

## GUIDELINE ON SUCTIONING VIA AN ENDOTRACHEAL TUBE


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## 1.0 Introduction

Effective suctioning is an essential aspect of airway management in the intubated critically ill child. They are unable to maintain a patent airway as glottic closure is compromised, preventing cough reflex, increasing secretions and also compromising their ability to clear endotracheal secretions (Morrow and Argent 2008, Royal Children's Hospital 2012). There are many associated risks and complications. The recommendations prior to suctioning include comprehensive patient assessment and patient preparation. The recommendations during suctioning include appropriate catheter selection, depth of insertion, suction pressure, duration of procedure and number of suction passes. Prevention of infection and maintenance of asepsis, i.e. hand – washing, wearing gloves, aprons and goggles are also essential. **Suctioning is an invasive procedure and should only be carried out if indicated and not on a routine basis** (Cordero *et al.* 2001, Morrow and Argent 2008).


## 2.0 Definition of Suctioning

Suctioning is described as the mechanical aspiration of pulmonary secretions from a patient with an artificial airway in position (American Association of Respiratory Care 2010).

## 3.0 Indications for Suctioning

The decision to suction should be based on individual patient assessment and the following clinical signs that may indicate the need for suctioning. Suctioning should be done as rarely as possible and as frequently as needed (Corderro *et al.* 2001).

- Visible or audible secretions – rattling or bubbling sounds, audible with or without a stethoscope
- Decreased oxygen saturation levels
- Bradycardia / tachycardia
- Increased pCO<sub>2</sub>
- Deteriorating blood gas values
- Changes in respiratory rate and pattern with increase respiratory distress
- Change of colour (cyanosis, pallor, mottled)
- Suspected endotracheal tube obstruction
- Ventilator alarms i.e. Increased proximal airway pressure / decreased tidal volume
- Decreased breath sounds / absent chest movement
- Increased airway pressure when ventilated (decreased tidal volumes)
- Decreased chest excursion / asymmetry
- Patient agitation
- (Moore 2003, Gardner and Shirland 2009, Royal Children's Hospital 2012, Davies *et al.* 2015).

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#### 4.0 Essential Equipment

- Oxygen source / oxygen mixer for preterm / neonates
- Monitoring equipment – oxygen saturation, heart rate and blood pressure
- Suction apparatus
- Appropriately sized suction catheters
- Selection of clean disposable gloves
- Disposable plastic apron
- Goggles
- Alcohol hand rub
- Sterile Water for Irrigation (OLHSC 2008, Dougherty and Lister 2015).

#### 5.0 Precautions with Endotracheal Suctioning

- Raised ICP
- Pulmonary Hypertension
- Pulmonary Oedema
- Pulmonary Haemorrhage

NB: These conditions may be exacerbated by suctioning and extra precautions taken (Morrow and Argent 2008).


#### 6.0 Potential Complications of Suctioning

##### **Respiratory**

- Hypoxia
- Bronchospasm
- Tracheobronchial mucosal trauma resulting in potential pulmonary haemorrhage
- Contamination of airway leading to nosocomial infection
- Unplanned Extubation
- Atelectasis (loss of ciliary function / glottis closure)
- Right upper lobe collapse (excessive suction pressures) (Boothroyd *et al.* 1996)
- Pneumothorax (Morrow and Argent 2008)

##### **Cardiovascular**

- Vagal response bradycardia
- Haemodynamic instability
- Pulmonary vasoconstriction

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### **Neurological**

- Changes in cerebral blood flow velocity / Raised intracranial pressure
- Decreased oxygen availability in cerebral blood flow increases risk of IVH and Hypoxic-ischemic encephalopathy

### **Infection**

- Nosocomial infections

### **Pain**

- Behavioural pain response in infants (Morrow and Argent 2008, Royal Children's Hospital 2012, GOSH 2014).

