Professor Ramadan Hashem Sayed & Usama Mohammed Rashad

- TRACHEOSTOMY -

❖ **Definition:** Creation of artificial opening in the anterior wall of cervical trachea (fig 32).

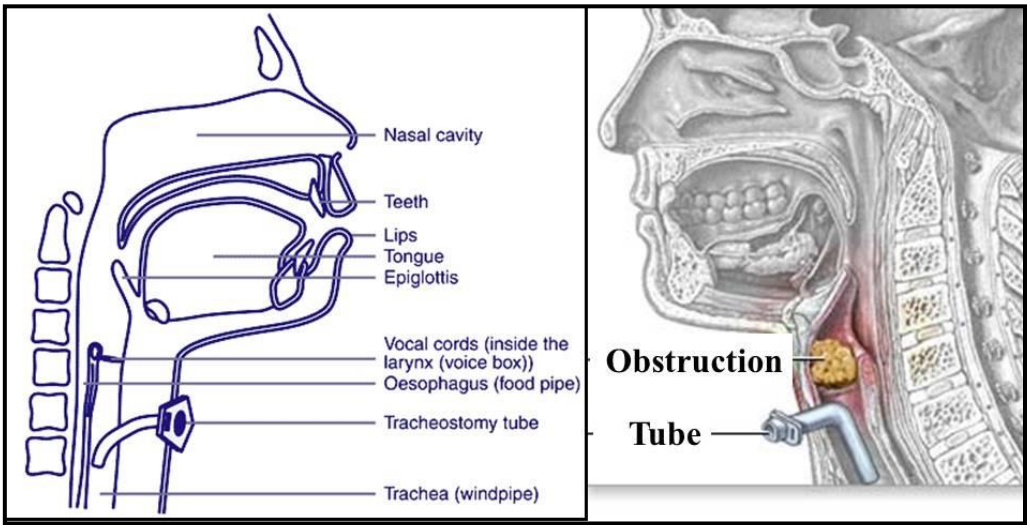

Fig (32) Tracheostomy

❖ **Indications:**

I. Upper airway obstruction: (if can bypass the obstruction)

- All causes of upper airway obstruction (see stridor)

II. Respiratory insufficiency:

A. Ventilatory insufficiency: with retained secretion

- Depression of cough reflex: due to:
  - Coma
  - Painful cough in case of: - Abdominal wound - Fracture rib
- Inability to perform effective cough: due to:
  - - Bulbar paralysis - Elderly, debilitated patient

B. Mechanical insufficiency:

- Failure of respiratory mechanics:
  - Neurological: due to:

    * Spasm of respiratory muscles: In:

      - Strychnine poisoning - Tetanus - Tetany

    * Paralysis of respiratory muscles: In:

      - Diphtheria - Poliomyelitis - Polyneuritis

      - Fracture cervical spine above C_4
  - Flail chest: due to multiple fracture ribs with flail chest piece.
- Chronic obstructive pulmonary diseases

III. Aspiration of fluids:

1- Bulbar paralysis (adductor paralysis) with aspiration

2- Hypopharyngeal malignancy with aspiration

IV. Preoperative tracheostomy:

A. Bloody operation:

- - Nasopharyngeal angiofibroma - Maxillectomy

B. Operations on the tongue and mandible:

- To avoid respiratory obstruction due to falling back of the tongue

C. Operations on the larynx:

- - Laryngofissure - Partial laryngectomy - Total laryngectomy

❖ Aim (values) of tracheostomy: (Rationale of tracheostomy):

- To bypass upper respiratory tract obstruction
- To aspirate retained secretions in lower respiratory tract
- To decrease dead space by 30-50%
- To provide artificial respiration
- To prevent further aspiration by cuffed tube

❖ Disadvantages of tracheostomy:

- **Loss of functions of the nose:**
  - No humidification of inspired air → dryness of secretions and crust formation
  - No purification of inspired air, loss of sense of smell
- **Loss of functions of the larynx:**
  - Loss of protective function, cannot swim
  - Loss of phonation unless closes the tube
  - Loss of straining unless closes the tube
  - Loss of chest fixation, so cannot carry heavy objects

❖ Alternatives to tracheostomy:

- - Laryngotomy (cricothyroidotomy) - Endotracheal intubation

❖ Types of tracheostomy:

I. According to the indications:

A. Elective tracheostomy: e.g. pre-operative tracheostomy

B. Urgent, emergent tracheostomy: In severe airway obstruction

II. According to the duration:

A. Temporary tracheostomy:

- - Pre-operative tracheostomy -Transient airway obstruction

B. Permanent tracheostomy: In total laryngectomy

III. According to the level:

A. High tracheostomy

- Level: in the 1st and 2nd tracheal rings (above the thyroid isthmus)
- Advantages: The trachea is superficial and relatively fixed, so more easily and rapidly approached in emergency
- Disadvantages: friction with cricoid can → perichondritis → healing by fibrosis → subglottic stenosis
- Indications: Done in emergency situations and after relieve of airway obstruction, it is replaced by mid tracheostomy

B. Mid tracheostomy:

- Level: in the 3rd and 4th tracheal rings (deep to the thyroid isthmus)
- Advantages: Operation of choice
- Disadvantages: Near to the larynx, so not suitable in cases of cancer larynx

C. Low tracheostomy:

- Level: in the 5th and 6th tracheal rings (below the thyroid isthmus)
- Advantages: Away from the larynx, so away from any laryngeal pathology. In addition, it decreases the dead space to the least.
- Disadvantages: The trachea is deeper, more mobile, and related to the great vessels at the root of the neck and the dome of right pleura; so its access is more difficult and more time consuming and risky. The soft tissue in the neck can obstruct the stoma of tracheostomy during changing the tube.
- Indications:
  1. Huge goiter obstructing the field
  2. Laryngeal tumours: - Multiple papillomas - Cancer larynx
  3. Operations on the larynx especially total laryngectomy
  4. Impacted FB

❖ Surgical technique: (fig 33, 34)

- **Anesthesia:**
  - General anesthesia: in elective tracheostomy
  - Local infiltration anesthesia with xylocaine-epinephrine
  - In emergency tracheostomy or in comatose patient
- **Position:** Supine position with neck extension by a pillow under the shoulders
- **Incision:**

- A horizontal incision midway between the cricoid cartilage and the sternal notch or vertical midline incision from the lower border of cricoid to the sternal notch
- Through the skin, subcutaneous tissue and platysma

- **Separate** the strap muscles in the midline.
- **The thyroid isthmus** is clamped and divided in the midline.
- **Open the anterior wall** of the trachea between the third and fourth tracheal rings.
- **Insert the tracheostomy tube** into the trachea and retained in position by tapes around the neck.

