# INTUBATION

## Resource Package

### February 2014

NSW GOVERNMENT Health
Hunter New England
Local Health District

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Endotracheal intubation is an invasive method of airway management involving placement of a tube under direct visualization through the vocal cords.

## Indications for Intubation

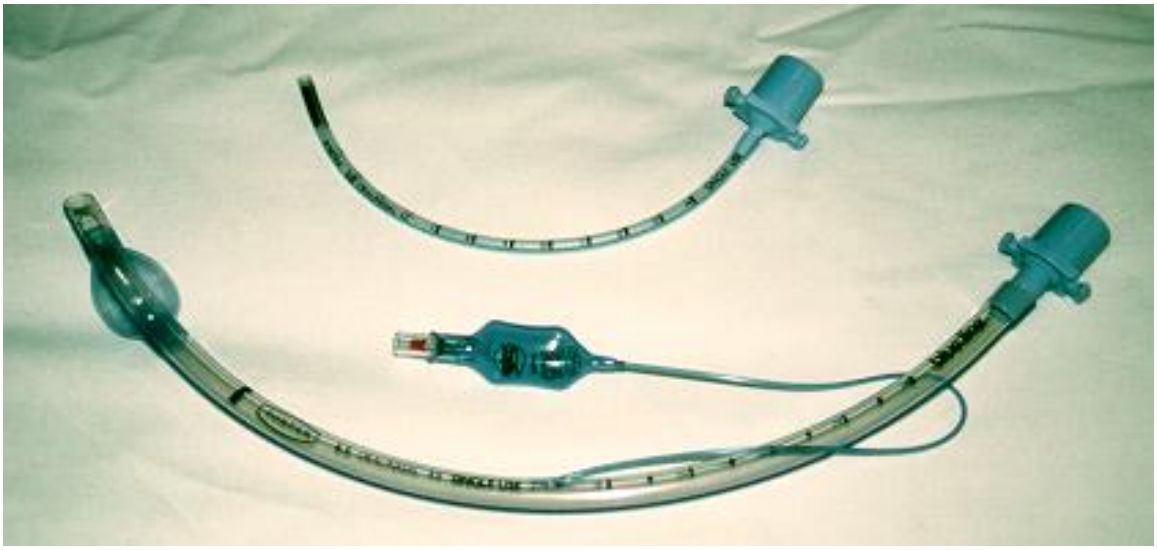
The primary reasons for intubation are:

1. Acute airway obstruction
2. Protection of the airway in those without protective reflexes
3. Respiratory failure requiring ventilatory support and high-inspired concentrations of oxygen
4. Facilitation of tracheal suctioning
5. Administration of drugs

(Botter, 2009)

Endotracheal intubation may be accomplished using the nose or the mouth. In the emergency setting, oral intubation is most common as it can be achieved more rapidly and provides better visualisation of anatomic structures. Furthermore, the oral passageway accommodates a larger tube, thereby reducing airway resistance.

## Endotracheal Tubes



- Endotracheal tubes come in various designs. The tube is curved and the tip is bevelled to ease insertion through the vocal cords.

- The tube is marked in centimetres to help estimate and maintain tube position while inserting or repositioning it. A radiopaque line runs along the shaft of the tube to help locate its position on X-ray.

- Tube sizes range from an inner diameter (I.D.) of 2.0mm for a premature newborn to 11mm for a large adult.

- For the adult female, tubes with an internal diameter of 7.0 – 7.5 mm are generally the most appropriate size and for Adult Males 8.0 –8.5 mm (Grey, 2003).

- *Adult tubes* have a 2 – 4cm long *cuff* bonded to the distal end of the tube so that no air escapes when positive pressure ventilation is applied. This also protects against aspiration.

## Adult vs. Paediatrics

*Figure 27: Adult Airway*
Anatomy of adult airway

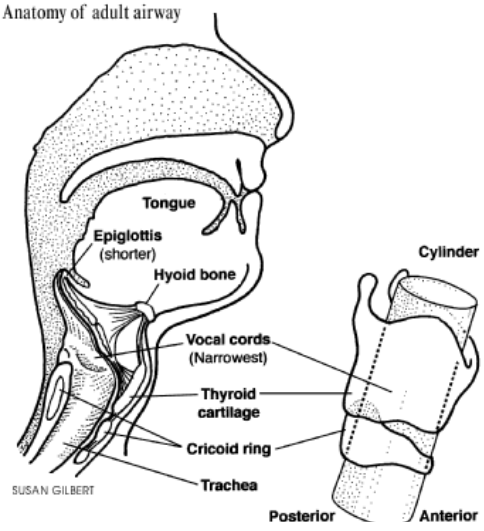
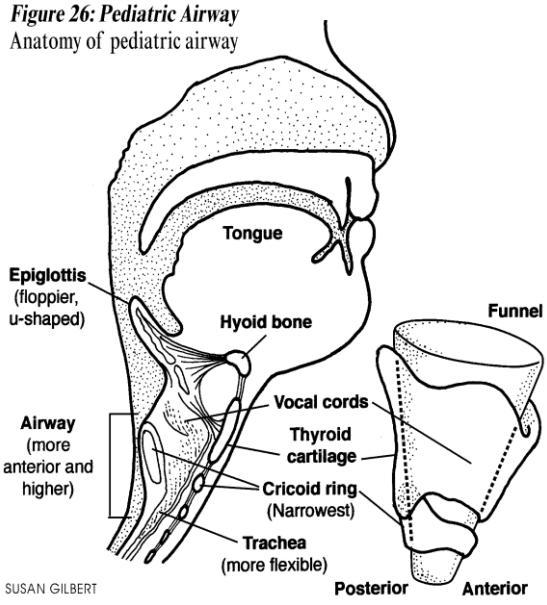



*Figure 26: Pediatric Airway*
Anatomy of pediatric airway




(Centre for Paediatric Emergency Medicine, 2001)

## Paediatric Tubes

- Cadaveric studies of the paediatric larynx established its conical shape with the apex of the cone (the narrowest portion of the cone) at the level of the cricoid

cartilage. Although the cricoid is unyielding the vocal cords and structures cephalad to the vocal cords may be distended with the placement of an oversized Endotracheal Tube (Aker, 2008).

- Historically uncuffed ET tubes were selected for infants and children under the age of eight years in order to minimise tracheal and laryngeal injuries (Aker, 2008).

- More recently there is an increasing body of evidence, supporting the use of cuffed ET tubes in paediatric patients. This combined with significant improvements in the design cuffed paediatric ET tubes has led to an increase in their use.

Listed in tables below are some advantages and disadvantages of both cuffed and uncuffed paediatric ET tubes.

| |
|---|
| • Air leak around endotracheal tube |
| • Additional laryngoscopy and endotracheal tube exchange |
| • Environmental pollution of operating theatre |
| • Unreliable ventilation and oxygenation |
| • Required high-inspired gas flow |
| • Imprecise capnometry and capnography readings |

Table 1: Disadvantages of uncuffed endotracheal Tubes, (Akers, 2008)

| |
|---|
| • Endotracheal tube sealing with cuff in trachea |
| • Use of low inspired gas flows |
| • Precise determination of end-tidal carbon dioxide |
| • Decreased environmental pollution |
| • Cuff volume easily adjustable |
| • Avoidance of repeated laryngoscopies |

Table 2: Advantages of cuffed endotracheal tubes, (Akers, 2008)

- The choice of whether to use a cuffed or uncuffed ET tube will be governed by a number of important considerations including but not limited to, the intubating practitioner's preference, product availability, local policy and various patient factors.

