

Tracheotomy: how to deal with it?

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Abstract. *Tracheotomy : how to deal with it?* Tracheotomy is one of the oldest surgical procedures and many different techniques are still in use. This guideline is focused on the indications, the choice of technique, open tracheotomy versus percutaneous tracheotomy, the complications, the materials and the management of the patient with a tracheotomy tube.

Introduction

Tracheostomy is one of the oldest surgical procedures and was already performed by the Egyptians in 3600 BC. The first successful tracheostomy was described in 1546 by the Italian physician, Antonio Musa Brasovola.^{1,2} Since then, tracheostomy has had worldwide use as a basic surgical procedure. The first systematic step by step description was reported by Chevalier Jackson in 1909. During the last two decades, the introduction of percutaneous tracheostomy has challenged some indications for the surgical procedures.³⁻⁵

Even the name given to the procedure of cutting a hole in the trachea remains a matter of controversy. The terms “tracheotomy” and “tracheostomy” are used interchangeably although these words have different meanings. “Tracheotomy” (from the Greek word “tome” – to cut) implies the performance of a non-permanent type of surgery, whereas “tracheostomy” (from the Greek word “stomoun” – to furnish with an opening or mouth) implies a more

permanent opening in the trachea. According to the International Organization of Standards, tracheotomy should be the correct name for the act of cutting a hole in the trachea whereas the actual hole and tube should collectively be called a tracheostomy.⁶

Many aspects of tracheotomy and tracheostomy have evolved in different directions through the years. Rather than producing an exhaustive list of the differences, this guideline is mainly focused on some specific issues and, in particular, the prevention of complications.

Indications

Table 1 summarizes the indications for tracheotomy. Prolonged intubation, a need for long-standing ventilatory support and management of bronchopulmonary secretions are indications, in which the otolaryngologist assists as a consultant in the intensive care unit or Neurology department. The gold standard for switching ventilation from translaryngeal to tracheal was around day 21 of intubation. A tendency

towards earlier tracheotomy occurred due to the availability of percutaneous techniques. Consequently, several authors now advocate a more aggressive approach and consider carrying out a tracheostomy after 1 to 3 days of intubation if there is an anticipated need for mechanical ventilation beyond days 7 to 10.^{3,5-11}

Additionally, a tracheotomy is indicated in the case of severe obstruction of the upper airway and as an adjunct to major elective head and neck or cardio-thoracic surgery.

Choice of technique

Once the decision is made to perform a tracheotomy, the technique has to be chosen. Most head and neck surgeons and Otolaryngologists are familiar with the open surgical technique. Because in some institutions percutaneous tracheotomy is performed almost exclusively in the intensive care setting by intensive care physicians without the assistance of head and neck surgeons, the technique of percutaneous tracheotomy is probably less known. This

Table 1
Indications for tracheotomy

1. Prolonged intubation; need for longstanding ventilatory support (reduce dead space or in neurological disorders)
2. Management of bronchopulmonary secretions – aspiration
3. Obstruction of the upper airway:
 - Benign or malignant tumours
 - Laryngotracheal injury
 - Congenital anomalies
 - Bilateral vocal cord paralysis
 - Maxillofacial trauma
 - Fixed foreign bodies in the upper airway
 - Inflammatory, infectious or allergic swelling not reacting to medical treatment
 - OSAS
4. Adjunct to major elective Head & Neck or Cardio-Thoracic surgery.

situation has led to two major side effects. Firstly, most head and neck surgeons are reluctant to learn this technique. Secondly, head and neck surgeons are called to the intensive care unit only when complications occur. For these reasons, we believe that any resident in head and neck surgery should be trained in both procedures.¹² In this way, the head and neck surgeon would be able to select the best suitable procedure according to local or general circumstances. Aware of the performed procedure, he would be present on the spot to adequately tackle potential complications, whether immediate or delayed.

The contra-indications to the percutaneous technique need to be recognized. Table 2 provides an overview of the absolute and relative contra-indications to percutaneous tracheotomy. It is clear that a learning curve exists before becoming familiar with the technique. This implies that the presence of an experienced surgeon is mandatory when converting from percutaneous to open tracheotomy. Failure to recognize this last point may lead to disastrous situations!

