PARTNERSHIP IN CRITICAL CARE DEPT. WAIKATO

CRITICAL CARE WAIKATO HOSPITAL

WORKBOOK

NAME: _____

Te Hanga Whaioranga Mō Te Iwi
Building Healthy Communities

Waikato District Health Board

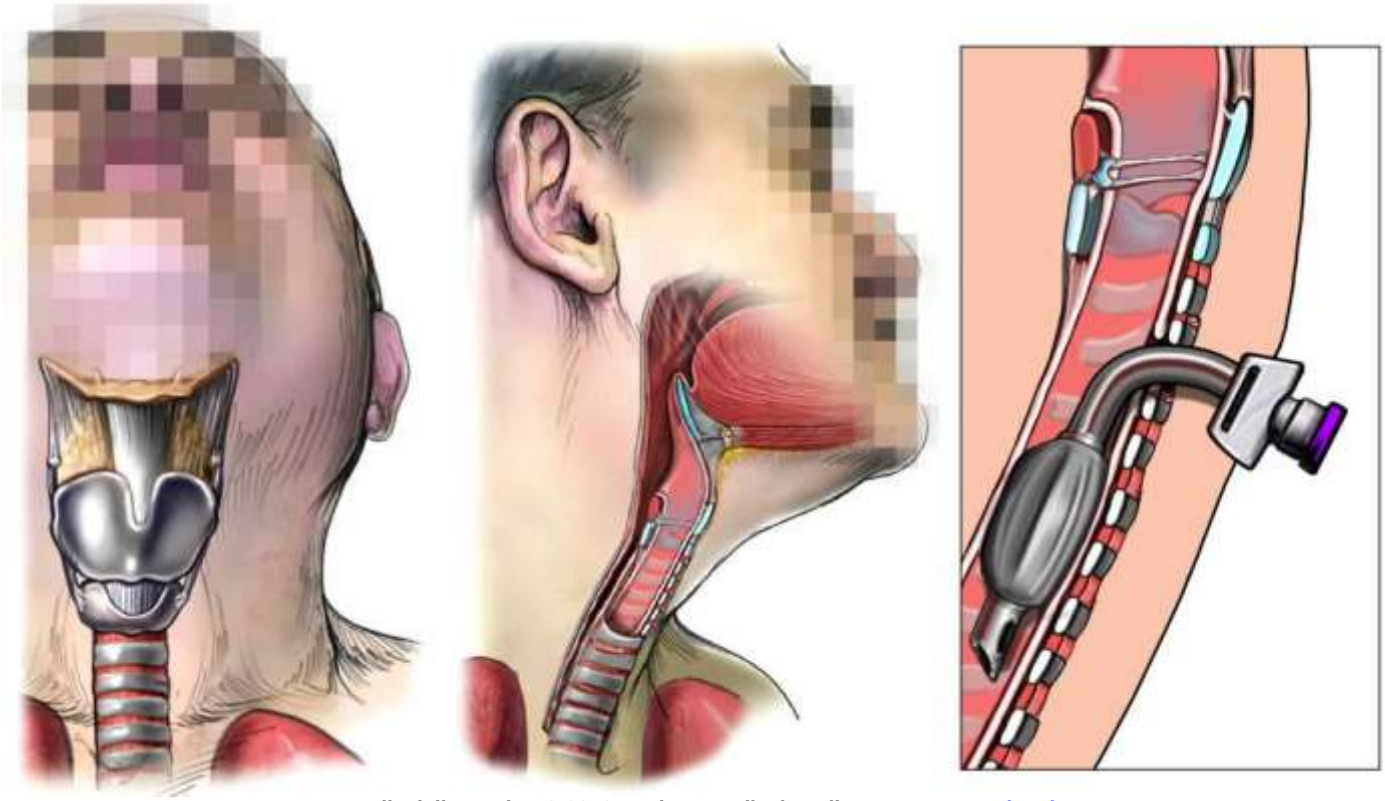
Section 4

Care of a patient with a Tracheostomy

Care of the patient with a tracheostomy

A tracheostomy is a surgical procedure performed to provide an alternative airway to assist with breathing and ventilation. An opening is created in the anterior wall of the trachea below the larynx between the 2nd and 3rd cartilage rings. A tracheal stoma is formed which is kept open with the placement of a tracheostomy tube.

The natural function of the upper airway is to provide a pathway for gas exchange to occur, humidification and protection to the lower airway by filtration. After placement of a tracheostomy, air bypasses these important components of a patient's defence against infection (Morris & Sherif Afifi, 2010).



