
Decannulation: speech therapy and physiotherapy approach

Decanulação: atuação fonoaudiológica e fisioterapêutica

Desentubación: actuación fonoaudiológica y fisioterapéutica

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Abstract

*It was undertaken a narrative and comprehensive review of studies and research about the decannulation process in patients undergoing tracheostomy. **Objective:** to analyze the speech therapy and physiotherapy approach on decannulation of tracheostomy patients, as well as possible complications throughout this process, from the literature indexed in national and international databases. **Methods:** The following databases were searched: Scopus, SciELO and PubMed, from 1996 to 2015. There were selected and analyzed 26 references, which showed the existence of few studies that establish specific criteria for decannulation, keeping the decision regarding this procedure still based on subjective judgments, in opposition to standardized protocols. **Conclusion:** The removal of the tracheostomy and the consequent decannulation depend on many factors and may be a complex process, being necessary others research not only about the most significant factors involved, but also on their evaluation and the interaction between them, taking into account the importance of the performance in multidisciplinary team in order to make the most effective and safe process.*

Keywords: Tracheostomy; Artificial Respiration; Intensive Care Units; Rehabilitation.

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Resumo

Foi realizada uma revisão narrativa e compreensiva de estudos e pesquisas sobre o processo de decanulação em pacientes traqueostomizados. **Objetivo:** analisar a atuação fonoaudiológica e fisioterapêutica no processo de decanulação de pacientes traqueostomizados, bem como as possíveis complicações ao longo deste processo a partir da literatura indexada em bases de dados nacionais e internacionais. **Métodos:** Foram pesquisadas as seguintes bases de dados: Scopus, SciELO e PubMed, referentes ao período de 1996 a 2015. Foram selecionadas e analisadas 26 referências, que mostraram serem escassos os estudos que estabelecem critérios específicos para a decanulação, mantendo a decisão a respeito deste procedimento ainda baseada em avaliações subjetivas em oposição a protocolos padronizados. **Conclusão:** O desmame da traqueostomia e a consequente decanulação dependem de muitos fatores e podem ser um processo complexo, sendo necessárias pesquisas, não somente sobre quais os fatores que estão mais significativamente envolvidos, mas também sobre sua avaliação e a interação entre eles, levando sempre em consideração a importância da atuação em equipe multidisciplinar, a fim de tornar o processo mais eficaz e seguro.

Palavras-chave: Traqueostomia; Respiração Artificial; Unidades de Terapia Intensiva; Reabilitação.

Resumen

Se realizó una revisión narrativa y comprehensiva de los estudios y investigaciones sobre el proceso de desentubación en pacientes traqueotomizados. **Objetivo:** analizar la actuación fonoaudiológica y fisioterapica en la desentubación de los pacientes traqueotomizados, así como las posibles complicaciones a lo largo de este proceso a partir de la literatura indexada en bases de datos nacionales e internacionales. **Métodos:** Fueron investigadas las siguientes bases de datos: Scopus, SciELO y PubMed, para el periodo 1996-2015. Se seleccionaron y analizaron 26 referencias, que mostraron ser escasos los estudios que establecen criterios específicos para desentubación. Todavía se mantiene la decisión con respecto a este procedimiento con base en juicios subjetivos, en oposición a los protocolos estándar. **Conclusión:** La eliminación de la traqueotomía y la consiguiente desentubación dependen de muchos factores y puede ser un proceso complejo, siendo necesarias investigaciones no sólo sobre qué factores están más significativamente implicados, sino también sobre su evaluación y la interacción entre ellos, teniendo siempre en cuenta la importancia de la actuación en un equipo multidisciplinario, con el fin de hacer el proceso más efectivo y seguro.

Palabras claves: Traqueotomía; Respiración artificial; Unidades de Cuidados Intensivos; Rehabilitación.

Introduction

Tracheostomy is a common surgical procedure that is used to facilitate the prolonged ventilatory support in critically ill patient. It allows an early discharge from the ICU and lower mortality associated with mechanical ventilation (MV). This procedure, previously performed only in the operating room, has become increasingly common in intensive care units. Indications for tracheostomy placement include unsuccessful removal of the MV, neurological patients who are unable to protect the lower respiratory tract, excessive amount of secretion and obstruction of the upper respiratory tract¹.