Table 2
Contra-indications for percutaneous tracheotomy

- Absolute contra-indications:
- Difficult airway
 - Non-intubated patient
 - Emergency airway needed
 - Inability to palpate cricoid and trachea:
 - Obesity
 - Neck masses
 - Tumour
 - Enlarged thyroid
 - Infection of soft tissues of the neck
 - Recent neck surgery
 - Inability to extend the neck:
 - Kyphosis
 - Arthritis of the cervical spine
 - Cervical fusion
 - Documented or suspected spinal injury
 - Halo traction
 - Children
 - Superior vena cava syndrome
 - Uncorrectable coagulopathy
 - Haemodynamic instability
 - High peak airway pressure
- Relative contraindications:
- Scarring from previous neck surgery
 - Previous neck surgery
 - Correctable bleeding diathesis
 - Irradiation induced tissue changes

Lastly, cricothyroidotomy or coniotomy may be the fastest means to obtain an airway under emergency circumstances. However, because cricothyroidotomy is associated with a higher incidence of both early and long-term sequelae, it is advisable to convert a coniotomy to a standard tracheotomy once the patient is stabilised and able to be transported to the operating theatre.

Open tracheotomy

Open tracheotomy is a surgical procedure performed under general anaesthesia and endotracheal intubation, as well as under local anaesthesia. Local anaesthesia with 1 or 2% lidocaine with epinephrine 1:200.000 is injected in a diamond shape around the planned incision.

Ideally the patient is placed in a dorsal decubitus position with the neck in extension. A rolled towel or sheet under the shoulders can help and a small pillow should stabilize the head. The skin incision is performed in a horizontal or a vertical plane. Each way has its advocates and review of the literature cannot help clarify which is the best. However, in an emergency situation, the vertical incision has the benefit of avoiding most of the veins in the superficial fascia of the neck and thus results in a less bloody surgical field.

Midline separation of the subhyoid muscles and exposition followed by division of the thyroid isthmus are standard surgical steps. Meticulous control of bleeding is required before opening the trachea, which in itself is still controversial.

Whereas some surgeons perform a horizontal incision in the tracheal cartilage, others prefer a vertical approach. Whereas some partly resect the anterior tracheal wall, others make a little inversed U-flap. Regardless of what is done, any injury to the cricoid cartilage or the remaining tracheal rings should be avoided. Finally, introduction of the tracheostomy tube into the trachea should be carried out with care.

In the paediatric population the trachea can only be incised in a vertical plane and no part of the anterior tracheal wall can be taken away. Safety sutures should be placed on both sides of the incision in order to facilitate introduction of the tube. Approximation of the skin incision at the end of the procedure should not be too tight. Fixation of the tracheotomy tube to prevent early extrusion ends the intervention.

Percutaneous tracheotomy

Two techniques of percutaneous tracheotomy are currently widely used: the dilatational tracheotomy and the dilating forceps method.^{1,4,5,11,12} Both techniques require general anaesthesia, are better performed under endoscopic vision and use a J-tipped guide-wire to locate the trachea.^{1,4,5,11,12}

In the first technique, serial dilations are performed over a guide-wire to create a lumen wide enough to introduce the definitive tracheostomy tube. In the second technique, a dilation forceps guided by the guide-wire creates the necessary space.

Complications

Table 3 lists the possible per- and postoperative complications of

Table 3
Complications of tracheotomy

<p>General:</p> <ul style="list-style-type: none"> • Death • Major haemorrhage • Minor haemorrhage • Pneumothorax • Pneumomediastinum • Tracheo-oesophageal fistula or laceration • Paratracheal insertion • Haematoma • Accidental extubation • Subcutaneous emphysema • Tearing of the cannula cuff • Hypotension, hypoxemia • Loss of airway • Resistance to insertion • Laceration of the cricoid • Injury to the recurrent laryngeal nerve • Local wound infection • Airway obstruction due to dried secretions in the cannula • Non-airflow rhinitis • Granuloma formation in the trachea • Laryngo-tracheal stenosis • Persistent tracheo-cutaneous fistula after decannulation <p>Specific to percutaneous tracheotomy:</p> <ul style="list-style-type: none"> • Failure to complete the procedure • Puncture of the endotracheal tube • Puncture of the bronchoscope
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tracheotomy. All surgeons must be aware of all these potential complications in order to both prevent and especially to recognize and treat them accordingly. In this way, permanent co-morbidity or even fatal outcome can best be avoided. Experience is critical to reduce the incidence of complications, and a tracheotomy procedure remains a step by step procedure, which must be respected.

