

Comparison of outcome of self-extubation and accidental extubation in ICU

Prithwis Bhattacharya, Arpan Chakraborty, Pawan Agarwal

Abstract

Introduction: The study aimed to assess and compare the vulnerability and severity of outcomes in patients who suffered self-extubation and accidental extubation during their stay in the ICU. **Design:** Prospective observational study. **Setting:** Sixteen-bedded mixed intensive care unit in a tertiary care hospital. **Materials and Methods:** All adult patients admitted in ICU with either an endotracheal tube or a tracheostomy were included in the study. The time and description of the type of unplanned extubation, the cause and severity of the incident and its impact on the course of the patient's illness, the person who noted the incident first and how it was detected were noted. **Results:** The rate of unplanned extubation was 32 (1.42/100 tube days) in 552 intubated patients (2243 tube days). Of them, 26 patients suffered self-extubation while the rest six patients were accidentally extubated. Re-intubation was required in eight patients after self-extubation while it was needed in all the six patients of accidental extubation. Three patients of accidental extubation went on to develop respiratory arrest including one patient who developed cardiac arrest. **Conclusion:** The outcome of the patients who suffered self-extubation is better than those with accidental extubations..

Key words: Accidental extubation, reintubation, self-extubation

Introduction

The intensive care unit (ICU) is a complex and dynamic environment. The extraordinary improvements in intensive care that have taken place over the last 20 years may be undermined by preventable human and system failures. All clinicians need to be vigilant to ensure that they are providing the best possible care for their patients. Airway related incidents (including unplanned extubations) comprised a significant percentage (20%) of adverse events in ICU (Australian Incident Monitoring Study).^[1] There is a need for retrospective analysis of patients who suffered unplanned extubation with regard to

susceptibility, preventability and severity of the outcome to help us avoid further untoward events.

Our present study was designed to assess and compare the vulnerability and severity of the outcome in patients who suffered self-extubation and accidental extubation among the patients in ICU, admitted over a period of one year.

Design

Prospective observational study carried out in a 16-bed mixed intensive care unit (ICU) over a period of one year.

Materials and Methods

The study was performed in a 16-bedded intensive care unit at SS Hospital, BHU where predominantly adult patients were admitted from all specialties with average

From:
Department of Anesthesiology, Institute of Medical Sciences, Banaras Hindu University, Varanasi, India

Correspondence:
Dr. Arpan Chakraborty, Department of Anesthesiology, Institute of Medical Sciences, Banaras Hindu University, Varanasi - 221 005, India.
E-mail: arpan_1977@sify.com

bed occupancy of 10-12 per day. The study included all the patients admitted to or already present in that ICU during a 12-month period from 1st November 2004 to 31st October 2005. All adult patients admitted to the ICU with either an endotracheal tube or a tracheostomy were included in the study. Endotracheal tubes were fixed with adhesive tape applied to the lower chin, orotracheal tubes were fixed to the cheek with adhesive tape and nasotracheal tubes were fixed with adhesive tape to the nose and forehead. Ties were also applied to secure the tubes in agitated patients. In patients with beards or patients with profuse oral secretions. Polyvinyl chloride tubes with high volume-low pressure cuffs were used both for endotracheal tubes as well as tracheostomy tubes. Tracheostomy tubes were secured with a tape tied around the neck. Heat and moisture exchange filters were used for humidification in every patient. All ventilated patients were sedated with infusions of midazolam or propofol or intermittent diazepam titrated according to the Richmond Agitation Sedation Scale.

The time and description of the type of unplanned extubation, the cause and severity of the incident and its impact on the course of the patient's illness, whether preventable or any requirement of re-intubation were noted. The person who noted the incident first and the manner of its detection were also noted. All identified events are rated on a 5-point numeric scale^[2] for relative severity based on the anticipated consequence of failure [Table 1].

"Self-extubation" is defined as endotracheal tube removal by the patient himself and "accidental extubation" is explained by any unplanned extubation other than self-extubation.

Results

Over a one-year period, 556 patients (mean admission APACHE II 18.24 ± 5.43) needed endotracheal intubation or tracheostomy (2243 tube-days). During that period, 32 episodes of unplanned extubation (1.42/100 tube-days) occurred in 29 patients (5.21%). Of them, the incidence of self-extubation was 26 and the rest six were cases of accidental extubation. None of the self-extubations led to any adverse event but in the three cases of accidental extubation, by the time of their detection, they had already suffered the sequelae of prolonged hypoxia. One patient suffered cardiac arrest and could not be revived. Reintubation was required in eight individuals with self-extubation. Two patients with self-extubation received non-invasive ventilation initially but needed to be reintubated within two hours. Rest of them were stabilized with oxygen supplementation without any need of non-invasive/invasive ventilation. Mechanical restraints were found to be ineffective in preventing self-extubation in 12 patients. No patients with tracheostomy suffered any unplanned removal.

Resident doctors detected 20 cases (76.92%) of self-extubation and four cases (66.66%) of accidental extubation while the rest were detected by nursing staff^[3] [Table 2]. The nurse-to-ventilated-patient ratio to total patient ratio was same in our ICU and it varied from 2:1 to 5:1. Six events of self-extubation and two accidental extubations happened in the night shift (12 midnight to 6 am) that included the incident of cardiac arrest. The outcomes of the unplanned extubations are depicted in table 3.