According to Moschetti², MV and tracheostomy are risk factors for oropharyngeal dysphagia. Changes in swallowing may occur due to multiple factors in patients who underwent tracheostomy: caused by the presence of the cannula, especially with the inflated cuff, reducing the regular movement of pharynx³; atrophy caused by the disuse of laryngeal muscles, inability to generate subglottic airway pressure and laryngeal and vocal fold desensitization, reducing the cough reflex. These factors compromise the dynamics of swallowing, which favors laryngeal aspiration, being considered the most predominant silent aspiration^{4,5}. The literature suggests that patients who underwent

tracheostomy may present a risk of aspiration of colonized contents of the oropharynx due to difficulty in mobilizing secretions⁴.

In order to minimize the disadvantages of tracheotomy, the removal of MV, as well as the removal of the orotracheal tube should occur as early as possible, since decannulated patients in the ICU have lower mortality when compared to patients who are discharged to the hospital ward when they are still tracheostomized¹.

The reasons for the indication of a tracheostomy must be considered before starting the removal process⁶. The tracheostomy removal starts when the cuff begins to deflate and finishes at the removal of the cannula and when the occlusive bandage of the stoma is made. The decision of when to start the removal of the tracheostomy is a team work. This would happen in order to minimize any predictive factor of failure⁶.

Some studies suggest the decannulation from the moment that the patient presents an adequate mechanical respiration, with no need for MV, with no obstruction of the upper respiratory tract, controlled secretions and previously evaluated swallowing¹.

Several factors can hinder decannulation. Some studies in the literature show that the respiratory muscles of patients who have undergone prolonged MV suffer loss of strength and endurance by disuse. Some of these studies also report that patients who are dependent on the MV are more prone to fatigue of the respiratory muscles and abnormal breathing pattern. When these problems are associated, they may lead to respiratory failure, making difficult to remove the MV. The loss of strength and respiratory muscle strength can hinder or even prevent the process of decannulation^{7,8}.

According to Kent⁹, decannulation needs caution, especially if the period of use of the tracheostomy has been extended, requiring multidisciplinary attention. Because of this, and considering the lack of publications on the subject, this study aimed to carry out a bibliographical survey on the speech therapy and on the physical therapy practices regarding the decannulation process.

Method

We carried out a narrative and comprehensive review of studies and research on speech therapy and physical therapy practices regarding the decan-

nulation process in tracheostomized patients. We selected the studies that addressed the procedures that are involved in the decannulation process, as well as its possible complications in its implementation and the consequences on the general state of the tracheostomized patient.

We collected the references presented in the literature from databases such as Scopus, SciELO and PubMed. The keywords and terms used in the search were: "tracheostomy and decannulation", "decannulation success", "tracheostomy and speech language pathology", "multidisciplinary and decannulation" and "tracheostomy and physical therapy".

The study included publications from 1996 to 2015. The most relevant database for our work was SciELO, followed by PubMed. We analyzed 31 references, 26 on the proposed topic; the other five references referred to the methodology on specific surgical procedures of tracheostomy – therefore, they were discarded.

The data were organized into three categories: Tracheostomy; Decannulation - speech therapy and physical therapy procedures and decannulation - complications.

Literature review

Tracheostomy

The word tracheotomy is of Greek origin and it means *opening the trachea*. The term tracheostomy defines an opening in the trachea to maintain communication with the exterior, usually by means of a cannula. Tracheotomy is one of the oldest surgical procedures. Illustrations of the procedure were found in Egyptian papyri dating back to 3500 BC. However, due to the little knowledge of anatomy and the poor results obtained hindered its acceptance in that time¹⁰.

After 1960, with the advances in intensive care, tracheostomy became to be routinely performed in patients in MV. As a result of the knowledge and the experience that was acquired, this procedure was simplified and, now, it is carried out in the intensive care units and, in most cases, not being necessary to take the patient to the operating room¹¹.

Tracheostomy is probably the most commonly performed procedure in critically ill patients, being approximately 10% of them subjected to

this procedure¹². The indication of tracheostomy aims primarily to reduce the discomfort with the orotracheal tube and to facilitate the removal of pulmonary secretions that with these benefits may allow a reduction of the MV time, the incidence of pneumonia and the time of hospitalization¹³.

According to Lewiss et al.¹⁴, the tracheostomy tube is placed below the cricoid cartilage, through the trachea, between the third and fourth tracheal rings, creating a secondary air passage (larynx) and allowing the passage of a greater volume of inspired air available to oxygenation. According to Filho et al.¹⁵, there are several types of cannulas that are classified according to the type of material that is used in its manufacture, its style and its type.

