TRACHEOSTOMY

- **DEFINITION**
- **FUNCTIONS**
- **EFFECTS**
- **INDICATIONS**
- **TECHNIQUES**

**DEFINITION:**
Tracheostomy is a means of exteriorising the trachea to the cervical skin until the opening has become epithelialized with the epidermis as the stoma

1st tracheostomy – 1546, Antonius Musa Brasavola

**FUNCTIONS:**
1. Bypasses upper airway
2. Decreases dead space by 70-100 ml, 10-15%
3. Decreases resistance to air flow
4. Protects against aspiration
5. Intermittent positive pressure respiration
6. Patient can swallow without reflex apnoea
7. Tracheobronchial toileting
8. Pathway to deliver medication and humidification
9. Decreases peripheral displacement of secretions in inspiratory phase of cough as decreases efforts of coughing
10. To administer anaesthesia

Breathing through Nose: Air becomes 100% humidified and warm to body temperature by time it reaches mid trachea, particles larger than 4-5microns get filtered out

**EFFECTS:**
1. Loss of olfaction
2. Humidification and filtration loss
3. Compromises defence system (mucociliary)
4. Patients more prone to Atelectasis
5. Pulmonary infections
6. The tracheostomy tube will act as a foreign body causing local inflammation
7. Unable to cough or phonate
INDICATIONS

1. Obstructive
2. Nonobstructive

1. Obstructive causes
   1) Congenital
      a) Laryngeal causes
         • Subglottic stenosis
         • Laryngomalacia
         • Glottic webs
         • Haemangioma
         • Large cyst
      b) Extra laryngeal causes
         • Pierre-Robinson syndrome
         • Cystic hygroma
         • Lymphangioma
         • Haemangioma of the base of the tongue
   2) Inflammatory
      a) Laryngeal causes
         • Acute laryngotracheobronchitis
         • Acute epiglotitis
      b) Extra laryngeal
         • Acute parapharyngeal abscess
         • Retropharyngeal abscess

3) Traumatic
   a) Laryngeal
      • Acute trauma
   b) Extralaryngeal
      • Maxillofacial trauma
      • Haematoma of the base of the tongue
      • Mandibular fracture
      • Cervical haematoma

4) Neoplastic
   Benign
   • Juvenile recurrent respiratory papillomatosis
   • Adenoma
   • Chondroma

   Malignancy
   • Malignancy of larynx.
   • Malignancy of pharynx.
   • Malignancy of thyroid.
   • Malignancy of oesophagus.
   • Malignancy of mediastinum.
   • Malignancy of trachea.

5) Neurological
   a) Bilateral abductor paralysis
      • Cardiac surgery

II. Nonobstructive causes
   • A-assisted ventilation
   • A-aspiration
   • A-anaesthesia
   • A-alyrnygeal
   • A-atelectasis

Assisted Ventilation

Brain
• Coma
• CVA
• Poisoning

Brainstem
Affects respiration—bulbar palsy.

Spinal cord
Poliomyelitis.

Jugular foramen
Acute vocal cord palsy.

Also done in cases of ASD, VSD
TECHNIQUES
1. Minitracheostomy / Cricothyrotomy
2. PDT
3. Tracheostomy

TYPES:
1. Based on Position: High, Mid (2,3,4), low High where laryngectomy planned, low where thyroid isthmus enlarged.
2. Based on indications: Elective and emergency

PROCEDURE
Minitracheostomy / Cricothyrotomy:

- The patient lies supine with the neck extended over a pillow
- Surgeon infiltrates the skin with local anaesthetic and adrenaline
- The thyroid cartilage is gripped between the thumb and middle finger of the nondominant hand; in this position the index finger can be used to palpate the cricothyroid membrane
- In an emergency the airway is entered using a needle and cannula attached to a 10-mL syringe half full of saline.
- Once air is aspirated, the needle is angled in a caudal direction and the cannula is passed over the needle into the trachea.
- An airway can then be maintained by connecting the cannula to an ambubag using a syringe with a 7-rom endotracheal tube adaptor.
- This should allow enough time for the patient to be taken to theatre for a formal tracheostomy to be performed.
- It should be remembered that while adequate tissue oxygenation can be achieved in this way, CO2 is not cleared effectively.
- Is likely to cause some trauma to the cricoid cartilage with the risk of subsequent subglottic stenosis

COMPLICATIONS:

COMPLICATIONS

Immediate
A. Apnea due to sudden decrease in CO2, which can be treated with carbogen

