consistency; weak reflex cough and strong voluntary cough. Feeding time is significantly increased and nutritional supplementation is indicated.
Level V: moderate oropharyngeal dysphagia	Significant risk of aspiration. Oral feeding supplemented by alternative route, signs of aspiration for both consistencies. Patients may eat some consistencies using specific techniques to minimize the potential for aspiration and/or to enable swallowing, with supervision required. Absent or weak reflex cough.
Level VI: moderate to severe oropharyngeal dysphagia	Tolerance of only one consistency with maximal care for using strategies, signs of aspiration requiring multiple clearing, aspiration of two or more consistencies, absence of reflex cough, weak and ineffective voluntary cough. If the pulmonary condition of the patient is affected, it is necessary to withdraw oral feeding.
Level VII: severe oropharyngeal dysphagia	Impossibility of having oral feeding. Difficulty in recovering from choke; presence of cyanosis or bronchospasms; silent aspiration for two or more consistencies; ineffective voluntary cough; inability to start deglutition.

Chart 2. Functional Oral Intake Scale (FOIS)[16]

Level 1	Nothing through the mouth.
Level 2	Depending on tube with minimal attempts to provide food or liquid.
Level 3	Depending on tube with oral consistent intake of food or liquid.
Level 4	Total oral diet of one single consistency.
Level 5	Total oral diet with multiple consistencies, but requiring special preparation or compensations.
Level 6	Total oral diet with multiple consistencies with no special preparation, but with specific food limitations.
Level 7	Total oral diet with no restrictions.

Statistical analysis

This study used non-parametric statistical tests and techniques because the conditions for the use of parametric statistical tests and techniques, such as the normality and homoscedasticity were not found in this database.

The Mann-Whitney test was used for the analysis of quantitative results and the tests for equality of two proportions were used to compare the groups in the variables with qualitative results.

The Kruskal-Wallis test was used to compare more than two variables simultaneously by measuring only if there was any difference among the groups, although it did not conclude which group presented the difference.

In this study the significance level was defined at 0.05 (5%), and all confidence intervals were built with 95% of statistical confidence.

RESULTS

The clinical diagnoses found in patients of Group 1 were: sickle cell anemia, polytrauma, lymphoma, puerperal infection, urinary tract infection, acute respiratory failure, intoxication, pneumonia, pulmonary metastasis, hepatic cyst, pulmonary thromboembolism, uterine myomatosis with bleeding, acute abdomen, firearm injury in the lower limb, liver transplantation due to fulminant hepatitis and severe sepsis.

All patients in Group 2 presented TBI of different degrees confirmed by computed tomography of the head.

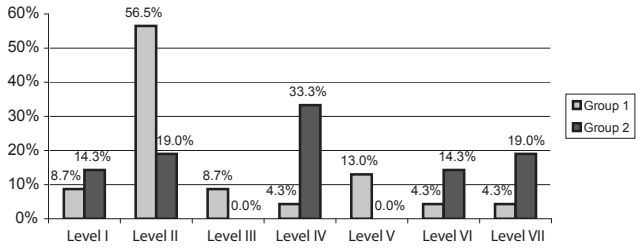
Table 1 depicts the results in terms of age, number and total duration of intubation and duration of extubation on the date of assessment; no statistically significant differences were seen between the groups.

Table 1. Analysis of sample homogeneity

Variables	Mean	Median	sd	CI	p value
Age					
Group 1	35.9	38	10.2	4.2	
Group 2	32.5	30	9.9	4.2	0.284
Orotracheal intubation time (days)					
Group 1	9.0	8	4.6	1.9	
Group 2	10.5	11	4.8	2.0	0.215
Number of orotracheal intubation					
Group 1	1.0	1	0.2	0.1	
Group 2	1.1	1	0.3	0.1	0.925
Extubation time (days)					
Group 1	2.3	2	1.5	0.6	
Group 2	2.6	2	1.5	0.6	0.566

sd = standard deviation; CI = confidence interval;

Speech pathology diagnosis was defined according to the DSS[15]. The results showed that Group 1 presented a higher percentage of functional swallowing and mild oropharyngeal dysphagia, while Group 2 showed a higher concentration of moderate to severe dysphagia and severe dysphagia (Graphic 1). Additionally, a significant difference was seen between the groups when the diagnoses of functional swallowing and severe oropharyngeal dysphagia were compared (Table 2).



Graphic 1. Distribution of dysphagia severity[15]

Table 2. Speech pathology diagnosis in the initial assessment according to the Dysphagia Severity Scale[15]

Speech pathology diagnosis	Group 1 (n = 23)		Group 2 (n = 21)		p value
	n	%	n	%	
Normal swallowing	2	8.7	0	0.0	0.167
Functional swallowing	13	56.5	4	19.0	0.011*
Mild oropharyngeal dysphagia	3	13.0	0	0.0	0.086
Mild to moderate oropharyngeal dysphagia	1	4.3	3	14.3	0.252
Moderate oropharyngeal dysphagia	2	8.7	3	14.3	0.560
Moderate to severe oropharyngeal dysphagia	1	4.3	4	19.0	0.125
Severe oropharyngeal dysphagia	1	4.3	7	33.3	0.013*

*p ≤ 0.05

The FOIS[16] indicated the possibility of oral intake on the date of assessment. According to the results, Group 1 presented better functional outcomes of oral intake when compared with Group 2 (Table 3).

