TRACHEOSTOMY TRAINING RESOURCES

A guide to tracheostomy management in Critical Care and beyond.

July 2009
North West Regional Tracheostomy Course
Introduction

This guide is a resource for tracheostomy training and management in the critical care setting and also beyond, on the wards and outpatient settings.

Included are descriptions of

- *What is a tracheostomy*
- *How and why a tracheostomy can be formed*
- *Different types of tracheostomy and tubes*
- *Emergency management of the patient with a tracheostomy*
- *Management of the day-to-day needs of the patient with a tracheostomy*
- *Suggested infrastructure and resources for immediate and ongoing care of the tracheostomy patient.*

You are welcome to use and adapt these resources as you wish. They are not intended to replace existing care pathways in your own institution, but you may wish to include some of the material in your own unit or ward’s policies.

There are also separate resources available covering

- *Competencies for tracheostomy care and management*

The authors do not accept any responsibility for any loss of or damage arising from actions or decisions based on the information contained within this publication.

Ultimate responsibility for the treatment of patients and interpretation of the published material lies with the medical practitioner. The opinions expressed are those of the authors and the inclusion in this publication of material relating to a particular product or method does not amount to an endorsement of its value, quality, or the claims made by its manufacturer.
Tracheostomies in critical care and beyond

Tracheostomies are common procedures in critical care practice. They are also becoming more commonplace on the general wards of the hospital. This is partly due to pressures on intensive care beds and the increasing drive to de-escalate care quickly along with increasing numbers of patients benefiting from temporary tracheostomy. These groups include those with chronic respiratory or neurological problems. Increasing numbers of patients with tracheostomies are being cared for on wards outside the critical care infrastructure.

This has implications for the safety of patients who may be cared for on wards without the necessary competencies and experience to manage this challenging cohort and local measures need to be in place to ensure that safe routine and emergency care can be provided. This guide has evolved to provide information to those caring for patients with temporary or permanent tracheostomies either regularly or occasionally. It aims to provide basic background information and the rationale for tracheostomy care. We have also developed simple emergency guidelines for dealing with tracheostomy emergencies both in critical care and beyond.
What is a tracheostomy?

A tracheostomy is an artificial opening made into the trachea through the neck. This may be temporary or permanent. A tracheostomy tube is usually inserted, providing a patent opening. The tube enables air flow to enter the trachea and lungs directly, bypassing the nose, pharynx and larynx.

![Diagram of larynx and trachea illustrating tracheostomy tube insertion sites.](image)

Indications for a tracheostomy

- To secure and clear the airway in upper respiratory tract obstruction (actual or potential).
- To facilitate the removal of bronchial secretions.
- Laryngeal incompetence and aspiration on swallowing.
- Poor cough effort with sputum retention.
- To protect the airway of patients who are at high risk of aspiration, that is patients with poor laryngeal and tongue movement on swallowing e.g. neuromuscular disorders, unconsciousness, head injuries, stroke etc.
- To enable long-term mechanical ventilation of patients in an acute ICU setting.
- To facilitate weaning from artificial ventilation in acute respiratory failure and prolonged ventilation.
- To secure and maintain a safe airway in patients with injuries to the face, head or neck and following certain types of surgery to the head and neck.
Physiological changes with a tracheostomy

- The upper airway anatomical dead space can be reduced by up to 50%, which improves ventilation to the lungs.

- The natural warming, humidification and filtering of air that usually takes place in the upper airway is lost.

- The patient's ability to speak is removed.

- The ability to swallow is adversely affected.

- Sense of taste and smell can be lost.

The tracheostomy will generally remain until the indication for insertion has resolved. In some instances however, the tracheostomy will be permanent and these patients will be discharged from critical care to a general medical or surgical ward.

Types of tracheostomy

Tracheostomy may be temporary or long term/permanent, and may be formed electively or as an emergency procedure. They may also be classified by their method of initial insertion – either surgical or percutaneous.

**Temporary** – will be formed when patients require long/short term respiratory support or cannot maintain the patency of their own airway. Certain maxillofacial or ENT surgical procedures require a temporary tracheostomy to facilitate the procedure. These tubes will be removed when the patient recovers.

**Long term/permanent** – are usually formed due to carcinoma of the nasooropharynx or larynx. Dependent on the stage of the disease either a tracheostomy or a laryngectomy will be performed. These patients are generally cared for in a specialist ward such as maxillofacial or ENT units.

Some patients need chronic respiratory support or long term airway protection and this requires a long term/permanent tracheostomy. For example, progressive neurological conditions, insufficient respiratory capacity to breathe without support.
Techniques for inserting a tracheostomy
There are two main techniques used to perform a tracheostomy: surgical or percutaneous

Surgical tracheostomy
This technique is usually carried out in an operating theatre where conditions are sterile and lighting is good. General anaesthesia is generally used however this technique can also be carried out with a local anaesthetic. A surgical opening is made into the trachea into which a tube is placed; this may then be sutured to the skin or secured with cloth ties or a holder.

Surgical tracheostomies may be formed as part of ENT or Maxillofacial surgical procedures, usually during face and neck dissections for tumour removal. Importantly, these procedures may involve removal of the larynx which means that there is no connection from the mouth or nose to the trachea. Using the tracheostomy is the only way of ventilating these patients.
Types of surgical tracheostomy

The tissues around the trachea are dissected and then the trachea is entered by making an incision in its anterior wall. This may be one of the following:

T-shaped tracheal opening through the membrane between the second and third or third and fourth tracheal rings. With this incision, a silk stay suture can be placed through the tracheal wall on each side and taped to the neck skin on either side. This facilitates tube replacement by pulling the trachea anteriorly and widening the opening should the tube dislodge in the immediate postoperative period. These sutures are removed after the first tracheostomy tube change 5-7 days postoperatively once the newly formed tract from the skin to the trachea becomes more established.

U- or H-shaped tracheal opening can be made and the tracheal flaps can be tacked to skin edges with absorbable sutures to create a semi-permanent stoma. Sutures can be placed in each tracheal flap and taped to the chest and neck skin, facilitating replacement of a displaced tube in postoperative care. Pulling on these sutures widens the tracheal opening. Most modern surgical tracheostomies will be of this type with the sutures remaining for approximately 1 week until the tract is formed.

Removal of small anterior portions of the tracheal rings can create a more permanent stoma. A different type of surgical tracheostomy is the Björk flap where a ‘ramp’ of trachea is sutured to the skin which allows easier replacement of tracheostomy tubes. There may be a suture to the skin here too, but this is to hold the ‘ramp’ in place, rather than to be used to elevate the trachea for a tracheostomy tube change. See the figures below.

Above: Different types of tracheal incision. The right-hand figure shows a tracheal flap.

Far left figure: Björk Flap with a ‘flap suture’ to the skin (blue)

Right figure: Slit-type tracheostomy with 2 stay sutures (blue) to the skin. These can be used to manipulate the trachea
Percutaneous tracheostomy
This is the most commonly used technique in critical care as it is simple and quick, can be performed at the bedside using anaesthetic sedation and local anaesthetic, and therefore is often the technique of choice in the critically ill. The procedure involves the insertion of a needle through the neck into the trachea followed by a guide-wire through the needle. The needle is removed and the tract made gradually larger by inserting a series of progressively larger dilators over the wire until the stoma is large enough to fit a suitable tube (Seldinger technique). This is then secured by cloth ties or a holder.

Types of tracheostomy tubes
The different types of tubes available can seem confusing. Essentially tubes can be described by the presence or absence of a cuff at the end, by the presence or absence of an inner cannula, or by the presence or absence of a hole or ‘fenestration.’ Tubes can finally be made of different materials and be different diameters and lengths

Cuffed Tubes
Cuffed tubes have a soft balloon around the distal end of the tube which inflates to seal the airway. Cuffed tubes are necessary when positive pressure ventilation is required or in situations where airway protection is essential to minimize aspiration of oral or gastric secretions (although all cuffs are not an absolute barrier to secretions).

If the tracheostomy tube lumen is occluded when the cuff is inflated, the patient will not be able to breathe. In this situation, it is important to deflate the cuff and call for medical assistance immediately.

Uncuffed Tubes
Uncuffed tubes do not have a cuff that can be inflated inside the trachea and tend to be used in longer-term patients who require ongoing suction to clear secretions. These tubes will not allow sustained effective positive pressure ventilation as the gas will escape above the tracheostomy tube. It is essential that patients have an effective cough and gag reflex to protect them from aspiration. Uncuffed tubes are rarely used in acute care.
Fenestrated Tubes
Fenestrated tubes have an opening(s) on the outer cannula, which allows air to pass through the patient’s oral/nasal pharynx as well as the tracheal opening. The air movement allows the patient to speak and produces a more effective cough.