B. Bleeding from veins or thyroid gland

C. Collapse of the lung
   Cardiac failure
   a) Excess adrenaline
   b) Rapid rise of pH
   c) Hyperkalaemia

D. Damage of surrounding structures
   - Nerves
   - Vessels
   - Cartilage

E. Embolism (air)/emphysema
   - Position of the patient will prevent embolism.
   - Emphysema—subcutaneous

F. Fistula tracheoesophageal fistula.

Intermediate
- Dislodgement of the tube
- Blocked tube
- Tracheitis
- Emphysema
- Bleeding
- Tracheovenous fistula
- Pneumothorax

Late
- Tracheocutaneous fistula—leads to:
  - Continued secretion
  - Skin irritation
  - Disturbed phonation
  - Frequent infection
Percutaneous Tracheostomy:

- Minimally invasive alternative to open tracheostomy.
- The most common technique is the dilatational technique
- BLUERHINO DILATOR used
- **Position**: Can also be done in sitting or semisitting position
- **Anaesthesia**: GA (best), LA, LA with ET tube

**Preparation**

- **Incision**: Elective – usually horizontal 2cm below cricoid cartilage or 2 finger breadth above sternal notch
- Emergency – Vertical – cricoid upto 4cm till the sternal notch
- Needle with cannula at T1. The needle is then withdrawn and a guide wire is inserted into the trachea using SELDINGER’s technique. The cannula is withdrawn and a single dilator or multiple graded dilators are used to create a passage wide enough to receive a tube.
- Dissection – thyroid isthmus lifted with cricoid hook
- **Incision should not extend over T2** to prevent tracheostomy tube from impringing on the cricoid cartilage and producing perichondritis
- Inferiorly based U shaped Bjork flap (tracheal incision) less desirable in temporary tracheostomy. In children it can cause tracheal stenosis and tracheocutaneous fistula

Paediatric Tracheostomy

- Tracheostomy in children is now an uncommon operation.
- **INDICATIONS FOR PAEDIATRIC TRACHEOSTOMY**
  - relieve upper airway obstruction
  - prevent complications of prolonged intubation
  - reduce anatomical dead space
  - allow suction toilet of the trachea
- The upper airway **(from the lips and anterior nares to the carina)**

<table>
<thead>
<tr>
<th>Anatomical site</th>
<th>Example</th>
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<tbody>
<tr>
<td>Oropharynx, tongue base</td>
<td>MacroGLOSSIA</td>
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<tr>
<td>Treacher Collins/Goldenhar syndrome</td>
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<tr>
<td>Cystic hygroma</td>
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<tr>
<td>Nose, nasopharynx</td>
<td>Choanal atresia</td>
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<tr>
<td>Supraglottis</td>
<td>Supraglottic cyst</td>
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<td>Glottis</td>
<td>Vocal cord palsy</td>
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<tr>
<td>Physical trauma</td>
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<tr>
<td>Subglottis</td>
<td>Subglottic stenosis, haemangioma</td>
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<tr>
<td>Trachea</td>
<td>Tracheomalacia</td>
</tr>
<tr>
<td>High tracheal stenosis</td>
<td></td>
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- **Prolonged intubation**: Ulceration at the level of the glottis and, particularly in children, the subglottis, (Being softer and more flexible) can lead to cicatrization and stenosis.
The neonatal larynx is able to tolerate prolonged intubation for relatively longer than the adult. Tracheostomy should normally be considered in older children after two to three weeks of endotracheal intubation. Indications for long-term ventilation include:
• failure of control of breathing
• chest wall dysfunction
• disorders of lung parenchyma
• large airway disease
• central sleep apnoea, Ondine's curse
• thoracic dystrophy
• bronchopulmonary dysplasia (BPD)
• tracheobronchomalacia

**TECHNIQUES OF TRACHEOSTOMY SPECIFIC TO CHILDREN**

**Positioning**
Theoretically, extension of the neck in infants increases the risk of injury to the great vessels in the root of the anterior neck. The infant is positioned supine on the operating table. Neck extension is achieved with a rolled towel or gel pillow under the shoulders. The neck can be fixed in extension and stabilized in the midline using adhesive tape such as Elastoplast®.

**Skin incision**
Skin incision is horizontal, situated halfway between the cricoid and sternal notch. An advantage of a vertical incision is that it facilitates midline dissection through the layers of the neck and is therefore sometimes advocated as the incision of choice in emergency tracheostomy.

