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Swallowing characteristics and oral intake before and after speech therapy follow-up of tracheostomized patients admitted to a university hospital

Características de deglutição e ingestão oral pré e pós acompanhamento fonoaudiológico de pacientes traqueostomizados internados em um hospital universitário

Características de deglución e ingesta oral antes y después del seguimiento logopédico de pacientes traqueostomizados ingresados en un hospital universitario

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Abstract

Introduction: Tracheostomy may impact swallowing and generate neurophysiological and mechanical alterations. **Objective:** To analyze the swallowing functionality in tracheostomized patients admitted to a university hospital, before and after speech-language therapy intervention through the analysis of the service protocols - Adapted Protocol (based on the FOIS scale and Dysphagia Risk Assessment Protocol - PARD). **Method:** Cross-sectional, retrospective, analytical observational study,

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Authors' contributions:
JMT: Experiment setup and data collection, tabulation, text writing.
KOP: Revision of the text and norms according to the journal.
SPR: Text review, statistical analysis.

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with a quantitative approach. We analyzed 114 swallowing assessment protocols, and checked the degree of dysphagia according to O'Neil's classification and FOIS scale over a four-year period. Research approved by the Institution's Research Ethics Committee (29894920.5.0000.5349). **Results:** After analyzing the protocols it was found that the majority were male with a mean age of 54.55 years. A predominance of the following previous health comorbidities was observed: pneumonia, systemic arterial hypertension and ischemic stroke. After the speech-language therapy follow-up there was an improvement in swallowing biomechanics with more patients presenting functional swallowing - one (0.9%) to 12 (10.5%), reduction in the number of subjects with severe dysphagia - 32 (28.1%) to 17 (14.9%) and greater oral intake - 79 (69.3%) of the patients increased the level of oral intake according to the FOIS scale. Most of the sample showed good tolerance to tracheostomy occlusion and 60 (52.6%) progressed to decannulation. **Conclusion:** The presence of a tracheostomy had an impact on swallowing functionality, since most patients had some degree of dysphagia. We emphasize the importance of speech therapy in the swallowing rehabilitation process, helping in the decannulation process.

Keywords: Speech, Language and Hearing Sciences; Tracheostomy; Swallowing disorders.

Resumo

Introdução: A traqueostomia pode impactar na deglutição e gerar alterações neurofisiológicas e mecânicas. **Objetivo:** Analisar a funcionalidade da deglutição em pacientes traqueostomizados internados em um hospital universitário, pré e pós intervenção fonoaudiológica por meio da análise de protocolos do serviço – Protocolo Adaptado (base na escala FOIS e Protocolo de Avaliação do Risco para Disfagia – PARD). **Método:** Estudo transversal, retrospectivo, analítico observacional, de abordagem quantitativa. Analisados 114 protocolos de avaliação da deglutição, verificou-se o grau de disfagia conforme a classificação de O'Neil e escala FOIS em um período de quatro anos. Pesquisa aprovada pelo Comitê de Ética em Pesquisa da Instituição (29894920.5.0000.5349). **Resultados:** Após analisados os protocolos constataram-se que a maioria era do sexo masculino com média de idade de 54,55 anos. Observou-se a predominância das seguintes comorbidades prévias de saúde: pneumonia, hipertensão arterial sistêmica e acidente vascular encefálico isquêmico. Após o acompanhamento fonoaudiológico houve melhora da biomecânica da deglutição com mais pacientes apresentando deglutição funcional – um (0,9%) para 12 (10,5%), redução do número de sujeitos com disfagia grave – 32 (28,1%) para 17 (14,9%) e maior ingestão por via oral – 79 (69,3%) dos pacientes aumentaram o nível de ingestão oral conforme a escala FOIS. A maior parte da amostra apresentou boa tolerância à oclusão de traqueostomia e 60 (52,6%) progrediram para decanulação. **Conclusão:** A presença da traqueostomia impactou sobre a funcionalidade da deglutição, pois a maioria dos pacientes possuía algum grau de disfagia. Ressalta-se a importância da atuação fonoaudiológica no processo de reabilitação da deglutição, auxiliando no processo de decanulação.

Palavras-chave: Fonoaudiologia; Traqueostomia; Transtornos de deglutição.

Resumen

Introducción: La traqueotomía puede afectar la deglución y generar cambios neurofisiológicos y mecánicos. **Objetivo:** Analizar la funcionalidad de la deglución en pacientes traqueostomizados ingresados en un hospital universitario, antes y después de la intervención logopédica mediante el análisis de protocolos de servicio - Protocolo Adaptado (basado en la escala FOIS y Protocolo de Evaluación de Riesgos para Disfagia - PARD). **Método:** Estudio observacional analítico, transversal, retrospectivo, con enfoque cuantitativo. Tras analizar 114 protocolos de evaluación de la deglución, se verificó el grado de disfagia según la clasificación de O'Neil y la escala FOIS durante un período de cuatro años. Investigación aprobada por el Comité de Ética en Investigación de la Institución (29894920.5.0000.5349). **Resultados:** Tras analizar los protocolos, se encontró que la mayoría eran varones con una edad media de 54,55 años. Predominaron las siguientes comorbilidades de salud previas: neumonía, hipertensión arterial sistémica e ictus isquémico. Después del seguimiento de logopedia, hubo una mejora en la biomecánica de la deglución, con más pacientes presentando deglución funcional - uno (0,9%) a 12 (10,5%), una reducción en el número de sujetos con disfagia severa - 32 (28,1%) %) a 17 (14,9%) y mayor ingesta