However, the fenestrations increase the risk of oral or gastric contents entering the lungs. It is therefore essential that patients who are at high risk of aspiration or on positive pressure ventilation do not have a fenestrated tube, unless a non-fenestrated inner cannula is used to block off the fenestrations (see figures below).

Suctioning with a fenestrated tube should only be performed with the non-fenestrated inner cannula in situ, to ensure correct guidance of the suction catheter into the trachea.

Un-cuffed, fenestrated tube.
These tubes allow much more air flow to the pharynx. The fenestration (hole) can be occluded with appropriate inner tube. These tubes are common in patients discharged from critical care.
Any patient transferred from Critical Care to a ward should have the cuffed un-fenestrated tube changed for a double lumen un-cuffed tube, which may be fenestrated depending on local policy and on patient factors. This allows easy cleaning of the inner tube on the ward and helps prevent blockage of the tracheostomy with secretions. (ICS & NPSA Guidance 2008/9).

The inner tube should be removed and cleaned in sterile water every 6 hours, and kept in a clean container at the patient bedside when not in use.

**Single Cannula Tubes**

Single cannula tubes are traditionally the first tube to be sited in a critical care area. The system is less complicated than a double cannula tube and is usually for temporary use only. These tubes can be cuffed or uncuffed. The larger inner diameter of the single cannula tube allows pressure support ventilation when the cuff is inflated to form a seal within the trachea. The Intensive Care Society in their 2008 guidance have recommended that these tubes are not used routinely in critical care owing mainly to concerns about them becoming occluded with secretions, and the difficulty in cleaning this type of tube.

**Double Cannula Tubes**

Double cannula tubes have an outer cannula to keep the airway open and an inner cannula which acts as a removable liner to facilitate cleaning of impacted secretions. Some inner cannula are disposable, others must be cleaned and re-inserted. Patients discharged from a critical care area with a tracheostomy should have a double un-cuffed cannula in place. This type of tube is the safest to use outside the critical care environment, although to reduce the incidence of tube occlusion, the inner cannula must be regularly cleaned.
The figure below shows two types of inner tube included with the un-cuffed tube, along with the blocking tube which can be used for insertion of the tracheostomy only. **This blocking tube must be removed once the tracheostomy is sited.**

The upper inner tube has no hole (or fenestration) and so air flow is allowed straight through the tube from one open end to the other. When this is in situ, minimal amounts of air pass through the patient’s upper airway. **This inner tube should be in place when the patient is suctioned** as there is a small risk of a suction catheter passing through the fenestration and damaging the tracheal mucosa.

The lower type of inner tube has a fenestration in it, which lines up with the fenestration in the outer tube. Air can then flow through the tube as before, but in addition, some air can flow through the holes and out through the patient’s mouth. This air flow to the upper airway allows the patient to talk.

If positive pressure needs to be given to the patient to aid ventilation, for example in the event of a cardiac arrest or worsening respiratory function, then the tracheostomy inner tube without the fenestrations should be fitted, this then allows positive pressure airflow to enter the lungs rather than escaping through the mouth.

**Adjustable Flange Tracheostomy Tubes**
These tubes are used in patients who have an abnormally large distance from their skin to their trachea, and a standard tube would not fit properly. Approximately 1/3 of critical care patients may require these types of tubes. Particular indications are:

- Patients with very large neck girth including the obese
- Oedema caused burns classically or a capillary leak syndrome (sepsis etc)
- Actual or anticipated oedema after surgical procedures (including tracheostomy itself)
It is essential to review the position of the flange (hence the length of the tube) on a daily basis. If the patient has neck swelling, the as this worsens or resolves, the flange may need adjusting. Adjustable flange tracheostomy tubes are more difficult to use and are associated with additional complications, some of which may be life threatening. Only use an adjustable flange tracheostomy tube when it is essential to do so. Patients within a ward area will not usually have an adjustable flange tube fitted on discharge. It is currently not possible to use inner cannulae with these tubes.

Mini Tracheostomy

A mini tracheostomy involves the insertion of a small 4 mm non-cuffed tracheostomy tube through the cricothyroid membrane. This can be done under local anaesthesia. It is primarily inserted to facilitate the removal of secretions. It does not protect the airway from aspiration and will only provide a route for oxygenation in the emergency situation.
Choice of tracheostomy tube

The Intensive Care Society produced guidance on tracheostomy care in 2008 which included information on the choice of tracheostomy tube. This is summarised below.

An important consideration is whether to use a tracheostomy with an inner tube from the time of initial percutaneous tracheostomy which may be done for weaning on the ITU. It is increasingly recognised that tube obstruction can occur in critical care areas as well as on the wards and the ICS recommend that these easily cleanable tubes should be used where possible as standard to reduce the risks of obstruction. The disadvantage is that these tubes have a reduced internal diameter which has implications for gas flow. This has to balanced against the increased risks of tracheostomy tube obstruction with single lumen tubes, and the 3-5 (ideally 7-10) days that a tracheostomy tube should not be changed for after a percutaneous procedure if the patient is to be moved to a non critical care area.

Factors influencing temporary tracheostomy tube choice (ICS 2008)

Respiratory function
Most temporary tracheostomies will be inserted whilst a patient is in an intensive care unit and still requiring some degree of positive pressure ventilation. As a standard, this will require the use of a cuffed tracheostomy tube (although it is recognised that long term mechanical ventilation can be delivered through an uncuffed tube).

Abnormal airway anatomy
Upper airway endoscopy following percutaneous insertion suggests that a standard tracheostomy tube may be anatomically unsuitable in as many as a third of adult patients. Obese patients may require a tube with an extended proximal length, whilst patients with fixed flexion abnormalities may not easily accommodate tubes with a fixed angulation. Airway pathology Localised airway pathology such as tracheomalacia, granuloma formation etc may on occasion necessitate the use of a tracheostomy tube that has a longer distal length than standard.

Compromised airway, protection and weaning problems
Many patients can be weaned to decannulation without any need to change to change from the cuffed tracheostomy tube that was initially inserted. In problematic cases however, it may be useful to consider options such as downsizing, to an uncuffed or fenestrated tube, or a tube with the option for sub-glottic aspiration of airway secretions. The introduction of a speaking valve may also aid swallowing and secretion control.

Obstructed / absent upper airway
Patients with an obstructed or absent upper airway are at particular risk should a tracheostomy become obstructed or misplaced. This has implications for both the choice of tracheostomy tube as well as the method by which the stoma is fashioned.

Clinical environment
Obstruction of a cuffed tracheostomy tube is a potentially life threatening emergency. Wherever possible a dual cannula tube (i.e. a tube with an inner cannula) should be used, particularly for patients in HDU or ward environments who may not have immediate access to clinicians with emergency airway skills. Ward staff can change inner tubes easily and quickly to relieve obstruction with secretions.
Complications of a tracheostomy

Once a tracheostomy tube is sited for airway management the patient should be observed for the following potential complications. These can be serious and sometimes fatal. These complications are usually grouped as follows:

1. **Immediate Complications (peri-operative period)**
   - Haemorrhage (usually minor, can be severe if thyroid or blood vessels damaged).
   - Misplacement of tube - within tissues around trachea or to main bronchus.
   - Pneumothorax.
   - Tube occlusion.
   - Surgical emphysema.

2. **Delayed Complications (post-operative period < 7 days)**
   - Tube blockage with secretions or blood. May be sudden or gradual.
   - Partial or complete tube displacement.
   - Infection of the stoma site.
   - Infection of the bronchial tree (pneumonia).
   - Ulceration, and/or necrosis of trachea.
   - Mucosal ulceration by tube migration (due to loose tapes or patient intervention).
   - Risk of occlusion of the tracheostomy tube in obese or fatigued patients who have difficulty extending their neck.
   - Tracheo-oesophageal fistula formation.

3. **Late Complications (late post-operative period >7 days)**
   - Granulomata of the trachea may cause respiratory difficulty when the tracheostomy tube is removed.
   - Tracheal dilation, stenosis, persistent sinus or collapse (tracheomalacia)
   - Scar formation-requiring revision.
   - Blocked tubes may occur at any time, especially if secretions become thick, the secretions are not managed appropriately (suction) and humidification is not used.
Potential problems post placement

Blocked Tracheostomy
One role of the upper airway is to moisten and warm inhaled air before it reaches the lungs. Cilia are small hair like protrusions that line the respiratory tract; the function of the cilia is to prevent infection within the respiratory tract by moving mucus and other particles away from the lungs.

Inserting a tracheostomy tube bypasses these natural mechanisms, which mean the lungs will receive cool, dry air. Dry air entering the lungs may reduce the motility of the secretions within the lungs and may reduce the function of the cilia. In addition the patient may not be able to cough and/or clear the secretions from their airways through the tracheostomy. This may cause the tracheostomy to become blocked by these thick or dry secretions.

Blocked tracheostomy tubes can be minimised by careful humidification, tracheal suction and inner tube care. However it is necessary to keep emergency equipment at hand at all times as a blocked tube may lead to respiratory arrest.