- Choice of tube size for children is difficult. For children one year and older the formulas below are helpful

| **Uncuffed ET Tubes** | **Cuffed ET Tubes** |
|---|---|
| $\frac{\textbf{Age (Years)}}{\textbf{4}} + 4$ | $\frac{\textbf{Age (Years)}}{\textbf{4}} + 3$ |

- Insertion depth for paediatrics > 1 year can be calculated approximately:

$$\frac{\text{Age (years)}}{2} + 12\text{cm} = \text{Oral tube}$$

$$\frac{\text{Age (years)}}{2} + 14\text{cm} = \text{Nasal tube}$$

- For Newborn and neonates: uncuffed tubes are used and ET tube size is calculated as gestational age in weeks divided by 10. A straight blade laryngoscope (size 1 for term infants and Size 0 or 00 for premature to extremely low birth weight infants) is preferred although a curved blade may be used by experienced ALS responders. (Page 9 of this document shows a table from the ARC guideline 13.5).

- It is useful to have an ET tube 0.5mm above and below the original selected size available as there is a lot of variation in paediatric airway size. This variation often results in multiple re-intubations in order to achieve optimal protection of the paediatric airway.

- If using a cuffed ET tube, and **air** is used to inflate the ET cuff**, regular measurements of cuff pressure must be attended to using a cuff pressure manometer**. The desired cuff pressure should be noted / prescribed by the intubating practitioner. Limits on cuff pressure are governed by many factors

including but not limited to, Intubating practitioner preference, size of ventilator leak and local policy, procedure and guidelines.

- Following intubation an oro or naso-gastric tube (NGT) should be inserted when appropriate (ARC 12.2, 2010)

- Initial nasal intubation should only be attempted if the oral route is obstructed. The use of cricoid pressure during intubation should be released if it hinders intubation

- Oral route in paediatrics is quicker, and less likely to cause trauma but is more at risk of being dislodged therefore securing the oral tube is very important

**A guide to uncuffed endotracheal tube size and length**

| Age | Size (mm) +/ - 0.5 | Insertion Length (cm) | |
|---|---|---|---|
| | | Oral | Nasal |
| Premature | 2.5 | 5.5 | 7 |
| Newborn–6 months | 3.5 | 9 | 11 |
| 6 months | 3.5 | 9 | 11 |
| 12months | 4.0 | 9.5 | 11.5 |
| 2 yrs | 4.5 | 10 | 12 |
| 4 yrs | 5.0 | 14 | 16 |
| 6 yrs | 5.5 | 15 | 17 |
| 8 yrs | 6.0 | 16 | 18 |
| 10 yrs | 6.5 (Cuffed) | 17 | 19 |
| 12 yrs> | 7.0 (Cuffed) | 18 | 20 |

Broslow, 2002 & HNEHS, 2006.

## Securing of Paediatric ET tubes

There is a high associated risk of accidental extubation when securing or changing ET tapes and advancing or pulling back on the ET tube. Only senior paediatric trained nurses or medical staff are able to change tapes. There must be a paediatric trained Doctor, who is aware of the procedure, immediately available if the patient requires urgent reintubation. Ensure that all required drugs and equipment necessary for reintubation are available at the bedside, to use if needed.
(Care of a Paediatric Airway, Intensive Care Services, John Hunter Hospital November 2012)

### Equipment

- String
- Tinc Benz
- Cotton tips
- 1 inch brown tape – 2 trouser leg pieces
- ½ inch brown tape – 1 trouser leg piece for securing NGT
- Stretchy brown tape
- Clear tape

### Procedure

1. Person 1 - Tie the string around the ETT using a reef knot, ensuring the knot is on the underside of the tube.
2. ONE PERSON IS REQUIRED TO HOLD THE STRING AT THE BASE OF THE EARLOBES UNTIL TAPING IS COMPLETE.
3. Person 2 - Apply Tinc Benz to the area that the tapes will be - avoid eyes as it will cause irritation (Fig 1)

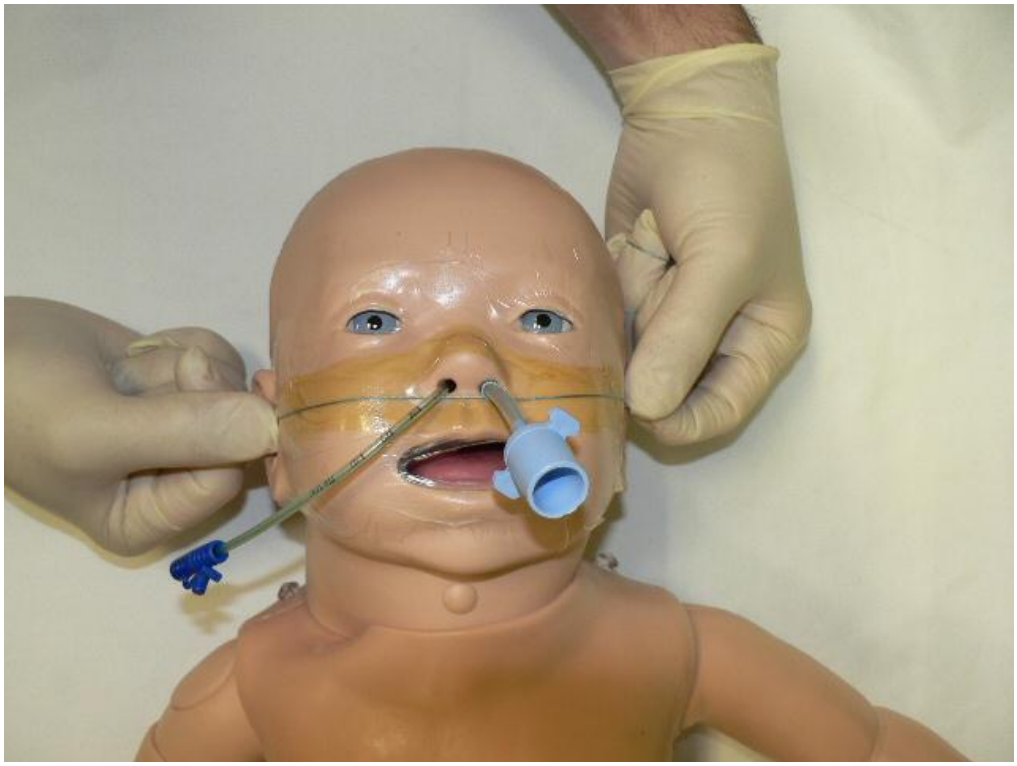


Figure 1

4. Place the trouser-leg 1 inch elastoplast across the nose with the upper part wrapping around the tube and lower part across the upper lip. The Elastoplast must be placed over the string to secure it (Fig 2)

