
Guideline for Adult Endotracheal Suction in Critical Care

AIM: To provide guidance on the management of endotracheal suction
SCOPE: All adult ICUs within Royal Sussex County Hospital and Princess Royal Hospital

1. INTRODUCTION

An artificial airway such as an endotracheal tube (ETT) or a tracheostomy tube, disrupts the normal function of the cilia, which trap and move particles trapped in mucus, out of the nose. Endotracheal intubation decreases the ability to cough and clear secretions.

Tracheal suction involves the mechanical aspiration of pulmonary secretions from a patient's artificial airway; it is necessary to clear secretions, to maintain airway patency and to maintain patient comfort.

Tracheal suction is a common, but potentially hazardous procedure and should only be performed when there are clear indications that excessive pulmonary secretions are affecting the patency of the airway, or the effective ventilation of the patient. Frequency of suctioning should be tailored to the individual patients needs and following clinical assessment, it should not be performed as a matter of routine.

Aim

The aim of the guideline is to outline the management of patients requiring tracheal suction in the Critical Care department.

2. PROCESS

Recommendation (Action)	Justification (Rationale)
<p>Patient assessment and indications for tracheal suction</p>	<p>Given the risks associated with tracheal suction, assessment of a patient's need for suctioning must be based upon sound criteria. Indications for suctioning include:</p> <ul style="list-style-type: none"> • Visible, audible or palpable secretions • Decreased oxygen saturation levels • Increased oxygen requirements or work of breathing • Patient distress and tachypnoea • Coughing or inability to clear secretions • Reduced chest movement or decreased air entry on auscultation. • Sawtooth pattern on the flow-volume waveform on the ventilator monitor • Presence of coarse crackles over the trachea • Increased peak inspiratory pressure during volume-controlled mechanical ventilation, or decreased tidal volume during pressure-controlled ventilation • To assess the patient's airway patency, cough reflex, or to obtain a sputum specimen (NTSP 2013)

Recommendation (Action)	Justification (Rationale)
Contraindications / caution	<p>Endotracheal suctioning is a necessary procedure for patients with artificial airways. Most contraindications are relative to the patient's risk of developing adverse reactions, or worsening clinical condition, as a result of the procedure. When indicated, there are few absolute contraindications to tracheal suctioning, because the decision to withhold suctioning in order to avoid a possible adverse reaction may be worse. Caution should be exercised in the following situations:</p> <ul style="list-style-type: none"> • Raised intracranial pressure • Severe coagulopathy / haemoptysis • Laryngospasm (stridor) / bronchospasm • Severe hypoxaemia • Severe cardiac instability /arrhythmias • Pulmonary haemorrhage
Potential complications	<p>Hypoxaemia: suctioning can cause atelectasis and disrupts ventilation. In the critical care setting, pre-oxygenating the patient via a ventilator, or increasing wall oxygen can reduce this risk.</p> <p>Mucosal trauma: associated with incorrect catheter size, poor technique and high suction pressures</p> <p>Cardiac arrhythmias and fluctuations in BP: secondary to hypoxaemia or vasovagal reflex stimulation, causing bradycardia and hypotension.</p> <p>Laryngospasm or bronchospasm</p> <p>Raised Intracranial Pressure (ICP): tracheal stimulation causes the patient to cough and increases intrathoracic pressure, which in turn can affect cerebral venous drainage and further increase ICP</p> <p>Pain and discomfort for patient</p> <p>Bleeding and infection of lower airways</p> <p>Infection risk to health professionals</p>