ACTION	RATIONALE EVIDENCE and REFERENCE
<p><b>Pre Procedure</b></p> <p>Comprehensive respiratory assessment.</p> <p>Explain procedure to patient / parents.</p> <p>Preparation of patient - physical, psychological and pharmacological i.e. sedation.</p> <p>Ensure all necessary equipment is available - see list above.</p> <p>Ensure the correct suction pressure is set</p> <p>Neonate 50 – 80mmHg</p> <p>Paediatric 80 – 100mmHg</p> <p>Older Child 100 – 120mmHg</p> <p>Calculate appropriate sized suction catheter, double the size of the endotracheal tube</p>	<p>To assess the need for suctioning (Day <i>et al.</i> 2002).</p> <p>To minimise anxiety and stress (Dougherty and Lister 2015).</p> <p>To reduce risk of complications (Dougherty and Lister 2015).</p> <p>To ensure effectiveness of procedure and minimise risk of complications (Dougherty and Lister 2015, Lippincott Williams and Wilkins 2011).</p> <p>.</p> <p>High negative suction pressures and deep suctioning may cause right upper lobe collapse in children. Also high pressures may damage respiratory mucosa and cause destruction of epithelial cilia of the airways (Boothroyd <i>et al.</i> 1996, Gardner and Shirland 2009, Hazinski 2013).</p> <p>To ensure effectiveness of procedure and minimise risk of complications. To guarantee maximum of 50%</p>

ETT Size (mm)	Suction Catheter Size
2.5	5 fg
3.0	6 fg
3.5	7 fg
4.0-4.5	8 fg

Decontaminate hands prior to procedure.

Put on apron and goggles.

Oxygen saturations, chest expansion and underlying disease should be used to determine the need for preoxygenation and / or hyperinflation.

Standard suction support hyperoxygenation is 30% above patients' baseline oxygen requirements using Servo I ventilation.

**NB: Preterm infants ensure maximum of 10-20% pre-oxygenation.**

**Also reduce hyperoxygenation in the cardiac patient with unbalanced circulation i.e. hypoplastic left heart syndrome (HLHS).**

Hyperventilate (up to five breaths) using rebreathing circuit as clinical indicated.

**NB: This is NOT a routine practice.**

of internal diameter which creates less negative pressure and prevents hypoxia and right upper lobe collapse / atelectasis. It also limits the risk of mucosal trauma. Too big a suction catheter has been demonstrated to reduce the tidal volume to < 10%. (Morrow *et al.* 2004, Pederson *et al.* 2008, Kiraly *et al.* 2009, AARC 2010).


Maintenance of asepsis and prevention of cross infection. Protection of practitioner (OLHSC 2007, OLCHC 2010, 2011).

(Gardner and Shirland 2009).

Suction support does not provide hyperinflation (Maquet 2008).


To prevent hyperoxemia and oxygen free-radical damage which may increase the risk of retinopathy of prematurity (ROP), periventricular leukomalacia (PVL) and chronic lung disease (Gardner and Shirland 2009). To prevent systemic steal or over perfusion of circulation to the lungs in infants with HLHS.

To prevent hypoxaemia. It also increases the residual capacity of the lungs and reduces the risk of atelectasis and shunting (Celik and Elbas 2000, AARC 2010).

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<p>Apply non-sterile glove to the dominate hand.</p> <p>Determine insertion approximately 0.5 -1cm beyond the length of the endotracheal tube (<b>Shallow Suctioning</b>).</p> <p>Check against a predetermined length i.e. paper tape measure posted at bedside.</p> <p>Remove the catheter from its sheath using dominate hand.</p>	<p>To maintain non-touch technique ANTT level 3 (<i>OLHSC 2007, OLC HC 2011</i>).</p> <p>Shallow suction is recommended in the literature. Superior benefit of deep suctioning over shallow suctioning has not been demonstrated and more adverse events may be associated with it. Deep suctioning stimulates vagal nerve predisposing infant to bradycardia and hypotension. It prolongs coughing, increasing intrathoracic pressure and decreasing venous return. Also increased risk of mucosal and cilia trauma, inflammation and infection. Desaturation may also occur (<i>Gardner and Shirland 2009, AARC 2010, Gillies and Spence 2013</i>).</p>
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ACTION	RATIONALE EVIDENCE and REFERENCE
<p><b>Suctioning Procedure</b></p> <p><b>Two practitioner technique is recommended on infant / child who is acutely ill / unstable and high risk of not tolerating the procedure, without profound decrease in heart rate, blood pressure and oxygen saturation.</b></p> <p><b>Monitoring</b> Monitor vital signs i.e. heart rate and oxygen saturations.</p> <p>Disconnect patient from ventilator and introduce suction catheter gently to required depth.</p> <p>Withdraw the suction catheter gently applying continuous suction pressure by placing the thumb over the suction control port, maximum 5-10 seconds.</p> <p>Observe the secretions for colour, consistency and amount.</p> <p><b>NB: Do NOT rotate the suction catheter.</b></p>	<p>(<i>Frasier 2013</i>).</p> <p>To have a baseline set of observations and allow monitoring throughout the procedure.</p> <p>To prevent mucosal damage (<i>Day et al. 2002</i>).</p> <p>To ensure patency of endotracheal tube and prevent hypoxia (<i>Moore 2003, GOSH 2014</i>). Take into consideration the patient's own respiratory / ventilation rate and clinical state (<i>Trevisanuto et al. 2009</i>)</p>

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Recovery period should be given when more than one catheter pass is needed and no more than three passes during any one suctioning session.

