Tracheostomies

Tracheostomy Basics

- Indications: upper airway obstruction, long term ventilation, ease of pulmonary toilet, to protect the airway.

- Tube selection based on:
  - Indication for tracheostomy.
  - Tracheal width/length/shape.
  - Upper airway resistance.
  - Lung mechanics.
  - Needs of the child for speech/ventilation/airway clearance.

- Tube diameter:
  - Outer diameter of the tube should not exceed 2/3 of the tracheal diameter.
  - Use the largest size possible to reduce airway resistance, keep work of breathing low, reduce the risk of aspiration, and allow efficient pulmonary toilet.

- Length of tube:
  - Should extend 2 cm distal to the stoma, but be no closer than 1-2 cm from the carina.
  - Should be 3-6 cm (neonatal length tube) for children under 1 year.

- Curvature of tube:
  - Distal end of tube should be concentric and co-linear with the trachea.

- Tracheostomy tube connector:
  - Needs standard 15 mm connector at upper end to allow connection to a bag or ventilator.

Types of Tubes

- PVC: Softens at body temperature but becomes more rigid with use and may develop cracks.
  - Shiley, Portex
Silicone: Less rigid, naturally soft, does not stiffen with repeated use, may be an option in children in whom standard PVC tube does not provide a satisfactory fit.

- Bivona

Cuffed: Indicated to prevent chronic aspiration, or when ventilating with high pressures.

- May cause tracheal erosion unless the cuff is regularly deflated.

Fenestrated: Allows the patient to breathe around and through the tube; may promote translaryngeal airflow and enhance secretion clearance.

Speaking valves: Have thin silicone membrane that allows inspiration via the tracheostomy tube and direct expiratory flow around the tube up to the vocal cords.

- If expiratory flow is obstructed, this may cause overinflation of the lungs.
- These should not be used in very small or very sick infants due to the superimposed increased work of breathing.

Care

Stomal care:

- Clean skin around the neck with a damp cloth.
- Encrusted secretions under neck plate can be removed with a cotton wool swab and normal saline twice a day and as needed.
  - Always remove secretions by rolling from the stoma outward.
- Skin around stoma should be kept dry; a partially slit dressing made of non-fluffy, water-permeable material may help.

Humidity: Lack of humidity in inhaled air will cause pathological changes in structure and function of airway, as well as thickening of secretions and increased risk of mucous plugging.

- Always add warm humidified oxygen to ventilator or tubing.
  - Cannot be used with speaking valves, and creates extra resistance.

Suctioning

- Best performed on as-needed basis.
- Indications: Oxygen desaturation, patient anxiety or restlessness, visible secretions in tube, or increasing respiratory distress with noisy respirations or tachypnea.
- Set suction pressure between 80-100 mmHg.
- Shallow suctioning: Only insert catheter to depth where side-holes reach tip of tube.
- Deep suctioning: Insert catheter until resistance met, apply suction on withdrawal
  - This technique **should not routinely be used** due to risk of mucosal damage.
- Suction rapidly (<5 sec) to prevent development of atelectasis.
- On withdrawal of catheter, twist between fingers to clear secretions as much as possible.
- American Thoracic Society does **not** recommend any use of saline during suctioning.
- Use clean technique (reuse catheters cleaned with alcohol and soapy water) at home.

- **Changing out tracheostomy**
  - Change the tube every few weeks; more frequently if develops inspissated secretions.
  - Replacement tube, smaller tube, and self-inflating bag should all be in easy reach.
  - Position infant with blanket under shoulders to extend neck slightly for visualization.
  - Use an obturator (the curved plastic device that fits inside trach tube) to place tube, with a downward curving motion, then immediately remove obturator once tube is in place.
  - Secure trach with twill tapes tied by triple square knots to both sides of neck flange.
  - Tapes should be tight enough to prevent accidental decannulation, but loose enough to allow for change in neck size during activity.
  - Correct tension is when one finger can be slipped beneath tape at back of flexed neck.