Recommendation (Action)	Justification (Rationale)
<p>Open and Closed suction systems</p>	<p>Suctioning systems can be ‘open’ or ‘closed’. Open suction describes the disconnection of the patient from a ventilator, or wall oxygen system, and passing a single-use suction catheter into the patient’s airway. Open suction is a single use event, with new gloves and catheter used for each pass of the suction catheter</p> <p>A closed suction system describes the use of a sterile suction catheter enclosed in an outer plastic sheath, which allows the same catheter to be used multiple times without disconnecting the patient from their breathing system. This system preserves the PEEP (positive end expiratory pressure) that helps keep the alveoli in the lungs open.</p> <p>The closed suction catheter system comes in two lengths, one longer catheter for use with an ETT and one shorter length catheter for use in patients with a tracheostomy. Closed suction systems are usually changed every 72hrs or according to manufacturer’s instructions and labelled to show the day when it should next be changed.</p> <p>There is some evidence to show that using closed suction in a ventilated patient may help to reduce the de-recruitment phase of ventilation and loss of positive end expiratory pressure (Cereda et al, 2001). Closed suction lessens the risk of environmental, personnel and patient contamination.</p>
<p>Depth of suction</p>	<p>Shallow suctioning describes a technique whereby the suction catheter is passed just beyond the tip of the endotracheal or tracheostomy tube, or, before then if a cough is elicited. This technique is often used if the patient has loose secretions that they are able to cough to the end of the tube. Use a shallow suction depth whenever possible and minimize the use of deep suctioning. Shallow suction is recommended in the literature (AARC, 2010). The benefit of deep suctioning, over shallow suctioning, has not been demonstrated and more adverse events may be associated with it.</p> <p>Deep suctioning, which describes advancing the catheter well beyond the end of the artificial airway to the carina, stimulates the vagal nerve and can predispose the patient to bradycardia and hypotension. It prolongs coughing,</p>

increasing intrathoracic pressure and decreasing venous return. There is an increased risk of mucosal and cilia trauma, inflammation and infection. Desaturation may also occur (AARC,2010)

Using the Ballard 72hr Trachcare closed system: to ensure the suction catheter reaches the correct depth in the patient's airway, slowly advance the catheter into the ET tube. Line up the depth number on the suction catheter with the same number marked on the ET tube, add 8cms and advance the catheter until that number is visible in the window across from the irrigation port. At this point the suction catheter will be 1cm beyond the end of the ET tube.



This use of the Ballard closed suction system is demonstrated in the following link:

<https://avanos.showpad.com/share/ZkBu3G4ozk0oHm450TqUB>

Suction catheter selection

Suction catheters with multiple “eyes” at the tip are recommended as best practice rather than single-hole catheters, as they distribute suction pressure thereby causing less trauma.

Tracheal damage and hypoxia can be minimised by using the correct sized catheter; if the catheter is too large it can cause mucosal trauma and will occlude the tracheal tube causing hypoxia. It is recommended that the diameter of the catheter is no more than half the diameter of the tracheal

tube (NTSP, 2013) If the catheter is too small, it will be inadequate to remove secretions.
If using the Ballard closed suction system choose the correct size of catheter by following the following equation: Multiply the ET diameter x 2, then select the next smallest catheter eg: 8mm ET tube x 2 = 16 select 14Fr suction catheter.
The National Tracheostomy Safety Project (NTSP) in the UK, recommends the following table to correctly size a suction catheter for use in a tracheostomy tube:

Inner diameter of tracheostomy tube (mm)	Suction catheter size FG (French Gauge)
10	14
9	14
8	12
7	10-12
6	10

The following link provides further resources
<https://www.tracheostomy.org.uk/>

Setting the correct suction pressure

To reduce the risk of mucosal trauma, hypoxaemia and atelectasis (lung collapse) the Intensive Care Society (2014) recommend setting a maximum suction pressure of 20kilopascals (kpa).
Choosing the correct suction unit pressure is a balance between clearing secretions effectively and limiting the potential for damage, either by directly traumatising the tissues or by aspirating oxygen from the trachea and contributing to hypoxia.
Most authors agree that a pressure of no greater than - 20kPa (150 mmHg) is appropriate for most patients (NTSP, 2013). Check the suction pressure by turning on the suction unit, kink the suction tubing, or place a gloved finger over the end of the suction tubing. Check the vacuum pressure is between -15-20Kpa /100-150mmHg, adjust as necessary.