Tracheostomy: before and after tube placement

Indications:

Indications include: Upper airway obstruction (swelling – burns, anaphylaxis, trauma), the need for prolonged ventilation and weaning (due to critical illness), to protect the airway (excessive secretions, impaired cough or swallow, inability to intubate) and following head and neck surgery.

Insertion of the tracheostomy can be performed in one of two ways:

Surgical tracheostomy is performed in the operating theatre, where an opening is made in the neck and dissected down to the trachea. An incision is made into the tracheal wall either as a horizontal slit, a vertical slit or a window (where a portion of the tracheal ring is removed).

Percutaneous tracheostomy is performed in the Intensive Care setting at the patient bedside. It is minimally invasive, involving the insertion of a needle initially, and then a guidewire into the trachea. A tapered dilator is then placed over the guidewire and used to enlarge the hole until it is big enough for a tracheostomy tube to be inserted.

For assisting with this procedure, please refer to the service specific document: Artificial Airway – Percutaneous Tracheostomy

Complications

Complications are categorised into 'Early', 'Intermediate' and 'Late' '

Early Complications

- Bleeding
- Pneumonthorax
- Pneumomediastinum
- Tracheal or tracheoesophageal laceration
- Tube malposition – dislodgement, false tract
- Subcutaneous emphysema
- Damage to the oesophagus or to the laryngeal nerve
- Tube blockage from blood clots, tube up against tracheal wall or secretions

Intermediate Complications

- Bleeding
- Accidental decannulation
- Peri-stomal abcess, cellulitis
- Tube occlusion
- Hyper-granulation
- Infection of trachea or around the stoma

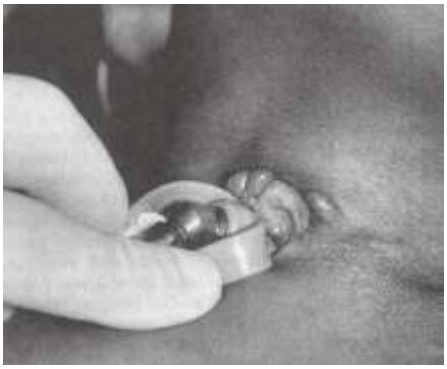
Late Complications

Over time other complications can develop due to pressure from the tube or cuff, infections with resulting scar tissue formation and tracheal friction from a tube that moves too much.

These include:

- Tracheomalacia
- Fistula formation - Tracheo-esophageal, tracheocutaneous,
- Granulation tissue
- Tracheal stenosis usually at stoma, tube tip or cuff site
- Mucosal ulceration

(Johnson, 2003)



Hyper-granulation around the tracheal stoma

Tube Types

Tracheostomy tubes come in a variety of sizes, lengths and adaptations. The tube of choice will depend on the patient's clinical condition, insertion method and expected duration of cannulation.

Portex Blueline Ultra

At Waikato Hospital, Portex Blueline Ultra adult tracheostomies are used. Sizes range from 6mm to 10mm (Internal diameter). These are made from transparent PVC that is rigid at insertion but softens with body temperature to adapt to individual airway anatomy (Sims Portex, 2003).

Portex Blueline Ultra cuffed Tracheostomy Tube

These tubes are cuffed for two reasons: 1) To create a seal within the trachea (when inflated) so that positive pressure **ventilation** can be effectively administered. The cuff must also be inflated as long as there is a high risk of **aspiration** (e.g. if a

patient has had a severe traumatic brain injury and cannot safely maintain their own airway).

Portex adjustable flange tracheostomy tubes

Adjustable flange tracheostomy tubes are used for those patients where a longer adjustable length of tube is required e.g. deep set trachea, oedema or obesity. The flange is movable and can be adjusted to the required length. Movement of the flange should be done under medical direction only (Sims Portex, 2003).