oral - 79 (69,3%) de los pacientes aumentaron el nivel de ingesta oral según la escala FOIS. La mayor parte de la muestra mostró buena tolerancia a la oclusión de la traqueotomía y 60 (52,6%) progresaron a decanulación. **Conclusión:** La presencia de traqueotomía repercutió en la funcionalidad de la deglución, ya que la mayoría de los pacientes presentaba algún grado de disfagia. Enfatiza la importancia de la logopedia en el proceso de rehabilitación de la deglución, ayudando en el proceso de decanulación.

Palabras clave: Logopedia; Traqueotomía; Trastornos de la deglución.

Introduction

The procedure for placing a Tracheostomy (TCT) tube is performed in order to maintain breathing in cases of upper airway obstruction, removal of tracheobronchial secretions and when prolonged mechanical ventilation (MV) is required[1].

TCT changes the anatomy and physiology of the respiratory system, thus affecting the sensitivity and mobility of hyolaryngeal structures, with negative impacts on the movement of the larynx. There is an alteration in the airflow that prevents the passage of air to the upper airways, as well as in the presence of the inflated cuff, impairing the protection of the airways and increasing the risk of dysphagia[2,3].

Neurophysiological and mechanical changes may increase the risk of aspiration: reduction in subglottic pressure resulting from adduction of the vocal folds, especially in TCT with an inflated cuff; reduction of hyolaryngeal elevation; alteration of laryngeal sensitivity with consequent reduction of the protective cough reflex; increased pharyngeal transit time with increased risk of aspiration when the vocal folds are abducted due to lack of subglottic pressure, especially cuffed cannulas that compress the posterior wall of the esophagus[4].

Therefore, the speech-language pathologist must stimulate TCT occlusion when the cuff is deflated, so that the larynx can reestablish its communication, swallowing and sensitivity functions[2]. The literature reports that the sooner it is possible to decannulate the patient, the smaller the consequences for the patient, but this may not always occur[4].

Speech-language pathologists and audiologysts are professionals who are duly trained to assess the swallowing of tracheostomized patients, aiming to detect its effectiveness, as well as all the processes involved, in addition to detecting the potential risk of bronchoaspiration. In this context, these professionals must work in a multidisciplinary team to reestablish the biomechanics of swallowing in dysphagic individuals[2].

The relevance of this study is explained by the mechanical, physiological and functional alterations found in patients who underwent the tracheostomy placement procedure, and given the importance of the speech-language pathologists in the evaluation and rehabilitation of the disorders found in these patients.

This study aimed to analyze the swallowing functionality in tracheostomized patients admitted to a University Hospital, before and after speech-language pathology intervention, through the analysis of service protocols (Adapted Protocol, based on the FOIS scale[5] and Dysphagia Risk Evaluation Protocol (DREP)[6] and Modified Blue Dye Test[7] over a four-year period. The specific objectives of the study were the following: to relate the swallowing profile based on the Functional Oral Intake Scale (FOIS) of tracheostomized patients with the type of TCT that was used; to describe aspects related to the swallowing of patients with an inflated cuff; to relate the swallowing profile with the underlying disease; to describe the TCT time observing its effects on the subjects' swallowing; to describe the patient's initial and final diet when using TCT; and to describe the benefits provided by the speech-language pathology intervention to the tracheostomized patients comparing the initial and final evaluation.

Method

This is a cross-sectional, retrospective, observational and analytical study with a quantitative approach, as the researchers analyzed data included in the medical records and swallowing assessment protocols of tracheostomized patients treated by the Speech-Language Pathology and Audiology department from May 2016 to May 2020. The researchers collected protocol data from patients

who remained hospitalized in ward and intensive care units.

Then, data from the protocols of adult and elderly patients, aged 18 years and older, were analyzed. The inclusion criteria for the study were patients with no complaints of dysphagia prior to hospitalization, in which the data collected for this research were recorded (which was verified through the history reported by the patient and/or family), as well as protocols of patients who underwent the procedure of tracheostomy for the first time during hospital stay. In turn, the exclusion criteria were the following: protocols for patients who were not evaluated for some reason by the speech-language pathologist and/or who were discharged before it was possible to collect the data necessary for the study, protocols for patients who underwent laryngectomy and/or head and neck surgery that could impair the prospect of decannulation in these cases, patients without clinical conditions for speech-language pathology intervention and patients younger than 18 years of age. This study was approved by the Research Ethics Committee under the No. 29894920.5.0000.5349.