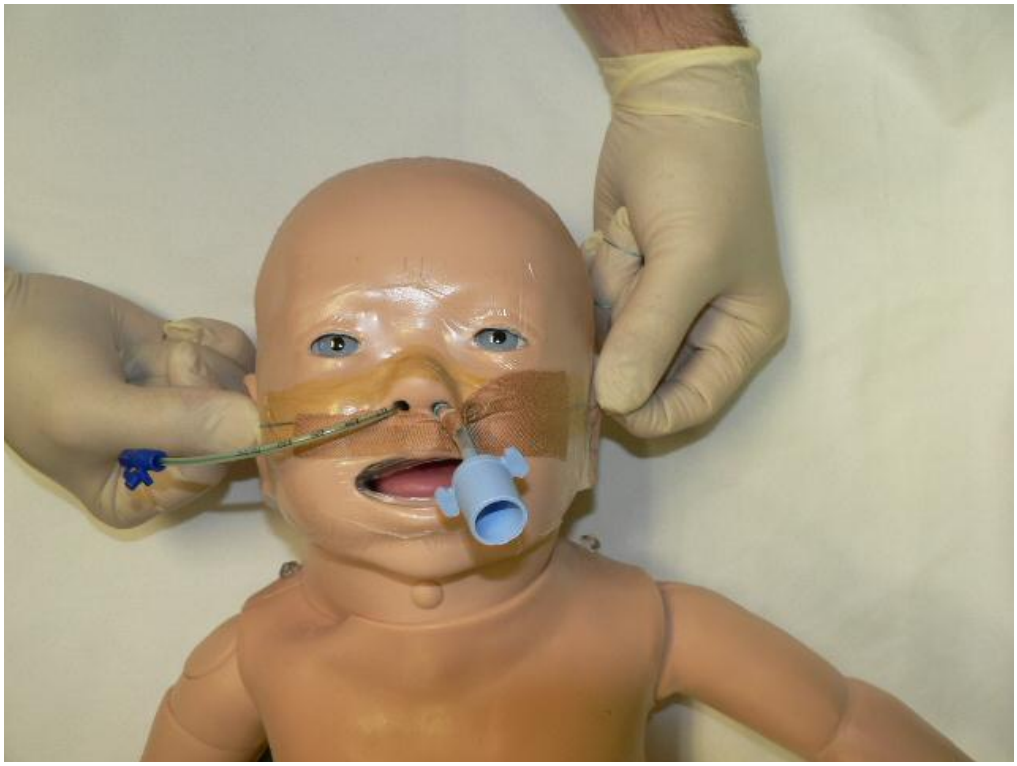


Figure 2

5. From the opposite side of the face, place the trouser-leg 1 inch elastoplast across the nose with the upper part across the nose and the lower part wrapping around the tube (Fig 3)

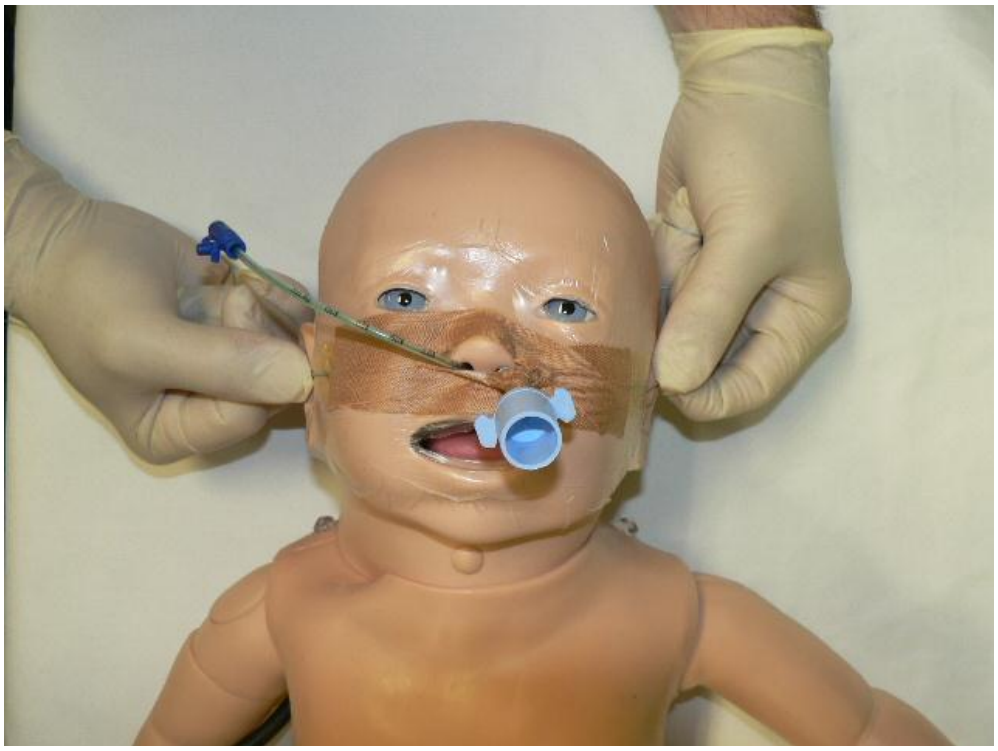


Figure 3

6. Cut a hole in the centre of the stretchy Elastoplast. The hole must be large enough for both ETT and NG tube to pass through. Place across all taping. Curl string up and lay on top of stretchy Elastoplast. Tape string down with clear tape (Fig 4b)

