International Journal of Nursing Science 2018, 8(2): 17-20
DOI: 10.5923/j.nursing.20180802.01

# Nursing Issues of Unplanned Extubation in ICU

**Hanan Mohammed Mohammed[1,*], Amal Arafa Ali[2]**

[1]Assistant Professor of Medical-Surgical Nursing Department, Faculty of Nursing, Ain Shams University, Egypt
[2]Lecturer of Critical-Care Nursing Department, Faculty of Nursing, Alexandria University, Egypt

**Abstract** The day of unplanned extubation is a critical time during an intensive care unit (ICU) stay. Extubation is usually decided after a weaning readiness test involving spontaneous breathing on a T-piece or low levels of ventilatory assist. Extubation failure occurs in 10 to 20% of patients and is associated with extremely poor outcomes, including high mortality rates of 25 to 50%. There is some evidence that extubation failure can directly worsen patient outcomes independently of underlying illness severity. Understanding the pathophysiology of weaning tests is essential given their central role in extubation decisions, yet few studies have investigated this point. Because extubation failure is relatively uncommon, randomized controlled trials on weaning are under powered to address his issue. Moreover, most studies evaluated patients at low risk for extubation failure, whose reintubation rates were about 10 to 15%, whereas several studies identified high-risk patients with extubation failure rates exceeding 25 or 30%. Strategies for identifying patients at high risk for extubation failure are essential to improve the management of weaning and extubation. Two preventive measures may prove beneficial, although their exact role needs confirmation: one is noninvasive ventilation after extubation in high-risk or hypercapnic patients, and the other is steroid administration several hours before extubation. These measures might help to prevent post-extubation respiratory distress in selected patient subgroups.

**Keywords** Nursing Issues, Unplanned Extubation, Quality Improvement, Intensive Care Unit

## 1. Introduction

The day of unplanned extubation is a critical time during the intensive care unit (ICU) stay in all patients surviving an episode of mechanical ventilation. Although extubation is generally uneventful after anesthesia, it is followed by a new episode of respiratory failure in a substantial number of ICU patients [1]. Very different clinical approaches have been used to manage extubation. Not all patients are equal regarding the risk of reintubation, and the pathophysiology of extubation failure is incompletely understood. Consequently, our knowledge about the best approaches for preventing and managing extubation failure remains limited [2].

The increased use of non-invasive ventilation (NIV) in the postextubation period has further limited the validity of this definition. A consensus conference on weaning defined success as the absence of ventilatory support during the first 48 hours after extubation. Reintubation, NIV initiation, or death within 48 hours after extubation were taken to indicate extubation failure, and these criteria were recently used in a prospective study on weaning. Death may occur in patients who are extubated with a prior do-not-reintubate decision [3]. NIV can be initiated to treat postextubation respiratory distress or prophylactically before the onset of respiratory distress. In the first situation, reintubation might have been required in the absence of NIV or shortly after the time of NIV initiation, although there is no strong evidence that NIV prevents reintubation in this setting. Nevertheless, because NIV may delay reintubation, the time interval needed to assess extubation failure when NIV is used should probably be longer than 48 hours and perhaps should be 72 hours or 1 week. The use of prophylactic NIV cannot be classified as failure of extubation. Also, some studies focused chiefly on the occurrence of respiratory distress. Reintubation can merely indicate poor clinical judgment, whereas resuming mechanical ventilation is probably a less subjective criterion than the occurrence of respiratory distress [5].

## 2. Frequency

The incidence of unplanned extubations per 100 intubated patients, which includes both self-extubation and accidental extubation, ranges from 0.5-14.2 patients. In a retrospective study of 273 patients admitted to the ICU and requiring intubation, Singh reported a 12.4% incidence of self-extubation. 1 When calculated per 100 intubation days, the incidence of unplanned extubation is 0.3-4.0 per 100 days. Self-extubation, defined as a deliberate action taken by the patient to remove the endotracheal tube, accounts for

* Corresponding author:
hanan.t2004@yahoo.com (Hanan Mohammed Mohammed)
Published online at http://journal.sapub.org/nursing

68%-95% of all unplanned extubations. Accidental extubation refers to any non-deliberate action, such as coughing, tube manipulation, etc., taken by either medical personnel or the patient that results in removal of the endotracheal tube [6].

# 3. Circumstances

### 3.1. Patient Related

Agitation in the intubated patient accounts for 50-74% of the unplanned extubations and is the most significant risk factor for these events. 3 Patient agitation is related to numerous factors, including prolonged immobility, the inability to communicate, and nursing and respiratory procedures, and increases the rate of self-extubation by 26% compared to non-agitated patients. In addition to agitation, the patient's level of consciousness is a strong predictor for self-extubation, and incidence is higher in patients with a Glasgow Coma scale score of 9-12 points [7].

