

EXPERIENCE EXCHANGE

Tracheostomy with emphasis on perioperative nursing care

Bradford Huffman¹, Hany Emam², Mark Stevens³

1. Department of Oral and Maxillofacial Surgery, Georgia Regents University, Augusta GA, USA. 2. Department of Oral and Maxillofacial Surgery, The Ohio State University, Columbus OH, USA. 3. Department of Oral and Maxillofacial Surgery, Georgia Regents University, Augusta GA, USA.

Correspondence: Bradford Huffman. Address: Department of Oral and Maxillofacial Surgery, Georgia Regents University, GRU OMFS 1430 John Wesley Gilbert Dr. Augusta, GA 30912, USA. Email: bphuffman@gmail.com

Received: October 7, 2012

Accepted: November 15, 2012

Online Published: October 15, 2013

DOI: 10.5430/jnep.v4n3p13

URL: <http://dx.doi.org/10.5430/jnep.v4n3p13>

Abstract

Tracheostomy is an important life-saving procedure performed by many surgical specialties. The indications for tracheostomy are vast, most commonly for the relief of upper airway obstruction, uncontrolled tracheobronchial secretions, obstructive sleep apnea and prolonged intubation due to respiratory insufficiency. Placement of a tracheostomy tube allows long term airway access and allows for removal of translaryngeal endotracheal tube (ETT tube). A brief discussion of anatomy and physiology, tracheostomy types, complications and post operative nursing care will be described.

Key words

Tracheostomy, Perioperative care, Tracheotomy, Percutaneous tracheostomy

Introduction

Tracheostomy is an important life-saving procedure performed by many surgical specialties ^[1]. The indications for tracheostomy are vast, most commonly performed in the chronic setting for the relief of upper airway obstruction, uncontrolled tracheobronchial secretions, obstructive sleep apnea and prolonged intubation due to respiratory insufficiency ^[2]. Acute Situations in which a tracheostomy may be needed include space occupying lesions or significant facial trauma in which the airway is compromised (see Table 1). Placement of a tracheostomy tube allows long term airway access and allows for removal of translaryngeal endotracheal tube (ETT tube). A brief discussion of indications, anatomy and physiology, tracheostomy types, complications, timing of tracheostomy and post operative nursing care will be described.

Anatomy

A tracheostomy is made by a surgical incision from the anterior aspect of the neck into the trachea by-passing the nasopharynx and oropharynx. The trachea is a cylindrical tube containing 18-22 C shaped cartilaginous rings that protect and support the airway from the larynx to the lungs. The trachea commences below the cricoid cartilage (signet shaped ring) and continues approximately 11cm until bifurcation into the primary bronchi ^[2]. The trachea is also protected

anteriorly by the sternohyoid, sternothyroid, sternocleidomastoid muscles, collectively known as strap muscles and the manubrium and sternum ^[3].

Table 1. Indications for Tracheostomy

Acute setting	Chronic setting
Severe Facial Trauma	Need for long term mechanical ventilation due to respiratory insufficiency
Head and Neck Cancers (Mass Lesion)	Extreme Obstructive Sleep Apnea in patients intolerant of CPAP machine.
Large Congenital Tumors of the Head and Neck (Branchial Cleft Cyst)	Uncontrolled tracheobroncheal secretions
Acute Angioedema and Inflammation of the Head and Neck	

There are many vital structures potentially encountered when performing a tracheostomy. The thyroid gland is a large butterfly shaped endocrine gland with an isthmus crossing the trachea at the midline connecting two lobes at the level of the second or third tracheal rings. Paratracheal structures include the recurrent laryngeal nerves which innervate the larynx and allow phonation by movement of the vocal cords. Another structure of concern in pediatric and obese patients are the great vessels such as the carotid arteries and internal jugular veins if dissection goes astray ^[5].

The thyroid has an arterial blood supply from the superior and inferior thyroid arteries. In rare cases, 2%-12% of patients may present with thyroid ima artery (Naubauer's artery) which is an artery branching directly off of the brachiocephalic trunk. Venous drainage of the thyroid is carried by superior and inferior thyroid veins.