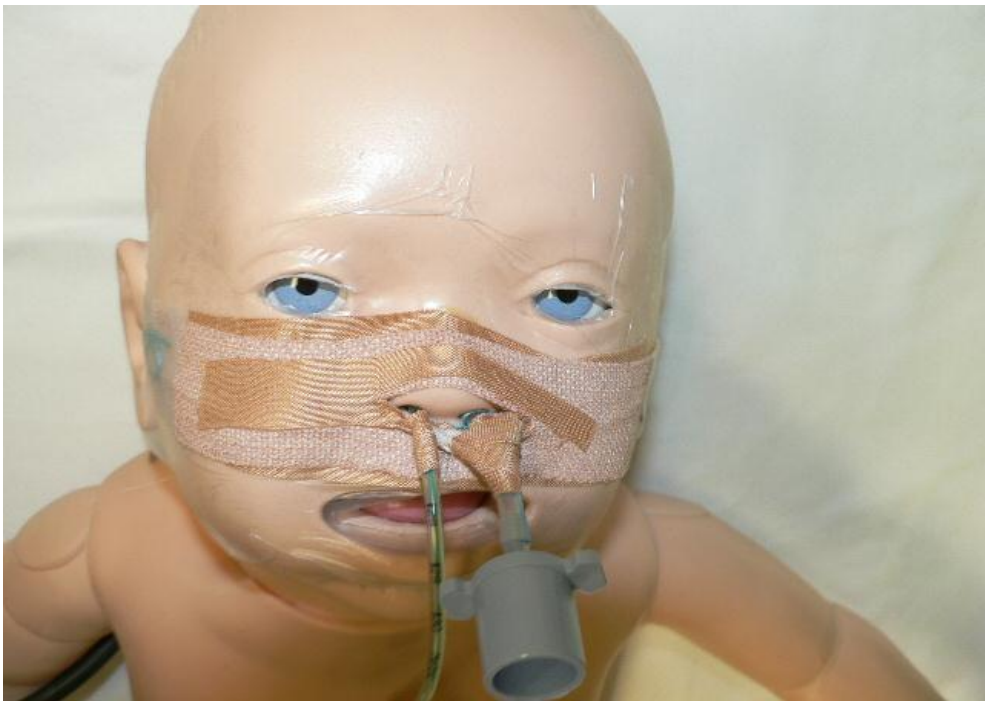


Figure 4a

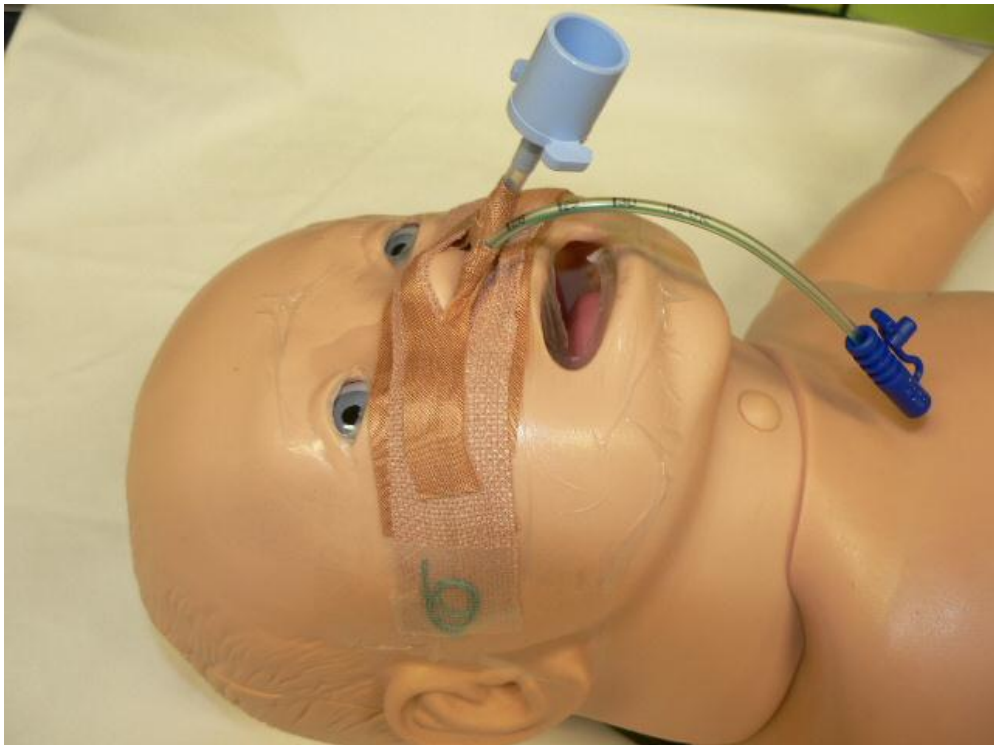


Figure 4b

7. If the patient has a NGT, secure using the ½ inch brown tape.

## Complications of Intubation

- Insertion trauma
- Hypoxia and ischaemia (can lead to bradycardia and asystole)
- Cardiac arrhythmias
- Aspiration of gastric contents
- Oesophageal intubation
- Laryngospasm
- Bronchospasm
- Right bronchial intubation
- Airway irritation and tracheal stenosis

## Equipment Required

- Resuscitation / Emergency trolley
- Laryngoscope – with straight or curved blade
- Endotracheal tubes and 10ml syringe (to check / inflate cuff)
- Bag valve mask / face mask / oropharyngeal airway
- Yankauer sucker / wall suction and tubing
- Intubation stylet (malleable)
- Boujee introducer may be required
- Lubricant
- Magill's Forceps.
- Tape to secure tube (tracheostomy tape)
- Intubation drugs
- Haemodynamic monitoring equipment (ECG, BP, $SpO_2$)
- Stethoscope
- Oxylog / ventilator
- Waveform Capnograph/$CO_2$ Detector (e.g. Easy Cap and / or paedicap)

## Preparation of Equipment

1. **Laryngoscope**
    - Check bulb is working and secure
    - White light is better
    - Select correct blade

2. **Tube**
    - Inflate/deflate cuff with syringe
    - Lubricate tube particularly the cuff – maintaining sterility of tube

- There may not be time to attend to these steps in the emergency intubation
- Insert introducer if required by doctor

3. **Bag valve mask**
    - Connect to appropriately sized facemask and high flow oxygen (at least 15L/min)
    - NB: paediatric bag valve mask should have a pressure limiting device (pop off valve designed to vent at approx 35 – 40cm$H_2O$)

4. **Suction**
    - Connect yankauer sucker to wall suction
    - Turn suction to 200mmHg and check that it's working effectively (150mmHg for children and 100mmHg for infants)

5. **Preparation of intubation drugs**
    - Sedation / anaesthetic agent
    - Neuromuscular blocking drug
    - Atropine for paediatrics
    - Vasopressor e.g. metaraminol or phenylephrine

6. **Ventilator**
    - Check ventilator is working correctly
    - Set ventilator to required settings

Please note the intubating person should ensure all team members present are aware of their secondary and tertiary plans in the event of an unsuccessful intubation so that the people assisting them can locate and prepare any additional equipment that maybe required.

## Patient Preparation

1. The patient must have a patent intravenous / intraosseous cannula and an infusion of Normal Saline 0.9% or Hartmann's may be commenced for flushing of medications.

2. Ensure patient is attached to:
    - ECG Monitor
    - Non and / or invasive blood pressure monitoring
    - Pulse oximetry

3. Remove head of bed and pull out from wall

4. Place a length of 'Trachy Tape' behind the patients' neck (with paediatrics, have desired tapes in reach) in readiness for securing the ET tube

5. Briefly explain the procedure to patient (if conscious) or parent if paediatric patient

## Intubation Procedure

**Resuscitation Personnel – minimum of 3 - 4 people required.**

**Person 1:** Doctor or anaesthetist performing the intubation
**Person 2:** Administers the drugs and passes equipment
**Person 3:** Performs cricoid pressure
**Person 4:** Monitors the patient and scribes

**Step 1** Pre-oxygenate patient via bag valve mask with 100% oxygen. (pre-oxygenation reduces the risk of hypoxaemia and related complications). If patient is unconscious, an oropharyngeal airway maybe inserted and the patient maybe manually ventilated.

**Step 2** Administration of drugs to sedate and paralyse the patient eg)
- Sedative/ Anaesthetic agent to induce sleep.

- Neuromuscular Blocking agent to induce muscle paralysis

**CRICOID PRESSURE** is applied as the patient loses consciousness following administration of anaesthetic agent as directed by the airway doctor (see Cricoid Pressure pg. 17).

**Step 3** Laryngoscope is inserted (secretions in the pharynx may need suctioning). ET tube is introduced through the cords and into the trachea.

**Step 4** Introducer (stylet or bougie) is removed (if used) and cuff is inflated with appropriate size syringe (10ml for adults and 3ml for paediatric). ET tube is connected to bag valve mask and patient is manually ventilated.

**Step 5** **Ensure $CO_2$ detector is connected to confirm correct placement of the ET Tube.** Check for equal air entry on both sides of the chest Prominence of breath sounds on one side of the chest or asymmetry of chest wall movements during respiration, often on the right, could mean that the tube has advanced too far down a main-stem bronchus and needs to be pulled back (after the cuff has been deflated).

Monitor patient colour and oximetry ($SpO_2$).

When the medical officer is satisfied that the ET tube is correctly positioned he / she will signal to release cricoid pressure.

**Step 6** Secure the tube in position with tracheostomy tape using an appropriate technique (one method is the clove hitch knot)

**Step 7** Connect ventilation device to endotracheal tube and confirm respiratory rate (frequency) and minute or tidal volume settings with medical officer.

Monitor peak inspiratory pressures.

**Step 8** The following must be documented:

- Vital signs
- Drugs given
- Ventilation settings
- Inspiratory pressure (airway pressure)
- Size of tube and position at which it is tied (at teeth or lips)
- ETT cuff pressure

**Step 9** The position of the ET tube should be confirmed by chest x-ray as soon as safe and practical

The tube should be approximately 2-3cm above the carina for an adult and 1 - 2 cm above the carina in a child (bifurcation of the left and right bronchus).

