

Lecture(3)

TRACHEOSTOMY

A tracheotomy is an operation to make an opening in the trachea, while a tracheostomy means converting this opening to a stoma on the skin surface. Tracheostomy should, whenever possible, be carried out as an elective procedure. Many disorders are now managed by endotracheal intubation, and this should always be carefully considered first, but the decision for tracheostomy should not be left until it is too late. Children especially can deteriorate very suddenly. There is an old adage that states 'the time to do a tracheostomy is when you first think about it'. In many centres, percutaneous dilatational tracheostomy has emerged as the principle method for performing tracheostomy in the intensive care unit setting.

Indications for tracheostomy

1. Airway obstruction. Advances in anaesthetics, including improved, less traumatizing types of Endotracheal tubes, have reduced the number of potential tracheostomies. Upper airway obstruction is now the least common indication for tracheostomy.

- Congenital (subglottic stenosis, laryngeal web, laryngeal cysts).
- Trauma (foreign body, severe head and neck injury, swallowing corrosive, inhalation of irritants).
- Infection (acute epiglottitis, laryngotracheobronchitis, diphtheria, Ludwig's angina).
- Tumour (tongue, larynx, pharynx, trachea, thyroid).
- Vocal cord paralysis (thyroidectomy complication, bulbar palsy).

2. Protection of the tracheobronchial tree. This includes patients who need temporary protection of their airway (e.g. those patients undergoing head and neck surgery). Patients may benefit from a long-term tracheostomy if they suffer from any chronic condition (which are often neurological diseases) leading to inhalation of saliva, food, gastric contents or blood, or the stagnation of bronchial secretions. A cuffed tube will protect the airway from aspiration and allow easy access to the trachea for regular suction.

- Neurological diseases (polyneuritis, tetanus, myasthenia gravis, bulbar palsy, multiple sclerosis).
- Trauma (burns of the face and neck, multiple facial fractures).
- Coma (drug overdose, head injury, cerebrovascular accident).
- Head and neck surgery (oral or oropharyngeal resections, supraglottic laryngectomy).

3. Ventilatory insufficiency. Tracheostomy reduces upper respiratory dead space by about 70%, bypasses resistance to airflow in the nose, mouth and glottis, and allows the use of mechanically assisted respiration if necessary (intermittent positive-pressure ventilation).

- Pulmonary diseases (chronic bronchitis and emphysema, severe asthma, pneumonia).
- Neurological diseases (as above).
- Severe chest injury (flail chest).

Tracheostomy tubes

The selection of tracheostomy tube depends on the reason for the procedure and the postoperative requirements. A cuffed tube is preferred if the patient needs protection of the lower airway from aspiration or haemorrhage. Removable inner tubes facilitate cleaning and removal of crusted secretions while the outer tube maintains the airway. A fenestrated tube permits the passage of air upwards through the glottis, thereby allowing the patient to speak. Tube types can be divided into metal and synthetic.

1. Metal tubes. These usually consist of an obturator, an outer tube and an inner tube. They usually have an expiratory flap valve on the inner tube which allows phonation, but they do not have a cuff. Examples include the silver tubes of Chevalier Jackson and Negus. These are short and should only be used in patients with thin necks. The Durham tube has an adjustable flange so that it can be used in patients with either thin or very fat necks. The Koenig tube has a long flexible wire that can be used if there is a narrowing of the trachea. The Alder Hey tube is a typical example of a paediatric metal tube: both the inner and outer tubes are fenestrated and a valve is available to allow transglottic expiration and speech.

2. Synthetic tubes. Most of these are made from PVC, silicone or other synthetic plastics that are nontoxic. Examples include the Portex and Shiley tubes. These tubes can be connected to an anaesthetic connector or respirator. Nowadays they have low-pressure cuffs which can remain inflated for days, preventing aspiration and without causing pressure necrosis of the trachea. Paediatric synthetic tubes include the Franklin tube of Great Ormond Street, the Portex paediatric tube and the Shiley paediatric or neonatal tube.

The Great Ormond Street tube and the Shiley are winged and sit comfortably in the infant's neck; the Portex is not winged but has square-ended flanges. None of the paediatric tubes have a cuff.

Postoperative management

1. Nursing care. Constant nursing attention is essential for at least the first 24 hours following the tracheostomy. The patient should be in a well-supported upright position; care must be taken in infants that the chin does not occlude the tracheostomy.

2. Suction. The patient will be unable to cough and clear secretions so suction should be applied regularly, by aseptic technique, to prevent a build-up of secretions in the trachea and bronchi. A sterile catheter is passed well down into each main bronchus in turn.