Suction catheter passes should be kept to a minimum and should not exceed 3 passes.

A new sterile catheter is used for each suctioning session unless contaminated.

**Oro-pharyngeal / Nasopharyngeal Suctioning**

Oropharyngeal suctioning should be carried out first.

Attach manual rebreathing circuit to patient and provide manual ventilation following suctioning as clinically indicated, observing airway pressures on manometer dial for infants.

Reconnect patient to ventilator

**NB: Routine Instillation of Normal Saline 0.9% prior to suctioning is NOT recommended.**

Suction catheters have multiple - eyes (holes) in their diameters and therefore the rotating method is not necessary (*Moore 2003*).

To allow oxygen levels to return to baseline and minimise mucosal damage (*Gardner and Shirland 2009*).

(*Skoble et al. 2001, Gardner and Shirland 2009*).

The literature lacks consensus on the number of passes a single catheter can be used for, ranging from a single pass to multiple passes. Research studies have shown no increase in nosocomial infection after using a single catheter for up to 24 hours (*Skoble et al. 2001, Pederson 2009*).

A new suction catheter must be used for oral nasal and endotracheal insertion (*Gardner and Shirland 2009*).

To reduce the amount of negative pressure in the lung and to reduce the level of hypoxia .


Re-oxygenating to reverse hypoxia or hypercarbia that may have developed. To reduce the risk of barotrauma (*Hazinski 2013*).

**The literature does not support this practice.**


Detrimental effects demonstrated in adults and of no theoretical benefit in Paediatrics (*Morrow and Argent 2008, Rauen et al. 2008, Gardner and Skirland 2009*).

Sputum and saline do not mix



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	<p>No increase in amount of secretion obtained when saline instilled</p> <p>It adversely effects tissue and arterial oxygenation</p> <p>Infants / children have experienced significantly greater desaturation following Normal Saline 0.9% instillation and may last up to 2 minutes (Riding, Martin and Bratton 2003, Barocco <i>et al.</i> 2009, Frasier 2013).</p> <p>It dislodges bacterial colonies contributing to lower airway contamination (Halm and Krisko-Hagel 2008).</p> <p>Increased incidence of bradycardia and need for increased FI.02 (Barocco <i>et al.</i> 2009, Trevisanuto <i>et al.</i> 2009).</p>
<p><b>Post Procedure</b></p> <p>Monitor the infant / child's oxygen saturation levels and heart rate for any decrease indicating hypoxaemia throughout the procedure.</p> <p>Wean oxygen if increased, to baseline.</p> <p>Dispose of the suction catheter in the clinical waste bin and rinse tubing by dipping it in a small container of sterile water, dispose gloves in the clinical waste bin adhering to universal health and safety precautions.</p> <p><i>NB: Discard container with sterile water after each suctioning episode.</i></p> <p>Evaluate effectiveness by conducting a comprehensive post suctioning respiratory assessment, including breath sounds.</p> <p>Wash hands after procedure.</p> <p>Document procedure and findings - colour, consistency and amount of secretions.</p>	<p>Early and timely intervention for instability (Day <i>et al</i> 2002). To reduce risk of complications (OLHSC 2008; Dougherty and Lister 2015, OLCHC 2011).</p> <p>(Gardner and Shirland 2009).</p> <p>To prevent cross infection (OLHSC 2007, OLCHC 2010).</p> <p>To ensure effectiveness of the procedure (Gardner and Shirland 2009).</p> <p>Maintenance of asepsis (OLCHC 2010).</p> <p>Document effectiveness of procedure. Continuation of nursing care and maintains accountability through</p>

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Allow patient 20-30mins before taking a blood gas.	<p>accurate recording of nursing intervention (<i>An Bord Altranais 2002</i>).</p> <p>To ensure an accurate sample.</p>
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