Additional factors that correlate with a higher frequency of self-extubation include male gender (67%), sedation given on an "as needed" basis rather than as a continuous infusion, and a current history of smoking. Self-extubation is more common in surgical patients, burn patients, and older patients. In a retrospective study conducted by Tung, the average age of patients who self-extubated was 65.3 years. Patients between ages 30-50 account for 47% of self-extubation episodes; 58.9% of episodes occur in surgical patients. Self-extubation also occurs more frequently in patients with certain conditions, such as chronic obstructive pulmonary disease, adult respiratory distress syndrome, or cardiac disease. This increased frequency could, however, simply reflect the longer intubation periods and weaning in these patient groups [8].

### 3.2. Nurse Related

Nursing care is an important factor that contributes to a patient's likelihood to self-extubate, and the attending nurse's absence from the bedside is the most important predictor. This is closely followed by decreased patient surveillance and a low nurse to patient ratio. The optimal ratio to decrease the incidence of self-extubation is probably one to one, and while this may not be feasible, patients with a high risk of self-extubation should be allocated more supervision. In addition, less experienced nurses are more likely to encounter self-extubation; staffing with registered nurses has significantly reduced the risk of self-extubation. It has been shown that patients under the care of an ICU nurse with >4 years of experience have a 2.6% lower incidence of self-extubations [9, 10].

The incidence of self-extubation is higher during the night shift (76%), which could reflect a higher risk for patient delirium at night or decreased patient surveillance. The effect of decreased patient surveillance on self-extubation is also demonstrated by the higher frequency of self-extubations occurring within the hour before and after shift changes, when patients are often monitored less. Self-extubation during shift changes between 7:00 am and 8:30 am and 7:00 pm and 8:30 pm accounted for almost 50% of the self-extubations in a tertiary care ICU over a one year period [6].

# 4. Outcomes

Self-extubation has the potential to damage the larynx and cause severe airway complications due to removing the tube with the cuff still inflated. Hypotension, arrhythmias, bronchospasm, aspiration, and laryngeal bleeding or edema can also occur. In addition, up to 20% of patients have a difficult re-intubation following self-extubation. However, self-extubation often occurs in patients who are ready for elective extubation within the next few hours. Patients who self-extubate within 72 hours of a planned extubation require re-intubation in only 14% of cases. Therefore, in the majority of patients who do not require re-intubation, self-extubation can actually decrease the length of intubation and weaning [11].

The complications of self-extubation are seen most often in patients requiring re-intubation, which occurs within an hour of self-extubation in 85%-90% of cases.2 Risk factors for re-intubation include a higher pre-extubation fraction of inspired oxygen (FiO2), a lower ratio of arterial oxygen tension to inspired oxygen concentration (PaO2/FiO2), assist/control ventilation mode, female gender, decreased mental status related to sedation or illness, organ dysfunction, infection, increased pulmonary secretions, tachycardia, temperature greater than 37.5°C, pH greater than 7.45, and poor pulmonary compliance. Only 45% of patients who self-extubate require re-intubation; however, these patients have a sevenfold higher ICU or hospital mortality rate compared to successfully self-extubated patients. In addition, patients who are re-intubated are more likely to have nosocomial ventilator-associated pneumonia [8].

# 5. Prevention

Physical restraints have been historically used to prevent self-extubation; however, according to Tung, restraint use is actually associated with self-extubation. He reported that 65% of patients who self-extubated were restrained either at the time of self-extubation or within 24 hours of self-extubation. Restraints are often used with agitated or delirious patients, whose risk for self-extubation is already increased [12]. A quality improvement initiative increased restraint use in agitated patients from 58% to 90% over four years and saw a 6% decrease in the number of self-extubations. It is important to note, however, that restraints can worsen agitation or delirium and increase the risk for self-extubation. It is likely that the reduction in

self-extubation was due to an increase in sedation, which ranged from 39% to 77% during the four years. The head-up position, with the bed elevated at 30 degrees, increases the risk for self-extubation by allowing the patient's hands to be in closer to the endotracheal tube. While this position may help prevent aspiration, it also promotes self-extubation and should be limited in some patients [13].