3. Humidification. Humidification of inspired air is essential to prevent drying of the airway, which encourages the formation of crusts and infection. Saline or sodium bicarbonate instillation into the trachea followed by immediate suction also helps to reduce the likelihood of such complications.

4. Apnoea. Some patients with chronic obstructive airways disease may develop apnoea following restoration of their airway. This is due to lowering of their P_{CO_2} , with loss of stimulation of their respiratory centre. These patients need monitoring and the administration of carbon dioxide via a flowmeter through the tracheostomy if necessary.

still functioning the patient can be shown how to speak by temporarily blocking the tube while exhaling. Patients with a permanent tracheostomy should if possible have a fenestrated tube with a speaking valve incorporated with the inner tube.

6. Swallowing. Some patients may experience problems, often because of the condition which necessitated the tracheostomy, but sometimes because of incoordination and the pressure of the tube's cuff. The tracheostomy tube may interfere with the normal mobility of the larynx during swallowing. Deflation of the cuff will sometimes help, but some patients may require a nasogastric tube.

7. Care of the tube. If there is an inner tube it should be taken out and cleaned whenever necessary; the outer tube must be held firmly while withdrawing the inner one. Replacement or cleaning of the outer tube is usually left for the first 5 days until a track has become established, then this should be done weekly or as required. If a cuffed tube has been used it should be inflated with the minimum amount of air that prevents an air leak, and it must have a low-pressure cuff to minimize the risk of tracheal stenosis. A spare tube of identical size and a tracheostomy dilator must always be available at the bedside in case a quick change is

necessary. The first tube change is usually done about 48 hours after the tracheostomy and should always be performed by a doctor, preferably the surgeon who performed the procedure. Whenever the nursing staff perform subsequent tube changes it should be done when the whereabouts of a doctor is known in case of a problem.

8. Decannulation. The tracheostomy tube should be spigoted and removed as soon as is feasible. It should only be carried out when it is obvious that it is no longer required. The patient should be able to manage with the tube spigoted for a full 24-hour period, including a period of sleep. There may be difficulties in children who have had the tracheostomy for a long period of time, sometimes because of a psychological dependence on the tube. They also have a relatively smaller tracheal airway which may be partly blocked by granulation tissue, and surgical closure by excision of the scar tissue and the tracheocutaneous track may be required in some cases. After decannulation the patient should remain in hospital under observation for at least 2 days.

Complications

As with any operative procedure the complications of tracheostomy can be immediate (during the first 24 hours), intermediate (1–14 days) or late (>14 days).

1. Immediate.

- Anaesthetic complications.
- Damage to local structures (cricoid cartilage, recurrent laryngeal nerve, oesophagus, brachiocephalic vein).
- Cardiac arrest.
- Primary haemorrhage.

2. Intermediate.

- Dislodgement/displacement of the tube.
- Surgical emphysema.
- Pneumothorax.
- Obstruction of the tube or trachea (excessive crusting).
- Infection (perichondritis, wound infection, secondary haemorrhage).
- Tracheal necrosis (may lead to tracheal stenosis or tracheo-oesophageal fistula).

3. Late.

- Subglottic and tracheal stenosis.
- Decannulation difficulty.

- Tracheocutaneous fistula.
- Scar (hypertrophic or keloid).

Percutaneous tracheostomy

Percutaneous tracheostomy (PCT) has gained attention as an alternative to the standard tracheostomy technique. Despite its growing use, many otolaryngologists remain sceptical about its safety.

1. *Technique.* Several techniques are described but the Ciaglia modification of the Seldinger technique has the most support in the literature. Ciaglia's method involves a small vertical incision at the lower edge of the cricoid cartilage and blunt dissection is performed to the level of the trachea. Then there is a placement of multiple progressive dilators into the tracheal lumen over a wire that is introduced through this tract. Bronchoscopic guidance should be used when available, as it increases the safety of the procedure.

2. *Indications/contraindications.* The indications are the same as for conventional tracheostomy. The relative contraindications include: age less than 15 years, enlarged thyroid isthmus, previous tracheostomy, cervical spine fractures, evidence of coagulopathy, indistinct anatomic landmarks and previous laryngeal or neck surgery.

3. *Complications.* The main early problems are from bleeding and paratracheal insertion. This potentially lethal problem has been reported and associated with deaths. Bronchoscopic guidance is therefore advisable. The question of laryngo- tracheal stenosis as a long-term complication has not yet been adequately evaluated.

Some benefits appear to exist from the procedure, i.e. increased speed, smaller and more aesthetic wound, decreased operative bleeding and decreased rate of local wound infection. Costs also appear to be reduced.