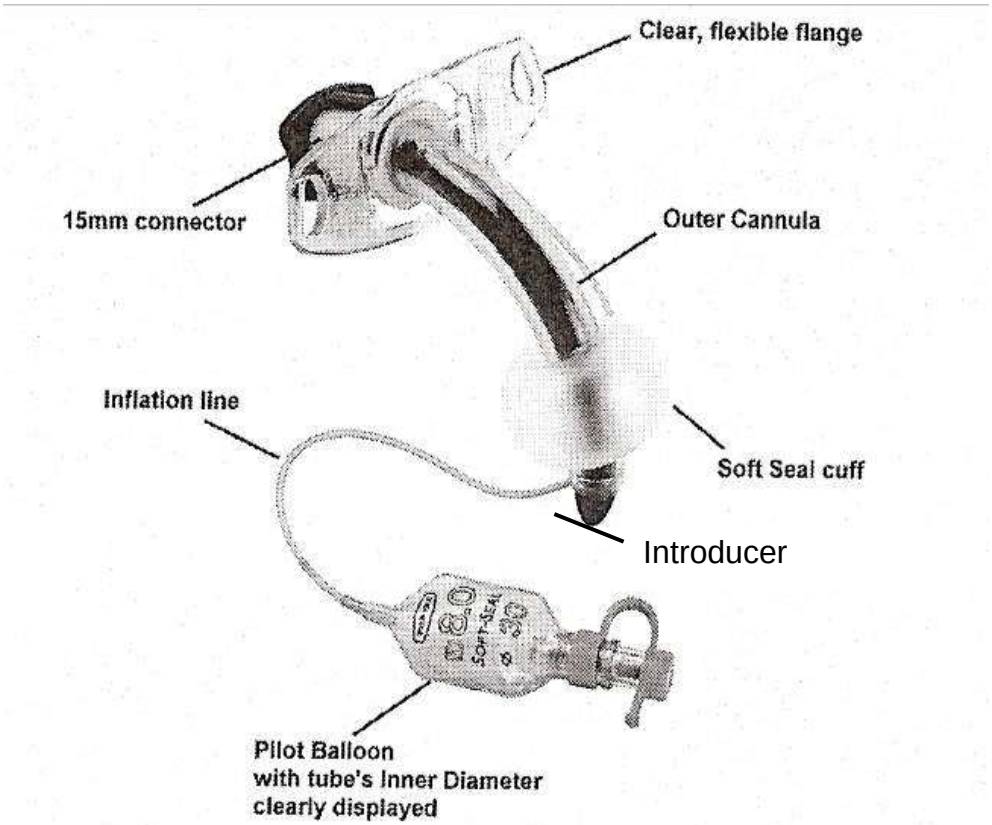
Portex Adjustable Flange Tracheostomy Tube

NB: Portex adjustable flange tracheotomy tubes have no inner cannula and careful observation is essential to reduce the risk of tube occlusion and tube movement.

Safety checks should be made at patient handover and should always include the following:

- The flange position is measured and clearly documented (measurement = from the top of the hub to flange)
- The screw that tightens the flange at the set position is firm
- The tube is patent

Tracheostomy Tube components



Size 8.00 Tracheostomy tube with introducer in place (NB: the introducer is used to facilitate insertion and is then removed)

Outer Tube (Cannula)

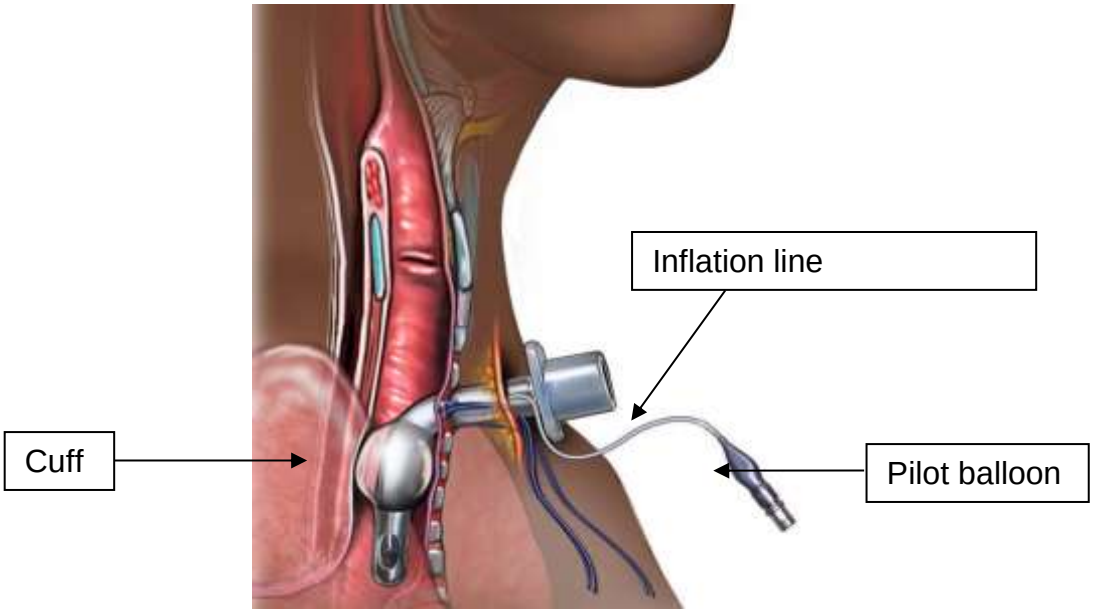
Sizes range from 6mm to 10mm (Internal diameter). These measurements are found on the flange or on the pilot balloon of a cuffed tube.

