GUIDELINE FOR SUCTIONING	
Version Number	V1
Date of Issue	September 2017
Reference Number	*GS-09-2017-LODET-V1*
Review Interval	*3 yearly*
Approved By *Name: Fionnuala O'Neill* *Title: Nurse Practice Coordinator*	*Signature:* *Date: September 2017* Fionnuala O'Neill
Authorised By *Name: Rachel Kenna* *Title: Director of Nursing*	*Signature:* *Date: September 2017* Rachel Kenna
Author/s	*Name: Linda O'Donnell* *Title: Clinical Nurse Facilitator, PICUs* *Name: Eileen Tiernan* *Title: Clinical Coordinator Graduate Diploma Critical Care Nursing (Children), PICUs*
Location of Copies	*On Hospital Intranet and locally in department*

Document Review History		
Review Date	***Reviewed By***	***Signature***
2020		

Document Change History	
Change to Document	***Reason for Change***

CONTENTS

		Page No
1.0	Introduction	3
2.0	Definition of Suctioning	3
3.0	Indications for Suctioning	3
4.0	Essential Equipment	4
5.0	Potential Complications	4
6.0	Procedure	5
7.0	References	9

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 pCO2
- 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).

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).

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).

5.0 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

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).

6.0 Procedure

ACTION	RATIONALE EVIDENCE and REFERENCE
Pre Procedure Comprehensive respiratory assessment.	To assess the need for suctioning (Day *et al. 2002).*
Explain procedure to patient / parents.	To minimise anxiety and stress (Dougherty and Lister 2011).
Preparation of patient - physical, psychological and pharmacological i.e. sedation.	To reduce risk of complications (Dougherty and Lister 2011).
Ensure all necessary equipment is available - see list above.	To ensure effectiveness of procedure and minimise risk of complications (Dougherty and Lister 2015, Lippincott Williams and Wilkins 2011).
Ensure the correct suction pressure is set: • Neonate 50 – 80mmHg • Paediatric 80 – 100mmHg • Older Child 100 – 120mmHg	High negative suction pressures and deep suctioning may cause right upper lobe collapse in children. Also high pressures may damage respiratory mucosa and cause distruction of epithelial cilia of the airways (Boothroyd et al. 1996, Gardner and Shirland 2009, Hazinski 2013).
Calculate appropriate sized suction catheter, double the size of the endotracheal tube **ETT Size (mm) / Suction Catheter Size** 2.5 / 5 fg 3.0 / 6 fg 3.5 / 7 fg 4.0 - 4.5 / 8 fg	To ensure effectiveness of procedure and minimise risk of complications. To guarantee maximum of 50% 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).
Decontaminate hands prior to procedure. Put on apron and goggles.	Maintenance of asepsis and prevention of cross infection. Protection of practitioner (OLHSC 2007, OLCHC 2010, 2011).
Oxygen saturations, chest expansion and underlying disease should be used to determine the need for preoxygenation and / or hyperinflation.	(Gardner and Shirland 2009).
Standard suction support hyperoxygenation is 30% above patients' baseline oxygen requirements using Servo I ventilation.	Suction support does not provide hyperinflation (Maquet 2008).
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).***	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.
Hyperventilate (up to five breaths) using rebreathing circuit as clinical indicated. ***NB: This is NOT a routine practice***.	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).
Apply non-sterile glove to the dominate hand.	To maintain non-touch technique ANTT level 3 (OLHSC 2007, OLCHC 2011).
Determine insertion approximately 0.5 -1cm beyond the length of the endotracheal tube (***Shallow Suctioning***). Check against a predetermined length i.e. paper tape measure posted at bedside.	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 (Gardner and Shirland 2009, AARC 2010, Gillies and Spence 2013).
Remove the catheter from its sheath using dominate hand.	