The lack of an appropriate sedation level is the most common factor contributing to self-extubation in the ICU [9]. Achieving optimal sedation can be difficult, as titration of appropriate sedation depends on both the hemodynamic and neurological status of the patient and differs from patient to patient. The goal is for the patient to tolerate the endotracheal tube, while at the same time maintaining consciousness. Patients with low sedation levels have a higher incidence of self-extubation, possibly explained by a lack of tolerance for the endotracheal tube and increased ventilator-patient asynchrony. Use of the Modified Ramsay Sedation Scale protocol has been shown to decrease self-extubation from 7% to 3% within one year due to appropriate management of patient agitation. However, it is equally important to avoid over sedation in mechanically ventilated patients, since this has been associated with prolonged mechanical ventilation, increased ICU length of stay, and an increased incidence of nosocomial infection [14]. Use of a nurse-driven sedation protocol can help prevent over sedation and significantly reduce the frequency of self-extubation. Nursing compliance with a weaning protocol also lowers the risk of self-extubation in medical ICU patients. In Jarachovic's study, 82% of patients who self-extubated were not on a weaning protocol; this demonstrates the need for a standardized weaning protocol. Weaning protocols reduce the overall duration of mechanical ventilation, re-intubation rates, and nosocomial infections [5].

The Self-Extubation Risk Assessment Tool (SERAT) was developed to identify patients at a high risk for self-extubation. It is based on the Bloomsbury Sedation Score (which is similar to the Richmond agitation scale) and the Glasgow Coma Scale and has 100% sensitivity and 79% specificity in identifying patients at risk for self-extubation. The SERAT tool predicts the risk for self-extubation with the highest accuracy when the Bloomsbury Sedation Score-Glasgow Coma Scale scores fall within the dark grey zone (top right zone) [4]. The risk for self-extubation can be predicted with the highest sensitivity when the scores falls within the light grey zone (middle zone). This tool indicates that higher Glasgow Coma scale scores and lower sedation scores both influence the risk for self-extubation. Patients identified by this tool as at risk should be monitored more closely by nursing [15].

## 6. ICU Quality Improvement

Monitoring self-extubation rates in ICUs provides a good ICU care monitoring tool. An increased number of self-extubations requiring re-intubation indicates a need to review nursing and sedation protocols. An increased number of self-extubations not requiring re-intubation indicates a need to review weaning protocols. Tracking the number per month provides a trend that might lead to a root-cause analysis if the number goes up [16].

## 7. Key Points [17]

1. The most common risk factor for self-extubation is inadequate sedation that leads to patient agitation. Optimal sedation can be difficult to achieve, but the use of sedation protocols can reduce self-extubation rates.
2. Self-extubation is more common in surgical patients, who account for 58.9% of all self-extubation cases.1 These patients should be monitored closely by experienced nurses who can help decrease the rate of self-extubation.
3. Self-extubations often occur in patients scheduled for elective extubation within a few hours, suggesting that health care personnel need to better manage weaning and extubation timing.
4. The frequency of self-extubation is higher during the hour before and after nursing shift changes, and this factor was relevant in almost 50% of self-extubations in a tertiary care ICU over a one year period. 1 Adopting a practice of increased patient surveillance during shift changes could help significantly decrease the incidence of self-extubation. ersonnel to prevent self-extubation.

## 8. Current Trends and Future Directions

Recent trends in critical care recommendations may mitigate potential risk factors identified in UE research [1]. Integration of lightened sedation and daily wake up periods for intubated patients may decrease prevalence of risk factors for UE, specifically agitation, physical restraint use, and altered level of consciousness, while routine weaning protocols may improve ventilatory outcomes, including UE. Nursing bedside report and purposeful hourly rounding are quickly emerging as mainstays of professional nursing care. Inherent in these 2 initiatives are increased surveillance and vigilance by health care staff, which can result in timely extubation of those who indicate readiness, as well as decreased incidence of adverse events [17]. Delirium remains a key factor that may be a likely cause for UE; recent trends towards early detection and proper management of delirium among ICU staff may result in improved ventilatory outcomes, including weaning, planned extubation, and the prevalence of UE [18]. Another important trend in critical care is the emergence of a

neurocritical care specialty and routine admission of neuro-critically ill patients to neuroscience ICUs. However, there are no studies investigating prevalence of UE among these patients, who often have higher rates of agitation or restlessness due to cognitive impairment. Among general ICUs, patients with a primary respiratory diagnosis accounted for 23% of all UE in one study, while those with a neurological diagnosis accounted for the second highest percentage (12%) among the study population. A separate study concluded that presence of neurological injury with a concomitant nosocomial infection increased risk of UE among patients in a mixed ICU. A recent systematic review of weaning protocols highlights positive effects on ventilatory outcomes but cites lack of evidence for effectiveness of protocols among those with neurological injury. Areas for future UE research should include factors specific to this patient population, as they may be at higher risk for adverse ventilatory outcomes due to the nature of the neurological injury [19, 20].