The material used in the manufacture of the cannulas can be: plastic (PVC) - widely used, but it can cause inflammation and formation of granuloma tissue, and it cannot be re-sterilized; silicone - it is not porous and it allows the sterilization, being able to be reused, and it is the most widely used synthetic material in bioengineering due to its high degree of biocompatibility; metal - it is rigid and heavy cannula and it presents the disadvantage of transmitting heat and cold to the patient - it is adopted for patients in home care, because it is more hygienic than the PVC cannula. In most cases, plastic and silicone cannulas are preferred over metal because of their flexibility, providing greater comfort to the patient¹⁶.

In relation to its style, the cannula tracheostomy standard presents an external cannula, an inner cannula, a mandrel, a fastening cord in the neck and a small device to obliterate the cannula when necessary. Regarding the type, they can be fenestrated or non-fenestrated; with or without a cuff and with or without inner cannula. The fenestrated cannulas have small holes that allow the passage of air to the vocal folds, restoring the standardization of air flow. The cuff is a small balloon at the distal end of the cannula that can be inflated and deflated according to the necessity. It is indicated in two situations: in patients who need MV and in patients with chronic aspiration¹⁶.

Tracheostomy presents several advantages when compared to the orotracheal tube, including less time to remove the MV, lower resistance to airflow, less dead space, less movement within the trachea, greater patient comfort and more efficient swallowing¹⁷. However, recent studies show that prolonged tracheostomy may favor the late occur-

rence of complications, including tracheal stenosis, bleeding, fistulas, infection, bleeding and aspiration¹⁸. Besides, mortality is higher for patients who are discharged from the intensive care unit (ICU) for the hospital ward when they are still tracheostomized. Therefore, removing the endotracheal cannula is an essential step in the rehabilitation of critically ill patients¹⁷⁻¹⁹.

Decannulation - speech therapy and physiotherapy procedures

There are several advantages in decannulation, including the improvement in the functions of swallowing and vocal folds, the hospital discharge becomes easier if the patient or caregiver does not need to learn to manage the cannula of tracheostomy, as well as the improvement in the appearance and comfort of the patient²⁰.

It is common to follow specific rules for the tracheostomy indication, but there are no decisive rules for the removal process. Chronic diseases and the lack of protocols for the removal and evidence-based decannulation make it difficult to predict the results of this process in the particularities of each patient²⁰.

Hernández et al.²¹ state that the classification of tracheostomized patients based on the indication of tracheostomy (mechanical ventilation with prolonged removal, or incapacity of handling respiratory secretions, including those ones with deteriorating level of consciousness due to brain damage) is an essential step for developing protocols for decannulation.

According to the study Tobin and Santamaria²² major decannulation criteria include ability to tolerate the cuff deflated for 24 hours, cough with the capacity to remove secretions from the mouth, intact upper respiratory tract, swallowing ability, speech with phonation or occlusion valve of the tracheostomy and with no need of oxygen support.

The same criteria were observed in a research carried out by Stelfox et al.¹⁸, who aimed to characterize the contemporary practices of decannulation, through interviews applied to doctors and respiratory therapists in the United States. As a result, this research found out that the four most important criteria for the decision of the decannulation are: the ability to tolerate occlusion of the tracheostomy tube, secretions, the effectiveness of cough and the level of consciousness of the patient. The decrease

in the level of consciousness has been described as a factor that is related to oropharyngeal dysphagia, associated with aspiration and pneumonia¹⁶.

In this sense, due to the complexity and peculiarities involved in the decannulation process, studies^{22,23,24} have demonstrated the importance of the teamwork between physiotherapists and speech therapists in the decannulation process. Mestral et al.²⁴ state that physiotherapist should be responsible for verifying the tracheostomy cannula, the oxygen system and also the tracheostomy tube, as well as to discuss daily issues of care of the tracheostomy with the nursing staff, patients and families. The same author states that the speech therapist is responsible for evaluating the ability of the patient to tolerate the speech valve (in other words, this professional is responsible for evaluating the level of consciousness, airway protection, phonation, management of secretions) and carry out recommendations regarding the use of the speech valve and / or strategies of communication.

Zanata et al.¹⁶ consider six important criteria for clinical evaluation: level of consciousness, breathing (plastic or metal tube, inflated cuff or not, and when cuff is inflated, if when deflated, the patient keeps the breathing pattern), tracheal secretion (quantity, appearance and color), phonation (responsive or non-responsive, and observing the presence of wet voice), cough (observing the presence of voluntarily cough reflex, and if it is effective or not) and swallowing (evaluating the level of impairment).

