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Effect of Accidental and Self Extubation on Mechanically Ventilated Patients' Outcomes in Intensive Care Units

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Abstract: ***Background: unplanned extubation (UE), which is defined as deliberate self-extubation by a patient receiving mechanical ventilation support or accidental extubation by staff nursing and medical procedures. Objective: assess the effect of accidental and self-extubation on mechanically ventilated patients' outcomes. Design: a descriptive research design was used in this study. Research question: what is the effect of accidental and self-extubation on mechanically ventilated patients' outcomes? Setting: This study was conducted in general and trauma intensive care units at Assuit University Hospital. Subjects: sixty critically ill patients attached with the endotracheal tube and mechanical ventilation Results: the majority of the studied critically ill patient had respiratory consequences after UE and statistically significant differences between self-extubation and accidental extubation patients regarding occurrences of aspiration and tachycardia on the first day. Conclusion: Unplanned extubation (UE) is a frequent event after endotracheal intubation with mechanical ventilation (MV). Self-extubation is the most common type of UE and accidental removal of the tube is a very poor patient outcome and needs more aggressive management than patients with self-extubation.***

Keywords: self-extubation, accidental extubation, mechanical ventilation, outcomes

1. Introduction

Intubation and extubation of ventilated patients are not risk-free procedures in the Intensive Care Unit (ICU) and can be associated with morbidity and mortality rate. Endotracheal intubation is needed in critically ill patients on mechanical ventilation (MV) to support oxygenation, ventilation, maintain lung volume and provide a suctioning route for the prevention of tracheal obstruction and hypoxia due to airway secretions. Mechanical Ventilation is defined as beginning with endotracheal tube intubation, maintenance of full and/or partial ventilation support, discontinuation of mechanical ventilation via weaning techniques[(1)]. Endotracheal tube (ETT) removal, or extubation, is performed by a physician or nurse after successful weaning from MV and represents the final step in liberation from MV. In contrast unplanned extubation (UE), which is defined as deliberate self-extubation by a patient receiving mechanical ventilation support or accidental extubation by staff nursing and medical procedures[(2)].

Unplanned self-extubation by the patient is the most common type of UE. Prospective single-site studies report similar or higher estimates of patient self-extubation, ranging from 75.8% to 91.7 %, while a multisite study of 10,112 patients revealed 32 of 35 UE (91.4%) were due to patient self-extubation[(3)]. Patients either physically pull out the endotracheal tube or use their tongue or coughing/gagging maneuvers to displace or intentionally remove the endotracheal tube. Agitation in the intubated patient accounts for 50-74% of the unplanned extubation and is the most significant risk factor for these events. Self-extubation also occurs more frequently in patients with certain conditions, such as chronic obstructive pulmonary disease, adult respiratory distress syndrome and cardiac disease. Only 3% to 8% of UEs are caused by inadvertent removal by health care staff[(4)].

Nursing is caring, enabling, knowledge based and competence assessed profession which is dynamic in meeting the changing health needs of society. The role of the nurse is evolving as the mode of health care delivery systemhas undergone major changes in the past decades[(5)]. Job satisfaction is a great concern among nurses. Satisfied nurses tend to be more productive, and creative[(6)].Nursing care is an important factor that contributes to a patient's probability of self-extubation, and the attending nurse's absence from the bedside is the most important predictor.This is closely followed by decreased patient surveillance and a decrees the number of a 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 [(7)].

The incidence of self-extubation is higher during the night shift, 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-extubation 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-extubation in a tertiary care ICU over a one year period[(7)].Stress is viewed as an individual's reaction to any change that requires an adjustment or response, which can be physical, mental, or emotional stress can arise due to admission of loved one in Intensive care unit (ICU)[(8)]. Stress on basis of mentally and physically is an important aspect of human resource so to gain the next level edge on competition and level of productivity [(9)].

Over the years several strategies have been proposed to reduce the risk of UE as physical restraints is one of the common procedures performing in various health care

setting especially in ICU'sin case of patient agitation have been historically used to prevent self-extubation[7]. Use The Self-Extubation Risk Assessment Tool (SERAT) was developed to identify patients at a high risk for self-extubation (Figure 1)[10]. 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). The risk for self-extubation can be predicted with the highest sensitivity when the scores fall 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 personnel to prevent self-extubation[10].

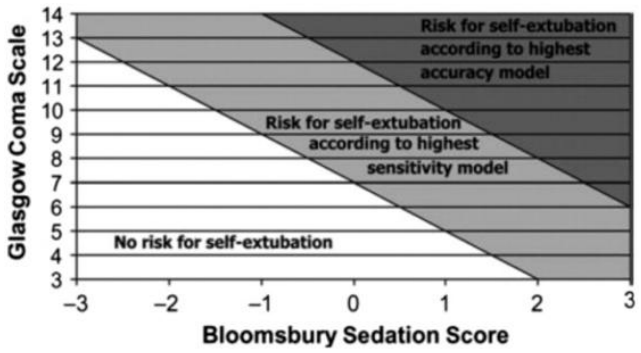

Figure 1: Self-Extubation Risk Assessment Tool (SERAT)[10]