***Further increments of sedation (Morphine / Midazolam / Propofol) and neuromuscular blocking drugs may be required, unless the patient is deeply unconscious and / or has no spontaneous respirations.***

## Cricoid Pressure

- Cricoid Pressure, also known as Sellick's Manoeuvre, is used to decrease the risk of pulmonary aspiration of gastric contents during intubation

- Cricoid pressure is indicated in the following situations:

    - During cardiopulmonary resuscitation (CPR) until the airway is secured
    - Immediately prior to the induction of general anaesthesia in the non-fasted patient
    - Delayed gastric emptying
    - Incompetent lower oesophageal sphincter, e.g. late pregnancy

- Cricoid Pressure consists of temporary occlusion of the upper end of the oesophagus by backward pressure of the cricoid cartilage against the bodies of the cervical vertebrae.

- Extension of the neck and application of pressure on the cricoid cartilage obliterates the oesophageal lumen at the level of the 5$^{th}$ cervical vertebrae.

- Pressure is maintained until:

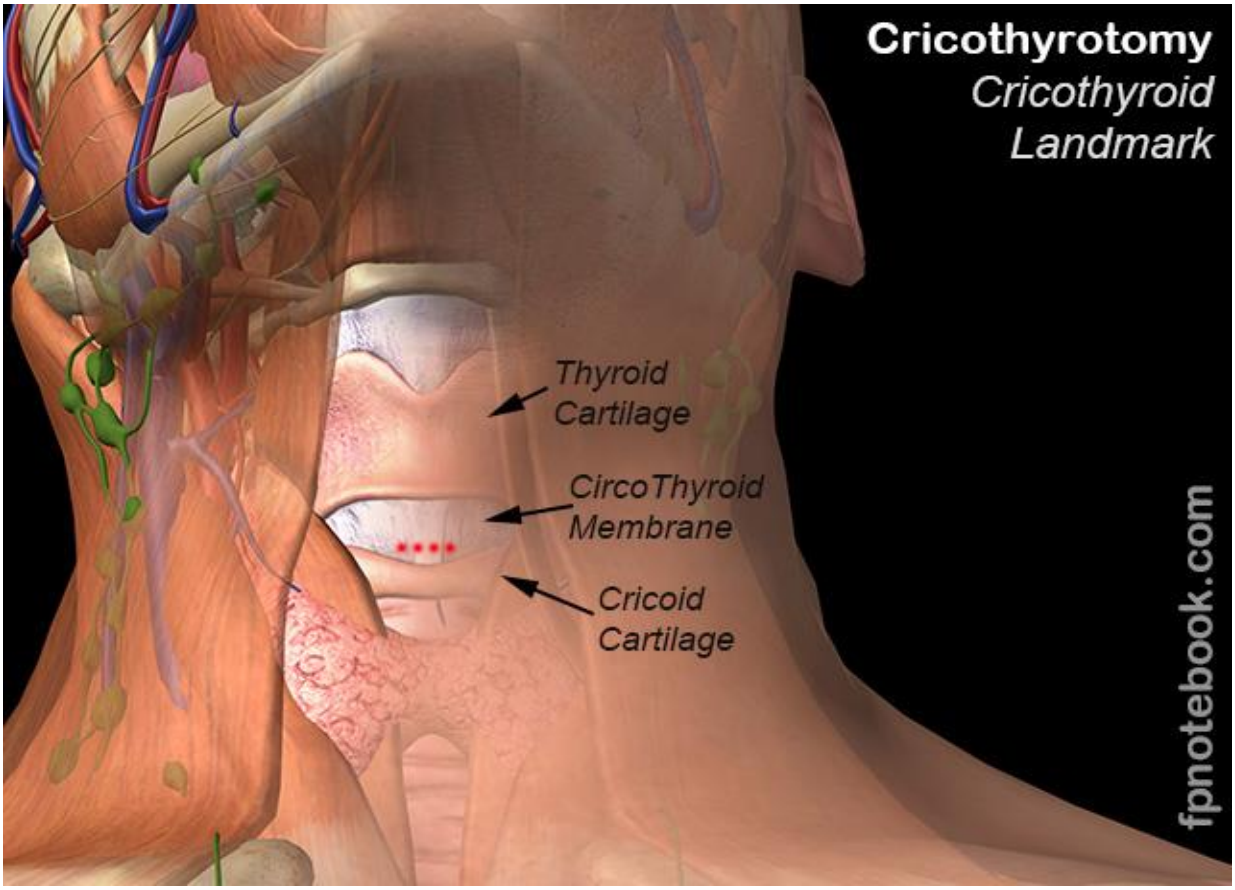
    - intubation and inflation of the cuff of the ET tube is complete
    - the medical officer performing intubation indicates that cricoid pressure is to be released

- Cricoid pressure should not be applied to the patient actively vomiting, as the resulting increased pressure may injure the oesophagus. The manoeuvre itself can induce gagging and even vomiting in the awake patient.

- The commonest problem with cricoid pressure is the failure to perform it correctly. Pressure is rarely applied with proper timing, namely starting with the onset of unconsciousness and continuing until the endotracheal cuff is inflated. In addition, insufficient pressure is applied. Researchers have demonstrated that 20N of force allowed regurgitation whilst 30N was enough to prevent it (Patten, 2006).

**Cricoid Cartilage**

The cricoid cartilage is shaped like a signet ring with the broad bulky portion placed posteriorly. Because it is the only complete skeletal ring of the airway, pressure applied to its anterior surface is transmitted to the oesophagus, which lies directly behind.




Moses 2013

In children the cricoid cartilage is **very soft and pliable**. Cricoid pressure or extremes of head position can **cause obstruction of the airway**. Cricoid pressure and overextension or overflexion of the head can make spontaneous or assisted ventilation difficult.

## Backwards Upwards Rightward Pressure (BURP)

In 1993 Knill coined the term “BURP,” describing the direction and pressure exerted on the thyroid cartilage by an assistant to improve laryngeal view at laryngoscopy (Levitan et al, 2006).

Both Cricoid Pressure and BURP maneuvers have been common practise for airway management for several decades; but numerous recent studies have shown they both worsen laryngoscopic view (Hwang et al, 2013).

## Bimanual Laryngoscopy

Bimanual laryngoscopy has been suggested to be more effective than cricoid pressure and BURP for improving laryngeal exposure. The laryngoscopist applies thyroid cartilage pressures using his/her right hand to obtain the best laryngeal view; and then the assistant takes over the laryngoscopist's external laryngeal manipulation. (Hwang et al. 2013)

## Cuff Inflation

During the emergency intubation scenario, initial cuff inflation volume is assessed by the pressure in the pilot tube cuff. This volume should provide sufficient tension for the cuff to feel firm but also allow give.

Over-inflating the cuff on an endotracheal tube places undue pressure on the tracheal wall.

Keep the cuff inflated no more than is necessary to prevent aspiration and loss of Tidal Volume.

### Cuff Inflation Techniques

Following stabilisation of the patient the tube cuff must be checked for appropriate volume and pressure. Listen for the leak on the inspiratory cycle. All other resuscitation procedures take priority

- **Minimal Leak Technique**

  Utilise two people. While listening to the trachea with a stethoscope, have a colleague inject air into the cuff until no leak is heard. Air is then removed in 0.1ml increments until a small squeak is audible. This represents a leak of approximately 0.5mls. This technique provides more protection against tracheal wall trauma.