Table 3. Results of the Functional Oral Intake Scale (FOIS)[16]

FOIS	Group 1	Group 2
Mean	4.0	2,1
Median	3	1
Standard deviation	2.0	1,7
CI	0.84	0,74
p value		0.001*

CI = confidence interval; *p ≤ 0.05

As to the assessment of the levels of alertness and consciousness, it was observed that the group of patients with brain injuries was significantly less alert, less interactive and less collaborative in the first assessment when compared with patients with no brain injury. The descriptive data are shown in Table 4.

Table 4. Comparing with cognitive-behavioral screening

Category	Group 1 (n = 23)		Group 2 (n = 21)		p value
	n	%	n	%	
Alertness					
awaken	22	95.7	14	66.7	
reduced	1	4.3	7	33.3	0.013*
Consciousness appropriate					
confused speech	18	78.3	3	14.3	<0.001*
unable to establish a contact	5	21.7	6	28.6	0.601
reduced ability to contact	0	0.0	7	33.3	0.003*
	0	0.0	5	23.8	0.013*
Collaboration					
collaborative	20	87.0	7	33.3	<0.001*
non collaborative	0	0.0	6	28.6	0.006*
not much collaborative	3	13.0	8	38.1	0.055#

*p ≤ 0.05; # p-value tends to be significant

Analyzing the influence of these aspects in the possibility of oral intake, we used the Kruskal-Wallis test to compare the result of the FOIS with the levels of consciousness and the degree of collaboration and a statistically significant difference was observed between these factors (Table 5). It should be emphasized that, for this analysis, no comparison between the groups was carried out.

DISCUSSION

The purpose of this study was to assess the differences between the groups of patients with and without neurological disorders, both groups previously undergoing OI, in terms of severity of dysphagia and possibility of oral intake. Initially, a comparative analysis between the groups was carried out for age, number of intubations, total duration of OI, time of extubation at assessment, and sample homogeneity was observed in terms of these variables. This homogeneity was expected to make the study results more reliable, due to a significant number of studies relating the swallowing abnormalities with prolonged OI pointing to the influence of age, number of OI, and time of extubation for speech pathology assessment in presence and severity of dysphagia[3,6,19,20].

Table 5. Comparing level of consciousness and degree of collaboration in the results of the Functional Oral Intake Scale (FOIS)[16]

FOIS	Level of consciousness				Degree of collaboration		
	Appropriate	Reduced ability to contact	Unable to esta0blish a contact	Confused	Collaborative	Not much collaborative	Non-collaborative
Mean	4.52	1.00	1.43	2.64	4,07	1,82	1,50
Median	5	1	1	2	3	1	1
sd	1.83	0.00	1.13	1.86	2,00	1,60	1,22
CI	0.78	- x -	0.84	1.10	0,75	0,95	0,98
p-value		< 0.001*				0.001*	

sd = standard deviation; CI = confidence interval; -x- = it was not possible to use statistics, *p ≤ 0.05

Literature shows that the swallowing process requires coordination between multiple physiological systems to reach an appropriate protection of lower airways, and this function is closely related to respiration due to the proximity of the esophagus to the larynx and because the air flow path and food transit divide the same organ – pharynx[5]. Due to this complexity, we can say that swallowing may be affected both after prolonged OI, as well as in neurological disorders, since both situations may compromise the anatomical and physiological integrity that assures a safe and coordinated deglutition[5,6,21,22].

Dysphagia after prolonged intubation may be related to numerous factors, such as decreased level of alertness due to residual effects of sedation, presence of feeding tube, abnormalities of oropharyngeal/laryngeal sensitivity, muscular atrophy caused by lack of use, suppression of gag and cough protective reflexes and abnormal deglutition reflex[1,3,5].

Postma et al.[19] observed, by means of laryngoscopic examination, a high incidence of laryngopharyngeal abnormalities in previously intubated patients; and the longer the duration of intubation, the more abnormalities. Laryngeal injury after OI may result from the traumatic insertion of the tube, need of prolonged mechanical ventilation, patient's agitation leading to friction of the tube against the laryngeal mucosa or merely due to the presence of the orotracheal tube[19].

In patients with neurological involvement, swallowing disorder accompanied by laryngeal penetration and aspiration is frequently seen because the swallowing mechanism depends on a complex activation of neuronal circuits requiring harmonic execution involving the integrity of afferent, efferent, sensory and motor pathways. Therefore, abnormalities in the neuronal functions may cause abnormalities in the neuromotor control with consequent neurogenic dysphagia and specific symptoms[5,10,12,23].

