Australian Critical Care 28 (2015) 11–18

Contents lists available at ScienceDirect

Australian Critical Care

journal homepage: www.elsevier.com/locate/aucc

Clinical indicators for the initiation of endotracheal suction in children: An integrative review

K. Davies RN, PG Cert (PIC), PG Dip (PIC), MNurs (Research), PhD Candidate [a,*],
L. Monterosso PhD, BNurs(Hons) [b],
M. Bulsara PhD, MSc, BSc(Hons) [c],
A.S. Ramelet RN, ICU Cert, PhD [d]

[a] Paediatric Intensive Care Unit, Princess Margaret Hospital for Children, Perth, Australia
[b] School of Nursing and Midwifery, The University of Notre Dame Australia, Edith Cowan University, Australia
[c] Institute of Health and Rehabilitation Research, The University of Notre Dame Australia, Australia
[d] Institute of Higher Education and Nursing Research, Faculty of Biology and Medicine, University of Lausanne, Switzerland

ARTICLE INFORMATION

Article history:
Received 9 December 2013
Received in revised form 5 March 2014
Accepted 18 March 2014

Keywords:
Paediatric
Intensive care
Endotracheal suction
Clinical criteria
Indicators
Adverse effects
Nursing practice

ABSTRACT

Background: Critical decisions and interpretation of observations by the nurse caring for the paediatric intensive care (PIC) patient can have dramatic and potential adverse impact on the clinical stability of the patient. A common PIC procedure is endotracheal tube (ETT) suction, however there is inconsistent evidence regarding the clinical indicators to guide and support nursing action. Justification for performing this procedure is not clearly defined within the literature. Further, a review of the literature has failed to establish clear standards for determining if the procedure is warranted, especially for paediatric patients.
Objective: The objective of the review is to identify current clinical indicators used in practice to determine why ETT suction should be performed.
Method: An integrative review using a systematic approach to summarise the empirical and theoretical evidence within the literature as it relates to clinical practice was used.
Results: Consensus of opinion indicates that ETT suctioning should only be performed when clinically indicated. There is no general consensus regarding which clinical indicators should be measured and used to guide the decision to perform ETT suctioning.
Conclusion: Research is required to identify the clinical indicators that could be used to design a valid and clinically appropriate tool to use to assist in the decision making process to perform ETT suction.

1. Introduction

In recent years the role of the paediatric critical care nurse has evolved in response to advances in technology, quality control, accountability, documentation and evidence-based practice.[1–6] Complexities in critical care arise from differing disease processes and fundamental differences in the physiological and co-morbidities between neonatal, paediatric and adult critical care patients.[7–13] In particular, compared with adults, neonatal and paediatric patients have immature respiratory and cardiovascular systems affecting compensatory mechanisms. The neonatal and paediatric airway is still developing until around eight years of age. Further, high chest wall compliance impedes counter traction recoil of the lungs producing lower lung volumes at end expiration and decreased respiratory reserve; combined with increased metabolic and oxygen requirements these patients are also prone to muscle fatigue resulting in respiratory failure.[7,8,10]

The care of the critically ill child therefore is complex, multidimensional and must be coordinated by a multidisciplinary team.[7,8] As with neonatal and adult critical care, there is an expectation from the health profession and family, that paediatric critical care nurses demonstrate highly developed clinical and communication skills, accountability, the ability to practice independently and deliver care that meets established standards of quality care.[3,14] The need to provide education and support to nurses in critical care areas to ensure safe care is delivered according to best practice norms

* Corresponding author at: Paediatric Intensive Care Unit, Princess Margaret Hospital for Children, Roberts Road, Subiaco, WA 6008, Australia. Tel.: +61 892039444.
E-mail addresses: Kylie.Davies@health.wa.gov.au, kdavies@davpub.com.au (K. Davies).

http://dx.doi.org/10.1016/j.aucc.2014.03.001

is now more important than ever. Further, the importance of clear and accurate documentation to fulfil legal, professional and social requirements cannot be underestimated.

The focus of this review is to identify current clinical indicators used in practice to determine why ETT suction should be performed in the paediatric intensive care unit (PICU). Airway management is a core component of multidisciplinary care within the PICU, and a critical component and responsibility of PIC nursing care. Mechanical ventilation for PICU patients can range from 17% to 65% of admissions, depending on the type of critical care service provided and the diagnostic group admitted within the specific unit.[15–18] The decision to perform endotracheal tube (ETT) suction in a critically ill child can have major implications and should only be performed after due consideration and mitigation of any known potential side effects if possible. There are a number of significant clinical side effects associated with ETT suction that can seriously affect the clinical stability of the critically ill ventilated patient that are well documented[7,8,19–21] (Table 1). The most significant complications relate to the respiratory stability of the patient and include changes in lung volume, lung compliance and oxygen and carbon dioxide gas exchange. These alterations in lung dynamics can cause hypoxaemia, which in turn can adversely affect the cardiac output of the patient, altering blood flow and oxygen delivery at a cellular level; hence ETT suction can adversely affect the clinical stability of the patient. More serious but less common complications associated with ETT suction include cardiac arrest and sudden death.[7,8,22] The range and complexity of situations and potentially hazardous outcomes make it essential that ETT suction be performed only when clinically indicated. These complications are dependent upon the clinical stability and underlying pathophysiology of the disease process for each individual patient. Some common problems associated with the ETT suction procedure may be directly linked to a respiratory disease. For example, a patient diagnosed with pulmonary hypertension is more likely to experience alteration in oxygen saturations following endotracheal suction than a patient suffering from renal dysfunction.[7,8]