- **Minimal Occlusive Volume Technique**

  The aforementioned procedure is first carried out. Air is then reinstilled until no leak can be heard. This technique protects better against aspiration and loss of Tidal Volume.

- **Cuff Manometer**

**Both adult and paediatric cuff manometers are available to measure pressure in mmHg. These are placed on the pilot tube and the needle should be within the highlighted pressure range on the gaugeDrugs used in Intubation**

**Midazolam (Hypnovel)**

- Benzodiazepine
- Central nervous system depressant
- Produces sedation, amnesia, and hypnosis
- Sedation reached in 2-3 minutes
- Duration is dose dependent
- Useful in induction of anaesthesia prior to giving other anaesthetic drugs
- Preparation: Midazolam (Variable ampoule strengths available)
- Add Normal saline 0.9% and make 1mg/ml solution
- Dose is titrated to effect

**Sodium Thiopentone (Pentothal)**

- Barbiturate anaesthetic (short acting)
- Onset 30 seconds
- Duration 3-8 minutes
- Rapid induction of anaesthesia
- May cause hypotension through vasodilation
- Preparation: Sodium Thiopentone (500mg ampoule)
- Dilute to 20mls with water for injection ampoules i.e. 25mg / ml

- Dose 5 - 7mg / kg ultimately dose is titrated to effect.

**Propofol** (Diprivan)

Preparation: Various ampoule sizes available

No dilution required

- Dose 2.0 -2.5mg / kg, ultimately dose is titrated to effect

**Suxamethonium (Scoline)**

- Depolarising neuromuscular blocking agent
- Rapid onset 30 seconds
- Short duration 2-3 minutes
- For profound muscle paralysis for endotracheal intubation
- May cause bradycardia
- Is contraindicated in conditions where there are high levels of $K^+$ (e.g. burns and ARF)
- Preparation: Suxamethonium (100mg ampoule)
- No dilution required (except with paediatric patients)
- Dose 1 mg / kg adult
- Dose 2 mg / kg paediatric
- Dose 3 mg / kg neonate

**Vecuronium**

- Non-depolarising neuromuscular blocking agent
- Onset 60 seconds
- Good intubation conditions by 2.5 - 3 minutes
- Duration 20-30 minutes
- Used to maintain paralysis of the intubated and ventilated patient
- Preparation: Vecuronium (Various ampoule strengths available)
- Dilute with water for injection ampoule to 1mg / ml strength
- Dose 0.1mg / kg

**Pancuronium**

- Non-depolarising neuromuscular blocking agent
- Onset 1-3 minutes
- Duration 45-60 minutes
- Used to paralyse the intubated and ventilated patient
- May cause increase in heart rate and blood pressure
- Preparation: 4mg/2ml ampoules
- Dilution not required
- Dose 0.06mg/Kg

**Rocuronium**

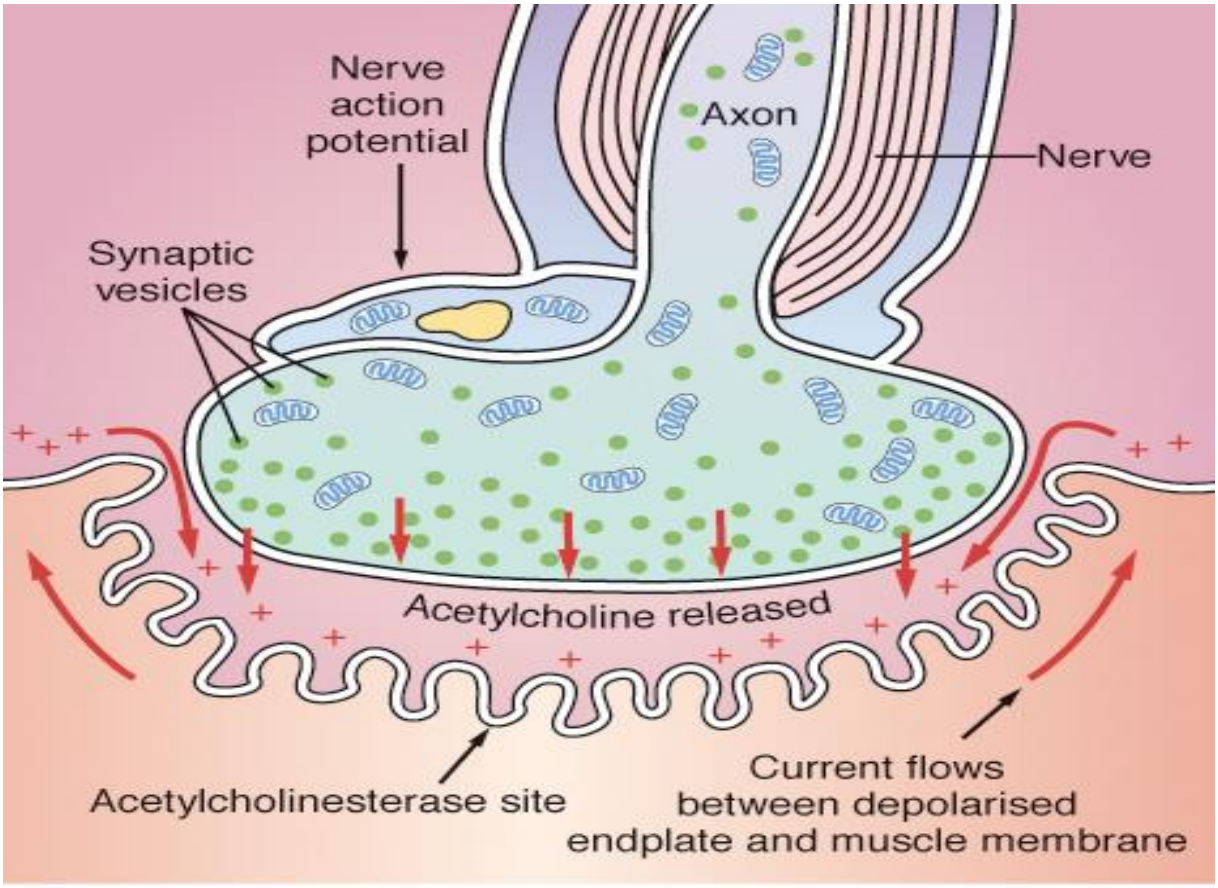
- Non-depolarising neuromuscular blocking agent
- Onset 60 seconds
- Duration 30-40 minutes
- Used to paralyse patients for intubation
- Maintain paralysis after intubation
- Preparation: Rocuronium (various ampoule strengths available)
- No dilution required
- Dose 1 mg / kg as part of rapid sequence intubation
- 0.6 mg / kg for maintenance of paralysis

**Giving Neostigmine and Atropine may reverse Vecuronium, Rocuronium. Pancuronium.**

Suxamethonium cannot be reversed.

## Neuromuscular Transmission

The basis of neuromuscular function may be understood from the following diagram, which depicts the neuromuscular junction.




Mosby's Dictionary of Medicine, Nursing and Health Professions, 2006

Acetylcholine (Ach), the neuromuscular transmitter, is synthesized in the nerve axon and stored in synaptic vesicles. When an action potential (current) arrives at the motor nerve terminal, Acetylcholine is released, diffusing across the synapse to combine with receptors on the muscle *motor end plate*. The resulting *depolarization* (change in membrane potential) is a local event (occurring only at the receptor site), but if the stimulus is strong enough, it causes an *action potential* to be generated and propagated along the muscle membrane, causing muscle contraction.