<p>Instillation of Sodium Chloride into the trachea</p>	<p>It is recommended that routine use of normal saline instillation prior to endotracheal suction, should not be performed. Routine use of normal saline instillation may be associated with the following adverse events: excessive coughing, decreased oxygen saturation, bronchospasm, dislodgement of the bacterial biofilm that colonizes the ETT into the lower airway, pain, anxiety, dyspnoea, tachycardia and increased intracranial pressure. (AARC, 2010)</p>
<p>Equipment Required for Suctioning</p>	<ul style="list-style-type: none"> • A functional high vacuum suction unit. Suction set between 15-20kPa (100-150mmHg) • Sterile, correctly sized single use suction catheters (or closed suction system) • Personal protective equipment: apron, gloves and goggles/eye protection • Bottled water for flushing suction tubing. • 0.9% Sodium Chloride plastic ampoules to flush suction catheter in closed suction system • Oxygen therapy - wall flow meter / portable unit • Yankauer suction catheter and sputum trap if required • Clinical waste bag for disposal of waste • Pulse oximetry established

Suction Procedure ~ Closed Suction Technique

Recommendation (Action)	Justification (Rationale)
Explain the procedure carefully to the patient and where possible seek their consent.	Provides reassurance & helps to reduce anxiety. Allows the patient to give verbal / non-verbal consent to the procedure
Wash & dry hands, wear apron, gloves and eye protection if performing open suction.	To minimise risk of cross infection to patient or health care professional
Check correct functioning of suction unit. Lift up the thumb valve cap to unlock it, then depress and hold the valve and simultaneously adjust the suction pressure. Ensure pressures between 15-20kPa (100-150mmHg)	Correct pressure minimises mucosal damage in trachea and atelectasis.
Preoxygenate the patient via the ventilator, or wall mounted oxygen, for at least 30 seconds. Check O2 saturations prior to beginning suctioning. Caution in patients requiring controlled oxygen therapy e.g.: patients with COPD, seek medical advice	To optimise the patient's oxygenation and minimise hypoxaemia & cardiac dysrhythmias. (NHS Quality Improvement Scotland 2007)
Insert the catheter gently on inspiration, do not apply suction during inspiration. Continue to pass the catheter until the patient coughs, or when the correct depth is reached. If resistance is felt, withdraw catheter 1-2cm before suctioning, to ensure tip is not touching the carina.	Suctioning while introducing the catheter causes mucosal irritation, damage and hypoxia (NTSP, 2013). Minimises mucosal damage to carina.
Apply suction continuously during catheter removal, withdraw catheter fully until the black marking on the catheter is visible.	Intermittent suctioning is less effective
The period of suction should not exceed 10 seconds	To minimise risk of hypoxaemia (NTSP, 2013)

Monitor the patient's condition throughout and following the treatment, to detect complications promptly.	Tracheal suction can cause vagal stimulation, leading to bradycardia, hypoxia or bronchospasm.
Repeat procedure as indicated but allow the patient time to recover between suction. It is recommended that no more than 3 episodes of suctioning are carried out in succession. Use saline vials provided to clean catheter tip after each pass of the catheter and remove vial immediately, do not leave attached.	To decrease risk of hypoxia, limit side effects and avoid patient tiring. Cleaning should take place after every suction pass to prevent contamination and catheter occlusion
When suctioning has finished, rotate thumb control to locked position.	For safe practice.
If oxygen was increased prior to the procedure, return to previous setting.	
Discard of any disposable items in clinical waste. Wash hands & document appearance of secretions	Minimise cross infection
Disposable suction unit liners and suction tubing are changed when the canister is $\frac{3}{4}$ full. Change the water bottle every 24 hours and mark with date.	To reduce the risk of bacterial growth in the water and tubing