At first, the sample consisted of 141 patient protocols and after applying the exclusion criteria, 27 were excluded from the analysis. Of these, 17 were excluded due to the presence of head and neck cancer, four due to inadequate alertness, four due to their age, below 18 years, one for having previous TQT and one for presenting therapeutic limitation, thus reaching the final sample of 114 protocols. Among all the protocols analyzed, 65 were male and 49 female. The following variables were analyzed in the study: sex, age, place of hospitalization, underlying diseases, oral sensorimotor assessment, previous orotracheal intubation, type of Speech-Language Pathology Intervention (speech-language pathology therapy), presence of pneumonia, type of TCT, TCT tube cuff, reason for tracheostomy, extubation failure, tracheostomy occlusion tolerance, decannulation, tracheostomy time, initial and final modified Blue Dye Test, initial and final FOIS scale, initial and final assessment of swallowing, type of initial and final diet, describing the feeding route used and outcome.

The swallowing assessment protocol (Adapted by Karen Passos and Prof. Dr. Maria Cristina Cardoso) was used to assess swallowing, based on the FOIS[5] scale; as well as the Risk Assessment Protocol for Dysphagia[6], in which the oral sensorimotor assessment was carried out, analyzing aspects related to strength, tone, mobility and sensitivity of the organs of the stomatognathic system. When necessary, the Modified Blue Dye Test (MBDT)[7] was performed in order to establish the degree of dysphagia, based on the classification proposed by O'Neill (1999)[8], after the initial and final assessment before and after speech-language pathology monitoring.

The results of continuous variables were expressed through measures of position (average) and dispersion (standard deviation), while the results of categorical variables were expressed through frequency analysis. The outcome analyses with each variable of interest were performed using the Chi-squared and Fisher's exact tests according to the assumptions of the tests. The collected data were introduced in an Excel® spreadsheet and statistically analyzed using the Statistical Product and Service Solutions® (SPSS) V22. A significance level of 5% ($p<0.05$) was adopted for statistical significance.

Results

The sample consisted of 114 protocols of tracheostomized patients treated by the Speech-Language Pathology and Audiology department, of which 65 (57%) were male and 49 (43%) were female. The age of the individuals ranged from 18 to 88 years with a mean age of 54.55 years and the most frequent place of admission was the ward with 72 patients (63.2%), followed by the Intensive Care Units with 42 patients (36,8%).

Regarding the history prior to hospitalization and health comorbidities, this study found a prevalence of Systemic Arterial Hypertension (SAH) as the most recurrent disease, with 49 (43%) cases, followed by 29 (25.4%) cases of previous smoking, 21 (18.4%) reported cases of diabetes, 20 (17.5%) cases of Ischemic Stroke, 16 (14%) cases of Acute Respiratory Failure (ARF), 15 (13,2%) cases of multiple trauma, 14 (12.3%) patients who had a history of alcoholism, 13 (11.4%) patients who had spine fracture, 12 (10.5%) cases of Traumatic Brain Injury (TBI) and Cardiopulmonary Arrest (CPA), and, finally, 11 (9.6%) cases of Chronic Obstructive Pulmonary Disease (COPD) and Congestive Heart Failure (CHF). In addition, among the 114 analyzed protocols, 80 (70.2%) had reports of pneumonia after TCT.

As shown in Table 1, most patients used metallic TCT tubes – 73 (64%) and did not use the cuff. Most individuals (78, 68.3%) needed to perform the tracheostomy procedure due to prolonged time of Orotracheal Intubation (OTI). Among the 114 protocols analyzed, 98 (86%) of the patients failed to extubate during the time they remained hospitalized, which was the reason for placing a TCT for 15 (13.2%) individuals. Most patients in the study underwent OTI for more than ten days, and 71 subjects (62.3%), 23 (20.2%) were on OTI for five to ten days, while 11 (9.6%) were not subjected to this procedure. Table 1 below shows the data regarding the TCT:

Table 1. Tracheostomy data of patients treated by the Speech-Language Pathology department.

Variables	n=114
Type of Tracheostomy	
Metallic	73 (64%)
Plastic	41 (36%)
Tracheostomy tube cuff	
None	73 (64%)
Inflated	40 (35.1%)
Deflated	2 (1.8%)
Reason for Tracheostomy	
Prolonged OTI	78 (68.3%)
Extubation Failure	15 (13.2%)
Structural Injury	6 (5.3%)
Emergency AW	5 (4.4%)
Pulmonary Sepsis	3 (2.6%)
ARF	2 (1.8%)
Tracheal Stenosis	1 (0.9%)
Not reported	1 (0.9%)
Extubation Failure	
Yes	98 (86%)
No	11 (9.6%)
Not applicable	5 (4.4%)

OTI=orotracheal intubation; AW=airway; ARF=acute respiratory failure.
Results expressed through frequency analysis.

Regarding the speech-language pathology assessment of swallowing, 93 (82.6%) patients had an altered oral sensorimotor assessment. In turn, Table 2 shows the initial and final data referring to the speech-language pathology assessment, which allow us to infer that there was an improvement in the swallowing profile after the follow-up. In this sense, there was an increase in the number of patients who were diagnosed with normal swallowing, from one (0.9%) to 12 (10.5%) patients, in the initial and final assessment respectively, as well as a reduction of the number of subjects diagnosed with severe Oropharyngeal Dysphagia (OPD), from 32 (28.1%) to 17 (14.9%).

Table 2. Comparison between the initial and final swallowing classification of tracheostomized patients treated by the Speech-Language Pathology department.