Acetylcholine is rapidly destroyed by Acetylcholinesterase, an enzyme located on the muscle fibre plasma membrane at the neuromuscular junction. This prevents continued muscle fibre contraction in the absence of additional stimulation.

**Definitions:**

*Depolarization* – the process by which the voltage (or membrane potential across a cell membrane) is changed. The cell interior becomes slightly less negative (i.e. reversal of the electrical gradient)

*Action Potential* – the sequence of the electrical changes propagated along the plasma membrane of the muscle fibre as a result of depolarization (it may be easier to think of the action potential as an electric current). Once started the action potential is unstoppable and results in full contraction of the muscle cell

*Motor End Plate* – the specific part of the muscle fibres' plasma membrane, which helps to form the neuromuscular junction

**Neuromuscular Blocking Agents**

All neuromuscular blocking drugs are structurally related to Acetylcholine. The similar structure permits interaction with receptors at the neuromuscular junction (and at receptors in the autonomic nervous system).

Two groups of neuromuscular blocking drugs exist: those that combine with the acetylcholine receptor (normally called cholinergic receptor) at the neuromuscular junction and cause depolarisation of the end-plate region (depolarising agents) and those that combine with the acetylcholine receptor to prevent depolarisation (non-depolarising or competitive agents).

**Depolarising Agents**

Suxamethonium (also known as Succinylcholine or Scoline) is the only depolarising muscle relaxant in clinical use. It has neuromuscular effects almost identical to those of acetylcholine. Initially Suxamethonium causes depolarisation and brief uncoordinated muscle contraction (called fasciculations). However, because it is more slowly metabolised than acetylcholine it remains at the motor end plate for longer, blocking further stimulation and causing paralysis. The muscle remains unresponsive until the end plate returns to its resting state, which is related to the concentration of Suxamethonium at the receptors and to the duration of exposure.

**Non-Depolarising Agents (Competitive Agents)**

These drugs (e.g. Vecuronium, Pancuronium and Rocuronium) compete with acetylcholine at the receptor sites of the neuromuscular junction preventing depolarisation of the motor end plate, thereby blocking neuromuscular transmission.

- No non-depolarizing muscle relaxant is currently available with an onset time or duration of action comparable to Suxamethonium, which remains the standard for rapid tracheal intubation.

- Neuromuscular Blocking agents are not central nervous system depressants. While motor function is lost, patients can still experience pain and may be completely aware of what is happening around them.

- **Muscle relaxants should always be given in conjunction with a sedating/anaesthetic agent.**

## Suctioning

The purpose of suction therapy is removal of secretions for optimal ventilation and airway patency, however, it should only be performed when needed and not as a routine procedure.

Signs and symptoms that indicate a need for suctioning include:

- Patient restlessness or anxiety.
- Diaphoresis
- Increase in blood pressure and heart rate.
- Increase in respiratory rate and pattern.
- Presence of rales and rhonchi on auscultation.

The visual inspection of the airway may also indicate a need for suctioning. A patient being ventilated via ventilator may develop increasing peak inspiratory airway pressures as a result of a built up of secretions. Any increase in airway pressure as

a result of secretions can be a mechanism for increasing risk of barotrauma (e.g. pneumothorax).

**Suctioning the Mouth and Pharynx**

- The most effective catheter for this area is a rigid yankauer sucker. It is easier to direct and allows for the removal of large volumes of fluid quickly. However, a 14g Y-suction catheter cut to about 10cm in length can be used instead of a yankauer.

- Use this sucker only under direct vision; it should not be inserted blindly.

- Insert the sucker so that the convex side goes along the roof of the pharynx; occlude the control port, moving the tip around the mouth and pharynx.

- Be aware of the increased risk of gagging or vomiting in the semi-conscious patient if the back of the throat is touched.

- Carefully time the suction; release the vacuum and withdraw the sucker.

**Suctioning via the Endotracheal Tube**

Endotracheal suctioning is not a strictly sterile technique but staff should adhere to strict infection control measures to protect themselves and other patients (Scobel et al, 2001). The outer diameter of the suction catheter should not exceed one half the inner diameter of the airway

**Do not perform endotracheal tube suction unless absolutely necessary.**

**Procedure**

- Monitor the patients' electrocardiogram

- Pre-oxygenate the patient with 100% oxygen with care

- Insert the catheter as far as possible, without force, remembering that no suction should be applied during insertion into the airway

- Withdraw the catheter 1cm to free it from respiratory mucosa, apply intermittent suction by occluding the control port with a thumb, and withdraw using a rotational movement. This exposes the catheter eyelets to a greater surface area and thus removes more secretions

- The entire procedure should be performed within 10 seconds and the patient re-oxygenated again with 100% oxygen

- If problems arise during suctioning e.g. bronchospasm**,** arrhythmia's, **remove the catheter and ventilate with 100% oxygen.**

**Suctioning via the Paediatric Endo/Nasotrachael Tube**

The aim of suctioning is to remove secretions from the Nasotrachael Tube (NTT)or ETT. Therefore, stimulating the carina should be avoided. This has been known to cause traumatic damage to the carina. Where able, the patient must have a closed, in-line suction system**.** This will avoid unnecessary hypoxia due to loss of ventilator support, as well as a reduced exposure risk to staff. When using the single sterile catheter technique, two qualified people must perform the procedure. This may be a medical officer, nurse or physiotherapist. If using the closed suction system, one nurse is adequate to perform procedure unless the patient is awake and active.
Saline instillation – do not instil saline down the NTT. To decrease the viscosity of secretions, efforts should be focused on adequate humidification of the circuit