Other studies report the main swallowing abnormalities found in patients with TBI, including the oral and/or pharyngeal phase disorders, characterized by an impairment in the bolus control, decreased tongue control/movement, decreased laryngeal elevation and closure, delayed deglutition reflex and presence of cough and/or wet voice after swallowing[10,12].

Taking into account the abovementioned studies, it can be inferred that patients with neurological disorders who underwent OI would have an increased risk of developing dysphagia. As to this fact, Terré and Mearin[9] described a positive correlation between the presence of silent aspiration with previous OI in patients who suffered a cerebrovascular accident and Mackay, Morgan and Bernstein[12] observed that patients with TBI who presented abnormal swallowing on videofluoroscopy were those who previously underwent mechanical ventilation for a longer time.

Two scales described in the literature were used for the analysis of the functional results of swallowing and feeding – the DSS[15] and the FOIS[16]. The DDS is part of the Protocol of Dysphagia Risk Assessment[15], which classifies the disorder according to its severity and provides the speech therapist with guidance on the management. The FOIS[16], in turn, is a measurement of the level of oral intake, an important clinical tool that allows the measurement of the progression of oral intake in patients[11]. By using theses scales, it was possible to justify the assessments performed, allowing pre-established data collection for further analyses and strict control of the speech intervention.

Comparison between the groups showed more favorable results in Group 1 (without neurological involvement) compared to Group 2 (with neurological involvement) in both scales used.

The results of the DSS showed a higher rate of severe oropharyngeal dysphagia in patients with neurological involvement with statistical significance. In their study, Morgan, Ward and Murdoch[23] observed that the greater the neurological impairment, the higher the risks of abnormal swallowing functions, including the laryngeal and tracheal aspirations.

Likewise, the FOIS[16] indicated less possibility of oral diet intake on the assessment date in this group. Hansen, Engberg and Larsen[11] corroborate these data in their study showing that the greater the brain injury severity, the lower the possibility of reaching a FOIS score of seven.

As to the assessment of the levels of alertness and consciousness, it was noticed that the patients with brain injury were less alert, interactive and collaborative in the speech pathology assessment compared with patients without brain injury. Additionally, we notice a lower possibility of oral intake in patients with abnormal levels of consciousness and collaboration.

According to Goldsmith[5], the level of alertness is important in the assessment of swallowing because neurological abnormalities may cause impaired attention, orientation and cooperation upon clinical assessment. Cognitive factors, such as attention agitation and memory *deficit* interfere in the introduction and progress of oral intake, and patients with abnormalities in these functions need an alternative feeding route for a longer period of time and/or changes in the volume and consistency of the diet[11,12,23]. Wilkins, Moylan and Carr[24] reported that the cognitive symptoms may decrease the individual abilities to perform their own care and to participate in activities.

Other studies report the importance of the cognitive aspects for the assessment of swallowing by relating the

neurological impairment with the possibility of oral intake and state that the restoration of the cognitive functions is closely related to the initiation of oral intake[10,12,23].

By means of cognitive tests and serial assessment of dysphagia, Morgan, Ward and Murdoch[23] showed the relation between resolution of dysphagia cases and the improvement of cognitive tests.

Hansen, Engberg and Larsen[11] reported that the scores of the Glasgow Coma Scale (GCS), Rancho los Amigos Scale (RLAS) and FOIS at patient's admission are statistically significant factors for the time and reintroduction of the oral route discussing the directly proportional interference of some factors, such as level of consciousness, cognition and functional measurements of feeding, at the time of diet reintroduction via the oral route. Therefore, these authors observed that the group with lower scores in RLAS, GCS and FIOS scales at admission were less likely to recover unrestricted oral route feeding when compared to the group of patients with higher scores.

It is important to consider that the cognitive levels affect not only the time to start oral intake, but some brain injuries may also cause abnormalities that modify the patient's appetite thus interfering in the individual ability to tolerate oral feeding[12].

According to these points of view, we can infer that the functional results of swallowing and feeding presented by patients with brain injuries are related not only to prolonged OI, but also to central nervous system injuries that may affect both the neuromotor control of swallowing and the cognitive-behavioral factors that impair refeeding by the oral route.

Thus, when analyzing dysphagia in extubated patients it is necessary to weigh the consequences that may be related to the patient's neurological picture and not consider only OI as an isolated causative factor of dysphagia. Therefore, studies about the swallowing abnormalities in patients undergoing OI that do not analyze the interference of the aspects of neurogenic dysphagia must be reconsidered[3,13-14].

CONCLUSIONS

In this study, patients undergoing prolonged OI presented different degrees of dysphagia with higher frequency and severity in patients with some level of brain injury.

Patients with neurological involvement presented worse outcomes in the assessment of deglutition and in the possibility of feeding by the oral route, with several of these abnormalities being related to the cognitive-behavioral status.

We conclude that OI alone cannot be considered a causative factor of dysphagia in patients with neurological injuries. Neurological abnormalities and especially the deficiencies in cognitive abilities caused by the injury must be taken into account in the assessment of swallowing function and in the management of dysphagia, since these are risk factors for increased frequency and severity of this disorder.

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