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International Journal of Current Research
Vol. 8, Issue, 11, pp.41253-41256, November, 2016

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

ISSN: 0975-833X

RESEARCH ARTICLE

DYSPHAGIA IN NEUROLOGICAL PATIENTS AFTER MECHANICAL VENTILATION

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ARTICLE INFO

Article History:
Received 17th August, 2016
Received in revised form
28th September, 2016
Accepted 23rd October, 2016
Published online 30th November, 2016

Key words:

Stroke,
Swallowing Disorders,
Intensive Care Unit,
Mechanical Ventilation,
Deglutition,
Deglutition Disorders.

ABSTRACT

Objective: To investigate the presence of dysphagia in neurological patients after mechanical ventilation (MV) in the Intensive Care Unit (ICU).
Method: Study case control study carried out in the ICU of a public hospital in the South. We evaluated 38 patients with primary neurological disorder, divided into group dysphagia and no dysphagia, which were on MV for a longer period than 24 hours and they were in the process of extubation of endotracheal tube (TOT) or Weaning from tracheostomy (TQT). Prior to extubation process was performed strength tests of the respiratory muscles, Glasgow Coma Scale (GCS) and Peak Cough Flow Reflex Test (PFTR) in patients. Between 24 and 48 hours after extubation or wean TQT, patients underwent clinical test by Protocol Risk Assessment for Dysphagia (PARD).
Results: It was possible to verify that the two groups had similarity in respiratory muscle strength, GCS and PFTR. Already age and time hospitalization showed significant statistical differences between the two groups.
Conclusion: dysphagia neurological patients have more advanced age and require greater hospital stay. Thus, advanced age affect the swallowing function in neurological patients and detect early dysphagia in this sample can reduce hospital stay.

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Citation: Roberta Weber Werle, Eduardo Matias dos Santos Steidl, Ana Tereza Bittencourt Guimarães, Marisa Bastos Pereira, Luiz Henrique Schuch and Renata Mancopes, 2016. "Dysphagia in neurological patients after mechanical ventilation", *International Journal of Current Research*, 8, (11), 41253-41256.

INTRODUCTION

Patients with pre-existing neurological disorders may develop acute respiratory failure requiring endotracheal intubation and mechanical ventilation (MV) in the intensive care unit (ICU) (Suarez *et al*., 2004). Survivors of neurological diseases that were intubated hace average survival of more than three years and still suffer from swallowing disorders, respiratory impairment, neurocognitive disorders and decreased quality of life (Hopkins and Jackson, 2006).

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The postextubation dysphagia may occur as a result of initial neurological disease or due to new cognitive/sensory changes caused by critical illnesses, as well as intubation itself (Ekberg *et al*., 2002). It is estimated that between 38 and 64% of stroke patients in the acute phase and 50% of stroke patients in chronic phase suffer from swallowing disorders (Mann *et al*., 1999). In these cases, the presence of this disorder is associated with several complications, including acute malnutrition, dehydration, pneumonia and airways obstruction, which can lead to longer hospital stays and reduced quality of life (Foley *et al*., 2006). Features such as decrease level of consciousness, need for mechanical ventilation, ineffective cough and comorbidities that are often present in patients hospitalized in

ICUs. The identification of swallowing disorders may help detect patients at high risk of aspiration, preventing pulmonary complications, such as aspiration pneumonia. The aspirations may be mildly symptomatic, requiring the active assessment of swallowing in these patients, especially the remaining intubated for more than 48 hours (Marik, 2001; Miller *et al*., 2005). Studies show that 50% of hospitalized patients in ICU under MV for period exceeding seven days develop electrophysiological abnormalities with 25% average incidence of respiratory muscle weakness and more than 20% incidence of dysphagia (Macht *et al*., 2012; Martin *et al*., 2013). These disorders acquired in the ICU generate difficulty in weaning from MV, high hospital costs and increased mortality (Alves *et al*., 2007). It is estimated the occurrence of mortality between 7.5% and 72% after episodes of aspiration pneumonia (Hickling and Howard, 1998). The objective was to investigate the presence of dysphagia in neurological post extubation patients in the ICU.