## 9. Conclusions

Prevention of UE remains an elusive target, evidenced by little change in reported rates over 2 decades. Research provides data on risk factors that may be patient, unit, or process related. Structuring prevention efforts around modifiable risk factors for UE is a feasible approach amenable to ongoing monitoring for effectiveness. Integration of current trends in health care safety and quality may produce an added benefit of reducing the occurrence of UE in critical care units. Future research evaluating these trends and the prevalence of UE in subspecialty populations is warranted.

## REFERENCES

[1] Jarachovic M, Mason M, Kerber K. The role of standardized protocols in unplanned extubations in a medical intensive care unit. Am J Crit Care 2011; 20: 304–11.

[2] Kapadia FN, Tekawade PC, Nath SS, et al. A prolonged observational study of tracheal tube displacements: Benchmarking an incidence <0.5-1% in a medical-surgical adult intensive care unit. Ind J Crit Care Med 2014; 18: 273–7.

[3] Healthcare Information and Management Systems Society. US EMR Adoption Model(SM). Retrieved April 18, 2014 from http://www.himssanalytics.org/hc_providers/emr_adoption.asp.

[4] Lee JH, Lee HC, Jeon YT, et al. Clinical outcomes after unplanned extubation in a surgical intensive care population. World J Surg 2014; 38: 203–10.

[5] Chang LC, Liu PF, Huang YL, et al. Risk factors associated with unplanned endotracheal self-extubation of hospitalized intubated patients: a 3-year retrospective case-control study. Appl Nurs Res 2011; 24: 188–92.

[6] de Groot RI, Dekkers OM, Herold IH, et al. Risk factors and outcomes after unplanned extubations on the ICU: a casecontrol study. Crit Care 2011; 15: R19.

[7] da Silva PS, Fonseca MC. Unplanned endotracheal extubations in the intensive care unit: systematic review, critical appraisal, and evidence-based recommendations. Anesth Analg 2012; 114: 1003–14.

[8] Roddy DJ, Spaeder MC, Pastor W, Stockwell DC, Klugman D. Unplanned extubations in children: impact on hospital cost and length of stay. Ped Crit Care Med 2015.

[9] Tanios M, Epstein S, Grzeskowiak M, et al. Influence of sedation strategies on unplanned extubation in a mixed intensive care unit. Am J Crit Care 2014; 23: 306–14.

[10] Barr J, Fraser GL, Puntillo K, et al. Clinical practice guidelines for the management of pain, agitation, and delirium in adult patients in the intensive care unit. Crit Care Med 2013; 41: 263–306.

[11] Morandi A, Jackson JC. Delirium in the intensive care unit: a review. Neurol Clin 2011; 29: 749–63.

[12] Banerjee A, Vasilevskis, EE, Pandharipande, P. Strategies to improve delirium assessment practices in the intensive care unit. J Clin Outcomes Manag 2010; 17: 459–68.

[13] Kerckhoffs MC, van der Sluijs AF, Binnekade JM, Dongelmans DA. Improving patient safety in the ICU by prospective identification of missing safety barriers using the bow-tie prospective risk analysis model. J Patient Safe 2013; 9: 154–9.

[14] Blackwood B, Burns KE, Cardwell CR, O'Halloran P. Protocolized versus non-protocolized weaning for reducing the duration of mechanical ventilation in critically ill adult patients. Cochrane Database Syst Rev 2014; 11: CD006904.

[15] Chia PL, Santos DR, Tan TC, et al. Clinical quality improvement: eliminating unplanned extubation in the CCU. Int J Health Care Qual Ass 2013; 26: 642–52.

[16] Gregory S, Tan D, Tilrico M, et al. Bedside shift reports: what does the evidence say? J Nurs Admin 2014; 44: 541–5.

[17] Chen CM CK, Fong Y, Hsing SC, et al. Age is an important predictor of failed unplanned extubation. Int J Gerontol 2010; 4: 120–9.

[18] Kurtz P, Fitts V, Sumer Z, et al. How does care differ for neurological patients admitted to a neurocritical care unit versus a general ICU? Neurocrit Care 2011; 15: 477–80.

[19] Kiekkas P, Diamanto A, Panteli E, et al. Unplanned extubation in critially ill adults: Clinical reviews. Nurs Crit Care 2012; 18: 123–34.

[20] King JN, Elliiot VA. Self/unplanned extubation: Safety, surveillance, and monitoring of the mechanically ventilated patient. Crit Care Nurs Clin North Am 2012; 24: 469–79.