Decannulation and Assessment of Deglutition in the Tracheostomized Patient in Non-Neurocritical Intensive Care

Andrés Alvo,* Christian Olavarria

Servicio de Otorrinolaringología, Hospital Clínico Universidad de Chile, Santiago, Chile

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Abstract With intensive care patients, decannulation and deglutition disorders are frequent reasons for otorhinolaryngological assessment.

The objective of a tracheostomy is to maintain a patent airway. It does not necessarily prevent episodes of aspiration and may even favour them. When the cause that led to the tracheostomy resolves, a decannulation may be proposed.

Deglutition is a complex act involving the coordinated interaction of several structures of the aerodigestive tract. Fibreoptic endoscopy and videofluoroscopy are 2 useful, complementary tools for the evaluation of patients with swallowing disorders. In managing these patients, a thorough knowledge of laryngeal and swallowing physiology, as well as of the different therapeutic alternatives, is required.

Although it is not uncommon for swallowing disorders to coexist in tracheostomy patients, decannulation evaluation is not synonymous with deglutition assessment. A patient could be a candidate for decannulation and have a swallowing disorder, or a tracheostomy patient could swallow adequately.

Knowing and understanding these concepts will lead to more efficient management and help to clarify communication between the intensive care physician and the otorhinolaryngologist. Ideally, a multidisciplinary team should be formed to evaluate and manage these patients.

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Decanulación y evaluación de la deglución del paciente traqueotomizado en cuidados intensivos no-neurocríticos

Resumen Las evaluaciones para la decanulación y los trastornos de la deglución son motivos frecuentes de interconsulta otorrinolaringológica para pacientes en cuidados intensivos.

El objetivo de la traqueotomía es mantener una vía aérea permeable. No previene necesariamente los episodios de aspiración e incluso podría favorecerlos. Cuando la causa que motivó la traqueotomía se resuelve, puede plantearse la decanulación del paciente.

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* Corresponding author.
E-mail address: andresalvo@gmail.com (A. Alvo).
Assessment of tracheostomies and deglutition alterations are 2 of the most common reasons for otolaryngology consultation in patients admitted at intensive care units (ICU). This has acquired an increasing relevance at centres where percutaneous tracheostomies are performed, usually by an intensivist. In a study conducted at our hospital, 38% of tracheostomised non-neurological ICU patients presented an associated deglutition disorder. 1

The aim of this article is to clarify some concepts on laryngeal function, tracheostomies, aspiration and assessment of deglutition, in order to facilitate communication between intensivists and consulting otolaryngologists. In our opinion, this would allow a more directed and precise study of the problem being assessed, thus optimising time and resources.

We believe that unifying criteria and teamwork will improve the interaction between different specialists, resulting in better patient care.

Physiology of the Larynx

The larynx is classically considered to have the following 3 main functions, in order of decreasing importance: (a) breathing, (b) protection of the airway during deglutition, and (c) phonation. A fourth function which has been described is the Valsalva manoeuvre, used during exertions such as lifting weight or else to increase subglottic air pressure during deglutition. 2

The larynx is divided into the supraglottis, glottis and subglottis. The glottis corresponds to the plane formed between the vocal cords and includes the bottom part of the ventricle, the vocal cords, arytenoids and anterior and posterior commissures, and extends for 1 cm in a caudal direction.

The laryngeal musculature is in turn divided into extrinsic and intrinsic, depending on whether one or both insertions are located in the larynx, respectively. Intrinsic muscles are in charge of adduction, abduction and tending the vocal cords, whereas extrinsic muscles lift the larynx, moving it as a block. 3 The only abductor muscle is the posterior cricoarytenoid. From a motor standpoint, all intrinsic muscles are innervated by the recurrent laryngeal nerve, except for the cricothyroid which is innervated by the superior laryngeal nerve and which tilts the thyroid cartilage over the cricoid, tending the vocal cords. 4

Sensory innervation of the supraglottis and glottis is carried out by the superior laryngeal nerves and that of the subglottis by the recurrent laryngeal nerves.