Swallowing Classification	Initial; n=114	Final n=114
Not reported	1 (0.9%)	1 (0.9%)
Regular	1 (0.9%)	12 (10.5%)
Functional	3 (2.6%)	19 (16.6%)
Mild OPD	12 (10.5%)	14 (12.3%)
Mild to Moderate OPD	9 (7.9%)	10 (8.8%)
Moderate OPD	17 (14.9%)	15 (13.2%)
Moderate to Severe OPD	39 (34.2%)	26 (22.8%)
Severe OPD	32 (28.1%)	17 (14.9%)

OPD=Oropharyngeal Dysphagia, according to the classification of degree of dysphagia proposed by O'Neil (1999).
Results expressed through frequency analysis.

The Modified Blue Dye Test (MBDT) was performed as a complement to the initial assessment and, in order to investigate the swallowing pattern, it was carried out during the speech-language pathology monitoring and at the end, as needed. With respect to saliva, 35.1% (40) subjects had a positive result for bronchoaspiration in the MBDT, and 14% (16) had a negative result in the initial evaluation. However, there was an increase of 32.5% (37) in the number of patients with a negative result for saliva aspiration in the final evaluation. There was a reduction in the number of patients who bronchoaspirated saliva after the speech-language pathology intervention.

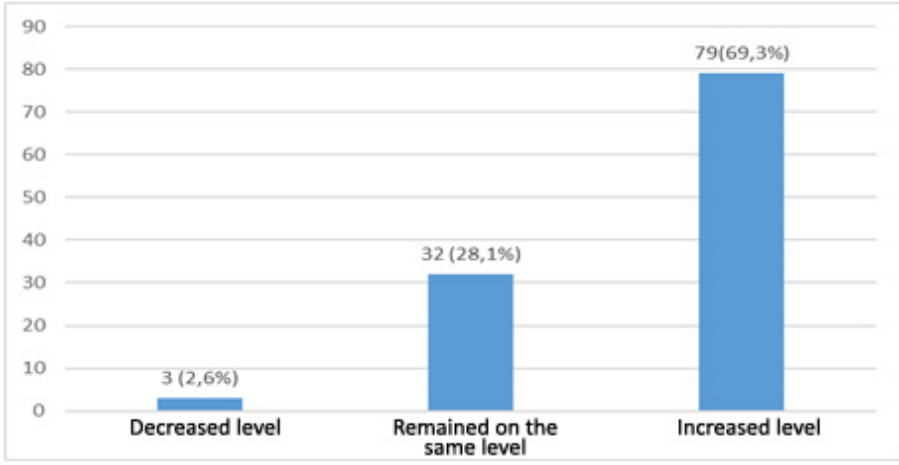
Table 3 shows that there was an improvement in the swallowing function of tracheostomized patients when using the FOIS scale. Of the 108 patients who were at level 1 (94.6%) before the speech-language pathology intervention, only 32 (28%) patients remained at this level after the intervention, which means that there was a reduction in the number of patients who received an exclusive alternative diet. A statistically significant difference (p=0.01) was found comparing the initial and final assessment of swallowing using the FOIS scale, which may mean that patients followed up by the Speech-Language Pathology and Audiology department had an improvement in functionality and oral intake after swallowing rehabilitation.

Table 3. Comparison between the initial and final FOIS scale of tracheostomized patients treated by the Speech-Language Pathology department.

FOIS	Initial; n=114	Final n=114
Level 1	108 (94.6%)	32 (28%)
Level 2	0 (0%)	18 (15.8%)
Level 3	0 (0%)	9 (7.9%)
Level 4	1 (0.9%)	5 (4.4%)
Level 5	1 (0.9%)	15 (13.2%)
Level 6	2 (1.8%)	12 (10.5%)
Level 7	2 (1.8%)	23 (20.2%)

FOIS=Functional Oral Intake Scale.
Results expressed through frequency analysis, according to the FOIS scale, as proposed by Crary et. al (2005).

As shown in Figure 1, there was an improvement in the dietary pattern according to the FOIS scale, since 79 (69.3%) participants increased the level of oral intake after the speech-language pathology intervention.



Results expressed through frequency analysis.

Figure 1. Graphic representation of the change in the FOIS scale of the treated tracheostomized patients, based on the initial and final FOIS.

The results obtained in relation to the type of diet, considering the initial and final diet, show that there was a reduction from 108 (94.6%) patients with an exclusive alternative feeding route (nasoenteral tube (NET) or gastrostomy (GTT)) to 48 (42%) at the end of the follow-up.

According to the initial data, two patients (1.8%) received a liquid diet and thin liquids orally, two (1.8%) patients received a semi-solid diet and thin liquids orally, and two (1.8%) patients received a solid diet with thin liquids orally. However, at the end of the intervention, there were six (5.3%), 12 (10.5%) and 23 (20.2%) in each category, respectively.

It should be noted that no patient was on an oral diet associated with the alternative feeding route. In addition, at the end of the study, there were ten (8.8%) patients on a liquid diet with thickened liquids via the NET and orally and 1 (0.9%) patient on a solid diet with thin liquids via the NET and orally.

Although the initial evaluation did not find any individual who received a liquid diet and thickened liquids orally, there were 9 (7.9%) patients in this situation at the end. The same was observed in cases of semi-solid diet with liquids thickened orally, with 4 (3.5%) patients at the end and 1 (0.9%) patient with solid diet and liquids thickened orally.