The flange provides support for the tube, preventing downward movement and pressure on the stoma and also allows the tube to be anchored securely to the neck with either tapes, Velcro ties or sutures. If the tube flange is sutured, it is important to establish from the medical/surgical staff why these sutures are needed – for example: it may be due to a neck flap where ties would cause a disruption of blood flow or because the patient may have a very difficult airway with concern relating to tube dislodgment.

Above the flange is a size 15mm connection that allows for the tracheostomy to be connected to an ambu bag or a ventilator.

Cuff

The cuff is the balloon at the distal end of the tube which is inflated to create a seal between the tube and tracheal wall. It is used to facilitate positive pressure ventilation and to protect the airway from gross aspiration (poor cough, gag or swallow reflex) (Roman, 2005).



The purpose of the inflation line and pilot balloon is to allow air to be inserted or removed to inflate or deflate the cuff. The balloon has a one-way valve to prevent air leakage and inadvertent cuff deflation. If the cuff is insufficiently inflated air will escape around the cuff and make a “bubbling” noise at the back of the throat.

If the tube is insufficiently inflated and a bubbling noise is heard, small increments of air should be added to the cuff until the leak around the cuff (the bubbling sound) is eliminated. After each inflation of the cuff, the pressure should be checked using a cuff manometer. Inform the ACNM or medical staff if you cannot eliminate the leak and / or if the pressure on the manometer exceeds 30cmH_2O. If the cuff is unable to hold its pressure an entire change of tube should be considered (Russell, 2005).

The cuff pressure should be measured with a manometer every shift and clearly documented. The desired range is 20-30cmH_2O. For full details on how to do this, please refer to the ICU procedure: **Artificial Airway – Tracheal Cuff Pressure Management** . There is also a video of this procedure on the Education Hub.

Measuring and maintaining the correct cuff pressure is a very important aspect of patient care. It is normal for secretions to pool and sit on the top of the tracheal cuff. A cuff that is underinflated will allow the aspiration of these pooled secretions. A cuff that is overinflated may cause significant mucosal injury at the point of contact on the tracheal wall, with reduced perfusion, necrosis, erosion and stenosis occurring (Serra, 2000)

Inner Tube (Cannula)

Some tracheostomies are supplied with an inner tube. Inner tubes are slightly smaller than the main tracheostomy tube and they fit snugly in place. Inner tubes are an important safety feature, because if the lumen of an inner tube becomes blocked with secretions it can be quickly removed to ensure a patent airway, whereas, if there is no inner tube, and the main tube becomes occluded, this becomes an emergency situation with potentially life-threatening consequences.

In ICU, inner tubes are not used, for two reasons: 1. the tube lumen is wider without an inner tube and this offers less resistance to ventilation 2. Patients in ICU have one-to-one nursing so any potential tube occlusion can always be rapidly detected and managed.

However, prior to transfer from ICU to HDU it is mandatory that an inner tube be inserted.

Introducer

An introducer fits into the outer tube and is used to smoothly pass the tracheostomy tube into the airway on initial insertion. Once the tube is placed the introducer is removed using a twist and pull motion. An introducer comes with all tracheostomy tubes and should stay with the patient once the tube is placed. It must be cleaned,

put into a sealed container and labelled (with patient's ID label) so that in the event of tube displacement it can be used to reinsert the tracheostomy tube (Roman, 2005).

Portex tube with introducer

Humidification

A tracheostomy bypasses the upper airway and therefore prevents normal humidification and filtration of inhaled air. In the initial post-operative period patients will experience increased mucus production, therefore the aim of humidification is to optimise motility of secretions, preserve muco-cilliary function and in turn prevent tube obstruction.

An ongoing aspect of patient care is maintaining adequate hydration with oral, IV or NG fluid. This assists with keeping the mucosal lining moist and the secretions less adherent to the tracheal wall, making the secretions easier to remove (Roman, 2005).

