

Research Brief

Risk factors associated with unplanned endotracheal self-extubation of hospitalized intubated patients: a 3-year retrospective case-control study

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Abstract

This 3-year retrospective case-control study aimed to identify risk factors associated with unplanned endotracheal self-extubation (UESE) of hospitalized intubated patients and to compare unplanned and planned extubation groups' characteristics of patients and nurses, vital signs, serum laboratory values, Glasgow Coma Scale scores, Acute Physiology and Chronic Health Evaluation II (APACHE II) scores, and use of physical restraints and sedatives. The study found that most UESEs occurred during evening or night shifts or during shifts staffed by nurses with less experience and less education. Most of the self-extubated patients (80%) were physically restrained. Pulse rate and APACHE II score were both significant predictors of UESE. Efforts to prevent UESEs should include identification of patients at higher risk.

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1. Background

A wide range of factors contributing to unplanned endotracheal self-extubation (UESE) has been identified, including respiratory failure (Chevron et al., 1998), inadequate sedation management (Atkins et al., 1997), and delirium (Hofso & Cover, 2007). The UESE has also occurred more frequently when there was not a nurse at the bedside or when nurse-to-patient ratio was low, especially during the night shift (Curry, Cobb, Kutash, & Diggs, 2008). However, to date, studies of nurse- and patient-related risk factors for UESEs have been conducted only in intensive care units (ICUs), and results have often been inconsistent or contradictory. In addition, only a few studies have used multiple parameters to analyze risk factors for UESE.

Therefore, this study is intended to help fill gaps in the literature by analyzing UESE incidents in a different environment (an acute-care hospital) using multiple parameters. This study aimed to identify risk factors associated with the UESE of intubated patients and to compare the characteristics of patients and nurses, vital signs, duration of intubation, serum laboratory values, Glasgow Coma Scale (GCS) scores, Acute Physiology and Chronic Health Evaluation II (APACHE II) scores, and use of physical restraints and sedatives between UESE and a control group of planned extubations.

2. Review of literature

Endotracheal intubation is a life-saving procedure for patients requiring mechanical ventilation. However, UESE is one of the most frequent incidents reported among mechanically ventilated patients and may result in serious harm and even death during reintubation (Bouza, Garcia, Diaz, & Segovia, 2007). Complications related to UESE vary and include dyspnea, hospital-acquired infections, airway trauma, laryngeal and tracheal edema, difficult

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intubation, lengthened hospitalization, and emergency cricothyrotomy (Curry et al., 2008; Frezza, Carleton, & Valenziano, 2000; Krinsley & Barone, 2005).

The reported incidence rate of UESE ranges from 4.47% (Moons, Boriau, & Ferdinande, 2008) to 22.5% (Yeh, Lee, Ho, Chiang, & Lin, 2004). This wide range is due to difference in study populations and medical facility types. For example, Curry et al. (2008) indicated that nearly all unplanned extubations occurred in surgical ICUs. In contrast, Mion, Minnick, Leipzig, Catrambone, and Johnson (2007) found that surgical ICUs had lower number of extubations (16.1 episodes) than general (23.6 episodes) and medical (23.4 episodes) ICUs.

Many studies have focused on identification of risk factors for UESE. For examples, Atkins et al. (1997) found that patients experiencing an UESE had a greater likelihood of abnormal levels of blood urea nitrogen (BUN) and PaCO₂ prior to the UESE, were more likely to be restless or agitated, and were more likely to be physically restrained. Chevron et al. (1998) also noted that UESE occurred more frequently in patients with respiratory failure. Balon (2001) found that there is a correlation between spontaneous self-extubation (SSE) in patients with a high level of consciousness and a low sedation and analgesia levels in a critical setting. This study further pointed out that about 30 SSEs (40%) occurred between 11:00 p.m. and 7:00 a.m. when nurse-to-patient ratio is usually low. In addition, Hofso and Cover (2007) found that despite frequent use of physical restraints to control unwanted behaviors such as agitation and delirium in the ICUs and to protect ICU patients from self-harm, 41% to 91% of self-extubations would still occur because of improper physical restraint and inadequate dose of sedative used. Nevertheless, in most cases, UESE attributable to these causes could be preventable if patients are under close surveillance and receive physical restraints or sedative intervention appropriately and promptly (Hofso & Cover, 2007; Powers, 1999). Therefore, it is critically important for clinical nurses to understand risk factors that contribute to increased incidence of UESE and to be trained to take effective actions to prevent UESE.

3. Methods

3.1. Study design, settings, and sample

A 3-year retrospective case-control study was conducted at a 776-bed teaching medical center in Taipei. Medical records of all adults admitted to the 11 units—1 medical ICU, 2 surgical ICUs, 6 medical, and 4 surgical—between January 2004 and December 2007 were reviewed. After excluding patients who had planned or accidental extubations, patients who died during hospitalization, and patients who had psychiatric histories, suicidal tendencies, dementia, or life-threatening conditions, only 21 UESE patients met the criteria for inclusion in the study. Twenty-one UESE patients were matched to 21 patients who had had planned extubation

based on the same *International Classification of Diseases, Ninth Revision, Clinical Modification* code, age (± 5 years), and gender. Nurses who were on duty at the time of the UESE occurred were also identified for the study samples. The demographic information of the nurses was retrieved from nursing personnel records. In general, the nurse-to-patient ratio for ICU patients at the study hospital was 1:1–2. In contrast, the nurse-to-patient ratio for general medical and surgical units was 1:6–7 patients during the day shift (7:00 a.m. to 3:00 p.m.), 1:12–15 patients during the evening shift (3:00–11:00 p.m.), and 1:15–20 patients during the night shift (11:00 p.m. to 7:00 a.m.).

3.2. Instrument

For the purposes of this study, a data collection tool (DCT) was developed by the research team and consisted of three parts:

1. Characteristics of patients: gender, age, days of intubation at the time of the UESE, units admitted to (medical ICUs and general wards, surgical ICUs and general wards), readmission within 72 hours, comorbidity, and smoking and drinking history.
2. Characteristics of nurses: age, years of experience as nurse, level of education, work unit, and work shift at the time of the UESE.
3. Outcome measures: vital signs, APACHE II scores, GCS scores (mild = 13–15, moderate = 9–12, severe = 8 or less) and serum laboratory values (glucose, BUN, creatinine, sodium, potassium, PaO₂, PaCO₂, and PH) taken closest to the UESE, use of physical restraints at the time of the UESE (yes/no), and sedation medication prior to the UESE (yes/no).

The DCT was tested by interrater reliability, measured as the correspondence of scoring of medical records between two authors. The percentage of agreement was 99%.

3.3. Data analysis

Descriptive statistics, a chi-square test, Fisher's exact tests, Student's *t* tests, and a multiple logistic regression analysis were performed to analyze data. The cutoff point used in the multiple logistic regression analysis was based on Chen et al. (2007) and included APACHE II scores of 17 or greater—indicating high-risk patients—and pulse rates of 100 bpm or greater, considered abnormally high. The *p* value for all statistical analyses was set at .05.

4. Results

4.1. Characteristics of sample

The mean days from the time of intubation to the time of the extubation was 4.5 days in the UESE group and 3.7 days in the control group. Patients who had UESEs were more likely to be medical than surgical patients ($n = 14$ and $n = 7$,

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