METHODS

This was a case-control study conducted in the ICU of a public hospital in southern Brazil. The research followed what was determined by the National Health Council in Resolution 466/12, which approves the guidelines and regulatory standards for research involving human beings. This study was approved by the Research Ethics Committee (REC) of the Federal University of Santa Maria (UFSM) under registration number 23676813.8.0000.5346. To calculate the sample size was considered the standardized effect size equal to 1, with 95% significance level of 5% error, and minimum percentage of individuals was necessary to evaluate 29 patients. A total of 38 patients with primary neurological event, with and without dysphagia after output of the VM, from 10 March 2014 to 10 March 2015 which were on MV for a period longer than 24 hours and who were in extubation process the endotracheal tube (TOT) or weaning from tracheostomy (TQT) and was evaluated by the Physical Therapy and Speech Therapy teams. Were excluded from the study, patients with spinal cord injury (SCI) patients with unstable medical conditions for the realization of physical therapy or speech therapy evaluation and sleepy patients and not responsive to the speech evaluation.

Physical Therapist Assessment

From the moment that the patient made use of invasive mechanical ventilation it was monitored daily by researchers. The data available in the medical records were collected. When decided together with the support staff that the patient was extubated when with TOT or weaned completely from the MV when tracheostomy earlier extubation and/or full weaning, it conducted the tests of strength of the respiratory muscles, Glasgow Coma Scale (GCS) and Peak Cough Flow Reflex Test (PFTR). To obtain the values of MIP and MEP, the technique recommended by the Guidelines for Pulmonary Function Testing was followed (Souza, 2002). A digital manometer model was used MVD 300, Globalmed brand, Porto Alegre-RS, with self-calibration system and the interface between the TOT or tracheostomy, with one-way valve, occluded for 20 seconds inspiratory entry in the measurement of MIP and input expiratory in the measurement of MEP (Passarelli *et al*., 2011). The equations were used for MIP and MEP proposed for the Brazilian population to assess the predictive value in the sample (Costa *et al*., 2010). To evaluate the PFTR a peak flow meter was used (Clement Clarke International brand, Mini-Wright AFS Low Ranger model) with variation ± 5% -ATS 95 (Andrew, 1995). The peak flow meter was connected to TOT for a part in "T" with one-way valve to allow free inhalation and exhalation through the interior of the instrument. To trigger the cough reflex mechanism was carried out by a mechanical input via nasal stimulation of a suction catheter or nasal catheter number eight (Kutchack *et al*., 2015). In order to assess the level of consciousness of patients, we used the GCS, drawing on the basic elements: "Eye Opening", "Verbal Response" and "Motor Response" (Jeffery *et al*., 2009). As the study occurred prior to extubation for the "Verbal Response", which ranges from 1-5, it is considered score 1 for all patients. "Eye Opening", ranging from 1-4, and "Motor Response", ranging from 1-6, were recorded separately, and subsequently the values summed in order to obtain the overall score of GCS.

Speech Therapist Assessment

Between 24 and 48 hours after extubation or wean TQT, patients underwent on clinical speech assessment, performed only in stable condition with cognition levels and adequate warning. The evaluation was conducted in the bed by a Speech Therapist with experience in the hospital, using the Protocol Risk Assessment for Dysphagia (PARD) (Padovani, 2007), and modified the order of presentation of consistencies, so that was first offered the pasty consistency, as this is considered the safest and then the liquid consistency. Also the syringe was not used for the provision, in that the non-functional manner in the subjects ingest foods. Thus, the test with the pasty food and swallowing of water was conducted, and setting the classification of the degree of dysphagia and conduits. The instruments used were disposable plastic spoons in sizes 5ml and 10ml and glasses for administration of higher volumes (10ml and 20ml continuous).