Pneumonia
A build up of secretions may also lead to consolidation and lung collapse, and this may lead to pneumonia. This can also be minimised by careful humidification, tracheal suction and inner tube care.

Aspiration of gastric contents may also lead to pneumonia. This can occur with patients who are unable to swallow safely. Any patient who you suspect may have aspirated will need to have a SALT (Speech And Language Team) assessment, be kept NBM and referred to a dietician to facilitate NG feeding.

Displaced Tracheostomy Tube
The tracheostomy tube can be displaced partially or completely and come out of the stoma or out of the trachea into the soft tissue of the neck. If not properly secured, the tube may become displaced by coughing, because of its weight or the weight of attached breathing circuits, or by patient interference. Partial tube displacement is more dangerous as it is not always visibly obvious that the tracheostomy is not patent.

In order to keep tracheostomy tubes in position they must be secured carefully and any concerns raised by the patient or nursing staff must be promptly investigated.

‘Red Flags’ such be acted upon as they may herald actual or imminent tracheostomy tube displacement. Prompt assessment by a senior clinician is required and a fibre-optic inspect of the position of the tracheostomy tube tip to confirm correct placement within the trachea is usually indicated. Red flags include:

- Increasing ventilator support or increasing oxygen requirements
- Respiratory distress
- The patient suddenly being able to talk (implying gas escaping proximally and the cuff no longer ‘sealing’ the trachea)
- Frequent requirement for (excessive) inflation of the cuff to prevent air leak
- Pain at the tracheostomy site
- Surgical (subcutaneous) emphysema (gas in the soft tissues)
- The patient complaining that they cannot breathe or have difficulties in breathing
- A suction catheter not passing easily into the trachea
- A changing, inadequate or absent capnograph trace
- Suspicion of aspiration (feed aspirated on tracheal toilet – suggests that the cuff is not functioning adequately)

Local Infection
There is a risk of site infection caused by introduction of organisms from the sputum. Careful observation and dressing of the site will reduce this. A stoma should be treated as a surgical wound and cared for appropriately.

As the stoma is an open wound opening directly into the respiratory tract there is potential for the lower respiratory tract to become infected. Poor suction technique may also increase the incidence of infection.

Tracheal Damage/ Ischaemia
Damage to the trachea may be caused by cuff pressure on the mucosa or by poor tracheal suctioning techniques. All tracheostomy tubes now have low pressure cuffs, however over-inflation should still be avoided. The pressure in the cuff should be just adequate to prevent air leakage.

Altered Body Image
This is an important factor as it can have a major psychological impact. If possible the patient should have careful pre-operative explanation. If this is not possible the patient must receive explanation and support post-operatively.

Inform the patient that scarring will be minimal when the tracheostomy is removed and the stoma has healed and, that speech will return (as long as the vocal cords remain intact). On average the stoma will close and heal within 4-6 weeks. However this may vary from patient to patient depending on factors affecting wound healing.

Communication
Patients with a cuffed tracheostomy will be unable to speak; loss of speech whilst the tracheostomy is in place could possibly cause great distress to the patient, even if he/she has warning beforehand. It can cause fear, because of inability to attract attention if needed or depression because of inability to communicate (even with the cuff down).

Generally patients who have an un-cuffed tube or the cuff deflated will be able to speak with a speaking valve in place.

Communication aids such as pen / paper or picture cards are vital to prevent the patient feeling frightened and isolated. In addition ensure the patient has a nurse call bell at all times.
**Speaking valves**

These are one-way valves that fit over the end of the tracheostomy. They allow the patient to breathe in through the tracheostomy, but not out. The air flow has to go up through the larynx and out of the mouth. This can allow the patient to talk, but can be tiring for the patient due to increased resistance to airflow.

Because air cannot flow out through the tracheostomy, these valves can be extremely dangerous.

**Speaking valves must only be used with a fenestrated tube and only when the fenestrated inner cannula is in place. Any cuff must be deflated.**

A Passy Muir valve is a common type of speaking valve, seen here fitted to the end of a tracheostomy tube.
Emergency management of the patient with a tracheostomy

Tracheostomies are common in ENT and Max Fax surgical procedures and are increasingly used in Critical Care. This means that tracheostomies are more frequently on ‘general’ wards. Managing patients with a tracheostomy can be challenging if unfamiliar and disasters can (and do) happen if emergencies occur.

Common emergencies include

- Obstructed tubes
- Completely dislodged
- Partially dislodged

Laryngectomy patients can also be very confusing for those unfamiliar with the anatomical steps involved in removing a patient’s larynx. It is important to understand the differences between those patients who do and don't have a larynx after a tracheostomy, and this is explained in the next section.

We have suggested an algorithm for the emergency management of patients with a tracheostomy who develop breathing difficulties. It is designed to be simple and is aimed at first responders to the patient who may be Medical, Nursing or Allied health staff.

We have made recommendations for airway ‘experts’ in the following section which should include critical care and anaesthetic doctors who are experienced enough to work at ST 3 level and above.

The guideline includes

- Steps and interventions to maintain oxygenation & ventilation
- Prepare patient for advanced interventions

The guidance is applicable to the patients with

- A tracheostomy (surgical or percutaneous)
- Recently decannulated (trachy removed)
- Laryngectomy
- Any breathing difficulties

There are some more advanced options included for the attending ‘Expert’ who will be called early in the management of a tracheostomy patient with breathing difficulties.
Symptoms of Respiratory Distress

The sort of patients that you will be called to see may show the following signs. Some of these are detectable clinically and others will be noticed by monitors such as pulse oximetry, Capnography and ECG. These may not all be in place in high dependency and ward environments.

- Apnoea
- Difficulty in breathing observed or reported
- Vocalisation (patient talking or whispering) when airflow should not be via the upper airway (cuff up)
- Increased respiratory rate
- Increased heart rate
- Low $O_2$ saturations
- Grunting, Snoring, Stridor
- Whistling noise when breathing or any noisy breathing
- Cyanosis (pale, blue colour around lips, nail beds, eyes)
- Restlessness, Confusion, Agitation, Anxiety
- Blood or blood stained secretions via the tracheostomy
- Retractions (pulling in of the skin between the ribs, and below the breast bone, above collar bones or in the hollow of the neck)
- Increased discomfort reported by the patient
- Cuff requires lots of air to remove air leaks

Any of the above clinical concerns should be considered as tracheostomy red flags and an assessment of the tracheostomy should be carried out by someone competent to do so. This is particularly important if the patient has any signs or symptoms suggesting that the tracheostomy may be displaced, usually air leaks or vocalizations. A prompt fibre-optic examination of the tube position is usually required and may allow the clinical situation to be rectified before the tracheostomy becomes completely displaced or blocked.
Why are there 2 algorithms?
This is because of the potential problems posed by patients with a laryngectomy. It should be clear from the bedside, handover and the patient notes that the patient has had a laryngectomy. Suggested signs are included in the appendix to be displayed at the patient bed head to make it clear what type of tracheostomy a patient has and whether they have a laryngectomy or not.

Surgical laryngectomy
A laryngectomy is the surgical removal of the ‘voice box.’ In this procedure the larynx is removed and the trachea is sutured to the skin creating a permanent stoma.

A total laryngectomy involves the removal of the hyoid, all of the thyroid and cricoid cartilages, and 1 or 2 tracheal rings. The overlying strap muscles are resected and the supraglottic, glottic, and subglottic areas are removed. The resultant cut end of the trachea is then sutured to the skin of the neck creating a permanent stoma.

The patient will then breathe through this stoma for the rest of their lives. There is no connection between the oral/nasal passages and the trachea following the procedure.

This is obviously vital information as the only way of delivering oxygen (or any other gas) to or from the patient’s lungs is via the stoma. Standard oral airway manoeuvres will not work as there is no connection between the mouth, nose or pharynx and the lungs.
Management of the tracheostomy patient with breathing difficulties - Patent upper airway

100% O2 applied to BOTH the face and the tracheostomy stoma
Call for airway expert help – Anaesthetics/ITU and ENT/Max Fax
Ensure airway equipment including fiberoptic scope is available

Assess breathing clinically
Attach Womers’ circuit to tracheostomy and ensure capnography is attached
Does the bag move spontaneously? Is there a CO2 trace?

Yes

The tracheostomy is patent
Consider partial obstruction
Suction the airway
Continue ABCDE assessment

No

Can you pass a suction catheter?