Regarding speech-language pathology intervention aimed at comprehensive rehabilitation, all patients received a combined therapy according to each need. This means that indirect and/or direct swallowing, orofacial and vocal myofunctional therapy was performed and, as some patients had received more than one therapy, the sum of the percentages presented here exceeds 100%. Thus, four (3.5%) patients did not receive Speech-Language Pathology Intervention and this information was not reported in one (0.9%) protocol. In addition, 90 (78.9%) patients received direct swallowing therapy, 75 (65.8%) received myofunctional intervention, 63 (55.3%) received indirect therapy, and 48 (42.1%) underwent vocal therapy.

It is important to consider the possibility of occlusion of the TCT tube during the speech-language rehabilitation process, aiming to reestablish upper airway patency and subglottic pressure. In this study, most (76, 66.7%) subjects had good tolerance to tube occlusion, while 22 (19.3%) patients had fair tolerance and 16 (14%) patients had low tolerance. It should be noted that this factor is considered one of the predictors for decannulation. In

the sample of this study, 64 (56.1%) patients were recommended to remove the TCT tube, while 50 (43.9%) individuals were recommended to avoid removal, 60 (52.6%) patients decannulated and 54 (47.4%) did not remove the TCT even after the intervention. Of these patients, 77.2% of the sample (88 subjects) required more than one month to decannulate, 23 (20.2%) required up to one month and 3 (2.6%) decannulated within one week.

Table 4 shows that the researchers compared the history of disease and comorbidities across large areas with the patients' swallowing profile using the FOIS scale. In this context, the researchers found a higher rate of patients with neurological comorbidities who remained at level 1 of the FOIS scale, as shown in Table 4:

Table 4. Comparison between the final Level of the FOIS scale and the history of comorbidities in tracheostomized patients.

History of comorbidities	Level 1 n = 32	Level 2 n = 18	Level 3 n = 9	Level 4 n = 5	Level 5 n = 15	Level 6 n = 12	Level 7 n = 23	p-value
Neurology	20 (62.5%)	11 (61.1%)	2 (22.2%)	2 (40%)	8 (53.3%)	1 (8.3%)	5 (21.7%)	0.03**
Pulmonology	14 (43.8%)	8 (44.4%)	7 (44.8%)	8 (53.3%)	4 (26.7%)	5 (41.7%)	4 (17.4%)	0.05
Cardiology	16 (50%)	9 (50%)	5 (55.6%)	2 (40%)	9 (60%)	8 (66.7%)	9 (39.1%)	0.77
Traumatology	4 (2.5%)	4 (22.2%)	2 (22.2%)	2 (40%)	5 (33.3%)	3 (25%)	15 (65.2%)	0.04
Vascular disease	2 (6.3%)	0 (0%)	1 (11.1%)	0 (0%)	1 (6.7%)	0 (0%)	0 (0%)	0.57
Urology	5 (15.6%)	1 (5.6%)	3 (33.3%)	1 (20%)	2 (13.3%)	0 (0%)	2 (8.7%)	0.31
Alcohol consumption	5 (15.6%)	1 (5.6%)	2 (22.2%)	1 (20%)	3 (20%)	1 (8.3%)	1 (4.3%)	0.60
Smoking	7 (21.9%)	4 (22.2%)	3 (33.3%)	4 (80%)	5 (33.3%)	3 (25%)	3 (13%)	0.09
Diabetes Mellitus	9 (28.1%)	0 (0%)	2 (22.2%)	1 (20%)	2 (13.3%)	4 (33.3%)	3 (13%)	0.19
Surgeries	3 (9.4%)	1 (5.6%)	0 (0%)	1 (20%)	1 (6.7%)	0 (0%)	1 (4.3%)	0.70
Psychiatric	0 (0%)	1 (5.6%)	1 (11.1%)	0 (0%)	1 (6.7%)	2 (16.7%)	2 (8.7%)	0.49
Other comorbidities	8 (25%)	2 (11.1%)	0 (0%)	1 (20%)	0 (0%)	3 (25%)	4 (17.4%)	0.26
Pneumonia	8 (25%)	5 (27.8%)	2 (22.2%)	1 (20%)	5 (33.3%)	3 (25%)	10 (43.5%)	0.79

Results expressed through frequency analysis.

In turn, Table 5 describes the relationship between variables related to tracheostomy and the final classification on the FOIS scale of patients treated by the speech-language pathology team. Regarding the type of TCT, there was no difference between plastic and metallic tubes, since 20 (62.5%) patients had metallic tubes and were classified on the FOIS scale at level 1 and 15 (65.2%) patients were classified on the FOIS scale at level 7. Considering the possible presence of the cuff and whether it was inflated or deflated, there were more patients at level 7 of the FOIS scale, 15 (65.2%) who did not have a cuff in the tracheostomy compared to 8 (34.8%) patients who had the cuff inflated, but there was no statistical significance.

Table 5. Comparison between the final level of the FOIS scale with the variables related to tracheostomy.