During breathing, the vocal cords open and this is their resting position. During deglutition the larynx rises and the vocal cords close momentarily, blocking the flow through the glottic plane. 5

The myoelastic and vibrating properties of the vocal folds enable them to act as a multilaminated vibrator during phonation, thus allowing sounds to be produced. These sounds are differentially amplified in the resonators of the vocal tract. 6

Physiology of Deglutition

Deglutition is a complex action which involves much more than just the closure of the vocal cords when the food bolus passes from the mouth to the oesophagus.

Academically, deglutition is separated into different phases: preparatory, oral, pharyngeal and oesophageal. 7 Each of these phases can be affected to a different extent, resulting in dysphagia, aspiration and regurgitation, among other disorders.

A normal deglutition function requires relative anatomical indemnity of the structures involved, sensory and motor integrity and an adequate coordination during the sequential functioning of all of the above.

The preparatory and oral phases involve mastication and transfer of the bolus. The pharyngeal phase requires adequate velopharyngeal, lingual, hypopharyngeal and laryngeal function. Ventricular bands and vocal cords close, the epiglottis becomes posteriorised, the larynx rises and the pharynx contracts. Lastly, during the oesophageal phase, the superior oesophageal sphincter relaxes and peristaltic waves commence.

Moreover, we must take into account that there are several grades of deglutition alteration. The disorder may become evident only with certain foods and not with others. Thus, some patients are capable of managing their saliva, but have trouble with liquids, purées or solids, or else present an overall disorder. These disorders are not necessarily stable over time, and can be intermittent.

Regarding central control of deglutition, there is a reflex swallowing action which takes place unconsciously, as a
protection mechanism for the airway, and another which is started voluntarily in wakeful subjects.3 The cortical and subcortical control pathways are important for a correct coordination of deglutition.6 This should be taken into account when assessing the deglutition function of patients with significant alterations of their consciousness levels.

There are several conditions which predispose ICU patients towards deglutition alterations, from general factors such as age, polymedication, altered consciousness and weakness, to specific factors such as probes and mechanical ventilation. There is contradictory evidence regarding whether or not the presence of nasoenteral probes irritates and alters laryngeal sensitivity and/or favours episodes of gastroesophageal reflux.9-11 The role of tracheostomy in deglutition disorders is controversial and, at present, some authors consider that it could even favour episodes of aspiration.13

Tracheostomy and Deglutition

The use of tracheostomies impedes the flow of air through the glottis, decreases glottic sensitivity and impedes the increase of subglottic pressure during deglutition.14,15 On the other hand, inflated balloons could alter the mechanism of deglutition.16,17 The role of the balloon or cuff of the tracheal tube is to provide an air seal around the tube and, ideally, to prevent the passage of secretions. Nevertheless, several studies suggest that the high volume/low pressure balloons which are commonly used do not prevent aspiration, enabling the flow of fluids through the folds which appear when this adapts to the tracheal wall.18-20

Moreover, the presence of the tracheostomy cannula could limit the rise of the larynx during deglutition,21 although recent studies suggest that this effect may be less significant than previously thought.22,23 Kang et al. studied 13 patients through videofluoroscopy before and after being decannulated and did not find significant differences in laryngeal kinematics during deglutition.22

Some recent studies have demonstrated that tracheostomy would not worsen deglutition among critical patients. From another point of view, these studies also suggest that episodes of aspiration would not worsen after the cannula is removed. Therefore, the presence of a tracheostomy would not favour aspiration, but would not prevent it either.24,25 Leder and Ross conducted a study on 25 patients comparing the presence of aspiration before and after performing tracheostomy and found no significant differences. In other words, those who presented aspiration prior to the tracheostomy maintained it, whereas those who did not present it did not develop it subsequently.24

Another work, conducted by Suter et al. in 2003, was not able to identify changes in the level of aspiration with an inflated vs deflated balloon.26

Assessment of Deglutition: Videofluoroscopy and Fibreoptic Endoscopic Evaluation of Swallowing

The clinical assessment of these patients evaluates the general and baseline conditions, neurological status, strength, sensitivity and mobility of head and neck structures, the ability to cough and speak and changes observed when swallowing water, among other variables.27 This initial semiological assessment can be complemented through the administration of dyes which, when swallowed after mixing with water or food, reveal aspiration by showing dyed secretions leaking from the tracheostomy.28

In addition to these clinical tests, there are also other diagnostic methods which offer relevant information during the study of these patients.