Suction Procedure ~ Open Suction Technique	
Recommendation (Action)	Justification (Rationale)
Explain the procedure carefully to the patient and where possible seek their consent	Provides reassurance & helps to reduce anxiety. Allows the patient to give verbal / non-verbal consent to the procedure
Wash & dry hands, wear apron, gloves and eye protection if performing open suction.	To minimise risk of cross infection to patient or health care professional
Check correct functioning of suction unit. Ensure pressures between 15-20kPa (100-150mmHg)	Correct pressure minimises mucosal damage in trachea and atelectasis.
Preoxygenate the patient via the ventilator, or wall mounted oxygen, for at least 30 seconds. Check O2 saturations prior to beginning suctioning. Caution in patients requiring controlled oxygen therapy e.g.: patients with COPD, seek medical advice	To optimise the patient's oxygenation and minimise hypoxaemia & cardiac dysrhythmias. (NHS Quality Improvement Scotland 2007)
Open catheter packaging at the top, attach suction tubing to top of catheter but leave in the packet and tuck under arm. Put on another clean glove over the glove of your dominant hand and prepare to withdraw the catheter from the packaging. Remove the catheter from the packet carefully, do not touch the lower third of the catheter.	To ensure lower third of catheter remains clean.

<p>Insert the catheter gently into the airway on inspiration, do not apply suction during inspiration.</p> <p>Continue to pass the catheter until the patient coughs, or when the correct depth is reached. If resistance is felt, withdraw catheter 1-2cm before suctioning, to ensure tip is not touching the carina.</p>	<p>Suctioning while introducing the catheter causes mucosal irritation, damage and hypoxia (NTSP, 2013).</p> <p>Minimises mucosal damage to carina.</p>
<p>Apply suction continuously during catheter removal, withdraw catheter fully until the black marking on the catheter is visible.</p>	<p>Intermittent suctioning is less effective</p>
<p>The period of suction should not exceed 10 seconds</p>	<p>To minimise risk of hypoxaemia (NTSP, 2013)</p>
<p>Monitor the patient's condition throughout and following the treatment, to detect complications promptly.</p>	<p>Tracheal suction can cause vagal stimulation, leading to bradycardia, hypoxia or bronchospasm.</p>
<p>Release thumb from suction, wrap dirty catheter around gloved hand, and pull glove off over the dirty catheter. Discard in clinical waste. Do not reuse or reinsert a catheter into the trachea or mouth, it can only be used once.</p>	<p>Catheters are single use only</p>
<p>Using a clean glove and new sterile catheter, repeat the procedure until secretions are cleared and the patient is breathing comfortably.</p> <p>Allow the patient sufficient time to recover between suction. It is recommended that no more than 3 episodes of suctioning are carried out in succession</p>	<p>To reduce the risk of infection, ensuring that secretions are removed and patient is comfortable.</p> <p>To reduce the risk of hypoxia, arrhythmias and reduce the patient's distress</p>

Monitor the patient's condition throughout and following the treatment to detect complications promptly. Document the appearance of secretions.	
If oxygen was increased prior to the procedure, return to previous setting.	
Discard of any disposable items in clinical waste. Wash hands & document appearance of secretions	Minimise cross infection
Disposable suction unit liners and suction tubing are changed when the canister is $\frac{3}{4}$ full. Change the water bottle every 24 hours and mark with date.	To reduce the risk of bacterial growth in the water and tubing

3. REFERENCES

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National Tracheostomy Safety Project (NTSP) <http://www.tracheostomy.org.uk/>

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4. ONLINE RESOURES

<https://avanos.showpad.com/share/ZkBu3G4ozk0oHm450TqUB>

National Tracheostomy Safety Project (NTSP) <http://www.tracheostomy.org.uk/>

The use of this guideline is subject to professional judgement and accountability. This guideline has been prepared carefully and in good faith for use within the Departments of Critical Care at Royal Sussex County Hospital and Princess Royal Hospital. The decision to implement this guideline is at the discretion of the on-call critical care consultant in conjunction with appropriate critical care medical / nursing staff.