Yes

The tracheostomy cuff is inflated

NO

NO

NO

The tracheostomy tube is blocked or displaced

Worsening hypoxia

REPLACE THE TRACHEOSTOMY TUBE
Reassess ventilation via stoma and mouth. Ensure oxygen re-applied

No ventilation or low SpO2

Cover the stoma (swabs / hand)
Standard ORAL airway manoeuvres
Bag-Valve-Mask
Oval or nasal airway adjuncts
LMA

No

Improvement

Unable to manage oral airway

Attempt intubation of stoma
Suggest smaller new trachy tube, 6.0 cuffed endotracheal tube or similar
Ventilator • Waters’ circuit or similar
If advanced airway assistance, consider Bougie / Aintree catheter / Suction catheter / Fiberoptic scope
Attempt ventilation via stoma if cannot intubate using LMA or small mask applied to skin

Support ventilation as required
Await expert management for re-insertion of tracheostomy

Support ventilation
Await expert management

Emergency Oxygenation
Explaining the algorithm – patent upper airway

It is important to note that these patients may still have had a surgically performed tracheostomy, but they still have their larynx intact. They may have had their tracheostomy performed percutaneously – it doesn’t matter. The important thing is that there is still a larynx and so a potentially patent upper airway to use in an emergency.

The initial response is firstly to apply 100% O2 to BOTH the face and the tracheostomy stoma. This guidance is the same for those patients with and without a laryngectomy to standardize the approach. Laryngectomy patients will get no benefit from facial oxygen, but it will do no harm. First responders to an emergency situation may not understand this however and there is a greater risk of NOT applying facial oxygen to a patient in whom it may be critical. You will need 2 oxygen supplies – one for the facemask and one for the tracheostomy. This may need the use of an appropriate cylinder, perhaps on the emergency trolley in ward environments.

Also within the initial response is a call for help to Anaesthetics or Critical care AND to ENT or Max Fax surgical teams as appropriate. The ‘Crash’ or cardiac arrest teams may also be required, but they might not have the relevant skills regarding tracheostomy management. A fibreoptic ‘scope should also be requested urgently. Quite who is called will depend on the patient location and local arrangements, but it is important to summon expert help urgently.

The next step is to make some assessment of the patency of the tracheostomy. The majority of patients with tracheostomies will have a potentially patent and useable upper airway and there is often some airflow past a tracheostomy, even with the tracheostomy tube still in place or partially displaced. This may be detected as

- Vocalisation
- Misting on a face mask
- Feeling breath
- By using Capnography (CO2 detection, usually in Critical Care)

Airflow may be detected at the mouth or at the tracheostomy stoma. One of the easiest ways of detecting the movement of air is by attaching a Waters’ circuit to the tracheostomy tube and looking for evidence that the bag is moving. This does of course require a spontaneously breathing patient, and the bag may not move if there is no respiratory effort at this stage. We are going on the assess the patency of the tracheostomy here though and will assess breathing more formally later in the algorithm.

In order to give ourselves the best chance of detecting the movement of air via the tracheostomy if there is any present, we advocate inflating the cuff at this point, if there is one present on the tube. This step is to aid in the assessment of the patency of the tracheostomy tube. We will deflate the cuff shortly if the trachy tube is not patent, as an inflated cuff may cause further problems if the tube is partially displaced (see section and figure later).

In Critical Care areas, the use of Capnography can prove essential in deciding whether a tracheostomy tube is patent or not. A consistent Capnography trace can
only come from the lungs, implying at least partially correct placement of the tracheostomy tube, and subsequent patency. Evidence would suggest that this is the most useful monitor when it comes to deciding if a tube has become displaced. A partially displaced tube is more than twice as likely to cause patient harm than a visibly obviously displaced tube, as the diagnosis may not be as apparent.

If the patient is connected to a closed suction system or similar breathing circuit, then it is usually a good idea to remove it from the tracheostomy at this point before connecting your rescue breathing system (eg Waters’ circuit, see figure below). This removes any doubts about the patency of this system which may itself have become blocked.

It is not a good idea to attempt vigorous ventilation at this point via the tracheostomy. There have been reports of partially displaced tubes being ventilated and this has caused significant and even fatal subcutaneous emphysema.

If there is no spontaneous breathing detected via the tracheostomy, we must assess whether it is patent. This is best answered initially by whether you can pass a suction catheter? A suction catheter should pass easily if the tube is in the trachea. If it does pass, then you may need to perform suction of blood or sputum which may relieve the problem.

It is important to know how long your suction catheters are and how much ‘dead space’ you need to negotiate before entering the tracheostomy tube. This will depend on the type of breathing circuit attached to the tracheostomy. The figure below demonstrates that with a closed suction system attached and with the tracheostomy in various misplaced positions, it is still possible to insert a suction catheter to about 17cms. Only easy passage of a catheter beyond 17cms should be used to confirm patency of the tube. As stated above, the simplest way of making you assessment is to remove all connections to the tracheostomy tube at this point.
The next step is to deflate the cuff again if present. This is because we have now established that the suction catheter will not pass through the tube meaning it is either blocked or displaced. As can be seen from the figure below, an inflated cuff in the trachea may impede attempts to oxygenate from above. The cuff was inflated to give us the best chance of assessing the patency of the tracheostomy, but we have completed that step now.

A partially displaced tube at this point is the most dangerous situation. It may not be visibly obvious and leaving the tube in situ, particularly with a cuff inflated may be making the situation worse.

Another important point here is to check if a double cannula tracheostomy is being used. If so, remove, clean and replace the inner tube which may be causing the obstruction.

It is important to replace the tube because some designs of tracheostomy tube require the inner tube to be in place to allow connection to a breathing circuit. The ‘tracheo-twist’ tubes are an example of such tubes (Figure to the right).

As with any intervention, if you have done something, you need to assess whether it has helped. Returning and reassessing breathing is mandatory at this point if an intervention has been carried out.

*Tracheo-twist tube. This inner tube needs to be inserted to allow connection of a suitable breathing circuit to the tracheostomy.*
Removing the tracheostomy

If none of the measures performed already cause the tube to become patent, it is either

- Totally blocked
- Totally displaced
- Partially displaced

The tracheostomy tube MUST be removed at this point if the patient is continuing to deteriorate. This may seem like a drastic step but as described above, it is currently offering no assistance and may be making the situation worse. There have been incidents described where the rescuers have continued to fruitlessly work on the tracheostomy when it is clearly not going to help and neglected other basic lifesaving maneuvers. The priorities are safe management of the airway and adequate oxygenation.

If an **airway expert** is present AND **safe, adequate oxygenation** is occurring via the facial route, then the expert may choose to attempt to manipulate the tracheostomy perhaps using a fibre-optic scope or similar adjunct (see below). This may be particularly relevant for a patient with a known difficult airway or tracheostomy. We have not recommended this for junior staff at this stage.

What to do now you have removed the tracheostomy tube

Firstly you should assess if your intervention has helped by assessing for spontaneous ventilation at the stoma and the mouth. Removing the displaced or blocked trachy may be all that is required to allow the patient to breathe spontaneously. Re-apply oxygen. If the patient is oxygenating well, await expert help.

If removal does not improve the situation, cover the stoma with some sterile gauze or similar to minimize air leaks and then proceed to manage the airway just like any other compromised airway. This will depend on your skills and experience, but the important step is to **oxygenate** the patient. It doesn't matter if you can't re-intubate them if they are safely oxygenating whilst expert help arrives.

Standard oral airway maneuvers may include the use of a head tilt and chin lift, a jaw thrust or use of adjuncts like oral or nasal airways. If your skills permit you, a Laryngeal Mask Airway (LMA) can be useful here. The patient may need sedative drugs at this point, **but only do this if you are skilled to deal with managing the airway of an anesthetised patient.**

Laryngeal Mask Airway

‘Guedel’ Oral Airways
Whatever your level of experience, it is important to prepare for the possibility of a **difficult airway** and a **difficult intubation**. This is due to airway trauma, oedema and bleeding which may be associated with the tracheostomy procedure or the underlying pathology. Remember also that critically ill patients do not have the same reserve as healthy ones and will become cardiovascularly unstable and desaturate more quickly than in health.

If you are intubating the patient, pass the tube beyond the stoma to seal it off (see figure). Use an un-cut tube to allow this but pay extra care that you haven’t passed the tube too far into the left or right main bronchi (endobronchial intubation). The ideal situation is a stable, ventilating, oxygenating patient. If this is achieved just by holding an appropriate facemask, then that’s fine! Get someone to gather appropriate drugs and equipment that may be used by an expert for definitive management of the airway or tracheostomy when they arrive.

**What if you can’t oxygenate using standard maneuvers?**

Turn your attention back to the stoma. This is going to be the only route left to try and oxygenate your patient. This is a very dire situation, but the following steps may help to secure a means of oxygenating the patient. It is important to stress that if the patient is adequately oxygenating, then the safest thing to do is to await an expert, but if the clinical situation is deteriorating, then the following outlines the options available to you.

**Attempt intubation of the stoma**

This can be attempted using a 6.0 cuffed endotracheal tube or a new tracheostomy tube. The reason for this choice is that it is likely to be readily available and familiar to non-experts. Always use at least one size smaller tube than the one removed, so if the patient had a 6.0 tracheostomy tube in situ, then use a 5.0 endotracheal tube instead. The same goes for a new tracheostomy tube. Experts may be experienced in a particular technique and may use different equipment here.