For the clinical evaluation of swallowing in tracheostomized subjects, the Blue Dye Test may be used. It consists of a procedure that is used for saliva staining / food with blue dye, in order to identify the saliva / food suction in tracheostomized subjects⁵.

In a study carried out by Santana et al.⁵, in which they applied a questionnaire to audiologists who were attending tracheostomized patients, it was found that all interviewed subjects use the Blue Dye Test as a resource in the clinical evaluation of swallowing to detect aspiration. Garuti et al.³ suggest the use of the test to detect the presence or not of aspiration, episodes of desaturation and respiratory complications to help in the decision of the decannulation.

In a study carried out with thirty patients after the treatment for head and neck cancer, the patients were submitted to a modified Blue Dye

Test and simultaneously to nasofibrolaryngoscopy of the swallowing. This study demonstrated that the Modified Blue Dye Test has a sensitivity of 95.24% and specificity of 100% for detecting aspiration in patients after the treatment for head and neck cancer.²⁵

Belafsky et al.²⁶ carried out the modified blue dye test in 30 tracheostomized patients, with a mean age of 65 years, and they found out that the sensitivity and specificity of the test were 82% and 38% respectively.

The respiratory therapy is very important as a way to start the process of decannulation in MV patients. It may decrease the pressure of the respirator, identification of the weakness of the peripheral and respiratory muscles and as an alternative to facilitate the speech valve adaptation – considering that the patients who undergo tracheostomy and prolonged MV suffer loss of strength and overall muscle strength by desuse⁷.

Mechanical ventilation causes changes in the physiology of swallowing, with change of tone and range of motion of oropharyngeal structures, thus compromising the laryngeal elevation and swallowing-breathing coordination.⁵

According to Frank, Mäder e Sticher²⁷, the main aspect in the treatment of swallowing in patients who underwent tracheotomy is the process of deflating the cuff and stimulating the swallowing and cough functions with deflated cuff, however, standardized protocols for the evaluation of swallowing are still rare in the literature. Authors²⁷ suggest the use of a protocol that was created in 2000 in the REHAB Basel rehabilitation center, in Switzerland. It establishes, as functions of the audiologist, to deflate the cuff during exhalation, if the patient tolerates the deflated cuff, performs digital occlusion of the tube or through the speech valve, extending the intervals with the cuff deflated daily until the patient tolerates at least 20 minutes, associated with the stimulation of swallowing, voice, cough and management of secretions.

The speech valve is a resource that can be used to contribute to the decannulation^{28,29}. In patients who breathe spontaneously and tolerate the occlusion of the tracheostomy, it is possible to place the speech valve over the cannula with the deflated cuff. The use of speech valve allows the air to flow into the cannula during inspiration, but during exhalation the air is directed to the vocal folds and to the

upper respiratory tract – moment when the voice is produced²⁰.

With the use of one-way speech valve - Passy-Muir type, fenestrated cannulas or occlusion of the tracheostomy, the adequacy of phonation and swallowing in tracheostomized patients occurs due to the restoration of the passage of air through the glottis, increased subglottic pressure and stimulation of central and peripheral nervous endings²⁹.

For a better tolerance of the speech valve and to avoid muscle strain, it is advisable to replace the cannula of the tracheostomy for another one with 1-2 smaller numbers, reducing the airway resistance (although the inspiratory one becomes increased) and also improving the management of secretions, which must be expectorated by the natural respiratory tract²⁸.

To contribute to the efficiency of the process of decannulation, O'Connor e White²⁰ comment that endoscopic inspection of the respiratory tract, although it is not essential for the decannulation, would be useful. The procedure is performed by nasoendoscopy with optical fiber in the subglottic space. This procedure is safe and requires only topical anesthesia. In a substantial number of patients, through an endoscopic evaluation, pathologies that require otolaryngological and thoracic surgery attention before the process of decannulation are identified.