Fibreoptic Endoscopic Evaluation of Swallowing

Fibreoptic endoscopic evaluation of swallowing (FEES) was conceived as an exhaustive evaluation of deglutition, including the anatomical study of the upper aerodigestive tract and the deglutition function through the administration of food with different volumes and viscosities.29 This evaluation enables a direct visualisation of the structures involved and a dynamic evaluation of the larynx. Its main disadvantages are the existence of a “blind spot” when the bolus passes through the pharynx and the inability to examine the oesophageal phase. Fibreoptic endoscopic evaluation of swallowing-sensory testing (FEES-ST) includes a study of laryngeal sensitivity through the application of pressurised air on the glottic structures to evaluate their reflex closure.30

Videofluoroscopy of Deglutition

On the other hand, videofluoroscopy is an imaging study in which barium is swallowed in order to observe its passage towards the digestive tract and, in cases of aspiration, towards the airway. Its main disadvantages are that it requires mobilisation of the patients to the radiology department, not offering clear anatomical details of the pharynx and larynx and not providing an adequate assessment of saliva retention.29,31

For these reasons, we do not consider one of these tests to be superior to the other, but rather complementary.

Decannulation

The most important indications for tracheostomy can be divided into 3 main categories: obstruction of the upper airway, need for prolonged mechanical ventilation (MV) and facilitating the management of bronchopulmonary secretions.32

Aspiration is not generally considered an indication in and of itself, although it can play a role in transient and mild cases by facilitating pulmonary washing.19,33 Cases of intractable aspiration require specific surgical methods.34

The decision to decannulate patients is adopted when none of these indications is being fulfilled.35 Like in most medical situations, clinical judgement is the key factor in this decision.

Generally, patients in an ICU are tracheostomised in order to avoid prolonged orotracheal intubation and do not present mechanical obstructions of the upper airway. Therefore, in these cases, the intensivist could start to consider decannulation once patients no longer require MV (Fig. 1).
We believe that requesting an otolaryngological assessment in cases where decannulation is not yet being contemplated is not efficient and does not provide much information, unless upper obstruction, massive aspiration or a similar condition is being sought, based on a specific clinical suspicion.

Once a consultation has been requested, the otolaryngologist must evaluate the general condition of the patient, as well as comorbidities and state of consciousness. Next, the pharynx is aspirated and an occlusion test, consisting in deflating the balloon and covering the cannula with a finger, is carried out. This test is useful when patients are capable of breathing and phonating without desaturation, which offers greater assurance for decannulation. If the patient presents breathing difficulties, this could be due to a failure of the lung pump or the larynx, or else to a hindered airflow due to an excessively narrow space between the tracheal wall and the tracheostomy cannula (unless a perforated cannula is used), so this does not necessarily represent a contraindication for decannulation.

The study must then assess the upper airway using a flexible nasopharyngolaryngoscope, which enables examination through the tracheostomy to seek obstructive lesions, secretions and erosions. Next, the pharynx and larynx are assessed through a nasal approach, seeking retention of secretions and aspiration, vocal cord mobility and laryngeal lesions, which could have an iatrogenic origin or be due to the baseline condition of the patient, or else have gone unnoticed previously.

Although it is not necessary for decannulation, if there is no evidence of aspiration and it is clearly justified (for example, when the reintroduction of oral feeding in a tracheostomised patient is being considered, if a tracheostomy and nasoenteral probe are going to be removed shortly or if a gastrostomy is being planned), it is possible to carry out a full FEES.