Patients who used TQT were evaluated by food consistency, added blue food coloring (Blue Dye Test modified) as routine service. The objective was to verify, after the offerings, the presence of blue color in tracheostomy topography or suction probe, indicating aspiration of food (liquid, paste or own saliva). After the clinical speech evaluation of swallowing, it was possible to determine the degree of dysphagia and split the patients into two groups for analysis of variables: Group with dysphagia and without dysphagia. Continuous quantitative variables were evaluated for data distribution pattern by the Shapiro-Wilk test. The variables considered in normal distribution (Age and MIP) were compared between subjects with and without dysphagia using the t test for independent samples. Those that are not found in normal distribution were evaluated using the nonparametric Mann-Whitney test. Categorical qualitative variables were compared between groups using the Chi Square test. Analyses were performed in XLSTAT 2015 program, considering a significance level of $p < 0.05$.

RESULTS

The sample consisted of 38 neurological patients, excluded 26 patients (2 SCI, 20 sleepy and not responsive to speech and language evaluation and 4 with unstable medical conditions for physical therapy and speech evaluation), with a mean age of 45 (± 16) years, between 18 and 81 years, and 84% (n = 32) were male.

Ischemic stroke type was found in 60.5% (n = 23) of the sample, followed by the hemorrhagic stroke in 13.1% (n = 5), head injury 18.4% (n = 7) and tumor brain in 7.8% (n = 3). Dysphagia was exhibited, 71% (n = 27) of the sample, 42.1% (n = 16) classified as mild dysphagia, 26.3% (n = 10) and moderate dysphagia 2.6% (n = 1) dysphagia serious. As for the qualitative variables (sex and extubation failure) was verified that there was no statistically significant difference between the groups with and had no dysphagia (p> 0.05) (Table 1)

Table 1. Characterization of the sample for the presence or absence of dysphagia (mean or median, standard deviation or percentiles, absolute and relative percentage frequencies)

Variable	With dysphagia N= 27	No dysphagia N= 11	P
Male N(%)	22(81,5)	10(90,9)	0,64
Age (anos)*	49 (±14)	37 (±17)	0,04
MIP (cmH_20)*	-60 (-83- -41)	-60 (-95 - -28)	0,94
MEP (cmH_20)**	51 (43-72)	48 (40-64)	0,77
PFTR (L/min)**	70 (60-100)	90 (60-160)	0,24
Glasgow Motor Response**	6 (5-6)	6 (5-6)	0,22
Glasgow Eye Opening**	4 (3-4)	4 (3-4)	0,93
Glasgow Verbal Response**	1 (1-1)	1 (1-1)	1,00
Time ICU Stays (days)**	15 (12-21)	12 (10-18)	0,11
Time MV (days)**	9 (6-12)	8 (4-12)	0,47
Hosp Stay (days)**	29 (25-50)	24 (15-27)	0,01
Extubation failure N (%)***			
Yes	13 (48,1)	2 (18,2)	0,13
No	14 (51,9)	9 (81,8)	

N - number of individuals, MIP - maximum inspiratory pressure, MEP - maximal expiratory pressure, Hosp - hospital ICU - Intensive Care Unit, MV - Mechanical Ventilation , TQT - Tracheostomy, PFTR - Peak Cough Flow Reflex
* T test for independent samples
** Mann-Whitney U Test
*** Chi-Square Test

It found that the two groups were similar for the variables "Glasgow motor response and Glasgow eye opening." Respiratory muscle strength appeared low in both groups, considering gender and age as predictive variables and following equations for MIP and MEP proposed for the Brazilian population (Costa *et al*., 2010). PFTR performed less in the dysphagia group, besides this group stay a day longer in MV, compared to the non dysphagia group. The variables "age" and "Length of Stay Hospital" showed differences between the two groups ($p < 0.05$), and the group with dysphagia showed higher mean age and higher average hospitalization time. "Length of Stay in ICU," that although no statistical significance was observed that patients with dysphagia tend to stay in hospital longer.