If you are experienced, then you may wish to consider using a Bougie / Aintree catheter / Suction catheter as guide. A fibre-optic scope may give you a better idea of where you are heading, but is not always as good as you might imagine, especially if there is tissue trauma or bleeding.
Attach the tube to a Waters’ circuit or similar and assess for signs that the tube is in the correct place. The ‘gold standard’ for this is Capnography if available, but clinical detection of breath sounds (spontaneous or on careful ventilation) should be possible. If there is resistance to ventilation, it is essential to stop. You have probably caused a false passage and further attempts will cause subcutaneous emphysema and worsen the situation.

**Attempt ventilation via the stoma**

If you cannot easily and safely intubate the stoma, then you may be able to oxygenate or even ventilate via the stoma by applying either a small facemask or an LMA to the skin surrounding the stoma (not into the stoma). You may not get a very good seal, but this technique may allow critical oxygenation of the patient.

**Laryngectomy algorithm**

The Algorithm is different in places for those patients who do not have a larynx as previously explained. The initial steps are similar in calling for help and applying oxygen to the face and stoma. Clearly, if those in attendance understand that applying facial oxygen is pointless in this situation then it is not necessary. This step has been left in to ensure consistency when managing the much more common emergencies with tracheostomies and a potentially patent upper airway (ie no laryngectomy) as described in the previous section.

There may not always be a tracheostomy tube in the stoma to remove. You can still assess the patency of the stoma by passing suction catheter however.

The algorithm is essentially the same until after the tracheostomy tube is removed. There is now no point attempting oral maneuvers as there is no communication
between the facial upper airways and the lungs. Attention is turned straight to the stoma, as this is the **only** method of oxygenating the patient.

The stoma is managed similarly to above by first attempting to oxygenate or ventilate by applying a small face mask or LMA to the stoma. If this is unsuccessful, attempts at intubation of the stoma should be attempted with either a small 6.0 endotracheal tube or a tracheostomy tube as described above.

An expert may choose their own technique or be familiar with guides like a suction catheter, Aintree catheter, Bougie, a minitrachesotomy or a fibre-optic scope.
Management of the tracheostomy patient with breathing difficulties - LARYNGECTOMY

100% O₂ applied to BOTH the face and the tracheostomy stoma*  
Call for help – Anaesthetics/ITU AND ENT/Max Fox  
Ensure airway equipment including fibre optic ‘scope is available

Inflate the tracheostomy cuff if present.  
Assess breathing clinically  
Attach Waters’ circuit to tracheostomy and ensure capnography is attached  
Does the bag move spontaneously? Is there a CO₂ trace?

NO

Can you pass a suction catheter?  
Remove, unblock and replace inner tube if present. Reassess breathing

NO

YES

The tracheostomy is patent  
Consider partial obstruction  
Suction the airway  
Continue ABCDE assessment

The tracheostomy is patent  
Consider partial obstruction  
Support ventilation  
Await expert management

The tracheostomy is patent  
Support ventilation  
Await expert management for re-insertion of tracheostomy

No Inner tube  
No Improvement

Remove tracheostomy tube if clinically deteriorating (will be blocked or partially displaced)  
An airway expert may choose to manipulate the tube with a fibre-optic scope or similar

Yes

Apply small Face Mask to stoma (try paediatric mask or LMA)  
Breathing spontaneously?  
Can you ventilate adequately?

No

Improvement

Support ventilation  
Await expert management for re-insertion of tracheostomy

Support ventilation  
Await expert management for re-insertion of tracheostomy

Attempt intubation of stoma  
Suggest smaller new trachy tube, 6.0 cuffed endotracheal tube or similar  
Ventilate – Waters’ circuit or similar  
If advanced airway assistance, consider Bougie / Aintree catheter / Suction catheter / Fibre-optic scope  
Attempt ventilation via stoma if can’t intubate stoma using LMA or small mask applied to skin

LARYNGECTOMY patients have an end stoma and CANNOT BE INTUBATED via the mouth.  
*Applying oxygen to the face & neck is a default emergency action for all patients with a tracheostomy.
Options available to the airway expert

The algorithms above are designed for first responders who may be non-medical or non-airway trained. They are thus designed to be simple and clear and allow safe initial management of the compromised tracheostomy patient. They should address life threatening situations in order and the focus is on oxygenation of the patient.

For the purposes of this guidance, an expert may be considered as an individual with training and experience in advanced tracheostomy and airway management who will be both confident and competent to manage these difficult situations. The standard will be that of an ST 3 doctor in training (or above) in critical care or anaesthesia.

An expert will be called early in the algorithm. On their arrival, there will be one of three situations

1. First responder has resolved the situation  
   a. Supportive intervention only  
2. Stable patient oxygenating by face or stoma  
   a. May need sedation or anaesthetic to facilitate re-intubation or re-fashioning of stoma  
   b. Non-emergency situation  
3. A loss of airway crisis

The purpose of the emergency algorithm is to provide a standard approach to managing respiratory difficulties in the tracheostomy patient. The key points are

1. Oxygenate by the oral and tracheostomy routes  
2. Early removal of the tracheostomy if it is blocked, partially or completely dislodged and the patient is deteriorating  
3. Simple oral airway maneuvers  
4. Appreciation that patients with a laryngectomy have no communication between the face and the lungs

Maintaining oxygenation and ventilation by oral or tracheostomy routes may mean that you encounter the patient in a stable condition and a decision about how to proceed in managing the tracheostomy is required. These options would also be applicable in managing the emergency situation with loss of the airway.

Several options are described below. Details of types of surgical tracheostomy are found in the earlier chapters.

There is no ‘right answer’ for these situations, and management will depend on your experience and expertise, the clinical situation and the patient. This guideline aims to provide details on the options that are available to you.

Decisions on whether to use sedation or paralysing agents again depend on your experience, and in your confidence in being able to manage an effective airway and adequately oxygenate and ventilate once spontaneous respiratory efforts have ceased. As a general rule, if there is spontaneous ventilatory effort and the patient is
safely oxygenating (by mouth or via the tracheostomy stoma) then sedation and muscle relaxation should not be given until skilled personnel and equipment are immediately available to manage the airway. This may require a return to the anaesthetic room, critical care environment or operating theatre. Once the patient is paralysed, then you must be able to ventilate the patient yourself, which may prove difficult or impossible.

**Manipulation of a surgical tracheostomy**

There may be stay sutures present that allow the trachea to be pulled more anteriorly and the opening in the trachea to be made wider. This can help facilitate re-insertion of a tracheostomy tube, particularly in the first 7-10 days after the stoma has been formed, as the tract will not have established itself.

Remember not to pull on the suture holding down the ‘ramp-like’ flap of a Björk flap type tracheostomy as this will probably just tear the flap and potentially worsen the situation. (See figures on page 6).

**Cautions with a percutaneous tracheostomy**

As explained above, the tract from the opening in the trachea to the skin does not establish itself fully until 7-10 days after formation. This is more likely with a percutaneous tracheostomy as the tissues have only been stretched (dilated) as against cut in the case of a surgical tracheostomy.

Practically, this means that once the tracheostomy tube has been removed, the tissues are likely to spring back into place quickly and this is more likely to happen the newer the tracheostomy is. Manufacturers do not recommend changing tracheostomy tubes for 7-10 days after a percutaneous tracheostomy for this reason, as the passage from the skin to the trachea may be lost quickly. If this happens, manipulation of the tracheostomy under the same conditions that it was inserted originally under is usually required, namely with the upper airway controlled and bronchoscopic guidance to visualize the guide, catheter or tracheostomy entering the trachea. Attempting blind placement may cause a false passage and should be avoided.

Figure showing intubated patient with tracheostomy being refashioned under bronchoscopic guidance. An anaesthetic, full monitoring and Capnography should ideally be used.
Advanced upper airway options

Depending on your skill and experience and the clinical situation, advanced airway techniques may be required to manage the upper airway. A full description is beyond the scope of this document. Whether to give sedative or paralysing drugs is a decision that depends on your experience and confidence in managing the situation and airway once consciousness has been lost.

Options for the upper airway include

- Alternative laryngoscope blades – McCoy, Straight blades
- Laryngeal Mask Airways – Classic, Proseal, Intubating LMAs
- Fibre-optic laryngoscopes – Airtrach, McGrath, Glidescope
- Fibre-optic endoscopes via the nose or oral routes
- Aintree Catheters or similar
- Blind placement of a tube, orally or nasally

Options for managing the stoma

If the upper airway cannot be managed safely, then attention will turn to the stoma. If the patient is stable, then the stoma should be managed in a controlled situation and environment if possible. This may necessitate a trip to theatre with an appropriate surgeon.

In an emergency, the following options are available.