## Indications

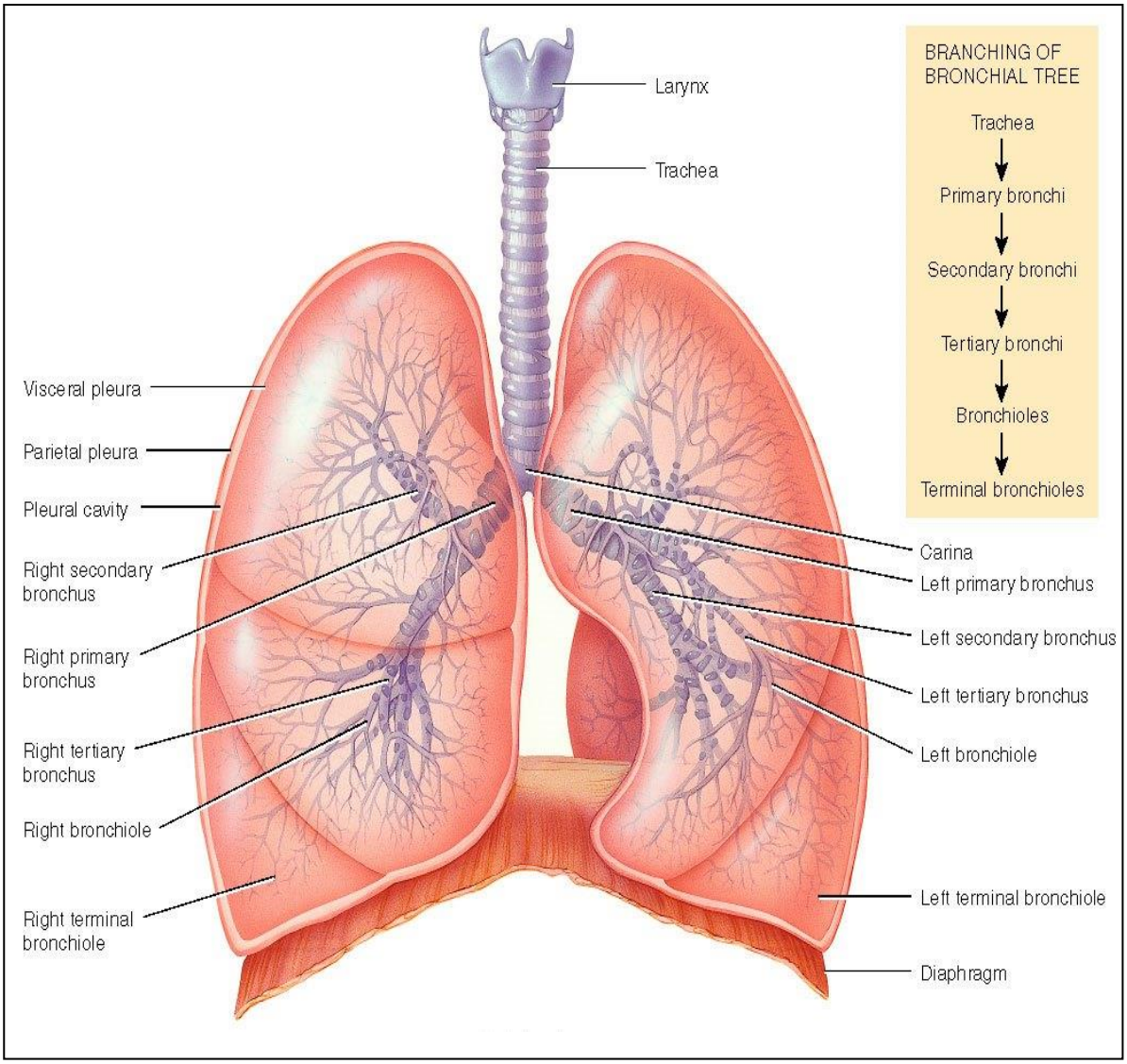
- Respiratory distress
- Poor respiratory effort
- Audible secretions
- Decreased $O_2$ saturations
- Raised PIP or reduced volumes

## Contraindications

- Bleeding via tracheal tube
- Coagulopathy
- Uncontrolled ICP

## Complications

- Bleeding
- Hypoxia
- Bradycardia
- Atelectasis
- Pneumothorax
- Airway haemorrhage
- Altered ICP
- Introduction of infection
- Mucosal trauma
- Bronchospasm
- Airway trauma




www.austincc.edu/lesalbin/Chapter%2023%20Respiratory%202304.ppt

In unusual circumstances i.e. inability to stimulate a cough, lavage may be indicated. Lavage does not loosen or break down secretions and may worsen patient condition e.g. introducing bacteria to the patient's airway. If a lavage is required, normal saline is used. The volume used is weight related. For a child less than 10kg the volume should be 0.3mls. For a child greater than 10kgs and less than 30kgs the volume should be 0.5mls

**Procedure for Open Suction technique**

It is mandatory for two health care professionals must perform this procedure

**Equipment**

A Y-suction catheter of the appropriate size - no more than half the internal diameter of the endotracheal tube

| Endo/nasotracheal size | Suction catheter size |
|---|---|
| 2.5, 3.0 | 6Fr |
| 3.5, 4.0 | 8Fr |
| 4.5, 5.0 | 10Fr |
| 5.5 or greater | 12Fr |

- Pre-oxygenate the child (either using the ventilator 100% oxygenate button or by manually ventilating the child using a resuscitator device) for at least five breaths.
- Measure the length of the NTT or ETT to the end and note the length on the suction catheter. You may also wish to make a note of the suction length on the patient's flow chart.
- Insert the catheter into the bullet connector of the nasotracheal tube in a smooth, rapid movement to the measured depth
- Withdraw the catheter while applying suction
- Recommence ventilation
- Observe the patient, ECG monitor and oxygen saturation during the procedure
- When these parameters have returned to baseline, repeat suction procedure if required, depending on patient condition/tolerance.
- Ensure fractional inspired oxygen has been returned to the prescribed concentration
- Suction nasopharynx and mouth if required
- Rinse suction tubing and dispose of contaminated equipment appropriately
- Document the quantity and consistency of secretions

**Procedure for Closed Suction Technique**

Closed suction systems are to be changed every 48 hours (Care of a Paediatric airway, Intensive Care Services, John Hunter Hospital November 2012). One health care professional is appropriate for this procedure, unless the child is awake and active, then two staff are needed.

For infants under 1 year, the suction catheter should only be inserted to the end of the ET tube to avoid adverse respiratory and cardiovascular side effects.

**Equipment**

- A closed suction catheter of the appropriate size
- PPE

Select appropriate size paediatric closed suction unit (Table 2). The suction catheter gauge size should be no more than twice the internal diameter of the ETT.

| **Endo/nasotracheal size** | **Suction catheter size** |
|---|---|
| 2.5, 3.0 | 6Fr |
| 3.5, 4.0 | 8Fr |
| 4.5, 5.0 | 10Fr |
| 5.5 or greater | 12Fr |

- Select the endotracheal tube adaptor that matches the patient's endotracheal tube size
- Attach suction catheter unit to the smallest port of the adaptor
- Attach ventilator tubing to the largest port of adaptor
- Remove blue connector from endotracheal tube (keep this for later use)
- Insert adaptor into endotracheal tube
- Attach label stating connection date
- Change entire closed suction unit every 48 hours

- Pre-oxygenate the child (either using the ventilator 100% oxygenate button or by manually ventilating the child using a resuscitator device) for at least 5 breaths
- Insert the catheter into the nasotracheal tube in a smooth, rapid movement. When resistance is felt or cough stimulated, withdraw the catheter slightly and apply suction
- Withdraw the suction catheter applying suction and gently rotating the catheter
- Recommence ventilation
- Observe the patient, ECG monitor and oxygen saturation during the procedure
- When these parameters have returned to baseline repeat suction procedure if required, depending on the patient's condition/tolerance
- Reduce fractional inspired oxygen to prescribed concentrations
- Suction nasopharynx and mouth as required
- Rinse suction tubing and dispose of contaminated equipment appropriately
- Document the quantity and consistency of secretion

## Workbook

1. State 4 reasons for intubation

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2. What are 4 major differences between an adult and child's airway?

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3. What is cricoid pressure?  How, when and why is it applied?

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4. List 4 complications of intubation

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5. The following intubation drugs have been prepared.

   100mg in 2mls of Suxamethonium

   500mg in 20ml of Thiopentone

   10mg in 10ml of Vecuronium

   The Medical Officer asks you to give 350mg Thiopentone; 75mg Suxamethonium, followed by 4mg of Vecuronium after intubation is complete. How many mL of each drug do you give?

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6. What methods are used to determine correct ET tube placement

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7. Outline your actions if you observed asymmetry of chest movement immediately after intubation?

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8. 20 minutes following intubation the patient begins to gag and bite on the ET tube. $SpO_2$ is decreasing. State what you think is occurring and outline your actions

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9. What size Y suction catheter would you use for suctioning the following ET tubes?

   Size 7.0cm……...

   Size 5.0cm……...

   Size 3.0cm……...

Congratulations on completing the resource package. You may wish to practise the following in your clinical area

- Tube tying and taping
- Assembling an Bag valve mask
- Preparing the Oxylog ventilator for use
- Suctioning

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