ACTION	RATIONALE EVIDENCE and REFERENCE
Suctioning Procedure ***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.***	(Frasier 2013).
Monitoring Monitor vital signs i.e. heart rate and oxygen saturations.	To have a baseline set of observations and allow monitoring throughout the procedure.
Disconnect patient from ventilator and introduce suction catheter gently to required depth.	To prevent mucosal damage (Day *et al.* 2002).
Withdraw the suction catheter gently applying continuous suction pressure by placing the thumb over the suction control port, maximum 5-10 seconds. Observe the secretions for colour, consistency and amount.	To ensure patency of endotracheal tube and prevent hypoxia (Moore 2003, GOSH 2014). Take into consideration the patient's own respiratory /ventilation rate and clinical state (Trevisanuto *et al.* 2009).
NB: Do NOT rotate the suction catheter.	Suction catheters have multiple - eyes (holes) in their diameters and therefore the rotating method is not necessary (Moore 2003).
Recovery period should be given when more than one catheter pass is needed and no more than three passes during any one suctioning session.	To allow oxygen levels to return to baseline and minimise mucosal damage (Gardner and Shirland 2009).
Suction catheter passes should be kept to a minimum and should not exceed 3 passes.	(Skoble *et al.* 2001, Gardner and Shirland 2009).
A new sterile catheter is used for each suctioning session unless contaminated.	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).
Oro-pharyngeal / Nasopharyngeal Suctioning Oropharyngeal suctioning should be carried out first.	A new suction catheter must be used for oral nasal and endotracheal insertion (Gardner and Shirland 2009).

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	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).
NB: Routine Instillation of Normal Saline 0.9% prior to suctioning is NOT recommended.	***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 • No increase in amount of secretion obtained when saline instilled • It adversely effects tissue and arterial oxygenation • 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 *et al.* 2009, Frasier 2013). • It dislodges bacterial colonies contributing to lower airway contamination (Halm and Krisko-Hagel 2008). • Increased incidence of bradycardia and need for increased FI.02 *(Barocco et al. 2009, Trevisanuto et al. 2009).*
Post Procedure Monitor the infant / child's oxygen saturation levels and heart rate for any decrease indicating hypoxaemia throughout the procedure. Wean oxygen if increased, to baseline. 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. *NB: Discard container with sterile water after each suctioning episode.* Evaluate effectiveness by conducting a comprehensive post suctioning respiratory assessment, including breath sounds.	Early and timely intervention for instability (Day *et al* 2002). To reduce risk of complications (OLHSC 2008, Dougherty and Lister 2011, OLCHC 2011). (Gardner and Shirland 2009). To prevent cross infection (OLHSC 2007, OLCHC 2010). To ensure effectiveness of the procedure (Gardner and Shirland 2009).

Wash hands after procedure.	Maintenance of asepsis (OLCHC 2010).
Document procedure and findings – colour, consistency and amount of secretions.	Document effectiveness of procedure. Continuation of nursing care and maintains accountability through accurate recording of nursing intervention (An Bord Altranais 2002).
Allow patient 20 – 30mins before taking a blood gas.	To ensure an accurate sample.

7.0 References

American Association of Respiratory Care (ARCC) (2010) Endotracheal suctioning of mechanical ventilated patients with artificial airways 2010. *Respiratory Care*, **55**(6): 758-764.

An Bord Altranais (2002) Recording *Clinical Practice Guidance to Nurses and Midwives*. An Bord Altranais: Dublin.

Barocco, V. Ometto, M.Simioni, P. Doglioni, N. and Trevisanuto, D. (2009) *Endotracheal Suctioning with or without Instillation of Isotonic Sodium Chloride Solution in Extremely Low Birth Weight Infants.* Proceedings of the European Society of Paediatric and Neonatal intensive Care, 20th Annual Congress, June 14th – 17th June, Verona, Italy.

Boothroyd, A.E. Murthy, B.V.S. Derbyshire, A. and Petros, A.J. (1996) Endotracheal suctioning causes right upper lobe collapse in intubated children. *Acta Paediatrica*, **85**(12): 1422-1425.

Celik, S.S. and Elbas, N.O. (2000) The Standards of suction for patients undergoing endotracheal intubation. *Intensive and Critical Care Nursing* **16**: 191-198.

Cordero, L. Sananes, M. and Ayers, L.W. (2001) A comparison of two airway suctioning frequencies in mechanically ventilated, very low-birthweight infants. *Respiratory Care*, **46**(8): 783-788.

Davies, K. Monterosso, L. Bulsara, M. and Ramelet, A.S. (2015) Clinical indicators for the initiation of endotracheal suction in children: An integrative review. *Australian Critical Care*, **28**: 11-18.

Day, T. Farnell, S. and Wilson-Barnett, J. (2002) Suctioning: a review of current research recommendations. *Intensive and Critical Care Nursing* **18**: 79 – 89.

Dougherty, L. and Lister, S. (eds) (2015) *The Royal Marsden Hospital Manual of Clinical Procedures*. 9th Edition. John-Wiley: Chichester.

