

Suctioning

Suctioning the airway is an essential part of routine care of the tracheostomy and laryngectomy patient. Sputum is continually produced in health and our native airways deal with this load without any difficulty. If there is an infection or the sputum load increases, there is an increased risk of the secretions causing problems such as airway obstruction or consolidation in the lung. These problems are compounded if the patient cannot cough effectively, the inhaled gases are not adequately humidified, the patient is on a ventilator or the presence of a tracheostomy or laryngectomy compromises the body's ability to deal with the secretions.

The health of the lower respiratory tract is usually maintained by its mucus blanket. Mucus produced in the trachea and bronchi is transported up to the larynx by the ciliated mucosa of the trachea. The mucus blanket is disturbed following tracheostomy for several reasons.

- The loss of normal humidification from the nasal airway
- The post-surgical inflammation produces a more tenacious mucus blanket
- The presence of the tracheostomy tube paralyses the cilia in contact with it
- The loss of a normal cough from bypassing the larynx

This results in the tracheal mucus collecting at the lower end of the tracheostomy tube. The amount of mucus build up and the problems it causes will vary between patients and with the duration of the tracheostomy. Some patients may be able to project the mucus through the tube by forced expirations, but most often it must be removed by suctioning the trachea via the tracheostomy tube. Suctioning is not a benign process and may cause hypoxia, cardiac arrhythmias, trauma, atelectasis and infection.

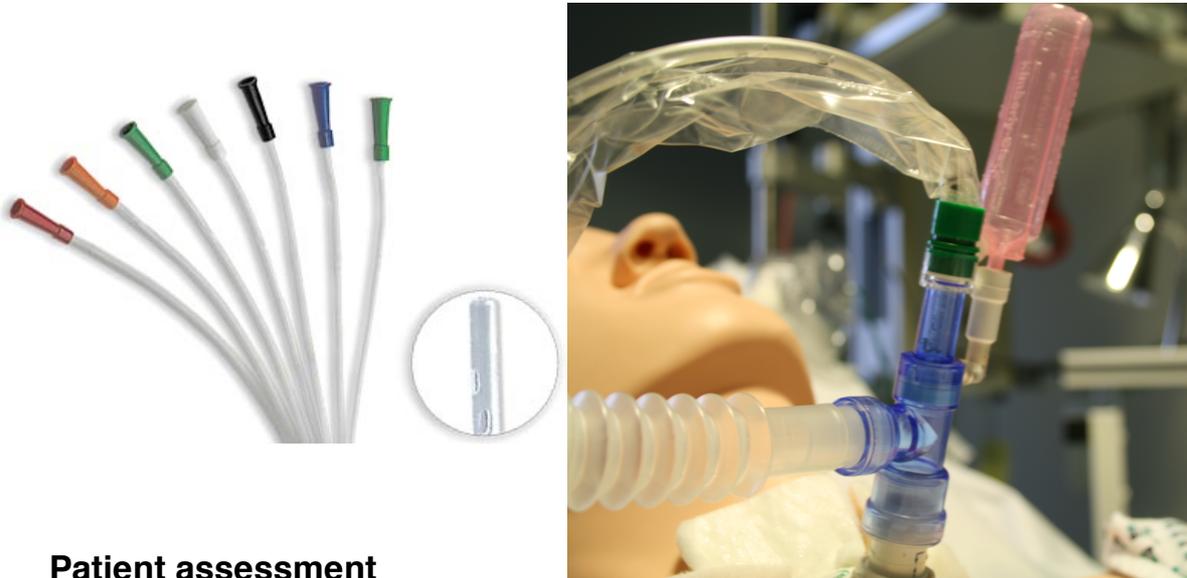
Types of Tracheal Suctioning

Most patients only need routine tracheostomy suction and this should be limited to the lumen of the tube. If the suction catheter is passed deeper into the normal trachea it can further paralyse the cilia and aggravate the problem. In some patients with chest problems the tracheostomy will have been performed to give access to the lower respiratory tract. In such patients deep bronchial suction may be required. Frequency of routine tracheostomy suction varies considerably between patients depending on their clinical status.

