

Surgical Airway

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Used sources:

D.SABISTON “Textbook of Surgery”, 1997 (pages 1815-1820)

TRACHEOSTOMY

Tracheostomy is one of the oldest operations and was long used for emergency management of upper airway obstruction. Tracheostomy was also employed to control secretions in severely ill patients. More recently, tracheostomy has provided a route for ventilatory support in respiratory insufficiency. This increased use of tracheostomy reawakened recognition of the large number of serious complications that may follow the procedure. A spectrum of lesions, principally associated with its use for ventilatory support, has been identified.

INDICATIONS

The occurrence of serious complications has caused critical reappraisal of the three classic indications for tracheostomy:

1. RELIEF OF UPPER AIRWAY OBSTRUCTION

Tracheostomy often cannot be avoided in organic upper airway obstruction, although in some situations a tube may be inserted beyond an obstruction until definitive treatment can be provided. Emergency management of airway obstruction is best effected by skillful dilatation of inflammatory stenosis or *coring-out* of tumor. These techniques are preferable, in terms of safety, efficiency, and cost, to the use of the laser.

2. CONTROL OF SECRETIONS

The accumulation of secretions has increasingly been controlled by adequate humidification and by intensive pulmonary physiotherapy, consisting of expert instruction and assistance in cough, positional drainage, and thoracic percussion. Tracheal suctioning is used in conjunction with these measures, and, occasionally, transcricoid instillation of saline has been helpful. The flexible bronchoscope is frequently employed at the bedside.

Minitracheostomy - the insertion of a relatively small-bore catheter percutaneously through the cricothyroid membrane for repetitive suctioning over a prolonged period of time--has increasingly been recognized as a simple alternative to conventional tracheostomy for this

purpose. Unlike conventional cricothyroidostomy, it is relatively free of complications when correctly used, because damage to the larynx is minimal.

3. VENTILATORY SUPPORT IN RESPIRATORY FAILURE

Patients with respiratory insufficiency or impending failure are usually supported by a respirator with an endotracheal tube for varying lengths of time. If it appears that more than a few days of support will be required, a *nasotracheal tube* is generally preferred for the patient's comfort. Patients may thus be supported for a brief period of needed ventilatory assistance postoperatively without tracheostomy. There is no firm indication regarding the length of time an endotracheal tube may be employed. If it becomes clear that long-term support is needed, a tracheostomy is usually done as an elective procedure within 5 to 7 days. Such a transfer becomes necessary because of the **dangers of tube obstruction**, the **discomfort to the patient** of a nasal or oral tube, and the considerable **damage to the larynx** that may follow prolonged intubation. This injury occurs especially in the posterior commissure, with damage to the arytenoid and interarytenoid area. In a prospective study of the sequelae of endotracheal intubation, Whited found three reversible laryngeal stenoses and one chronic posterior stenosis in 50 patients intubated for 2 to 5 days, five chronic laryngotracheal stenoses in 100 patients intubated for 6 to 10 days, and six complex laryngeal stenoses in 50 patients intubated for 11 to 24 days. Early conversion to tracheostomy prevented these injuries.

The data support a policy of conversion from endotracheal tube to tracheostomy after 7 days.

COMPLICATIONS

Conversion of tracheostomy to a carefully performed elective procedure has largely eliminated the IMMEDIATE AND EARLY complications of the procedure. The LONGER-TERM complications of tracheostomy present mainly in three ways: (1) sepsis, (2) hemorrhage, and (3) obstruction of the airway. Additional complications are tracheoesophageal fistula and persistence of the stoma. In general, the longer a tracheostomy is in place (especially with an inflated cuff), the greater the chance that complications will occur.

SEPSIS

All tracheostomies are clinically contaminated, and *Staphylococcus aureus* (often a resistant strain), *Pseudomonas aeruginosa*, and a variety of other bacteria such as *Escherichia coli* and *Streptococcus* can be cultured. Despite this inevitability, sterile care and cleansing of the stoma and respiratory equipment must be maintained to minimize the possibility of invasive infection of the lower airway. **Antibiotics** are probably best reserved for use when there is evidence of tracheobronchitis, pneumonitis, or cellulitis, because premature use does not sterilize the stoma but may merely permit other flora to become established.