**Dissection**
Although in adults and larger children the thyroid isthmus is traditionally divided and tied to prevent haemorrhage, in infants it is usually adequate to divide the isthmus of the thyroid with bipolar diathermy.

**Tracheal incision**
A vertical incision is made in the midline, usually in tracheal rings 3-4. It has long been established that too high an incision in the trachea predisposes to subglottic stenosis. Recently, a cruciate incision in the trachea, the tracheal edges being closely apposed to the skin edges.

**Stay sutures**
Stay sutures are placed in the wall of the trachea on either side of the vertical incision. These are generally a removable suture (e.g. 4/0 PROLENE) and are left in situ until the first tube change.

**Securing tracheostomy tubes**
The tapes should be tightened with the neck flexed, sufficiently tight to allow one finger to be inserted between the tapes and the neck skin.

**Suturing the flange of the tracheostomy tube to the skin should be avoided in children.**
After seven days the first change is undertaken

**TRACHEOSTOMY CARE**
Critical in the first two to three postoperative days.
Risk of tube displacement is at its highest as the tract can close very quickly making reinsertion difficult.

Suction
Immediately after tracheostomy, the change from air that is warmed and humidified by the upper airway to dry cold air leads to a rapid increase in airway secretions.

Humidification
Given via nebulizers and a tracheostomy mask
Longer-term humidification may be achieved by using a Swedish nose or a tracheostomy bib. A 'Swedish nose' attachment contains a filter which becomes saturated by the moisture in exhaled air; this in turn humidifies the inhaled air. The tracheal bib works in a similar way. Both devices have the advantage of acting as filters for inspired air.

Skin care
Change of tracheostomy tube
The first change of tube is generally undertaken at around the seventh postoperative day. (1 WEEK)
If oral intubation is difficult or impossible (e.g. retrognathia, laryngeal stenosis) it is advisable to undertake the first change in the operating theatre in case surgical intervention is needed
The tube needs to be changed before dried secretions start to reduce the lumen of the tube.
(if you can hear a tube you should change it) or if the suction catheter cannot be passed due to obstruction

TUBE SIZE:
- < 6 mnths → 3.5 French gauge system of sizing
- 6 mnths - 18 mnths → 4
- 1½ yrs - 3 yrs → 4.5
- 3 yrs - 9 yrs → 5
- 9 yrs - 12 yrs → 6
- 12 - 14 yrs → 7

Length:
Excessive will damage carina, less will lead to decannulation. Ideal is 1-2 cm above carina and 2 cm inside stoma.
Tube tip position can be assessed on chest x-ray, at regular rigid bronchoscopy or by passing a flexible endoscope down the lumen of the tube to inspect the carina.

Material
Silicone is now the most widely used material.
One advantage of metal tubes is that as the stronger metal wall is thinner, it is possible to achieve a smaller outside diameter for the same internal diameter as a silicone tube.

Cuff
The presence of a cuff increases the risk of mucosal ischaemia and subsequent tracheal stenosis.
Cuffed tubes are rarely indicated in paediatric practice; until adolescence, a sufficient seal to allow positive pressure ventilation can normally be achieved with an uncuffed tube. Used firstly where there is a significant risk of aspiration, secondly, ventilation pressures need to be raised temporarily.

COMPLICATIONS OF TRACHEOSTOMY
Tracheostomy complications are more likely in children than in adults, and more common in children under two years particularly preterm infants.
Peristomal granulations can generally be controlled with steroid/antibiotic preparations
The anterior tracheal wall immediately superior to the stoma itself softens and prolapses into the lumen of the subglottic trachea. More significant collapse will require surgical treatment. The simplest of these involves excision and transfixion of the tracheostomy tract followed by endotracheal intubation for two to three days to support the trachea as the stoma heals.

Types Of Tubes

- **Ideal Tube**
  - (optimum air flow, shorter shaft, greater radius of curvature, smooth inner surface, nontoxic, minimum tissue reactivity, easily connected to a ventilator, easy to clean and change)
- **Types**:
  - **Metallic Tubes**:
    - Fuller, Jackson, Alder Hay tube
  - **Non Metallic**:
    - Cuffed protex and non cuffed portex
  - **Others**:
    - Cole's, Parker, Patterson, Negus, Edinburg, Shiley paed. tube, portex paed. Tube
- **Material used for tubes**:
  - Silicon, Rubber, Latex, PVC, German Silver.