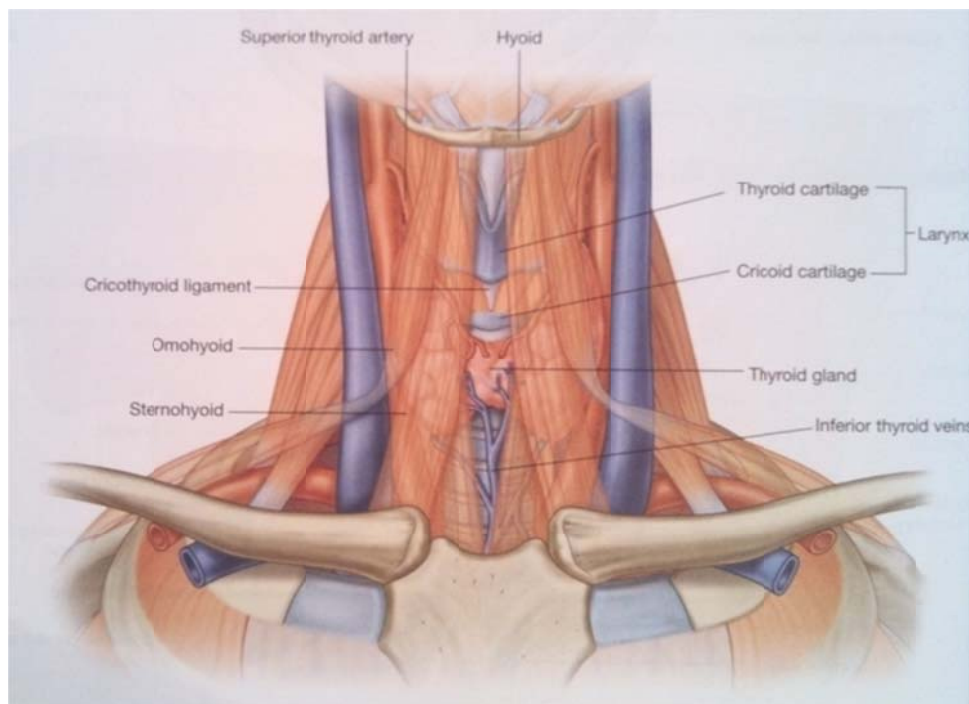


Figure 1. Larynx and Associated Structures of Neck, from Gray's Anatomy ^[19]

Airway assessment

During a history and physical, the airway may be assessed by various techniques. Patients who may potentially be hard to ventilate via bag mask technique may be identified using the acronym O.B.E.S.E. ^[5] (see Table 2). In patients with two or

more of the following characteristics generating positive pressure ventilation may be difficult^[5]. The Mallampati classification system is a tool that maybe used to identify potentially problematic or difficult airways^[6]. Using this classification system a patient is asked to open their mouth and the structures of the oropharynx are assessed (See Figure 2). The fewer structures that can be visualized the more challenging the airway.

Table 2. O.B.E.S.E Acronym

O	Obese (BMI > 26)
B	Bearded
E	Elderly (> 55)
S	Snorers / Sleep Apnea
E	Edentulous

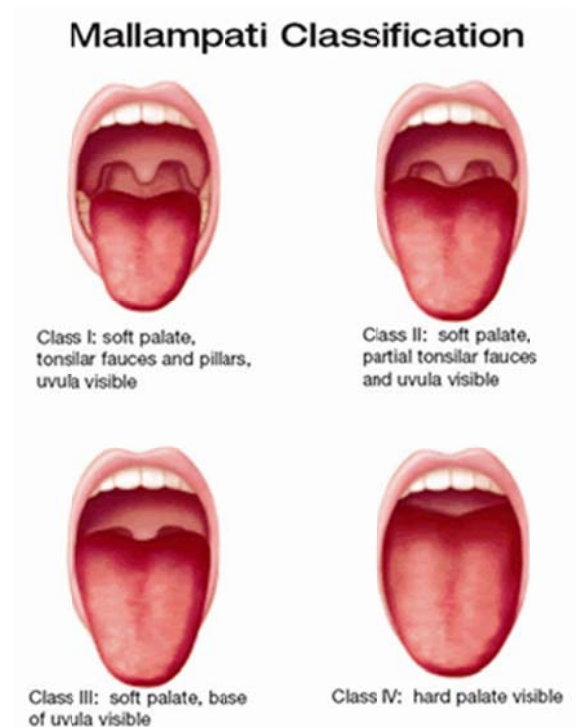


Figure 2. Mallampati Airway Classification^[20]

Procedure

There are two ways to perform a tracheostomy: surgical and percutaneous. The standard surgical tracheostomy is performed in the operating room in a controlled setting, and the percutaneous dilational tracheostomy can be performed in the intensive care unit at the bedside. Surgical and percutaneous techniques and complications are discussed below; however, it is important to note that both techniques are associated with a low rate of serious or intermittent complications when performed by an experienced surgeon.

Surgical tracheostomy

Surgical tracheostomy is performed under general anesthesia in the operating room. First, a skin incision is made, then the investing fascia is divided at midline separating the paired strap muscles. Next, the thyroid gland is divided in half using high-energy electrocautery (Bovie). The pretracheal fascia is defined and the trachea is stabilized using a cricoid hook.