- Attempted ventilation of the stoma, as described in the previous section
- Using a suction catheter (probably the least traumatic) an Aintree catheter (allows oxygenation) or a gum-elastic bougie to try and enter the stoma. A tracheostomy tube can be ‘rail-roaded’ over the guide, but there is a risk of false passage creation and incorrect placement. Capnography would be ideal here.
- Blind placement of a small (6.0) endotracheal or tracheostomy tube.
- Specialist tubes. There are tapered tubes available, or some tubes which come with shaped introducers, as shown below.
Advanced Algorithm

ADVANCED TRACHEOSTOMY ALGORITHM
(FOR SECONDARY RESPONDERS)

Ensure FiO₂ of 1.0 is connected to upper airway at all times via face mask and/or Water’s circuit

Railroad Aintree catheter over Fibre-optic Bronchoscope (FOB)

Insert FOB directly into stoma if tracheostomy removed or down tracheostomy tube if still present

Advance FOB carefully
Identify tracheal rings and advance towards carina

Railroad Aintree catheter into airway and withdraw FOB

Railroad tracheostomy tube over Aintree catheter into airway or advance existing tracheostomy tube over Aintree catheter

Check position of tracheostomy tube using FOB and document position above carina

Connect water’s circuit with FiO₂ of 1.0 and capnography

Ensure good air entry bilaterally and the ability to easily pass a suction catheter

INDICATIONS
➢ Obstructed tracheostomy with stable SpO₂
➢ Tracheostomy removed with stable SpO₂
➢ Tracheostomy tube position check
➢ Emergency airway following inability to secure upper airway

SEDATION
Sedation and anaesthetic agents should only be used by appropriately experienced responders during airway emergencies.
Essential Equipment for Emergencies

Any clinical area caring for patients with a tracheostomy must have emergency equipment immediately available.

This may be in the form of the trachi-case or similar that accompanies the patient, or stocked on a difficult airway trolley in a critical care area.

Basic and advanced equipment lists are detailed elsewhere in this guide, but to summarise, the following equipment must be available.

- Basic airway equipment – oxygen masks, self inflating bags, oral and nasal airways
- Advanced airway equipment – LMAs and laryngoscopes with appropriate tubes (arrest trolley or similar)
- Trachy equipment – spare tubes, different sized tubes, tracheal dilators and bougies
- A fibre-optic endoscope to assess trachy position.

A fibre-optic scope may not be necessary on all wards that receive the occasional tracheostomy patient, but everyone caring for the patient should know where a ‘scope is and how to get access to one immediately. Critical care areas and areas who look after a high volume of tracheostomy patients should all have immediate access to a fibre-optic scope. This should ideally be portable and able to be used quickly without a lightsource and separate stack system.
Management of the day-to-day needs of the patient with a tracheostomy

There should be a detailed plan of care for all patients with a tracheostomy. A suggested care plan is provided as an appendix, but local policies may already be in place. The care plan should be reviewed on a daily basis and updated if there is any change.

The patient with a tracheostomy needs diligent observation and assessment. The nurse caring for the patient is responsible for this, seeking advice from other professionals as appropriate.

Patient assessment
At the start of each shift the Staff Nurse caring for the patient with a tracheostomy should carry out a full assessment of the patient which should include:

- Why does the patient have a tracheostomy?
- When was the tracheostomy performed? Was it surgical or percutaneous (may have implications for ease of re-insertion) and does the patient have a larynx? (Ie do they have a communication between the oral airway and the lungs?)
  - There may be information sheets available at the patients' bed space to quickly and easily communicate this information.
- Type and size of tracheostomy tube & availability of spare & emergency equipment
- Cough effort
- Ability to swallow, including any SALT assessments
- Sputum characteristics (Colour, Volume, Consistency, Odour)
- Check inner cannula for any build up of secretions.
- Check tracheostomy holder is secure and clean
- Check stoma dressing is clean
- Routine observations

This assessment should be documented on the care plan at the start of every shift.
**Humidification**

It is mandatory that a method of artificial humidification is utilised when a tracheostomy tube is in situ, for people requiring oxygen therapy – ‘dry’ oxygen should never be given to someone with a tracheostomy.

The type of humidification will be dictated by the needs of the patient. Advice may be sought from the Physiotherapist or Outreach team.

In normal breathing, inspired air is warmed, filtered and moistened by ciliated epithelial cells in the nose and upper airways. However, these humidifying functions are impaired by a tracheostomy tube and air inspired will be cold and dry (eg oxygen therapy), due to the body’s natural mechanisms for warming/moistening inspired air being bypassed.

Inadequate humidification can result in a number of physiological changes which can be serious to the patient and potentially fatal, including:

- Retention of viscous, tenacious secretions
- Impaired mucociliary transport
- Inflammatory changes and necrosis of epithelium
- Impaired cilia activity
- Destruction of cellular surface of airway causing inflammation, ulceration and bleeding
- Reduction in lung function (e.g. atelectasis/pneumonia)
- Increased risk of bacterial infiltration.

As a result, humidification must be artificially supplemented to assist normal function and facilitate secretion removal.

**Failure to adequately humidify could result in tube blockage as secretions become dry and viscous, forming a crust around the tracheostomy.**

**Methods of artificial humidification**

**Heated Humidification**

Heated Humidification operates actively by increasing the heat and water vapour content of inspired gas, so that gas is delivered fully saturated at core temperature. It is indicated for tracheostomy patients requiring mechanical ventilation or oxygen therapy for ≥ 96 hours.
Cold Humidification
Cold humidification bubbles gas through cold water, but only delivers a relative humidity of 50% at ambient temperatures.

For tracheostomy patients on high inspiratory flow rates of oxygen with tenacious secretions or patients complaining of subjective dryness a heated device is indicated and can be incorporated into the circuit.

Note: Condensation from heated or cold humidification should be considered infectious waste and disposed of according to hospital policy using strict universal precautions.

Because condensate is infectious waste, it should never be drained back into the humidifier reservoir.

Humidifier

Saline Nebulisation
The nebuliser unit converts saline into a supersaturated aerosol of liquid droplets which penetrates the lung moistening the airways. It may be indicated in tracheostomy patients who are mechanically ventilated, receiving oxygen therapy or self-ventilating on air.

Saline nebulisers help to reduce the viscosity of secretions which makes them easier to remove by suction or cough.
- Saline nebulising involves administration of 5 mls 0.9% sterile normal saline into the nebuliser unit 2-4 hourly or as required.
- Nebulisers must be connected to a gas source with a flow rate of 6-8 litres/minute (or follow manufacturer's guidelines).
- Ensure nebulisation is given via the tracheostomy (not the face mask!). A nebuliser can be attached to tracheostomy mask or T-piece circuit.
**Heat Moisture Exchanger**

Eg *Thermovent, Swedish nose*

The Heat and Moisture Exchanger (HME) operates passively by utilising the principle of replication of the functions of the naso-oropharynx, by storing heat and moisture obtained from condensation during expiration.

HMEs consists of rolls of metal gauze or a condenser element like propylene sponge/fibre sheet/corrugated paper. It is indicated for tracheostomy patients who are mechanically ventilated or on oxygen therapy for short periods (< 96 hours) or who are self-ventilating on air.

*Thermovent*  

*Swedish nose*
Buchanan Bib/Foam Filter

Acts in a similar way to a heat moisture exchange device and is indicated for long term tracheostomy/laryngectomy patients to ensure moisture of the stoma/airways.

Bedside equipment

All patients with a tracheostomy in situ cared for on the general wards must have spare equipment to deal with airway emergencies immediately available.

It is important to check all equipment is available prior to the patient arriving on the ward, and also at the beginning of every shift.

TRACHI-CASE is one of a number of commercially available kits for this purpose.
Ideally, the case will arrive with the patient if they are admitted to the ward from a Critical Care area. If a patient is admitted from another source a box must be obtained from the Critical Care Unit or contact the Outreach team.

This box will be sealed and include equipment needed in case of airway emergency. It should not be opened at any other time. This box will stay at the patient's bedside at all times. If the patient is decannulated, discharged to another hospital site or dies the box must be returned to the Critical Care Unit or the Outreach team. This box will then be cleaned and re-used.