Variables	Final FOIS							
	Level 1 n = 32	Level 2 n = 18	Level 3 n = 9	Level 4 n = 5	Level 5 n = 15	Level 6 n = 12	Level 7 n = 23	p-value
Type of TCT Tube								0.87
Plastic	12 (37.5%)	5 (27.8%)	4 (44.4%)	1 (20%)	5 (33.3%)	6 (50%)	8 (34.8%)	
Metallic	20 (62.5%)	13 (72.2%)	5 (55.6%)	4 (80%)	10 (66.7%)	6 (50%)	15 (65.2%)	
TCT Tube Cuff								0.17
None	20 (62.5%)	12 (66.7%)	5 (55.6%)	4 (80%)	10 (66.7%)	6 (50%)	15 (65.2%)	
Inflated	12 (37.5%)	6 (33.3%)	4 (44.4%)	1 (20%)	3 (20%)	6 (50%)	8 (34.8%)	
Deflated	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (13.3%)	0 (0%)	0 (0%)	
Reason of TCT								0.65
Prolonged OTI	19 (59.4%)	12 (66.7%)	8 (88.9%)	3 (60%)	10 (66.7%)	10 (83.3%)	16 (69.6%)	
Extubation Failure	6 (18.8%)	4 (22.2%)	1 (11.1%)	1 (20%)	1 (6.7%)	1 (8.3%)	1 (4.3%)	
Emergency AW	0 (0%)	1 (5.6%)	0 (0%)	0 (0%)	2 (13.3%)	0 (0%)	2 (8.7%)	
Pulmonary Sepsis	2 (6.3%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (4.3%)	
ARF	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (6.7%)	0 (0%)	1 (4.3%)	
Structural Injury	4 (12.5%)	0 (0%)	0 (0%)	0 (0%)	1 (6.7%)	1 (8.3%)	0 (0%)	
Tracheal Stenosis	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (4.3%)	
TCT Tube Occlusion Tolerance								0.01**
None	14 (43.8%)	0 (0%)	1 (11.1%)	1 (20%)	0 (0%)	0 (0%)	0 (0%)	
Regular	7 (21.9%)	7 (38.9%)	2 (22.2%)	1 (20%)	0 (0%)	1 (8.3%)	4 (17.4%)	
Good	11 (34.4%)	11 (61.1%)	6 (66.7%)	3 (60%)	15 (100%)	11 (91.7%)	19 (82.6%)	
Decannulation recommended								0.01**
Yes	7 (21.9%)	5 (27.8%)	3 (33.3%)	3 (60%)	15 (100%)	11 (91.7%)	20 (87%)	
No	25 (78.1%)	13 (72.2%)	6 (66.7%)	2 (40%)	0 (0%)	1 (8.3%)	3 (13%)	
Decannulation								0.02**
Yes	5 (15.6%)	6 (33.3%)	3 (33.3%)	3 (60%)	13 (86.7%)	10 (83.3%)	20 (87%)	
No	27 (84.4%)	12 (66.7%)	6 (66.7%)	2 (40%)	2 (13.3%)	2 (16.7%)	3 (13%)	

TCT=Tracheostomy; OTI=Orotracheal intubation; AW=Airway; ARF=Acute respiratory failure
Results expressed through frequency analysis.

In addition, Table 5 also shows that there was a statistically significant difference with the results obtained for the TCT tube occlusion tolerance and the final level of the FOIS scale, since patients who showed good occlusion tolerance progressed to the level of oral intake, with 19 (82.6%) of the sample being at level 7 of the FOIS scale. This finding was similar to the decannulation recommendation variable and the final level of the FOIS scale. In this sense, 20 (87%) patients who were at level 7 of the final FOIS scale received a recommendation for decannulation and only 3 (13%) patients received a recommendation to avoid decannulation. In addition, 25 (78.1%) patients did not receive a recommendation for decannulation and remained at level 1 of the FOIS scale, and 27 (84.4%) patients were not decannulated and also remained at level 1. Finally, 20 (87%) subjects were decannulated and were at level 7 of the FOIS scale.

Finally, Table 6 shows the association between the time the subject used the TCT and the swallowing profile according to the final assessment. The researchers found more patients with functional swallowing among patients who used TCT for up to one month, but dysphagia was more severe in patients who remained with tracheostomy for more than one month, as 21 (23.9%) patients had moderate to severe dysphagia.

Table 6. Association between tracheotomy time and final swallowing assessment.

Final Swallowing Classification	TCT use time		
	Up to a week n=3	Up to a month n=23	More than a month n=88
Not reported	0 (0%)	0 (0%)	1 (1.1%)
Regular	0 (0%)	3 (13%)	9 (10.2%)
Functional	1 (33.3%)	5 (21.8%)	13 (14.8%)
Mild OPD	1 (33.3%)	4 (17.4%)	9 (10.2%)
Mild to Moderate OPD	0 (0%)	1 (4.3%)	9 (10.2%)
Moderate OPD	0 (0%)	2 (8.7%)	13 (14.8%)
Moderate to Severe OPD	1 (33.3%)	4 (17.4%)	21 (23.9%)
Severe OPD	0 (0%)	4 (17.4%)	13 (14.8%)

OPD=Oropharyngeal Dysphagia, according to the classification of degree of dysphagia proposed by O'Neil (1999).
Results expressed through frequency analysis

Discussion

Most of the sample in this study consisted of male patients, with 65 (57%) cases, which is in line with recent studies that report a higher prevalence of male tracheostomy patients[2, 3, 9, 10, 11]. This finding is also in line with a review carried out in 2019[3] that reported a prevalence of 62.1% males in the investigated sample. The mean age of patients was 54.55 years, which is also in line with another study that reported a mean age of 56.6 years[12].