HEMORRHAGE

The curve of the tube may erode the *innominate artery* and produce late hemorrhage, especially in children, in whom the trachea is small and the artery high. Massive hemorrhage also occurs from erosion by tracheostomy cuffs or even by the tip of a tube through the trachea into the innominate artery as it passes obliquely over the trachea. Bleeding from granulations or more superficial tracheal erosions is more common and less massive. **Rx.:** only immediate tamponade of a major arterial leak, digitally (when due to erosion at the

stoma), or with an inflated cuff (when caused by cuff or tip injury) lower in the trachea, and prompt surgical treatment lead to salvage. Resection of the injured artery with suture closure of both ends is one of the few possibilities in such a contaminated field. In the small number of cases in which this has been done successfully, there have been no neurologic problems. The trachea requires only closure when arterial injury occurs at the stomal level. Injuries at the cuff level require resection and reconstruction.

OBSTRUCTION

Airway obstruction may occur while the tube is in place. If a tube with an inner cannula is used, crusts may be easily cleaned. With proper humidification, obstruction of single-lumen tubes is uncommon. Occasionally, a valve type of crust may form at the tip of a tube, so that a suction catheter may be easily passed without relieving the obstruction. If such a problem is found on flexible bronchoscopy, the tube must be changed. If change is necessary early after tracheostomy, it should be done over a guiding catheter, with adequate instruments and personnel available to reinsert an endotracheal tube or a rigid bronchoscope from above in the event that the tube is not easily replaced. Occasionally, obstructive granulations also form at the tip of a tube that is still in place.

A major syndrome of postintubation airway obstruction has been recognized (D.SABISTON "Textbook of Surgery", 1997 Fig. 51-38). Improvements in cuffs and awareness of the problems have reduced its incidence. **Every patient with signs of upper airway obstruction - wheezing or stridor, dyspnea on effort, episodes of obstruction from secretions - who has been previously intubated with either an endotracheal tube or a tracheostomy tube must be considered to have organic obstruction until it is proved otherwise.**

Unfortunately, many such patients who have been discharged from the hospital are still treated for asthma to the point of death or subtotal obstruction before the lesion is recognized.

- A. Obstructive LARYNGEAL LESIONS from prolonged endotracheal intubation may occur at the vocal cord level and consist of granulation tissue or cicatrix, particularly in the posterior commissure. Large tubes relative to airway size may cause erosion at the subglottic and cricoid levels, with subsequent severe stenosis. Cricothyroidostomy, proposed to avoid the complications of tracheostomy, fails to eliminate cuff lesions and transfers serious stomal lesions from the trachea to the subglottic larynx - where surgical treatment is more difficult, less satisfactory, and often impossible.
- B. AT THE STOMAL LEVEL, obstruction may be due to a polypoid granuloma that forms on the healing surface of the stomal site. Narrowing and indentation at the point of cicatrization of the stoma are often seen after tracheostomy. When the stoma is large - because of overgenerous initial surgical therapy, erosion by local infection, or, most commonly, the prying action of heavyweight equipment that connects the tracheostomy to the ventilator--healing may produce clinically obvious obstruction. Such a stomal obstruction is usually three-sided, obstructing anteriorly and laterally, because the posterior wall is intact. Occasionally, some scarring occurs posteriorly as well. A combination of granuloma and stenosis may also produce obstruction. If the tracheostomy is placed too high, erosion of the cricoid cartilage may occur, with loss of substance and resultant subglottic stricture.

Clinical Symposia "Maxillofacial Injuries"

Tracheostomy

Careful observation of tracheostomy and inner cannula is paramount. Hemorrhage, dislodgement of tube, obstruction from clot formation, and pneumothorax are all complications of tracheostomy. Auscultation of chest for breath sounds should be done and chest x-ray obtained as soon as possible following tracheostomy, to establish baseline for monitoring patient's condition.

CARE

- keep **OBTURATOR** taped to wall behind bed.
- **speech evaluation** for swallow and PMV use.
- trach change: #6 DCT → #6 Shiley CFS → when secretions better under control → #4 CFS → after tolerating PMV regularly → capping trials → once tolerating capping trials > 24 hours → can be decannulated.

CONIOTOMY

Clinical Symposia "Maxillofacial Injuries"

A temporary means of establishing airway is by coniotomy, incision made below laryngeal cords to bypass upper airway obstruction. The opening is made percutaneously through cricothyroid membrane using 13-gauge needle, No. 10 knife blade, or commercially available coniotomy instrument. Once airway is in place, 100% oxygen in high flows (15 to 20 liters per minute) is administered, and patient may need additional respiratory assistance. The patient should be closely observed for operative site bleeding, and other means of airway maintenance must be instituted as soon as possible.