Suctioning systems can be 'open' or 'closed'. Open suction involves using single-use catheters inserted via the open end of the tracheostomy tube. Closed suction systems allow the same catheter to be used multiple times. They are especially useful if the patient is connected to a breathing circuit of a ventilator as repeated disconnection of the circuit is not required. Closed systems are cleaned following use with sterile saline and the systems are

usually changed every 72 hours, or according to manufacturers instructions. They do add a degree of weight to the breathing circuit and the constantly attached suction tubing risks getting caught accidentally, which may increase the risk of inadvertent disconnection or tube displacement.

The images below show a selection of 'open' suction catheters and a 'closed' suction system, as described above. Note the inverted red saline ampule.



Patient assessment

In order for the practitioner to assess whether the patient requires suctioning, with an awake, co-operative patient, it may be possible to firstly encourage them to cough up the secretions, thereby reducing excessive suctioning. Support the patient in a position that will aide coughing (unless contra-indicated) and address any factors that may reduce the effectiveness of coughing such as pain or hydration status.

Indications that the patient may require suctioning include:

- Noisy and or moist respirations
- Increased respiratory effort
- Prolonged expiratory breath sounds
- Restlessness
- Reduced oxygen saturation levels
- Increased or ineffective coughing
- Increased use of intercostal muscles
- Patient request
- More sinister signs of airway obstruction such as hypoxia and cardiovascular changes

Sedated or ventilated patients may have deep secretions which may not lead to some of the signs described above. These secretions may need to be mobilised by physiotherapy and attention to humidification before suctioning becomes effective.

Suction catheter selection

Tracheal damage and hypoxia may be caused during tracheal suction. This can be minimised by using the appropriate sized suction catheter. If the catheter is too large the suction it creates can cause damage. A large catheter will also occlude the tracheal tube which may cause hypoxia. It has been recommended that the diameter of the catheter should be no more than half the internal diameter of the tracheal tube. If the catheter is too small it will not be adequate to remove secretions so repeated attempts will be necessary which have also been shown to damage the trachea. A rough guide to choosing the correct size of catheter was proposed by Odell and others (1993):

(Size of endotracheal or tracheostomy tube – 2) x 2 = Correct French gauge

The table below illustrates this.

Inner diameter of tracheostomy tube (mm)	Suction catheter size (French Gauge or mm)	
	FG	(mm)
10 mm	14	(4.5)
9mm	12	(4)
8 mm	12	(4)
7 mm	12*	(4)
6 mm	10	(3.3)
5 mm	8	(2.6)

* It is more appropriate to use a size 12 catheter as although it is slightly larger than ½ diameter it is more effective for secretion removal.

The frequency of suctioning

There is no clear consensus on how frequently a patient should receive suctioning. This will be dictated by the various patient factors related to their ability to spontaneously clear their own secretions. Attempting tracheal suction at least once per 8 hours strikes a reasonable practical balance. This should ensure that the tube remains patent. Failure to pass a suction catheter is a 'Red Flag' warning that that tube may be blocked or displaced and should prompt assessment by an appropriately trained individual.

The depth of suctioning

Passing a suction catheter to the tip of the tracheostomy tube can be considered 'shallow' suctioning. This is often all that is required if the patient has reasonably loose secretions which can be coughed towards the end of the tube. Passing a suction catheter any further than this can be considered as 'deep' suctioning and may be required if more shallow suctioning does not clear the secretions adequately. Many authors advocate advancing the suction catheter through the tube until it reaches the carina (where resistance

will be encountered). The catheter should then be withdrawn slightly before suction is commenced. Clearly, the length of the tracheostomy tube in situ needs to be known so that the suction catheter is inserted to an appropriate distance. There is no clear message from the literature to guide suction technique, despite a Cochrane review.

The pressures for suctioning

Choosing the correct pressure is a balance of effectiveness of clearing secretions against limiting the potential for damage, either by directly traumatising the tissues or by aspirating oxygen from the trachea and contributing to hypoxia. Pressures used effectively in the literature range from as little as -80 mmHg to -300mmHg. Most would agree that a pressure of no greater than -150 mmHg (-20kPa) is appropriate for most patients.