The third tracheal cartilage ring is carefully cut with a horizontal H opening. Traction sutures are placed in the two lateral flaps in case of emergency decannulation or accidental dislodgement of the tracheostomy tube. The tracheostomy tube of appropriate length and width is placed into the open window of the trachea with the obturator in place. It is important to never place a tracheostomy tube without the obturator in place because this can cause damage to the inside of the trachea. The cuff is properly inflated and the lungs are auscultated for bilateral breath sounds. The tracheostomy tube should be secured with sutures and a neck strap. Anteroposterior chest films should be taken postoperatively to verify tube position and rule out pneumothorax^[1].



Figure 3. Vertical Division of Thyroid Isthmus with Bovie Electrocautery. Haspel *et al.*^[1]

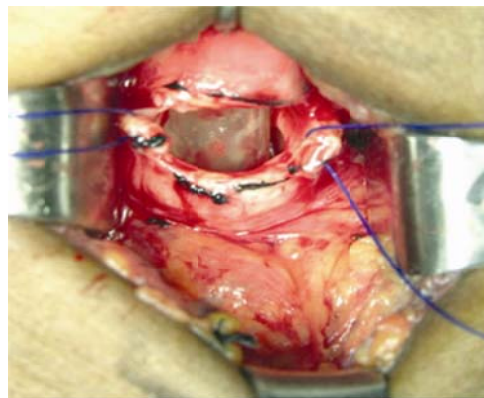


Figure 4. 2-0 Prolene Retraction Sutures in Tracheal Flaps. Haspel *et al.*^[1]

Percutaneous tracheostomy

Percutaneous dilation tracheostomy is a newer technique that was introduced in 1985 by Ciaglia. Tracheostomy kits are available for bedside use. A common brand used is the Blue Rhino tracheostomy kit. Percutaneous tracheostomies are performed as a team approach with a surgeon and anesthesia provider. Sedation is given and then the anesthesia provider may use a bronchoscope during placement to aid the surgeon in placement of the needle. The visualization of the trachea via the bronchoscope aims to prevent injury to the posterior tracheal wall.

The cannulation process involves inserting the needle followed by a guide wire over which a dilator is advanced. A tracheostomy tube replaces the dilator and is visualized on the monitor^[7]. Once the trachea is entered and bilateral breath sounds are confirmed a tracheostomy collar is placed. The skin is sutured to the tracheostomy tube, but the skin is not closed primarily to avoid the risk of subcutaneous emphysema and subsequent pneumomediastinum. An iodine soaked gauze or xeroform gauze is commonly placed between the skin and the flange to prevent infection and ameliorate skin oozing.

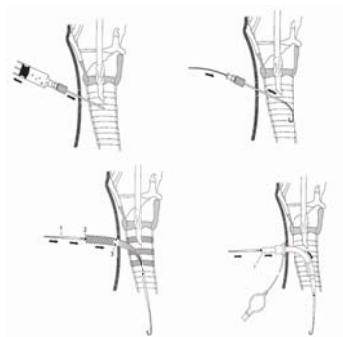


Figure 5. From Cook Medical, Blue Rhino Percutaneous Introducer Set Instructions^[18]

Complications

Early complications following tracheostomy tube placement include bleeding or oozing at the site. Air entrapment may occur either trapped around the lungs (pneumothorax), in the deeper layers of the chest (pneumomediastinum), or underneath the skin around the new tracheostomy tube (subcutaneous emphysema). Patients on high ventilator PEEP settings are at increased risk of subcutaneous emphysema. Careful inspection is essential to ensure the tracheostomy tube is not being displaced anteriorly out of the trachea leading to accidental decannulation. Difficulty swallowing or dysphagia may occur due to overinflation of the cuff or from damage to the esophagus. Damage to the recurrent laryngeal nerve that innervates the vocal cords will result in hoarseness or aphonia. The tracheostomy tube may become clogged with blood clots or mucous secretions. A list of immediate, early and late complications are found in Table 3. Frequent suctioning and the use of humidified air are essential nursing interventions used to prevent such clots in the management of fresh tracheostomy patients.

There are cuffed and uncuffed varieties of tracheostomy tubes depending on the mode of ventilation needed. One important aspect of cuffed tubes is to ensure that they are properly inflated. Over inflation of the cuffed tracheostomy tube can cause tracheomalacia which is pressure necrosis around the tube and the delicate inner lining of the trachea. Impingement of the esophagus can occur which may cause reflux and difficulty swallowing. In some cases, a tracheoesophageal fistula may form due to necrosis of the posterior wall of the trachea that is intimately in contact esophagus.