Conversely failure to intervene with appropriate ETT suction, or, suction that is ineffectual could lead to accumulated mucus within the ETT, trachea and lower airways affecting tube patency.[23–25] The result could include altered airflow and ventilation which may lead to the following: repeat ETT suction, ETT blockage requiring reintubation with associated risks of atelectasis, hypoxia, trauma or increased risk of ventilator acquired pneumonia.[23,26,27]

2. Problem formulation

Advances in patient care delivery and the increased reliance on technology within the health care setting, particularly in intensive care units, has changed the knowledge base, skills and standards of nursing care required to effectively care for the critically ill patient.[14,28] Critically ill paediatric patients may have complex problems that are often associated with changes in the child's clinical condition such as the deterioration from an initial diagnosis of aspiration pneumonia to multi-organ failure, which can lead to multi-morbidities.[14,28,29] As a specialty area, the PICU is faced with complex care issues requiring both clinical and technical expertise. The accurate assessment of ventilation and oxygenation of the ventilated critically ill patient is fundamental to the care of the patient in the intensive care setting.[7,8] A review of medical and nursing literature about competency in respiratory assessment skills identified a number of inadequacies including poor assessment skills; errors in physical diagnosis and poor quality of nursing judgement in making a respiratory assessment.[30,31] Compounding these issues was inadequate knowledge of protocols and practices that directly impacted on the quality of patient care.[32–38]

In 2006, Bolton and colleagues[1] published a review article from their evaluation of a systematic review and meta-analysis of published articles relating to nursing interventions and patient outcomes in acute care settings. One aspect of the review indicated that quality of nurse staffing is strongly linked to patient care outcomes such as adverse events, though the limitations of available evidence impaired the author's ability to establish a direct association between nursing interventions and patient outcomes. The authors recommended that research undertaken to standardise assessment tools, integral to nursing interventions, would add to the understanding of the effect nursing interventions had on patient outcomes. Furthermore, the expertise of the nursing staff providing care impacts on the quality of care delivered for the patient. Chlan and colleagues[39] suggested that competence and intensive care skills for the ventilated patient require specific education strategies and support. If nurses engage in evidence-based practice projects at the unit level and participate in research, nurses can contribute to improving outcomes for mechanically ventilated patients.

These issues, together with the potential complications associated with ETT suction, add further support to the identification of clinical indicators for ETT. The aim of this integrative review of the published literature relating to ETT suction is to identify current

Table 1
Adverse effects of airway suctioning.

Respiratory effects	Haemodynamic effects
Altered pulmonary compliance[6–8,23,24]	Anxiety[6–8,23,24]
Bleeding[6–8,23,24]	Cardiac arrest[6–8,23,24]
Bronchospasm and bronchial constriction[6–8,23,24]	Cerebral blood flow alterations[6–8,20,23,24]
Contamination of airway, infection and sepsis[6–8,23,24]	Cyanosis[6–8,23,24]
Decrease in arterial oxygenation[6–8,23,24]	Dysrhythmias[6–8,20,23,24]
Hypoxaemia[6–8,20,23,24]	Haemodynamic compromise[6–8,23–25]
Increased airway resistance[6–8,23,24]	Heart rate changes[6–8,23,24]
Laryngospasm[6–8,23,24]	Hypertension[6–8,23,24]
Microatelectasis[6–8,20,23,24]	Hypotension[6–8,23,24]
Mucosal damage[6–8,20,23,24]	Increased intrathoracic pressure[6–8,23,24]
Necrotising tracheobronchitis[6–8,23,24]	Oxygen consumption changes altering haemodynamics[6–8,23,24]
Negative intra-pulmonary pressures[6–8,23,24]	Pallor[6–8,23,24]
Oxygen saturation changes[6–8,20,23,24]	Stressing of patient during procedure[6–8,23,24]
Paroxysmal coughing[6–8,23,24]	Sudden death[6–8,23,24]
Perforation[6–8,23,24]	Vagal stimulation causing hypotension[6–8,23,24]
Pneumothorax[6–8,23,24]	
Pulmonary haemorrhage[26]	
Tissue damage[6–8,23,24]	
Trauma[6–8,20,23,24]	
Tube blockage[6–8,23,24]	