Materials

A wide variety of commercially available tracheostomy tubes or cannulas exists. Each of these has its advantages and disadvantages, and each has its particularities and matched accessories. Numbering of the different types is unique to each manufacturer, so the real measures always need to be

checked on each tube itself. The size of the outer cannula should not fill more than 2/3 of the tracheal lumen and the diameter of the trachea should approximate the width of the index finger. In male patients, the tracheal size ranges from 15 to 22 mm, in female patients from 13 to 18 mm. In the paediatric patient, the reader will find a table with measures according to age in the guideline “Management of stridor in neonates and infants”.¹³

Management of the patient with a tracheostomy tube

Correct management of the patient with a tracheotomy is critical to avoid temporary or more permanent complications.

In the early postoperative period, aseptic wound care should

prevent local wound infection, which, if not controlled, could end in painful granulation around the stoma.

When a cuffed cannula is to remain in place for a prolonged period, daily control of the cuff-pressure is necessary. Twenty to 25 cmH₂O should not be exceeded.

Most patients suffer from excessive tracheo-bronchial secretions early after tracheotomy and regular cleaning of the tube lumen and careful aspiration in the tracheo-bronchial tree are essential. In contrast, because of the lack of natural warming and humidification of the inspired air, some patients have dried secretions and encrustations in both the cannula and trachea. A heat and moisture exchanger is indicated in these patients. At times, external humidification or regular aerosols with mucolytics are necessary.

Most patients and, unfortunately, many medical care providers show aversion towards patients with a tracheotomy. Good practical and psychological support should certainly be organised in patients in whom tracheotomy is expected to be permanent. Most manufacturers have a set of accessories that can comfort the patient in this difficult situation (speaking valves, comfortable and re-usable neck laces, neck scarves, etc.).

Regular changing and cleaning of the inner cannula is needed to ensure a patent airway. The frequency varies from individual to individual. Most patients can take self-care of their inner cannula with some teaching. Changing and cleaning of the outer cannula has no appropriate timing and its frequency depends on signs of infection or other problems. Regardless

of complications or problems, a good policy may be to change the outer cannula every 1 to 3 months.

In case of planned decannulation, it is imperative to check the airway for patency. Temporary and progressive size reduction and progressive capping of the cannula can help the patient with a long-standing tracheotomy prepare for re-use of normal transglottic breathing. A proper dressing, reaching the stomal edges and pressure-supported by the patient when coughing or speaking, will stimulate the spontaneous closure of the tracheo-cutaneous fistula. Surgical closure of the fistula may be necessary if the tracheotomy was present for longer than 16 weeks.

Conclusions

Tracheotomy is a surgical procedure that can lead to serious complications when performed by inexperienced physicians. The head and neck surgeon must be trained to perform both surgical and percutaneous procedures and be capable of selecting the best suitable procedure when a patient requires a tracheotomy.

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CME questions

1. Which condition is an absolute contra-indication to percutaneous tracheotomy?
 - A – Diabetes
 - B – Uncorrectable coagulopathy
 - C – Correctable coagulopathy
 - D – Palpable cricoid and trachea

2. When a cuffed cannula is to stay in place for a long period, the daily controlled cuff-pressure should be between:
 - A – 10 to 15 cmH₂O
 - B – 15 to 20 cmH₂O
 - C – 20 to 25 cmH₂O
 - D – 25 to 30 cmH₂O

3. The ideal diameter of the outer cannula to be inserted in a trachea can be estimated by measuring the width of his:
 - A – Thumb
 - B – Index finger
 - C – Middle finger
 - D – Ring finger

4. In the ideal situation for placement of a percutaneous tracheostomy:
 - A – No endoscopist is needed
 - B – A trained ENT-surgeon is present on the spot
 - C – A trained ENT-surgeon is not necessary
 - D – An anesthesiologist can take care of complications

5. In a paediatric tracheotomy, the incision of the trachea:
 - A – Must be vertical
 - B – Must be horizontal
 - C – Is followed by the placement of traction sutures
 - D – Is best done in a circular way

Answers: 1B; 2C; 3B; 4B; 5A