



LITERATURE REVIEW

Prevention strategies for unplanned extubation in NICU – A literature review



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KEYWORDS

Unplanned extubation;
Prevention strategy;
Endotracheal tube
(ETT);
Neonatal intensive
care unit (NICU)

Abstract Unplanned extubation in neonatal intensive care units is one of the common adverse events for the mechanically ventilated infants. This is a significant patient safety issue and the prevention is very important for both infants and organisations. The purpose of this review is to explore and identify the prevention strategies for unplanned extubation in literature. This literature review discussed prevention strategies in terms of endotracheal tube fixation, use of sedation, use of physical restraints, nursing workload, and quality improvement programme/project. There was limited research in neonatal populations. However, future research and some prevention practices would be beneficial for further reduction of the unplanned extubations.

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Introduction

Looking after mechanically ventilated neonates and infants via endotracheal tube (ETT) intubation is one of the common nursing practices in neonatal intensive care units (NICUs). During nursing care

for those infants, unplanned extubation (UE) is one of the recurrent adverse events in the NICUs. UE is a significantly serious issue for patient safety (Barber, 2013) and a potentially life threatening event (da Silva and de Carvalho, 2010).

UE is defined as dislodgement or removal of the ETT from the patient's trachea while receiving invasive mechanical ventilation not specifically planned by a physician but as unplanned or accidentally occurring (Merkel et al., 2014; Roddy et al., 2015). UE puts the neonate/infant at risk of respiratory deterioration, such as hypoxia and hypercarbia, as well as traumatising the pharynx

Abbreviations: ETT, endotracheal tube; NCCD, newborns classified by care demand; NICU, neonatal intensive care unit; PAL, patient acuity level; PICU, paediatric intensive care unit; QIP, quality improvement programme/project; UE, unplanned extubation.

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and larynx in case of emergency re-intubation procedures post extubation (Veldman et al., 2006). UEs lead to a significant increase in hospital costs and length of stay (Roddy et al., 2015). The main risk factors of UEs include loose ETT, age (younger than two to six years old), agitation, and high saliva secretions (Fitzgerald et al., 2015; Razavi et al., 2013). The acceptable UE rate measure in paediatric populations is one event per 100 ventilation days (Roddy et al., 2015). The UE rate in NICUs is 2.2–4.8 events per 100 ventilation days (Barber, 2013). This rate is higher than paediatric and adult populations (0.11–2.7 and 0.1–3.62 UEs/100 ventilation days respectively) (da Silva and de Carvalho, 2010; da Silva et al., 2013). Despite the high UE rates, prevention strategies for the UEs have not been fully explored in adult intensive care settings (Tanios et al., 2010).

The purpose of this review is to explore and identify the UE prevention strategies for neonatal populations from the recent available literature and to draw some recommendations for best future practice. In this review, literature search methods and the results will be presented followed by findings and discussion of recommendations.

Methods

The initial literature search was conducted using CINAHL, ProQuest, Cochrane Library, Ovid, and PubMed databases. The search terms and year used were: unplanned extubat*, accidental extubat*, self extubat*, unintentional extubat*, prevent*, reduc*, newborn, neonat*, infant*, preterm, and risk, from January 2005 to September 2015. Initially, the search population was limited to only neonatal populations, however, there were a few studies and review articles related to the UE prevention. Consequently, the search populations were expanded to paediatric populations. The adult populations were excluded as management, care, and equipment in those populations are often different from neonatal and paediatric populations. In addition, the reference lists of the identified articles were searched to find more related studies or review articles for the topic.

Results

In total, 20 articles were selected for this literature review. These consisted of one literature review, four systematic reviews, and 15 study

articles. Eleven articles were related to neonatal populations and nine articles were from paediatric populations. The summary of those selected articles are shown in Appendix 1. The findings from those selected articles were thematically categorised into the following headings: ETT fixation, sedation, physical restraints, nursing workload, and quality improvement programme/project (QIP).

Findings and discussions

Endotracheal tube (ETT) fixation method

Inadequate ETT fixation should be targeted in prevention strategy because this is the possible main contributor to UE (Veldman et al., 2006). There are various ETT fixation methods described for neonates in literature: different types of tape, umbilical cord clamp, commercially available ETT fixation devices (Logan Bow, NeoBar), and bonnet (Veldman et al., 2006; Lai et al., 2014; Loughhead et al., 2008; Volsko and Chatburn, 1997; Merkel et al., 2014; Brinsmead and Davies, 2010; Grammatikopoulos et al., 2003), and different intubation routes (Carvalho et al., 2010; Spence and Barr, 2009). There were five studies and one systematic review examining some of the ETT fixation methods and UE rates.

A systematic review (Lai et al., 2014) examined ETT securing methods, the effects on the risk of UE, and other complications in neonates from five randomised controlled trials (RCTs). They concluded that there was a lack of evidence due to poor methodological quality, small sample size, and different ETT fixation methods used.

A retrospective review study including 306 infants in a tertiary NICU in the USA (Loughhead et al., 2008) compared two ETT fixation methods: conventional taping and umbilical cord clamp with UE rate for over five-year period. They reported that UE rate was significantly reduced from 4.8 to 0.9 UE events/100 ventilation days.

A prospective study including 244 infants in a level two NICU in the USA (Volsko and Chatburn, 1997) examined the UE rates between use of conventional taping and an ETT fixation device (Logan Bow) in an 18-month period. UE rates in both groups showed no significant difference in the infants who weighed over 1.5 kg. Conversely, in the infants weighing 0.5–1.5 kg, the UE rate in conventional taping group was approximately six times higher than Logan Bow group ($p < 0.0001$).

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