Equipment for suctioning

- 'Clean' disposable gloves as per local policy
- Protective eyewear
- Appropriately sized sterile suction catheters (See selection guide above)
- Sodium Chloride 0.9% ampoules (only for closed circuit units)
- Oxygen therapy – wall flow meter & tracheostomy mask - if necessary
- Oxygen saturation monitor – where appropriate
- Suction equipment (wall or portable unit)
- Disposable, sterile 'double' gloves can be used to keep the catheter tip sterile from the packet and allow easy disposal

Most closed suction systems allow the suction tubing from the wall mounted suction unit to be constantly connected to the catheter assembly. To prevent continuous suction being applied, there is a valve to stop the suction being applied (white lock between the green sections below, right). The tip of the catheter should always be in the withdrawn position when not being used, as shown below (the visible black marker indicates that the tube is withdrawn).



Summary

The table below summarises key actions related to suctioning and their rationales (adapted from NPSA expert working group)

Action	Rationale
Explain the procedure to the patient	Relieve patient anxieties
Consider analgesia prior to or following suctioning	Suctioning can be a painful procedure
Switch suction unit on and check that the suction pressure on circuit occlusion does not exceed-150 mm Hg or 20kPa pressure	To ensure the machine is working correctly. Too great a suction pressure can cause trauma, hypoxaemia and atelectasis
Wash hands, put on gloves, apron and goggles	Reduce the risk of cross infection
Ensure that an appropriate non-fenestrated inner tube is in place	Larger fenestrations allow the suction catheter to pass through, causing trauma to tracheal wall or giving the false impression that the catheter will not pass
Consider pre-oxygenation if receiving oxygen or ventilated	To prevent hypoxaemia
Remove tracheostomy devices prior to open suctioning	To allow access for sterile suction catheter tip
Connect suction catheter keeping catheter tip covered (sterile)	To reduce the risk of transferring infection from the hands to the suction tubing.
Place top 'double' glove on dominant hand	To aide removal and replacement of fresh gloves per each suction episode
Do not apply suction whilst introducing the catheter, or push against resistance at any time	Suctioning while introducing the catheter causes mucosal irritation, damage & hypoxia
Occlude suction port with gloved thumb and suction on removal of suction catheter (no need to rotate on removal as catheters have circumferential holes)	Prolonged suctioning can result in hypoxia and trauma
Period of suction should not exceed 10 seconds	To reduce risk of mucosal damage and hypoxaemia
Suctioning should be continuous not intermittent	Intermittent suctioning does not reduce trauma and is less effective

Day-to-day management of Tracheostomies & Laryngectomies

Observe the patient throughout the procedure to ensure their general condition is not affected.	Tracheal suction may cause vagal stimulation leading to bradycardia, hypoxia and may stimulate bronchospasm
For patients requiring oxygen therapy, reattach O ₂ within 10 seconds.	To limit hypoxia
Remove the glove from the dominant hand by inverting it over the used catheter & dispose clinical waste bag	To minimise the risk of infection
Assess the patient's respiratory rate, skin colour and/or oxygen saturation to ensure they have not been compromised by the procedure and determine if they need further suction.	Suction should be performed only when needed and not as part of a routine, so that damage to the trachea is avoided
It is recommended that no more than 3 episodes of suctioning are carried out in succession	To limit side effects and maximise recovery period
Difficulties in suctioning tenacious mucus may be due to inadequate humidification. Try a more effective humidifier. Consider use of nebulizer, mucolytics and concurrent physiotherapy. Saline instillation may be useful in some situations such as deep bronchial suction and bronchial lavage.	
If O ₂ delivery was increased, review for return to previous level.	To prevent unnecessary oxygen delivery
Flush through the connection tubing with the clean water. Empty water receptacle and ensure this is ready for further use. Wash hands.	To minimise the risk of infection
If the patient needs further suction, repeat the above actions using new glove & a new catheter	

Videos demonstrating open and closed suction techniques can be found by clicking the links below, and as part of the e-learning modules available at www.tracheostomy.org.uk.

- [Open suction](#)
- [Closed suction](#)
- [Assessment of patency of a laryngectomy stoma](#)