- **Speech development**
  - Crucial factors affecting speech and language are the age at and duration of cannulation.
  - Use speaking valve (e.g., Passy-Muir valve), if tolerated, in infants as young as 2 weeks.
  - If not tolerated, alternative methods of communication should be introduced.
  - All patients with a tracheostomy should be followed by speech therapist.

- **Additional concerns:**
  - When continuous presence of a competent caregiver is not available, child should always be connected to a reliable monitoring device.
  - Oral feedings should always be supervised to prevent aspiration through tracheostomy.
  - Bath water level should not be higher than the abdomen; constant supervision and care are necessary to prevent aspiration of splash water.
  - Clothing should not have furry or fluffy materials; high necklines should be avoided.
Avoid exposure to feathery or furry pets, garden sprinklers, fountains, swimming pools, sand pits, powdery building or cleaning materials, smoke, household sprays.

Smoking should be forbidden around a patient who has a tracheostomy.

**Emergency package should be with child at all times and contain:**

- Spare tracheostomy tube of same size and one size smaller, scissors, ties, suction catheter, normal saline, gloves, self-inflating bag with appropriate sized mask.
- Information card with details on brand, size, and length of tube; catheter insertion depth; reason for tracheostomy; potential individual risks; names and telephone numbers of physicians, therapists, nurses, and service and maintenance companies.

**Complications**

- **Mortality directly associated with tracheostomy ranges between 0.5% and 3%.
  - Most result from accidental decannulation or blockage of tracheostomy tube.

- **Granuloma formation is the most frequent complication.
  - Usually occurs just superior to the internal stoma site on the anterior tracheal wall.
  - Large granulomas may cause bleeding, aphonia, and accidental decannulation.

- **Accidental decannulation:** Emergency kit described above should always be at hand.

- **Blockage of the tracheostomy tube will cause sudden deterioration in a child with a tracheostomy.**
  - Suction, and give positive pressure breaths with the self-inflating bag.
  - If no response, change the tracheostomy tube.
  - If tube cannot be replaced, bag-mask ventilate while occluding stoma.

- **Bleeding**
  - Tip of tube may irritate tracheal wall, causing irritation, inflammation, and ulceration.
  - Anterior wall erosion can invade innominate artery, causing catastrophic hemorrhage.

- **Infection**
  - Bronchitis/tracheitis may cause increase in purulent secretions with an increased risk of plugging.
  - Peristomal infection may cause erythema or drainage around stomal site; treat with topical antimicrobials, more frequent tube changes and cleanings.

- **Tracheo-esophageal fistula may occur as a result of posterior wall erosion.**
Aspiration is a risk associated with fractured tracheostomy tubes or other foreign objects.

Granulation tissue that grows around the external stoma causing partial occlusion may be treated with silver nitrate application.

Suprastomal collapse
  - Pressure on tracheal cartilage just superior to the stoma may cause chondritis and weakening of the cartilage.

Subglottic stenosis may be caused by intraoperative damage to cricoid, tracheostomy placed too high, mucosal trauma, or low-grade chronic inflammation.

**Followup and Decannulation**

Once stable, patients should be seen every 1-3 months by ENT; initially they should be seen more frequently.

Imaging is not routinely required, only when complications develop.

Routine endoscopic evaluation by flexible bronchoscopy on a 6- to 12-month basis to assess airway pathology and readiness for decannulation.

Decannulation:
  - Most children are able to be decannulated within 2 years.
  - Tracheostomy tube is serially downsized, and when the child tolerates it, capped.
  - Stoma usually closes within few hours of tracheostomy tube’s removal.
  - Removal creates an increase in dead space, resulting in an increased work of breathing.

Persistent tracheocutaneous fistula
  - Occurs in up to 40% of children post-decannulation.
  - May signal an underlying airway obstruction; assess airway patency prior to closure.