The bedside emergency case should contain the following items:

- Spare tracheostomy tubes: the same size and a size smaller
- Tracheal dilators- sterile packed
- Stitch cutter- if the tube is sewn in
- 10ml syringe- for cuff deflation
- Scissors- to cut neck tapes in the case of emergency
- Spare trachy holder
- Spare trachy dressing
- Catheter mount
- Yankeur sucker

Other essential equipment to be available in the Critical Care area caring for the patient with a tracheostomy

- Fibreoptic intubating endoscope
- Suction equipment and a selection of suction catheters including yankauer
- Aintree (airway exchange) catheter
- Capnography
- Bag and Valve circuit (eg a Waters’ circuit or similar)
- Facemask
- Piped oxygen
- Appropriate humidification system
- Oral airway equipment such as a range of laryngoscopes and endotracheal tubes should be available on the cardiac arrest trolley

Other equipment to be kept at the bedside

- Sterile water- for cleaning the suction tube
- Clean pot – for spare inner cannula
- Sterile gloves- for performing deep suction
- Tracheostomy dressings
- Tracheostomy tapes
- Large yellow bag- for clinical waste e.g. suction catheters
- Nurse call bell- the patient may be unable to verbally call for help
- Communication aids- the patient may not be able to verbalise
- The bed-side of a tracheostomised patient should have a checklist completed at least once every 24 hours of the above equipment.
Equipment to be kept at the bedside of a ward patient

This list is likely to be open to local negotiation and will depend on the type of ward and its casemix. Minimum equipment for each patient should include:

- Trachicase or similar emergency trachy equipment
- Cardiac arrest trolley or similar containing
  - Bag and Valve circuit (e.g., a Waters’ circuit or similar)
  - Facemask
  - Oral airway equipment such as a range of laryngoscopes and endotracheal tubes
- Suction equipment and a selection of suction catheters including Yankauer
- Piped oxygen
- Appropriate humidification system
- Sterile water - for cleaning the suction tube
- Clean pot – for spare inner cannula
- Sterile gloves - for performing deep suction
- Tracheostomy dressings & tapes
- Nurse call bell - the patient may be unable to verbally call for help
- Communication aids - the patient may not be able to verbalise

Clear guidance should be in place regarding where to obtain a fibreoptic endoscope and monitoring such as Capnography in the event of an emergency.
Changing tracheostomy tubes

Changing the tracheostomy tube should be a multidisciplinary decision. The first change should always be performed or supervised by a suitably trained member of the medical staff.

The stoma and tract to the skin from the patient's trachea may not be fully formed initially. Ideally the first tube change should not take place for 3-5 days (ideally 7-10 days – ICS 2008) for a percutaneous tracheostomy, but may be sooner for a surgical tracheostomy. Consult local guidelines or the surgical team involved if you are not sure. Thereafter, changing the tube can be performed by a competent and suitably trained person but medical assistance and emergency equipment should be readily available at all times. The tubes may be changed like-for-like, changed for a different type of tracheostomy (eg fenestrated tube), changed for a smaller tube (down-sizing) or removed completely (decanulation).

Indications for Tube Change

- Every 7-10 days for a tube without an inner cannula, but less frequently as secretions reduce and the stoma becomes more established (ICS 2008).
- Every 28-30 days (or as clinical need dictates) for double cannula tracheostomy tubes (European Directive 1993).
- Evidence of tracheostomy tube obstruction that may lead to a rapid deterioration in the patient's respiratory status.
- Infection around stoma site.
- Part of weaning process.

Equipment Required

- Pen torch. Two tracheostomy tubes of appropriate make.
- 1 same size, 1 size smaller.
- Tracheostomy tube tape and possibly Tracheostomy tube holder.
- Dressing Pack
- Normal saline (0.9%) to clean
- 10 ml syringe
- Sterile gloves and protective eye wear.
- Water soluble lubricating gel.
- Tracheal dilators.
- Forceps and scissors.
- Suction equipment and suction catheters.
- An exchange device Aintree catheter /Bougie.
- Pre-cut keyhole tracheostomy dressing – uncut gauze swabs are not recommended.
- Resuscitation equipment.
- Fibreoptic scope available.
Decanulation
When a patient no longer needs their tracheostomy, it can be removed. The requirements to remove a tracheostomy tube include

- No longer requiring respiratory support
  - Practically this means no CPAP or assistance for at least 24 hours with an FIO$_2$ of 40% or less and improving respiratory parameters
- Able to clear secretions without tracheal suction
  - Able to cough secretions into the mouth or out of the tracheostomy tube
  - Secretions should be reducing in volume
- Able to tolerate the cuff (if present) being deflated for 24 hours ideally
- A patent upper airway
  - Can be assessed by occluding the tracheostomy tube with the cuff down
  - The patient may be able to talk past the tube and vocalize
  - Surgical patients may require endoscopic assessment
- Able to manage secretions: swallow saliva
  - Crude bedside swallowing tests may be used
  - Formal referral to SALT services to assess swallowing may be required
  - The presence of a tracheostomy tube may actually be hindering the swallowing mechanism, so removal may actually benefit the patient. This must be balanced against the risks of aspiration.

These decisions may all be obvious or each may require expert assessment. If the patient remains in a critical care environment, then the decision may be taken by attending medical, nursing or allied health staff. Once the patient reaches the ward, then the assessment of suitability for decanulation should be agreed prior to critical care discharge and may involve a multi-disciplinary approach. This may include SALT and physiotherapy teams with support from critical care outreach or medical teams.

Once the tube has been removed, the stoma should be covered by a clean dressing. The stoma will usually heal within 1-2 weeks, depending on its age, how it was formed and patient factors such as intercurrent illness, infection and nutrition.

Suctioning a Tracheostomy Tube
Suctioning is important for patients with a tracheostomy as they may not be able to clear secretions themselves, risking tube obstruction and complications like pneumonia. Where a patient has a good cough reflex and can clear their own secretions passed the tracheostomy tube, suction should not be performed routinely or at set times and should be performed only when the patient requires it. Clinical signs indicating that suction may be required include

- Viscous secretions
- Reduced breath sounds
- Restlessness
- Increased use of intercostals muscles
- Sweating
- Visible or audible gurgling sounds
- Increased heart and blood pressure
- Reduced air flow at stoma site during respiration
- Decreased oxygen saturation levels
- Inability to cough up secretions
- See-saw breathing

Where patients have a poor cough effort or none at all all suctioning should be carried out at least every 2-4 hours and documented on the care plan. In this group of patients if no secretions are removed on the first pass do not attempt again but wait until suctioning is due again or the patient is showing any of the above signs.

If no secretions are removed do not increase the suction pressure above the recommended levels as this causes trauma to the trachea, check the patient has adequate humidification and hydration.

Ideally the maximum amount of secretions should be removed with the minimal amount of tissue damage and hypoxemia. In the hands of a skilled practitioner suctioning may be no more than a discomfort.

Potential **complications** of suctioning are

- Hypoxia,
- Cardiac arrhythmias (usually a bradycardia due to vagal stimulation if the suction catheter irritates the carina of the trachea)
- Trauma to the tracheal mucosa

The complications can be considerably reduced if

- Pre/post oxygenation is used,
- The use of an appropriate technique with an appropriately sized suction catheter
- Adequate suction pressure - no greater than 80-150mmHg
- Appropriate duration and frequency of the procedure. - the procedure should last for no longer than 15 seconds

The correct size suction catheter should be used and can be calculated by using the following formula:

\[
\text{(Size of the tube internal diameter -2) } \times 2
\]

**For example**

<table>
<thead>
<tr>
<th>ID</th>
<th>Calculation</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>6mm</td>
<td>((6-2) \times 2)</td>
<td>size 8 suction catheter</td>
</tr>
<tr>
<td>7mm</td>
<td>((7-2) \times 2)</td>
<td>size 10 suction catheter</td>
</tr>
<tr>
<td>8mm</td>
<td>((8-2) \times 2)</td>
<td>size 12 suction catheter</td>
</tr>
<tr>
<td>9mm</td>
<td>((9-2) \times 2)</td>
<td>size 14 suction catheter</td>
</tr>
</tbody>
</table>
Or by using the table below:

<table>
<thead>
<tr>
<th>Trache tube internal diameter (shown on the box and the flange)</th>
<th>Recommended suction catheter size</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.5 - 7.0</td>
<td>10 Ch Black</td>
</tr>
<tr>
<td>7.5 - 8.0</td>
<td>12 Ch White</td>
</tr>
<tr>
<td>8.5 - 9.0</td>
<td>14 Ch Green</td>
</tr>
</tbody>
</table>

Procedure for suctioning

- Explain to the patient what you will be doing and obtain consent
- Ensure oxygenation prior to the procedure
- Assess the patient’s cough reflex (if strong some patients require very little suction)
- Aseptic technique should be used with hand washing before and after the procedure. Gloves do not replace the need for thorough hand washing
- Apply sterile gloves, apron and eye protection
- Encourage the patient to cough up secretions
- Quick but smooth insertion of the appropriately sized suction catheter without applying the suction pressure
- When either the patient coughs or resistance is felt (indicates the level of the carina) the suction pressure should be applied continuously whilst withdrawing the catheter
- Rinse the suction tubing by dipping the end into a bottle of sterile water. The disposable catheter part which has been inserted into the tracheostomy should be discarded and not used again
- Oxygen should be re-applied following suction
- Suction should not be performed more than 3 times in quick succession. This allows time for the patient to receive oxygen therapy before continuing
- Ensure correct disposal of suction catheter and gloves and prepare equipment for later use

Figure below shows the correct technique for tracheostomy suction.
Stoma care

Tracheostomy stoma care aims to keep the area clean and dry, reducing the risk of skin irritation and infection. Secretions collected above the tracheostomy tube cuff may ooze out of the surgical incision and stoma site. The resultant wetness can promote irritation of the skin and can lead to skin maceration and excoriation. This increased moisture may act as a medium for bacterial growth or prevent the stoma site from healing.