Discussion

The rate of unplanned extubations in our study was

Table 1: Severity rating scale

Rating	Description	Definition
5	Catastrophic event	Death or serious or psychological injury or the risk thereof. Serious injury specifically includes loss of limb or function. Must meet two of the three criteria: Result in unanticipated death or major permanent loss of function. Associated with a significant deviation from the usual process. It has the potential for undermining the public confidence.
4	Major event	Injury or permanent loss of bodily function (sensory, motor, physiologic or intellectual), disfigurement and surgical intervention required, increased LOS and increased level of care.
3	Moderate event	An event, occurrence or situation involving the clinical care of a patient in a medical facility which could have injured the patient but did not cause an unanticipated injury or require the delivery of additional healthcare services
2	Minor event	Failure is not noticeable to the patient and would not affect delivery of care. Failure can be overcome with modifications to the process; failure may cause minor injury.
1	Near miss	A process variation that does not affect the outcome but for which a recurrence carries a significant change of a serious outcome. No injury, no increased LOS or level of care.

Table 2: Self-extubation vs. accidental extubation

	Self-extubation (n=26)	Accidental extubation (n=6)
Reintubation	8 (30.76)	6 (100)
Midnight incidents	6 (23.07)	2 (33.33)
Detection by residents	20 (76.92)	4 (66.66)
Detection by nurses	6 (23.08)	2 (33.33)
Catastrophic event	0	1 (16.6)

Figures in parentheses are in percentage

Table 3: Outcome of unplanned extubations

	Self-extubation (n=26)	Accidental extubation (n=6)
Transient desaturations	18	0
Hypoventilation	8	3
Respiratory arrest	0	3
Bradycardia	2	3
Cardiac arrest	0	1
Aspiration pneumonia	0	1

found to be 1.42/100 tube days, which is comparable with studies done by Epstein *et al.*^[4] (1.6%), Carrion *et al.*^[5] (1.5-2.4%) and Chatterjee *et al.*^[6] It is significantly higher in comparison with Moons *et al.*^[7] (0.68/ 100 tube-days) and Kapadia *et al.*^[8] (0.14%).

In our study, we tried to differentiate between the etiologies behind the incidents of self-extubation and accidental extubations. Self-extubations occurred in those who were alert or agitated or violent in spite of sedation or mechanical restraints - though no adverse outcomes occurred in them as they were recognized early and might have already been fit to be extubated around that time. These alert or agitated patients easily brought their attention to the doctors on duty or staff nurse before any significant hypoxia could occur. Re-intubation^[9-11] was needed in only eight patients following self-extubation. Only transient desaturations occurred in the others (as an effect of self-extubation) and could be managed by oxygen supplementation through venti-mask.

In contrast, when accidental extubations occurred in sedated or obtunded patients, these events led to more adverse incidents due to the late recognition or the patients were too sick to withstand even short episodes of hypoxia. All the patients who suffered accidental removal of the tubes required to be reintubated to help them combat the subsequent hypoxia. These patients were ventilated as a sequel of head injury or cerebrovascular accident. The Glasgow Coma Score was below 8 in all of them and they were unable to maintain airway

and ventilation on their own. These obtunded individuals were unable to draw attention to them before significant desaturation occurred. The one event of cardiac arrest happened in the midnight to a head injury patient (Glasgow Coma Score -5) in whom the endotracheal tube was dislodged by the pull of the ventilator circuit compounded by the loosening of the adhesive tapes around the tubes due to secretions and beards. Regular shaving also should be part of patient bed making to avoid those adverse events. Tracheostomised patients did not suffer any unplanned removal, may be due to the tracheostomy tubes being adequately secured by tapes around the neck more efficiently.

The detection of incidents were mostly by the resident doctors on duty, as the patient-nurse ratio in our ICU varies from 2:1 to 5:1 according to the shift of the day, usually being least in the night shift. The improvement of the patient-nurse ratio will be certainly helpful in helping to prevent and detect the incidents early. The relationship between unplanned extubations and nursing workload can be used as an indicator for the optimization of staff resources in the intensive care unit.^[12] Apnea or low-pressure alarms from the ventilator, SpO₂ and ETCO₂ alarms, the absence of the ventilator waveforms, vocalization of the patients and direct observation of the incident contributed to the detection of the incidents of unplanned extubations. Partially blocked endotracheal tube was found in three incidents of self-extubation.

The close observation in sedation scores in patients receiving sedation is mandatory to prevent unplanned extubations. Richmond Agitation-Sedation Scale (RASS) was found to be easy to teach and use as a guideline for sedation in ICU.^[13] The study on assessment of different sedation scales in ICU patients and their role in prevention of adverse incidents is going on in our ICU. The failure to maintain RASS score between -1 to -2 with sedatives may be a contributing factor to self-extubation. The need for increase in the dosage of sedatives due to the development of tolerance needs to be kept in mind in patients with prolonged ICU stay. Effective communication with the patients as well as frequent reassurance is a must when they wake up. Agitations due to inadequate sedations should be treated with additional bolus doses and not only by increasing the rate of infusion. Moons *et al.* showed that systematic administration of the Bloomsbury Sedation Score and the

Glasgow Coma Scale and the use of the stratification scheme, allows identification of patients at risk of self-extubation.^[7]

Transient desaturation occurred following 18 cases of self-extubation while lack of adequate tidal volume and retention in CO₂ led to reintubation in rest of them.^[14] Non-invasive Bi-PAP ventilator was ineffective in the two patients who needed reintubation. The outcomes of the accidental extubation group were grave as three of them suffered respiratory arrest and aspiration pneumonia occurred in one patient. Significant desaturation in two patients compelled us to initiate urgent airway control by intubation. Severity rating in this group was much higher with 5 points for the cardiac arrest and 4 points for the respiratory arrests.

Conclusion

The severity of the outcome in the patients who suffered accidental removal of tube is very poor and needs more aggressive management than the patients with self-extubation due to difference in susceptibility of the patients and time duration of detection of the incident before irreversible sequelae are likely to occur.

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