Although the assessment of glottic closure is often requested, these patients rarely present bilateral vocal cord palsy in a paramedian position which would cause severe dyspnoea, or else a paralysis in an open position which would generate massive aspiration. In our experience, most cases present normal or reduced vocal cord mobility and aspiration is generated when the cords open, either by an alteration of sensitivity, absence of cough (due to an absence of glottic airflow) and/or accumulation of supraglottic secretions which tend to penetrate the laryngeal plane.

Since the evidence regarding the relationship between tracheostomy and deglutition is scarce and contradictory, and there is a lack of evidence-based protocols, the assessment of deglutition alterations in these patients is not standardised. As previously explained, although some studies have not shown an improvement of deglutition after decannulation, they do not seem to worsen it either, and there is evidence that it could alter other factors involved, such as subglottic air pressure and laryngeal sensitivity. For this reason, at our centre we consider that, insofar as possible, when a tracheostomy is transient the patient should be decannulated before a thorough evaluation of deglutition through FEES is carried out.

Lastly, if the conditions are correct, the examiner may decannulate the patient. Although this is not clearly protocolised in the literature, in our local experience we prefer to monitor ventilation for some minutes and employ pulse oximetry during and after the procedure, in case there is breathing difficulty. In general, the tracheocutaneous fistula should be "mature", epithelised and stable (7–10 days)
before a tracheostomy can be safely removed, due to the possibility that the patient may have to be recannulated.

A simple, occlusive bandage that can be easily changed should be placed on the stoma and fixed with adhesive fabric.

It is advisable to maintain a clean cannula on the bedside table and also to have a Trousseau–Laborde type tracheal dilator available in case it is necessary to replace the cannula. If recannulation becomes necessary and a cannula is not available, a fine orotracheal tube can be used through the stoma, or else orotracheal intubation, especially if the patient does not present any associated highly obstructive factors.

Aspiration in Tracheostomised Patients

As previously mentioned, aspiration is probably the most controversial aspect to be evaluated in these patients. Although it is debatable that the balloon of the tracheostomy cannula protects against aspiration, at least from a theoretical standpoint, the presence of an inflated balloon in the trachea would prevent the passage of secretions towards the tracheobronchial tree.

This raises some questions which must be evaluated by the otolaryngologist in each individual case: could the accumulation of secretions be due to the presence of the inflated balloon in the trachea? If that were not the case, could an effective laryngeal reflex eliminate these secretions? How long did the saliva take to accumulate in the larynx? Is it a deglutition disorder per se, or is it secondary to tracheostomy? Unfortunately, there are no guidelines in the literature which offer an answer to these questions, so clinical judgement and individual and group experience still play a key role.

In these cases it is helpful to aspirate the secretions and observe how they begin to collect, whether the patient is able to swallow them and if there are any efforts to eliminate them. If this is not the case, decannulation could be deferred.

Conclusions

The presence of a tracheostomy implies a series of physiological changes which, theoretically, should alter ventilation and deglutition. The main concerns to be considered once it has been decided that a tracheostomy is no longer necessary are the obstruction of the upper airway and the possibility of aspiration. The evidence available regarding whether the presence of a tracheostomy cannula prevents or worsens aspiration is scarce and controversial.

In tracheostomised patients, the main objective of the evaluation of decannulation is to determine whether the patient will be able to breathe without a cannula. Evaluating decannulation is not the same as evaluating deglutition, although logically both aspects can be studied together. A patient may be candidate for decannulation whilst still suffering a deglutition disorder, or else a tracheostomised patient could manage to swallow correctly. Therefore, and although it is often used indistinctly in the literature, FEES should be reserved for cases requiring a thorough evaluation of deglutition.

In most cases, tracheostomy by itself is not a treatment for aspiration or deglutition disorders. Severe deglutition disorders require other treatments, including laryngeal elevation manoeuvres, nasoenteral probes, gastrostomies and surgical techniques which divide the aerodigestive tract.

An adequate communication between otolaryngologists and intensivists will facilitate performing the correct procedure for each patient. Ambiguous terms, like “evaluation of glottic function”, should be replaced by specific requests regarding the problem to be assessed.

Conflict of Interests

The authors have no conflict of interests to declare.

References