Frasier, D. (2013) Health problems in newborns. In: Hockenberry, M.J. and Wilson, D. (eds) *Wong's Essentials of Pediatric Nursing*, 9th Edition. Elevier Mosby: St Louis, 228-307.

Gardner, D.L. and Shirland, L. (2009) Evidence-Based Guideline for Suctioning the Intubated Neonate and Infant. *Neonatal Network,* **28**(5): 281-302.

Gillies, D. and Spence, D. (2013) Deep *Versus Shallow Suction of Endotracheal Tubes in Ventilated Neonates and Young Infants.* Cochrane Database of systematic Reviews. Available online: http://www.cochranelibrary.com/ (Accessed October 27th 2015).

GOSH (2014) Suction. Great Ormond Street Children's Hospital: London. Available online: http://www.gosh.nhs.uk/health-professionals/clinical-guidelines/suction (Accessed October 21st 2015).

Halm, M.A. and Krisko-Hagel, K. (2008) Instilling normal saline with suctioning: beneficial technique or potentially harmful sacred cow? *American Journal of Critical Care* **17**: 469-472.

Hazinski, M. (2013) Nursing Care of the Critically Ill Child, 3rd Edition. Elsevier Mosby: St. Louis.

Kiraly, N.J. Tingay, D.G. Mills, J.F. Morley, C.J. Dargaville, A. and Copnell, B. (2009) The effects of closed endotracheal suction on ventilation during conventional and high frequency oscillatory ventilation. *Paediatric Research,* **66**(4): 400-404.

Lippincot, Williams and Wilkinson (2011) *Show me the Evidence*. Available online: http://www.nursingcenter.com/evidencebasedpracticenetwork/home/tools-resources/collections/understandingevidencebasedpractice.aspx (Accessed February 28th 2013).

Maquet (2008) *Ventilation Servo-I Ventilator System V4.0*: User's Manual. Maquet Critical Care: Sweden

Moore T. (2003) Suctioning techniques for the removal of respiratory secretions. *Nursing Standard* **18**(9): 47-55.

Morrow, B.M. Futter, M.J. and Argent, A.C. (2004) Endotracheal suctioning: from principles to practice. *Intensive Care Medicine* **30**:1167-74.

Morrow, B.M. and Argent. A.C. (2008) A comprehensive review of pediatric endotracheal suctioning: Effects, indications and clinical practice. *Pediatric Critical Care Medicine*, **9**(5): 465-477.

OLCHC (2010) Guidelines *on Hand Hygiene*. Our Lady's Children's Hospital Crumlin: Dublin.

OLCHC (2011) Standard *Universal Precautions*. Our Lady's Children's Hospital Crumlin: Dublin.

OLHSC (2007) Aseptic *Non-Touch Technique*. Our Lady's Hospital for Sick Children: Dublin.

OLHSC (2008) Infection *Control / Waste Policy*. Our Lady's Hospital for Sick Children's: Dublin.

Pederson, C.M. Rosendahl-Neilson, N. Hjermind, J. and Egerod, I. (2008) Endotracheal suctioning of the adult intubated patient. What is the evidence? *Intensive and Critical Care Nursing,* **25**: 21-30.

Rauen, C.A. Chulay, M. Bridges, E. Vollman, K. M. and Arbour, R. (2008) *Critical Care Nurse,* **28**: 98-123.

Riding, D.A. Martin, L.D. and Bratton, S.L. (2003) Endotracheal suctioning with or without instillation of isotonic sodium chloride in critically ill children. *American Journal of Critical Care*, **12**(3): 212-219.

Royal Children's Hospital (2012) Endotracheal *Suctioning of Ventilated Neonates.* RCH: Melbourne. Available online: http://www.rch.org.au/rchcpg/hospital_clinical_guideline_index/Endotracheal_Tube_Suction_of_Ventilated_Neonates/ (Accessed October 21st 2015).

Skoble, M.K. Copnell, B. Taylor, A. Kinney, S. and Shann, F. (2001) Effects of reusing suction catheters on the occurrence of pneumonia in children. *Heart and Lung,* **30**: 225-233.

Trevisanuto,D. Doglioni, N. and Zanardo, V. (2009) The management of endotracheal tubes and nasal canulae: The role of nurses. *Early Human Development*, **85**(10): S85-S87.