The tracheostomy stoma dressing should be reviewed each shift, and should be changed at least every 24 hours. However the frequency of dressing changes will be indicated by the amount of secretions oozing around the stoma site, therefore if the dressing is contaminated - change it. If there is any evidence of infection swab the site and send to microbiology.

A slim, absorbent dressing is the most appropriate - specific tracheostomy dressings will have a keyhole design for easy placement around the tracheostomy tube. Hydrophilic, polyurethane foam dressings e.g. Lyofoam™ or Allevyn™ are preferable as they are designed to absorb moisture away from the skin interface thereby reducing maceration risk.

Tracheostomy tube holders/tapes hold the tube in place as long as they are secure around the neck – one finger should slide comfortably between the neck and the holders. Check the holder each shift and change if contaminated.

Changing a stoma dressing requires two members of staff, one to hold the tracheostomy tube and the other to carry out the dressing change. This ensures that the tube is not dislodged.

After the tracheostomy tube has been removed the stoma is not often stitched but left to heal; healing time may vary but is usually between 5-7 days depending on how long the tracheostomy tube has been in place.. During the healing time the stoma should be dressed with an absorbent dressing and secured with a transparent dressing e.g. Biocclusive™ or Opsite™. Do not use gauze as loose threads can be

Some types of trachy-mask (which supply oxygen to the patient via a tracheostomy) have an opening in them to allow suction without having to interrupt the supply of oxygen.
inhaled. Sleek dressing should not be used post-decannulation due to its adhesive and opaque nature; it is very irritating to the skin and encourages bacterial growth.

**Cleaning the inner cannula**
This procedure aims to remove secretions from the inner cannula to reduce the risk of potential obstruction with sputum and reduce the risk of infection. Secretions can adhere to the internal lumen of a tracheostomy tube and severely reduce the inner lumen diameter over time. This potentially can increase the work of breathing and/or obstruct the patient’s airway.

The inner cannula should be removed and inspected at least every 6 hours or if the patient shows any signs of respiratory distress.

Ensure the inner cannula is the appropriate size for the tracheostomy tube, replace with inner cannula of same size. If a larger cannula is forced into a tracheostomy tube it will protrude through the tip of the tracheostomy tube causing erosion of the soft mucosa of the trachea. Conversely if the inner cannula is too small secretions may build up between the inner cannula and the outer lumen.

**Equipment required**

- Emergency equipment and functional suction equipment should be readily available
- 2 x Tracheostomy inner cannula - same size as tracheostomy tube – in case one becomes contaminated - check clean and dry
- Tracheostomy sponges for cleaning
- Clean container for placement of soiled inner cannula
- Bactericidal alcohol hand rub
- Powder free gloves and apron
- Goggles
- Yellow clinical waste bag

**Oral and Personal Hygiene**
Patients with tracheostomies, especially those who are nil by mouth, require regular oral care due to the reduced evaporation of oral secretions, which accumulate in the mouth. This is due to the disruption of normal airflow during inhalation and exhalation.

Patients who are able to should be encouraged to maintain their own oral hygiene by using a toothbrush and using mouthwashes. Incapacitated patients should have a daily assessment of their buccal mucous membranes to observe for bacterial, viral or fungal infections, skin tears or ulceration.

Aspirated infective saliva can contribute to respiratory problems. If the patient has a dry mouth then consider artificial saliva.
- Regular oral hygiene - minimum x 2 per day but preferably every 2-4 hours if possible. Document on care plan.
- Patient’s teeth should be brushed with toothbrush and toothpaste at least twice a day if not self caring.
- If patient self caring encourage oral hygiene.
- There is no reason why patients with tracheostomies can’t wear their dentures.
- Showering is permitted
- If the patient will tolerate oxygen being off for the duration of the shower
- The tracheostomy is covered with a Heat Moisture Exchange Device (HME) - Thermovent/Swedish Nose. See p
- Ensure the patient is angled away from shower spray. It is easier if the shower is angled from behind.

**Cuff management**

The tracheostomy cuff provides a seal to enable positive pressure ventilation and may also provides some protection against aspiration of secretions. If the cuff is over-inflated, this may cause ischaemia of the tracheal. The pressure within the cuff should be checked regularly with a hand held pressure manometer and should be maintained ideally below 20 – 25cm H2O. It is good practice to document cuff pressure and inflating volume on a daily basis and following any intervention.

If the cuff pressure is at the maximum recommended and there is evidence of an ineffective seal (usually gas escaping via the mouth, vocalising, or problems with achieving ventilation targets) then the tracheostomy may have become displaced and may require changing. This should prompt a review and assessment of the tracheostomy by someone competent to do so.

Finger tip pressure on the external pilot balloon is not an accurate method of measuring cuff pressure.
APPENDIX

Suggested care pathways for the day-to-day care of tracheostomy patients

Equipment check lists

The bed-head information explaining what type of tracheostomy a patient has in situ.

References
This patient has a **LARYNGECTOMY**
and CANNOT be intubated via the mouth

Follow the **LARYNGECTOMY** guideline if breathing difficulties

- Performed on (date).................................
- Trachy Tube size (if present) .................
- Patient Name........................................
- Hospital/NHS No. ...................................

Emergency Call: ANAESTHETIC SpR bleep 479;  INTU SpR bleep 444;  ENT SHO bleep 271

---

This patient has a **TRACHEOSTOMY**
There is a potentially patent upper airway (Intubation may be difficult)

Surgical / Percutaneous

- Performed on (date).................................
- Trachy Tube size (if present) .................
- Patient Name........................................
- Hospital/NHS No. ...................................

Emergency Call: ANAESTHETIC SpR bleep 479;  INTU SpR bleep 444;  ENT SHO bleep 271
ICS suggested daily care plan for patients with a tracheostomy

TRACHEOSTOMY CARE

WARD BASED APPRAISAL OF NEED

DATE OF TRACHEOSTOMY:

TUBE TYPE: SIZE: FENESTRATED: Y/N

(Y= YES, N = NO, v= satisfactory, CFC = cause for concern)

<table>
<thead>
<tr>
<th>DATE:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>PREVIOUS TUBE CHANGE</td>
<td></td>
</tr>
<tr>
<td>?Problems- Y/N</td>
<td></td>
</tr>
<tr>
<td>GCS</td>
<td></td>
</tr>
<tr>
<td>C.PAP DEPENDENT Y/N</td>
<td></td>
</tr>
<tr>
<td>O2 DEPENDENT % FIO2</td>
<td></td>
</tr>
<tr>
<td>BREATHING RATE/PATTERN</td>
<td></td>
</tr>
<tr>
<td>Speaking Valve Y/N how long?</td>
<td></td>
</tr>
<tr>
<td>Occlusion Cap Y/N how long?</td>
<td></td>
</tr>
<tr>
<td>AIRWAY VOICE Strong/Weak?</td>
<td></td>
</tr>
<tr>
<td>SWALLOW assessment?</td>
<td></td>
</tr>
<tr>
<td>COUGH strong/weak/into mouth?</td>
<td></td>
</tr>
<tr>
<td>SECRETIONS sticky/infected</td>
<td></td>
</tr>
<tr>
<td>SUCTION No./24 HRS</td>
<td></td>
</tr>
<tr>
<td>EXCESS DEMAND? e.g. Anaemic/pyrexial/LV Function</td>
<td></td>
</tr>
<tr>
<td>? Abdominal Distension</td>
<td></td>
</tr>
<tr>
<td>FAILED Decannulation?</td>
<td></td>
</tr>
<tr>
<td>WEANABLE ? cuff Deflated</td>
<td></td>
</tr>
<tr>
<td>Formal SALT assessment?</td>
<td></td>
</tr>
<tr>
<td>DOCTOR/PHYSIOTHERAPIST:</td>
<td></td>
</tr>
</tbody>
</table>

North West Regional Tracheostomy Course
References


J. M. Barker and K. Prasad Difficulty with a flanged tracheostomy tube. Anaesthesia September 2005 :60; P 939

Kinking of a long tracheostomy tube can present as severe acute asthma Anaesthesia. December 2002: 57; 1238

Portex Instructions for use


Fluck RR (1985) Suctioning – Intermittent or continuous? Respiratory Care, 30,837-838


Regan M (1988) Tracheal mucosal injury – the nurses role Nursing, 29, 1064-1066


Hamaker R., Hamaker R. Surgical Treatment of Laryngeal Cancer. Seminars in Speech and Language. 16(3) 221-231 August 1995