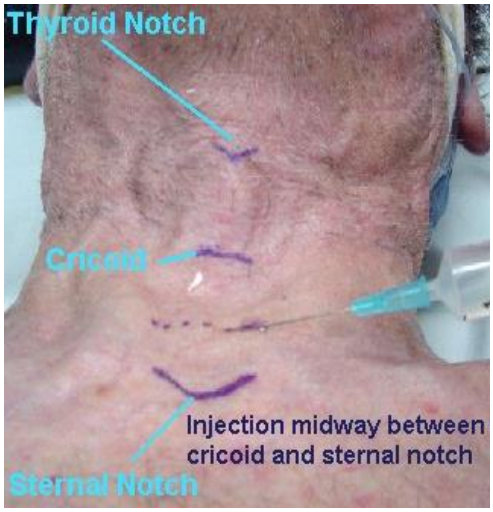

Fig (33) Infiltration anaesthesia

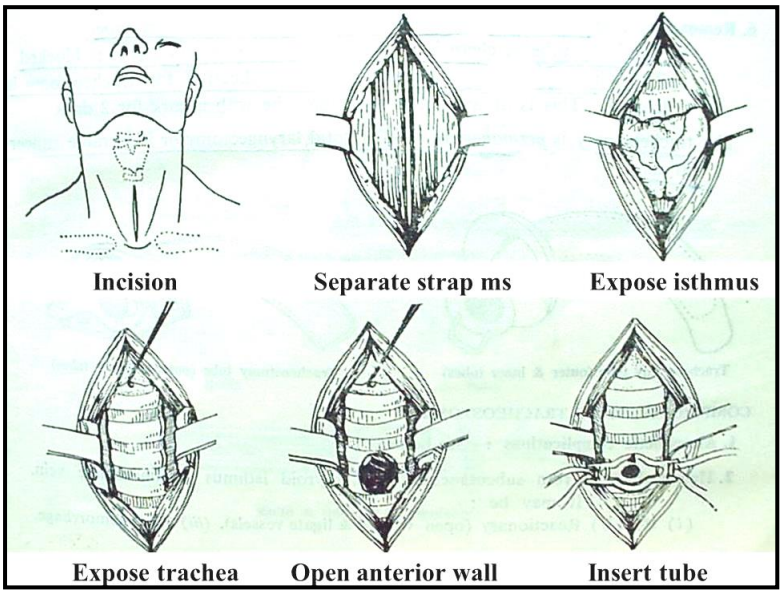

Fig (34) Steps of tracheostomy

- **The neck of infants and young children differs from that of the adults in:**
  - The neck is shorter and the larynx is higher
  - The innominate vein may be higher at the root of the neck and may be injured during tracheostomy
  - The arch of aorta is higher
  - The thymus gland is present in this age and may be injured during the procedure or it may obstruct the stoma during changing the tube.

❖ Complications of tracheostomy:

A. Immediate complications:

1. **Anesthetic complications:**
   - Of general anesthesia:

     - Cardiac arrest - Pulmonary complications - Succinylcholine apnea
   - Of local anesthesia:

     - ShocK - Hypersensitivity reaction - CNS complications
2. **Cardiovascular complications:**

- Hemorrhage:
  - Primary hge: due to injury of anterior jugulare vein, thyroid isthmus, innominate vein
  - Reactionary hge: due to slippage of a suture or dislodgement of blood clot
  - Secondary hge: due to infection
- Air embolism: due to injury of a large neck vein and suction in of a large volume of air that passes rapidly to right atrium, may → cardiac tamponade and death.
- Cardiac arrest: due to excessive adrenaline secretions; rapid rise of PH (due to CO_2 wash); or hyperkalaemia 2ry to respiratory alkalosis.

3. **Respiratory complications:**
   - Apnea: due to relieve of airway obstruction with sudden correction of hypoxia → failure of respiratory center. Avoided by gradual opening of tracheostomy. Treated by closure of tracheostomy for a while and allowing the patient to breathe a mixture of 95% O_2 and 5% CO_2.
   - Acute pulmonary edema: due to sudden release of the raised intrapulmonary pressure → capillary dilatation and transudation. Avoided by gradual opening of the tracheostomy to allow gradual ↓ of the intrapulmonary pressure.
   - Pneumothorax: due to injury to dome of the right pleura and lung → respiratory distress after initial improvement. If large → correction by intercostal tube connected to underwater seal.
   - Surgical emphysema: escape of air into the soft tissues of the neck due to tight closure of skin around tracheostomy tube or air leak due to a small tube and wide opening.
4. **Injury of surroundings:**
   - Injury of recurrent laryngeal nerve.
   - Injury of cricoid cartilage → risk of subglottic stenosis.

B. Intermediate complications: (Tubal complications)

1. **Dislodgement (slipping) of the tube** especially with low tracheostomy
2. **Blockage of the** distal end of the tube by granulation tissues or crusts
3. **Crust formation** due to dryness of secretions by under humidification → blockage of the tube

   1-3 will → respiratory distress after initial improvement following tracheostomy.
4. **Dysphagia**: due to tethering of the larynx by the tube
5. **Tracheal necrosis:** due to pressure by oversized tube or cuffed tube
6. **Infection:**
   - Wound Infection
   - Chest Infection: bronchopneumonia or lung abscess

C. Late complications:

1. **Stenosis:**
   - Tracheal stenosis: due to pressure necrosis or repeated incisions in the trachea
   - Laryngeal stenosis: due to high tracheostomy with injury of cricoid cartilage
2. **Difficult decannulation (difficult extubation):** due to:
   - Laryngeal stenosis or tracheal stenosis or
   - Failure of the larynx to regain activity, mostly in children. Treated with application of tracheostomy with expiratory valve and gradual decannulation.
3. **Fistula:**
   - Tracheo-esophageal fistula: due to necrosis of the **p**osterior wall of the trachea rand anterior wall of the esophagus → tracheo- esophageal fistula
   - Tracheo-arterial: due to pressure necrosis on the adjacent carotid → fatal hge
   - Tracheo-cutaneous fistula: due to epithelialization of the tracheostomy track if the tracheostomy remains for a long time. Treated with fistulectomy and repair.

❖ Care after tracheostomy:

- Humidification of inspired air by steam inhalation
- Aspiration of secretions by sterile catheter
- Care of the tube by regular removal of the inner tube for cleaning
- Care of the wound
- Prophylactic antibiotic to avoid secondary infection