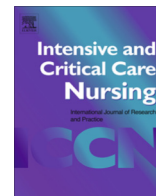




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Review

Factors associated with unplanned extubation in the Intensive Care Unit for adult patients: A systematic review and meta-analysis

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ABSTRACT

Objectives: To explore factors associated with unplanned extubation in Intensive Care Unit for adult patients.

Research methodology: A systematic review and meta-analysis were performed of studies identified through Pubmed, CINAHL, Cochrane Library, PsycINFO and Web of Science published from initiation to September 2017. Only articles in English were included. The Newcastle-Ottawa Scale was used to evaluate the quality of the included articles.

Results: Ten eligible studies were identified, encompassing a total of 2092 patients (457 in the unplanned extubation group; 1635 in the control group). The subsequent meta-analysis identified significant risk factors for unplanned extubation are male [odds ratio (OR) 1.54, 95% CI 1.12–2.12; $P = 0.008$], confusion [OR 0.10, 95% CI 0.05–0.17; $P < 0.00001$], physical restraint [OR 3.10, 95% CI 2.21–4.34; $P < 0.00001$], higher GCS scores [mean difference (MD) 1.06, 95% CI 0.59–1.52; $P < 0.00001$] and lower APACHE II scores [MD -2.26, 95% CI -3.35–-1.16; $P < 0.0001$]. Renal disease is a protective factor for unplanned extubation [OR 0.32, 95% CI 0.15–0.70; $P = 0.004$].

Conclusion: Patients were male, confused, having physical restraint, with higher GCS and lower APACHE II scores are significant risk factors for unplanned extubation in Intensive Care Unit adult patients.

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Implications for Clinical Practice

- Unplanned extubation has a high incidence in the adult intensive care unit that can result in serious outcomes.
- Risk factors for unplanned extubation include male gender, lower APACHE II scores, higher GCS scores, physical restraint and confusion; a protective factor is renal disease.
- Screening patients at risk on basis of these risk factors might reduce the rate.

Introduction

Endotracheal intubation for mechanical ventilation (MV) support is an important intervention for managing patients with respiratory failure in the intensive care unit (ICU) (Chao et al., 2017a,b). Artificial airways are always used to facilitate ventilation and the endotracheal tube is the most common method used (Gardner et al., 2005). However, endotracheal intubation with MV can result in life-threatening complications and unplanned extubation is one of them. Unplanned extubation (UE) is defined as a premature removal of the endotracheal tube by the patient (i.e. deliberate self-extubation) (Chevron et al., 1998) or premature removal during nursing care and manipulation of the patient (i.e. accidental extubation) (Moons et al., 2004).

Unplanned extubation can result in prolonged MV, longer ICU and hospital stay, increased need for chronic care (Epstein et al., 2000) and increased medical costs (Fraser et al., 2001). In addition, 60% of UE patients need reintubation (de Groot et al., 2011) which could represent a threat to survival and increase the risk of ventilator-associated pneumonia (Gao et al., 2016).

Nowadays, UE has been considered to be a marker of quality assurance of mechanical ventilation (Peñuelas et al., 2011). Therefore, to decrease the incidence of UE, there have been many studies exploring risk factors and measures of UE, such as the assessment of the risk of UE (Curry et al., 2008; Aydogan and Kaya, 2017), multidisciplinary interventions and continuous quality improvement (Chao et al., 2017a,b; Chiang et al., 1996) as well as sedation strategy (Girard et al., 2008; Junior and Park, 2014) and method of securing the tube (Clarke et al., 1998).

However, the rate of UE reported by researchers was still very high, varying from 2 to 8.7% in studies over the past ten years (Chang et al., 2008; de Groot et al., 2011). Peñuelas et al. (2011) believed that it is crucial to understand the factors associated with UE to develop interventions to reduce the incidence of UE. UE is affected by many factors and therefore, a systematic review and meta-analysis to summarise these factors would be a useful way to decide what factors affect UE, and to take effective measures aimed at associated factors to reduce UE.

The purpose of our study was to explore the factors associated with UE in ICU for adult patients with the method of systematic review and meta-analysis.

Methods

The PRISMA statement (Moher et al., 2009) consisting of a 27-item checklist was used for reporting the items preferred for the systematic review and meta-analysis.

Search strategy

We searched Pubmed, CINAHL, Cochrane Library, PsycINFO and Web of Science databases for the period spanning from initiation to September 2017. The search was based on the PECO method where the population was represented as ICU adult patients, the exposure as risk factors, and the outcome as UE.

The search strategy included the following key words: “unplanned extubation”, “non-planned extubation”, “spontaneous extubation”, “accidental extubation”, “unintentional extubation”, “unexpected extubation”, “self extubation”, “inadvertent extubation”, “airway accident” and “intensive care”, “critical care”, “ICU”, “critically ill”. In addition, the reference lists contained in the articles retrieved were checked, and review articles were also included in the search to identify other potentially relevant articles. Only English-language articles were included. Reference lists of potentially eligible studies were also manually explored.

Study selection

Two authors (ZA & XG) independently and sequentially reviewed citations, titles, abstracts, and full-text articles to select eligible studies. The titles and abstracts or both, selected by either author were included in the subsequent steps of the selection process. Disagreements were resolved by consensus.

The meta-analysis inclusion and exclusion criteria are displayed in Table 1. Eligible studies were case control and cohort studies that assessed factors associated with UE in adult ICU patients.

Table 1
Meta-analysis inclusion and exclusion criteria.

	Inclusion criteria	Exclusion criteria
Language	English	Non-English
Publication dates	All years	/
Participants	<ul style="list-style-type: none"> –Ages ≥ 18 years old –with oral or nose ETT –with ETT ≥ 24 h –no history of UE –data to determine risk factors of UE had to be available 	<ul style="list-style-type: none"> –Ages < 18 years old –with ETT < 24 h –with tracheotomy –pregnant –were diagnosed with brain death –discharge from hospital directly before extubation –with history of UE
Study design	<ul style="list-style-type: none"> –Case-control study –Cohort study 	<ul style="list-style-type: none"> –Case report –Reviews –Protocol –Commentary –Letters

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