The most frequent place of admission was the ward with 72 patients (63.2%), followed by the Intensive Care Units with 42 patients (36,8%). This finding can be explained by the greater demand for speech-language pathology follow-up of tracheostomized patients after discharge from intensive care units. In this situation, patients no longer require invasive mechanical ventilation (IMV) and there is usually an improvement in alertness during hospitalization in the wards, which favors the return to a safe oral feeding route.

In this study, 14 (12.3%) patients had a history of alcohol consumption, 29 (25.4%) of smoking and 21 (18.4%) of diabetes. In addition, of the 114 patient protocols analyzed, 80 (70.2%) were affected by pneumonia after TCT. It should be noted that this finding was also described by some authors who reported a greater recurrence of pneumonia in tracheostomized patients compared to patients who did not undergo the procedure[9,13]. Although the use of TCT reduces the need for IMV, there is no agreement among authors on the efficiency of this procedure in terms of prolonging survival[14].

The most recurrent comorbidities found in the patients in this study were SAH, Ischemic Stroke, TBI, ARF, multiple trauma, spine fracture, CPA, CHF and COPD. In turn, the associated comorbidi-

ties found in tracheostomized patients in other studies[9,13,15] were as follows: SAH, kidney disease, drug use, stroke, acute myocardial infarction, meningitis, diabetes mellitus, acquired immunodeficiency syndrome, femur fracture, COPD and heart failure.

Prolonged IMV results in decreased lung capacity, increased chance of pulmonary complications and higher mortality rates. The shorter time of IMV reduces the length of stay in the ICU and mortality rates[14], in addition to the decrease in ventilator-associated pneumonia[16]. Thus, it is necessary to consider the benefits of performing a tracheostomy to favor the ventilatory rehabilitation of hospitalized patients. In their study, Júnior and Silveira (2017)[13] reported that patients benefited from early tracheostomy, as in cases of stroke, TBI, CVA, spinal cord trauma and COPD, as there was a reduction in the time required for IMV.

There are several reasons to perform a tracheostomy, but the most common reason is prolonged OTI, as shown in previous studies[9, 17]. The main reason for performing tracheostomy in the patients in this study was the prolonged orotracheal intubation time, as in 78 (68.3%) patients. In turn, 71 (62.3%) patients required intubation for more than ten days, which is in line with a study that reported an average of 11 days of orotracheal intubation for tracheostomy[15] and 11.6 days[16]. Tracheostomy can be considered early when performed up to the 13th day of orotracheal intubation, as described in this study, or late when performed after the 14th day[16].

Some studies[2,3,12,18-21] emphasize the importance of early intervention in dysphagia to minimize patient discomfort. In this sense, the speech-language pathology monitoring is important with a view to returning swallowing functionality, since the presence of efficient swallowing is also a predictor of tracheostomy tube removal. The speech-language pathologist plays a fundamental role in the multidisciplinary team aiming to reestablish the swallowing biomechanics in cases of dysphagia in tracheostomized patients[2]. This study found an improvement in swallowing biomechanics after speech-language pathology monitoring, with an increase in the number of patients who were diagnosed with normal swallowing and a reduction in the number of subjects diagnosed with severe oropharyngeal dysphagia. There was also an improvement in the level of oral intake evaluated by the application of the FOIS scale, as shown in Figure 1. The results obtained in relation to the type of diet ingested show a reduction in the number of subjects with exclusive feeding by alternative route and more patients with some level of oral feeding, which is with studies carried out by other authors[12,18]. On the other hand, oral ingestion was not always possible in patients with a history of neurological diseases, since there was a greater number of subjects who remained at level 1 of the FOIS scale (Table 4). This finding is similar to that of another study that suggests that decannulation is slower for patients with neurological injuries, more specifically ischemic stroke[3]. This can be explained by the profile of these patients, who usually have some degree of cognitive and/or motor impairment that may explain the permanence of the tracheostomy, altering swallowing and sometimes making oral ingestion impossible[2, 3].

During speech-language pathology rehabilitation, professionals perform compensatory maneuvers to minimize the signs and symptoms of dysphagia, in addition to postural changes and changes in food characteristics, such as volume, viscosity, temperature and flavor, in order to restore the physiological swallowing[12]. Most patients in this study received combined therapy, with indirect and/or direct swallowing, orofacial and vocal myofunctional therapy. However, direct therapy was the most recurrent therapeutic resource, found in 78.9% of the patients in the sample. Only four (3.5%) of the evaluated patients were not submitted to speech-language pathology intervention, which was due to clinical issues (altered and inadequate alertness to perform care or clinical instability) that made the intervention impossible.

