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Reveiw

Tracheostomy in critically ill patients

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Abstract ENT surgeons are called in more often these days to perform tracheostomy in critically ill patients. When to perform tracheostomy is a question, which is most often asked. There are definite advantages for performing tracheostomy at an early stage of intensive care, but at the same time we need to be aware of the possible complications that are associated with it. Tracheal stenosis being one of the most common complications, which can be prevented if proper care is taken from the time tracheostomy is done.

Keywords Tracheostomy · Tracheal stenosis · Tracheo-innominate artery fistula

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Introduction

As ENT surgeons we are called in more often these days to perform tracheostomy in critically ill patients in the intensive care unit. The advances and improvements in treatment of critical illness have resulted in more patients' who require prolonged airway and ventilatory support [1]. The advantages include patient comfort, safety, ability to communicate, and better oral and airway care**.** Bedside techniques allow rapid tracheostomy with low morbidity**.**

When to perform a tracheostomy in a patient with critical illness? Tracheostomy should be performed as soon as the need for prolonged airway support is recognised. Patients with respiratory failure who cannot be weaned within 7–10 days are candidates for tracheostomy.

Most severely injured trauma patients requiring intubation longer than 5 days will require airway support and will benefit from early tracheostomy [2]. Patients with supratentorial intracranial bleeds who do not awaken within 3–5 days will most likely require a tracheostomy if they survive [3]. Delay of tracheostomy in these groups of patients is associated with longer hospital length of stay and more pneumonia. The presumed aetiology of ventilator assisted pneumonia is aspiration of oral secretions into the larynx and then past the tracheal cuff, into the lungs. Since glottic competence is maintained by tracheostomy, early tracheostomy may prevent or lower the incidence of ventilator assisted pneumonia [4].

The trachea is easily accessible at the bedside. As such it provides ready access for emergency airway cannulation (eg, in the setting of acute upper airway obstruction) and for chronic airway access after laryngeal surgery. More commonly, tracheostomy tubes are placed to allow removal of a translaryngeal endotracheal tube. Tracheostomy tubes have an important effect on respiratory physiology. The most recent and methodological robust studies indicate that these tubes reduce resistive and elastic work of breathing, when compared to endotracheal tubes. This is a result of tracheostomy tubes lessening inspiratory and expiratory airways

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resistance and intrinsic positive end-expiratory pressure [5].

A recent series of 1,130 patients who underwent tracheostomy had a combined procedural, early, and late complication rate of approximately 4%, which is an improvement from the earlier complication rate. In the recent series, tracheal stenosis overtook haemorrhage as the leading complication, by 2 to 1. Tracheal stenosis accounted for nearly half of the complications. Half of the tracheal stenoses required surgical correction. All the patients who developed tracheal stenosis had endotracheal tubes for > 12 days before tracheostomy [6].

Tracheal stenosis

The mechanisms for tracheal stenosis is due to the piston like motion of the tube when the patient is on ventilator, duration of intubation if its prolonged, abrasion of the mucosa by the tube during deglutition, direct trauma to the mucosa during the procedure.

The diagnosis of tracheal stenosis is first made by rigid bronchoscopy . If a web-like stenosis is detected, laser excision and bronchoscopic dilation are employed. If this approach proves ineffective and the patient is a good surgical candidate, tracheal resection is performed. If the patient is not a good surgical candidate or if the tracheal stenosis is long and complex, a tracheal stent is placed. In some instances, after eventual removal of the stent, the tracheal lumen remains patent. In others, the stenosis persists, necessitating “permanent stenting” (in a non operative candidate) or tracheal resection [7].

Tracheomalacia

Tracheomalacia, or a weakening of the tracheal wall, results from ischemic injury to the trachea, followed by chondritis and subsequent destruction and necrosis of supporting

tracheal cartilage. With the loss of airway support, the compliant tracheal airway collapses during expiration. This can result in expiratory airflow limitation, air trapping, and retained respiratory secretions. In addition, with a loss of cartilaginous support, the trachea may also

be compressed by other surrounding structures. In the acute setting, tracheomalacia may present as failure to wean from mechanical ventilation. Alternatively, it may present

as dyspnoea in a patient with a history of previous tracheostomy [8]. The treatment of tracheomalacia depends upon the severity of expiratory upper-airway obstruction. In mild cases, a very conservative approach may be best. In contrast, with more severe cases, therapeutic options include placement of a longer tracheostomy tube, stenting, tracheal resection, or tracheoplasty.

Tracheo-innominate artery fistula

One of the most feared complications of tracheostomy is the development of a tracheo-innominate artery fistula.Risk factors for the development of tracheo-innominate fistula

include excessive movement of the tracheostomy, high pressure (or overinflated) cuff, or a tube that has been placed too low. The innominate artery lies adjacent to the trachea and crosses that structure at approximately the 9th tracheal ring. If the tracheostomy tube is placed too low,below the 3rd tracheal ring, the inferior concave surface of the cannula may erode into the artery. Alternatively, an overinflated tracheostomy cuff balloon or the tip of the tracheostomy tube can severely damage the tracheal mucosa, leading to necrosis and eventual erosion into the innominate artery. This complication occurs in less than 1% of all patients undergoing tracheostomy. The vast majority of cases (approximately 75%) will occur within 3–4 weeks of tracheostomy placement. The mortality rate approaches 100%, even when surgical intervention is undertaken.The most common clinical presentations are bleeding around the tracheostomy tube or massive hemoptysis. Because of the extraordinarily high mortality associated with this condition, the best treatment is avoiding the complication in the first place. It is therefore recommended that one avoid prolonged or extreme hyperextension of the neck. Furthermore, using lightweight tubing to avoid excessive downward pulling of the tube is also recommended.Treatment of active bleeding from tracheo-innominate fistula includes emergency digital or tube-cuff compression of the fistula to achieve hemostasis and allow for transport to the operating room for immediate surgical repair 56. The surgical approach consists of interrupting the innominate artery which, if successful, is associated with a low risk of rebleeding [9].

Tracheo- oesophageal fistula

This is an iatrogenic complication resulting from injury to the posterior tracheal wall. Tracheo-oesophageal fistula can occur because of a perforation of the posterior tracheal wall during placement of a percutaneous tracheostomy. Alternatively, excessive cuff pressure or the tip of the tracheostomy tube can cause posterior tracheal wall injury. The presence of a nasogastric tube, and resulting oesophageal injury, may also contribute to the development of this complication [10]. Tracheo-oesophageal fistula may manifest as the copious production of secretions. Additional manifestations include recurrent aspiration of food, increasing dyspnoea, a persistent cuff leak, or severe gastric distension (as air moves from the respiratory side to the stomach via the fistula).

Modalities used to make the diagnosis include barium swallow or CT scan of the mediastinum. Treatment includes placement of a double stent (in oesophagus and trachea) in

non operative patients or surgical repair in patients capable of tolerating thoracic surgery [11].

Factors involved in the delayed or difficult decannulation are anterior tracheal wall dislocation, granulation tissue around the stoma, oedema of tracheal mucosa, inability to tolerate upper airway resistance on decannulation, subglottic stenosis, tracheomalacia, impaired development of larynx as a result of long standing tracheostomy and the patient may have persistence of the condition which originally necessitated the tracheostomy.

Summary

Tracheostomy is more often done these days in the critically ill patients as the numbers are increasing each day due to the advances and improvements made in the treatment of critical illness. Tracheal stenosis being the most common, we need to be careful in preventing its formation.

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