Inadequate humidification adversely affects the lower airways. The epithelium of the trachea and bronchi become dry and crusted which results in:

Impaired ciliary activity
Damage to mucus glands and surfactant loss
Inflammatory mucosal ulceration
Copious, thick, tenacious secretions
Retained secretions, mucus plugging
Atelectasis and pneumonia
Reduced pulmonary compliance with increased work of breathing
(Russell, 2005)

Heated humidification:

Heated humidification for tracheostomy patients should be delivered via a Fisher & Paykel humidifier. The machine is set to deliver optimal humidity (maximum level of water vapour in the delivered gas) at $37^{O}C$ (Ryan & Peterson, 2003).

Indications for use:

- Mechanical Ventilation
- Immediately post tracheostomy surgery

- Oxygen delivery via tracheostomy mask
- Management of thick secretions
- Respiratory infection with increased secretions

Heat Moisture Exchanger (HME)

A HME (also known as a 'Swedish Nose') provides a barrier or filter to airway irritants such as dust and insects and has a small connector through which oxygen can be entrained.

The device contains a sponge that warms and moistens inhaled air. On exhalation the moisture in the air is trapped in the sponge surface, then on inspiration air passes over the surface and captures the moistened and warmed air and carries it into the airway (Oberwaldner & Eber, 2006).

HME's - Thermovent T (left) & Swedish Nose (right)

The device can be used independently or interchanged with heated humidification. It is routinely replaced daily. However, if it is excessively moist or blocked with secretions it requires changing immediately to avoid increase work of breathing or blockage (Choate & Barbetti, 2003; Edgetton-Winn & Wright, 2005).

Tracheostomy necktape

NB: If the ties become loose it is a priority to resecure immediately

Tracheostomy Tube change

Please refer to the ICU Procedure document: 'Artificial Airway – Tracheostomy tube change'.

Weaning & Decannulation

Weaning

NB: in this section weaning refers to a process of working towards decannulation, *not* weaning from the ventilator. This mainly applies to patients who have been transferred to HDU, but may occasionally apply to an ICU patient who remains on ICU but is no longer ventilator-dependent.

Most patients will only require a tracheostomy tube for a temporary period. Once the initial reason for tube insertion is resolved and the patient is stable, the weaning process can begin. The weaning period can range from short to long depending on the patient's clinical condition (e.g. neurological deficits, severe weakness, etc.).

Tube weaning is a planned, gradual, sequential approach involving the whole team with the objective being to decannulate (remove the tube). Our role is to assist the patient in adapting both physiologically and physically towards breathing without the tube (Serra, 2000).

Criteria for weaning:

Primary reason for tracheostomy resolved

Self-ventilating

Effective cough (ability to cough secretions into or beyond the tracheostomy tube) and gag reflex

Decreasing secretions and suction requirements

Decreasing oxygen requirement (<40%)

(Russell, 2005; Woodrow, 2002; Stelfox, Crimi et al, 2008)

All stages of the weaning and decannulation process require close consultation with the appropriate medical team.

Cuff Deflation

Weaning commences with deflating the cuff. Ensure the correct protocol for cuff deflation is followed to avoid aspiration. Close patient monitoring is performed throughout and after the procedure. Full cuff deflation will indicate the patency of the upper airway and the patient's ability to protect from aspiration of oral secretions (Choate & Barbetti, 2003).

Cuff deflation should be considered as soon as clinically indicated (no longer ventilator dependent and patient able to protect their airway). It should then remain deflated unless the patient is compromised and reinflation is indicated.

Procedure for cuff deflation in Critical Care:

Medical staff will decide whether a patient can undergo cuff deflation. The criteria usually include the patient requiring an oxygen percentage lower than 30%, plus the presence of intact gag/swallow reflexes and a strong cough.

Once this decision has been made, the following procedure is followed:

Equipment required

Ambu-bag & Cobbs connector
Tracheal suction equipment & Personal Protective Equipment
10 ml syringe

Preparation

1. All enteral feeding is stopped at least 2 hours before the procedure
2. The naso/oro gastric tube is aspirated just before the procedure
3. The procedure is explained to the patient and family (if applicable)
4. Hand hygiene practices are followed as per the '5 moments'
5. The procedure requires at least 2 nurses
6. Place the patient on their left side, head down if tolerated
7. Perform tracheal suction as per protocol
8. Perform oropharyngeal suction

Cuff deflation

9. Preoxygenate the patient for 2 minutes on 100% oxygen (via F & P or Ambu-bag)
10. Tell the patient that you will be giving 3 breaths with the Ambu-bag and that on the third breath you will deflate the cuff
11. The first nurse administers the 3 breaths