DISCUSSION

The incidence of post extubation dysphagia found in this study was 71%, but the majority (42.1%) had mild dysphagia, justified by the majority of patients had a diagnosis of ischemic stroke, not hemorrhagic.In addition, dysphagia patients had a longer hospital stay, compared to no dysphagia, corroborating the literature, in which dysphagia is a common consequence and critical in acute stroke patients and is associated with pneumonia, prolonged hospitalization, increased mortality and poor long-term results (Martino *et al*., 2005). Between 1998 and 2008 the mortality rate in stroke fell 34.8% and the actual number of deaths fell 19.4% (Remesso *et al*., 2011). Despite the decrease in this rate, the complications that the patient might present are many and mainly affect mobility, speech and swallowing. (Remesso *et al*., 2011). In this study, 60.5% patients had stroke of ischemic type, being reported in the literature that ischemic stroke is the most common, but the bleeding that contributes more negative changes to swallowing (Galovic *et al*., 2013). In the present study, patients with dysphagia remained one day more MV, compared to the non dysphagia group, inferring that this prolonged MV entail disuse atrophy and increased proteolysis at the diaphragmatic muscle fiber (Vassilakopoulos and Petrof, 2004), since it starts rapidly in MV patients (in 18 hours or less) and is significant both in relation to the diaphragm and in peripheral muscles during controlled ventilation process (Silva *et al*., 2008). In addition, intubation for longer than 48 hours can cause injury to the larynx, with the consequent reduction in protection mechanism and increased incidence of oropharyngeal secretions, damaging the protective ability of the airways against aspiration (Larminat *et al*., 1995). The loss of respiratory muscle strength during prolonged MV, seems to be an important determinant of weaning failure, one of the physiological parameters that predict success or failure in the output of mechanical ventilation (Carlucci *et al*., 2009). Thus, in this study the dysphagia patients, spent more time in MV and had more failures in the output of the life support (48.1%), compared to the non dysphagia group (18.2%).

This disuse atrophy of muscles during MV can interfere with the cough flow and neurological dysphagia patients. In the present study neurological dysphagia patients had lowest cough flow than non dysphagia patients and can be justified by the small excursion of the diaphragm in these patients (Voyvoda *et al*., 2012), which can result in pulmonary dysfunction, restrictive type (Fugl-Meyer *et al*., 1983), asymmetry ventilation and limiting the production of an effective cough, because cough needs an adequate inspiration along with the coordination of the expiratory muscles, increasing the risk of aspiration (Park *et al*., 2015). Both dysphagia patients and non dysphagia showed decreased respiratory muscle strength following the equation Costa *et al* (Costa *et al*., 2010), in this study, probably due to neurological condition that impairs the respiratory muscle strength and prolonged MV. The aging process also interferes with neurological dysphagia group, which had older age compared with non dysphagia in this study. The muscle mass of the entire body is decreased with advancing age, including oropharyngeal muscles involved in swallowing (Martino *et al*., 2005), leading to greater amounts of waste valleculae and significantly increasing the risk of penetration and aspiration (Molfenter and Steele, 2013). Thus, the global functional status harmed reflects the general lack of coordination and proprioception decreased affecting the firing of swallowing (Solh *et al*., 2003). The increased risk of post extubation dysphagia was reported in patients with GCS score of $\leq$14 in (Barquist *et al*., 2001) or age $\geq$ 55 years (Barquist *et al*., 2001). Thus, these changes may lead to a reduction in swallowing function (Murakami *et al*., 2015). Findings of this study showed no difference in GCS, only in age between groups. It should be noted that the limitation of the study was the absence of imaging to quantify the extent of neurological damage. There is also need for longitudinal studies of the variables studied, with more representative samples and control more variables that allow the expansion of the associations presented here. We declare that there is no conflict of interest involved in this work.

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