Other complications include loss of voice which may lead to frustration and psychological distress from not being able to express one's needs. Patients with tracheostomy also have reduced sense of smell and taste due to loss of the aerogastric tract and this may lead to disturbances in appetite and weight loss. The cuffed tracheostomy tube may hinder the larynx movement and epiglottis inversion leading to increased risk for aspiration. Fluid that makes its way past the epiglottis may pool at the cuffed tube and may sensitize the protective cough reflex.

Table 3. Immediate, Early, and Late Complications

Immediate	Early Complications	Late Complications
Apnea due to loss of hypoxic respiratory drive	Hemorrhage	Swallowing Problems
Hemorrhage	Plugging with mucous	Tracheal Stenosis
Pneumothorax	Tracheitis	Tracheo-innominate artery fistulas
Injury to adjacent structures (recurrent laryngeal nerves)	Tube Obstruction	Tracheo-esophageal fistula
Post obstructive pulmonary edema	False passage	Granuloma formation
	Tube Displacement	Persistent Stoma
	Subcutaneous Emphysema	Failure to decannulate
	Atelectasis	

Timing of tracheostomy

The ideal timing for a tracheostomy has not been well established and varies from three days (Early) to three weeks (Late), in the literature ^[9, 10]. Tracheostomy performed earlier rather than later has shown to decrease the length of stay in an Intensive Care Unit significantly, early tracheostomy patients have reduced duration of mechanical ventilation and consequently lower cost of hospitalization ^[10, 11]. There is debate as to whether early tracheostomy decreases the frequency of pneumonia. There is no significant reduction in mortality in patients who receive early compared to late tracheostomy ^[11-14].

Nursing implications

Postoperative care and frequent assessments are critical to maintain a fresh tracheostomy. The recently injured trachea produces copious secretions and it is not unreasonable for required irrigation with saline and suctioning every fifteen

minutes initially ^[15]. Suctioning should be done in less than fifteen seconds while staying in the tracheostomy tube. Suctioning not only blocks the airway but also removes air from the lungs ^[15]. It is important to not to suction past the length of the tracheostomy tube to prevent tracheitis and tracheal ulceration.

Edema at the insertion site is greatest at twelve to twenty-four hours after placement and accidental decannulation of the tracheostomy tube can lead to very serious complications even death if handled incorrectly. Until a mature stoma has formed, accidental decannulation and subsequent attempts at recannulation of a fresh tracheostomy may lead to a false passage and the inability to ventilate through the tracheostomy site. It is important to always keep two tracheostomy tubes and obturators at bedside incase of accidental decannulation. Most patients will be able to be ventilated with positive pressure ventilation via a bag mask in the event of an emergency until a health care provider specialized in airway management arrives.

Nursing interventions

The first tracheostomy tube is changed by the surgeon a few days to a week after placement and then a nurse or respiratory therapist trained in tracheostomy changes will insert the next tracheostomy tube as ordered and as needed ^[16]. Humidification of oxygen is important in tracheostomy patients because physiologic humidification is lost due to bypassing the nasopharynx and upper airway; therefore, it is important to ensure that the patient is receiving the humidified mist of oxygen. Humidity will loosen the patient's secretions allowing easier suctioning or expectoration.

It is important to remove the inner cannula for cleaning and to remove dried secretions. Diluted hydrogen peroxide and a brush will aid in the removal debris from the inner lumen of the cannula. Caution is needed when removing the inner cannula to avoid inadvertent removal of the entire tracheostomy tube.

Dressing changes are important for maintaining skin integrity. Maintaining healthy intact skin is a challenge when skin is exposed to moisture. Foam dressings may be used because they are absorptive, moisture retentive and insulating keeping the area dry while allowing oxygen to reach the area ^[17]. Skin breakdown typically can occur in three areas: immediately around the stoma, the attachment wing area, and the neck from the securing device ^[16]. Surgeons often suture these wings in place to prevent movement. Sutures may last up to 10 days and any changes observed with the skin integrity in this area should be relayed to the surgeon.

Another important aspect of tracheostomy care is the use of a manufactured split gauze pad around the stoma to prevent the attachment wing area from rubbing the skin. It is important to use a manufactured pad, rather than making one by using scissors and cutting regular gauze because the cotton fibers are loose at the cut site and may cause irritation and serve as a potential nidus for bacteria. The Velcro neck ties are more comfortable to patients and have fewer tendencies to abrade the skin than twill tape ^[17]. It is recommended that the site be cleaned twice a day because secretions can cause infections ^[18]. Excellent nursing care is the cornerstone for reducing the morbidity and postoperative complications of tracheostomy.

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