12. The second nurse deflates the cuff to coincide with the third breath

After cuff deflation

13. It is likely that at some stage after the cuff deflation the patient will cough (caused by secretions above the cuff descending to the lungs). Be prepared to do further tracheal suctioning
14. Return the patient to a comfortable position
15. Observe the patient closely for any deterioration in their respiratory status, especially for signs of aspiration

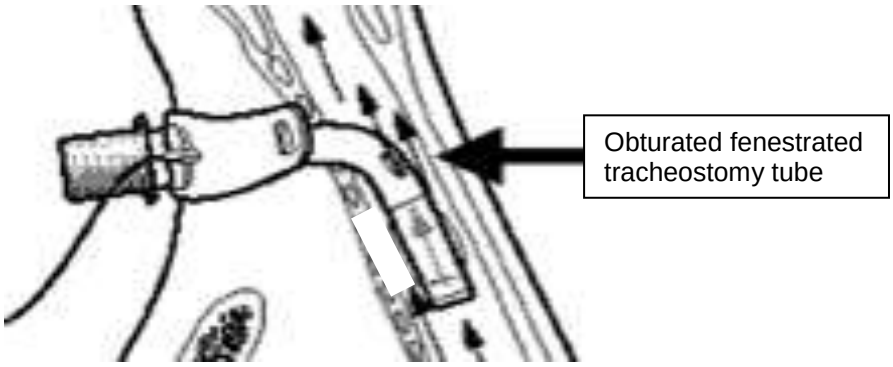
NB: A modified version of the above procedure can be used for **short term tracheostomy patients** who are very awake and alert (e.g. patients following head and neck surgery, rather than patients who have had a tracheostomy performed to facilitate prolonged weaning from the ventilator during critical illness). The same procedure is followed except that the cuff is deflated while the patient is sitting up and the patient is asked to cough upon deflation of the cuff.

Obturation

Following successful cuff deflation, the tracheostomy tube can be obturated with an occlusive cap for 24 hours, (Tamburri, 2000). The cap prevents any air movement through the lumen of the tracheostomy tube. Obturation is not always required prior to decannulation. The medical team may decide that decannulation can be performed without a trial of obturation, depending on the individual patient's clinical situation.

If obturation is performed, the cuff **must be deflated** prior to obturation, or the patient will have an occluded airway and will asphyxiate.

Once obturated, monitor the patient for signs of respiratory distress. If they have breathing difficulty the cap should be removed to reopen the tube lumen. Inner cannulas must remain insitu and be cleaned as usual to maintain the patency of the tube in the event that it needs to be used.



Obturated fenestrated trache with cuff deflated. There is no flow through the tube. All airflow is diverted around the side of the tube

After a successful 24-hour trial of obturation, including overnight SpO_2 monitoring (to ensure no desaturations occur) decannulation should be considered (Woodrow, 2002; Russell, 2005).

To minimise the work of breathing for the patient, downsizing to a smaller sized, cuffless, fenestrated tube (which occupies less anatomical space and causes less resistance to air flow in the trachea) should be considered. (Serra, 2000).

Decannulation

Decannulation criteria:

Primary reason for tracheostomy resolved

Cuff successfully deflated

Effective cough (able to expectorate secretions) and swallow reflex

Decreasing oxygen requirements

Successful obturation with adequate ventilation for 24 hours

Patient in stable condition

(Russell, 2005; Woodrow, 2002; Stelfox, Crimi et al, 2008)

A detailed description of this procedure is given in the ICU Procedure document: 'Artificial Airway – Tracheostomy removal'. This document can be followed to guide practice. However, the following is an overview of the **general principles** of the procedure:

The procedure requires 2 registered nurses to perform. Prior preparation of emergency equipment, suction, dressings and patient education is essential.

Enteral feeding or must be stopped 4 hours prior to decannulation to avoid inadvertent aspiration. Encourage the patient to cough and clear the airway before removal.

Once the tube is removed, the area is cleaned and dried. The stoma edges are brought together without tension and large Steri-Strips are applied. These **are not to be cut** but are to remain at full length to reduce the risk of inhalation into the stoma and lungs. The stoma site is then covered with a 100% occlusive dry dressing.

If the dressing lifts or becomes moist it must be changed. Encourage the patient to apply gentle pressure over the dressing when talking or coughing to keep the dressing intact, minimise air leaks and promote wound closure (Choate & Barbetti, 2003).

Following decannulation the patient requires close observation and monitoring for at least 24 hours.