

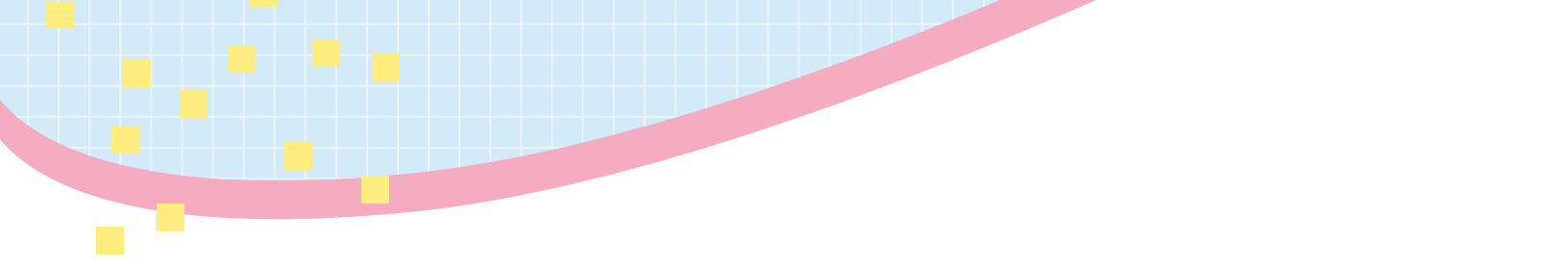
Tracheostomies

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.
 - Passive humidifier (artificial nose, Heat-Moisture-Exchanger): picks up heat and moisture during exhalation and partially returns it during inspiration.
 - 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.

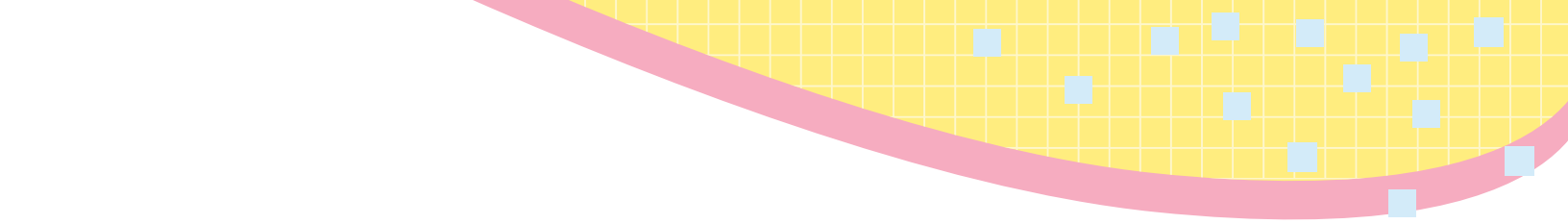
■ Bleeding

- 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.