Recently, Santus et al.³⁰ published a systematic review that aimed to identify quantitative and semi-quantitative parameters for decannulation and to develop a clinical score, involving speech therapy and physical therapy evaluations. Among the quantitative parameters, the authors included cough measures (expiratory muscle strength ≥ 40 cm H₂O; peak of cough flow > 160 L/min) and the occlusion of the cannula ≥ 24 , each of which receives a score of from 0, in the case of impairment, or 20 if it is appropriate. On the other hand, for the semi-quantitative parameters, the authors included: level of consciousness (drowsy/alert), secretion (thick/thin), swallowing (impaired/normal), capnia (PaCO₂ < 60 mmHg), respiratory tract clearance (tracheal stenosis $< 50\%$ seen by bronchoscopy), age < 70 years, indication of tracheostomy (others/pneumonia or respiratory tract obstruction) and comorbidities (≥ 1 or none). The score of each semi-quantitative parameter receives a score from 0 (impaired) or 5 (adequate).

It should be noted that the proposed score was not validated, which requires studies with methodological rigor and adequate sample in order to identify the appropriate score for decannulation. However, the authors hypothesize that the quantitative criteria, when appropriate, present more chances to succeed in the decannulation; if only one of the quantitative parameters is appropriate it is necessary a careful evaluation of semi-quantitative criteria; and if none of the quantitative criteria are appropriate with the impairment of more than three of semi-quantitative parameters, the failure in the decannulation is greater.

The interaction between physical therapist and speech therapist allows reducing the tracheostomy time, accelerating its removal, making it safer for the patient, with less risk of failure and complications¹. All professionals who are involved in patient care need to be alert to warning signs of complications, which include the presence of saliva residue or food in the trachea, change in color or appearance of the secretion, fever, oxygenation worsening, reduced consciousness level and abrupt change in radiographic chest image. It is observed that few studies have proposed decannulation protocols within the stipulated period in this review. However, among the relevant items to be evaluated, they point to the respiratory condition, swallowing function, level of consciousness and respiratory muscle strength of the patient.

Decannulation - complications

Although promoting great benefits to the patient when compared to the use of endotracheal tube, tracheostomy should be performed with proper technique and with precautions applied correctly. Complications are not frequent, but when they happen, they can lead to death. According to Choate et al.³³ the major cause of failure in the decannulation is the retention of secretion. Difficulties in removing the cannula also occur in situations in which there is the persistence of the cause that led to the tracheostomy; displacement of the anterior wall of the trachea, blocking the tracheal lumen; mucosal edema; intolerance to the increase of air resistance by the passage of air into the nostrils (common in children and in elderly people); stenoses or tracheomalacia.

Obstructive and restrictive respiratory conditions may present difficulty in staying out of the

MV during the night by hypoventilation or sleep apnea. They can be benefited by non-invasive nasal ventilation with cannula of tracheostomy occluded through the night until finally being decannulated¹.

O'Connor e White²⁰ emphasize the need for monitoring the oximetry of patient during the first 24 hours after the decannulation. The vocalization usually returns to normal when the stoma closes completely, which can occur by secondary intention from five to seven days in most patients. The presence of fibrous scar on stoma closure can be aesthetically disturbing and it may contribute to dysphagia due to adherence of the skin into the trachea, making the laryngeal elevation difficult. These cases are capable of being corrected surgically.

An accidental decannulation can result in serious consequences if the tracheostomy is recent and if the patient has a difficult path. After the seventh day of the placement surgery of the tracheostomy cannula, the replacement is usually easy. If the decannulation occur before the seventh day, recannulation can occur inappropriately. Patients with short neck or increased circumference are at greater risk of this fact occur¹.

Immobility, followed by generalized muscle weakness, are important complications found in the tracheostomized patient, especially in subjects who remain dependent of the MV⁸ for long periods. It may be a factor of failure during the decannulation procedure. In this context, Lima et al.¹² verified the influence of peripheral muscle strength in the success of decannulation of 57 patients, in which 46 progressed successfully and 11 with failure. The subjects who were successfully decannulated presented significantly higher peripheral muscle strength when compared to the failure group (41,11±11,52 X 28,33±15,31, p=0,04). In this study the strength evaluation was performed by the Medical Research Council scale (MRC).

Final considerations

The removal of the tracheostomy and the consequent decannulation depend on many factors and it may be a complex process, which should always take into account the importance of the multidisciplinary team performance in order to make process more effective and safe.

In addition to pulmonary issue, muscle atrophy caused by the disuse, with consequent loss of

strength and endurance of skeletal muscle should be the intensive focus of physiotherapy in the removal process. The speech therapy work in the decannulation process aims to adapt swallowing, making it safe and effective, as well as act in the protection of the lower respiratory tract, working the sphincter function of the larynx and cough.

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