The initial saliva test was not performed in 58 (50.9%) patients, which shows that this test is not always necessary to assess the swallowing of tracheostomized patients, and reinforces the clinical evaluation as the main method of analyzing the swallowing of this population. Even though some studies use this test as one of the predictors for decannulation, since the test is based on the presence of saliva or food aspiration, the test has no reliability value due to the high number of false-negative results. In this sense, it has already been found that the sensitivity and specificity of this test are 82% and 38% respectively[3, 20], and the negative MBDT does not mean absence of aspiration, but it can be considered a screening test for the evaluation of swallowing in tracheostomized patients[22]. This reinforces the need for swallowing assessment for

successful tracheostomy removal. In this sense, there was a literature review that used the swallowing assessment as a step of the decannulation process most cited in the analyzed articles, showing the importance of the speech-language pathologist in this process[21].

Regarding the presence of the cuff (inflated or not), this study found a greater number of patients at level 7 of the FOIS scale full oral intake in solid consistency) who did not have a cuff in the tracheostomy compared to patients who had an inflated cuff. It should be noted that tracheostomy tube cuff can cause tracheal injuries, strictures and increase swallowing difficulty[19, 23]. Cuff deflation should be performed as soon as possible when there is no large volume of secretions in the airways and the patient is in a good state of alert, as the device does not protect from aspiration. When the tube cuff is inflated, it anchors the larynx and may increase silent aspiration of saliva[20].

Regarding speech-language rehabilitation, it is necessary to verify the patient's tolerance to the occlusion of the tracheostomy tube, since this information is essential for subsequent decannulation. Most of the sample (76 patients, 66.7%) in this study showed good tolerance to the tracheostomy tube, which is one of the predictors for successful decannulation. In addition, 64 (56.1%) of the tracheostomized patients in this study were recommended to remove the tracheostomy and 60 (52.6%) had the tracheostomy removed. When compared with some studies performed by other authors, it is possible to note that this study found a high rate of decannulated patients, since a study performed by another author[2] reported a success rate of 42.8% of decannulated patients. There was another study[15] that divided the sample into two groups of patients who were discharged from hospital, finding in group 1 16.66% patients who were decannulated, and 28.57% of patients in group 2 had the tracheostomy removed. Given that the underlying disease has a great impact on this issue, it was found that there is a lower rate of decannulation for patients with central neurological diseases, taking longer to remove the device in post-stroke patients[3].

When comparing the tracheostomy tube occlusion tolerance and the patient's final FOIS scale level, patients who had good tube occlusion tolerance progressed to the level of oral intake, with a statistically significant difference. This is due to the fact that the subglottic pressure is reestablished[2, 4] when there is occlusion, which favors the physiological process of swallowing.

As for the use of tracheostomy, individuals who used tracheostomy for up to one month had functional swallowing, but, in turn, dysphagia was more severe (moderate to severe) in patients who remained with tracheostomy for more than one month. This finding is in line with a study[18] that reports an improvement in oral intake when the tracheostomy is removed, also improving quality of life.

Regarding the time taken to remove the tracheostomy from the patients who had it, most required more than a month for this procedure. It should be noted that this data is subjective, as many patients are still awaiting specific surgery, depending on the case, and remain with tracheostomy. According to a previous study[3], there is great variation in the average length of stay with the tracheostomy, ranging from 16 to 91 days, and with the completion of the decannulation process in 7 to 74 days.

Conclusion

The presence of dysphagia and use of an exclusive alternative feeding route according to the FOIS scale analysis show that the presence of tracheostomy impacts the swallowing functionality of hospitalized patients. Also, as the patients remained at level 1 of the FOIS scale, it can be said that neurologically-based diseases impact the level of oral intake. In addition, the findings showed that the longer the time of tracheostomy use, the greater the difficulty in resuming oral intake. This could be observed in patients who used tracheostomy for up to one month and had functional swallowing, while patients who remained with tracheostomy for more than one month had more severe dysphagia.

Speech-language pathologists should work together with the multidisciplinary team to achieve success in decannulation, since in addition to preserved swallowing; tolerance to occlusion of the tracheostomy tube is one of the predictors for decannulation. The final evaluation showed the diagnosis of a greater number of patients with swallowing, and the MBDT showed a reduction in the number of patients with the presence of salivary aspiration, in addition to a reduction in the number of patients using an alternative feeding route. Based on the assessment using the FOIS scale, patients

who had good tolerance to tube occlusion showed an evolution in the level of oral intake and therefore decannulation was recommended for them. In this study, no patient had oral intake associated with the use of an alternative route and only a few had oral intake when using tracheostomy. However, there was an improvement in oral intake after speech-language pathology follow-up, opening the possibility of a full oral diet.

The main limitation of this study was the reduced number of researches in the area of tracheostomized patients, mainly in relation to the importance of speech-language pathology practice in this population, which encouraged the authors to carry out the study. Another limitation was the lack of specific protocols for carrying out evaluations aimed at this population, since there are several recommendations and adaptations of protocols, but none specific for the evaluation and guidance of the therapeutic process of tracheostomized patients.

Regarding future perspectives, further studies are expected to be carried out in the area, aiming to demonstrate the importance of speech-language pathologists in this process. These professionals must integrate the multidisciplinary team in the follow-up of tracheostomized patients, being able to contribute to the rehabilitation process and return of swallowing functionality for this population.

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