The other strategies to reduce the risk of UE the use of ABCDE Bundle; Awakening and Breathing Coordination, Delirium Monitoring and Management, and Early Mobility. This approach aims to an early rehabilitation of the patient through interventions such as the daily interruption of sedation, the reduction of all avoidable delays in weaning, the delirium prevention, and the person's early mobilization[11]. Regardless of the cause of the UE, there are adverse consequences for both patients and hospitals. For the patient, UE can lead to serious hemodynamic or airway complications, including bronchospasm, aspiration pneumo-nia, hypotension, arrhythmias, and cardiorespiratory arrest. These complications can result in poor clinical outcomes for patients in the intensive care unit (ICU). Some studies reported prolonged mechanical ventilation and longer ICU stay and hospital stay in patients who experienced unplanned extubation. In particular, reintubation after UE was associated with the increased mortality rate [12]. For hospitals and health care organizations, the need for reintubation results in increased hospital costs and ICU care. Therefore the study was done to assess the effect of accidental and self-extubation on mechanically ventilated patients' outcomes.

Aim of this Study

Assess the effect of accidental and self-extubation on mechanically ventilated patients' outcomes

Research Question

What is the effect of accidental and self-extubation on mechanically ventilated patients' outcomes?

2. Materials and Method

Materials

Research Design

The descriptive research design was used in this study.

Setting

The study was conducted in two critical care units (CCUs) of Assuit Main University Hospital namely: general intensive care unit (eight beds) and trauma intensive care unit (seventeen beds).

Subjects

A convenient sample of approximately sixty critically ill patients attached with the endotracheal tube and mechanical ventilation admitted to the previously mentioned ICUsregardless of their diagnoses were included in the study.

Tools

One tool was used in this study: **"Unplanned extubation tool"**

This tool was developed by the researcher after reviewing the related literature[13-5] and used to assess the effect of self and accidental extubation on mechanically ventilated patient outcomes. It consists of four parts namely; patient assessment data, intubation data, unplanned extubation data, and patient outcomes.

- Part one: patient assessment data which included two parts; patient's demographic data such as age, sex and level of education and patient clinical data such as ICU length of stay, ICU name, current medical diagnosis, past medical history, level of consciousness, attached machine, patient to nurse ratio, patient agitated , sedation and physical restraint
- Part two: intubation datasuch as time, type and reason of intubation, number of days intubated, the onset of MV, the method of a tracheal balloon and tube fixation.
- Part three: unplanned extubation datasuch as time, type of extubation and patient data before and after extubation (level of consciousness, ABG, lab result, patient condition after extubation and MV data)
- Part four: patient outcomes after unplanned extubation such as respiratory and cardiovascular consequence, length of hospital stay, duration of MV and death

Method

The study design was accomplished as follow:

- Permission to conduct the study was obtained from the hospitals' responsible authority after explanation of the aim of the study.
- Informed consent was obtained from every critically ill patient or their relativesafter the explanation of the aim of the study.
- The study subjects were assured about the confidentiality of the data collected and the right to refuse to participate in the study.

- "Unplanned extubation tool" was developed by the researcher based on reviewing the related literature [13-5].
- Content validity was done for the tool by five experts in the fields of critical care and emergency nursing at Assuit and Alexandria University and the necessary modifications were done accordingly.
- A pilot study was conducted on six critically ill patients to test the tool for the clarity, objectivity, feasibility, then necessary modifications were carried out and the results were excluded from the study.
- The reliability was tested for thetool of unplanned extubation by using Cronbach's coefficient alpha (r= 85.3) which is acceptable.

Actual Study

The current study was carried out in **two phases**:

- Phase one: the researcher assessed the patient on admission for demographic and clinical data such as current medical diagnosis, past medical history, level of consciousness, attached machine, patient to nurse ratio, patient agitated, sedation, physical restraint, intubation data and setting of mechanical ventilation
- Phasetwo: all patients attached with ETT and mechanical ventilation were monitored by the researcher for unplanned extubation. The researcher was assessing the patients' level of consciousness, ABG, lab result, and outcomes after unplanned extubation such as patient reintubation, dyspnea, bronchospasm, hypoxia, bradycardia, cardiac arrhythmia, and death.
- Data was collected by the researcher for approximately three months starting from 30thDecember 2014 to 30thFebruary 2015.

Statistical Analysis

The raw data were coded and transformed into coding sheets. The results were checked. Then, the data were entered into SPSS system files (SPSS package version 18) using a personal computer. Output drafts were checked against the revised coded data for typing and spelling mistakes. Finally, analysis and interpretation of data were conducted.

The following statistical measures were used:

- Descriptive statistics including frequency, distribution, mean, and standard deviation were used to describe different characteristics.

The significance of the result was at the 5% level of significance.

3. Results

Table -1. Show the distribution of the studied critically ill patients according to their characteristics. It was found that (78.3%)of critically ill patients were male and less than half of them (48.3 %) aged between 18 to less than 40 years old. The same table presents that more than half of the critically ill patient had a cardiovascular disorder on admission and history of cardiovascular and endocrine disorders (53.3 %, 58.3%, and 53.3% respectively). As regards the patient level of consciousness half of critically ill patients (50%) had GCS 9-12. According to the ICU length of stay, more than one third of the critically ill patients (40%) stayed in ICU between 1 to 7 days.The majority of them (86.7%) attached with central venous line and all of the critically ill patients (100%) attached with mechanical ventilation

Table -2: explains the distribution of the studied critically ill patients according to intubation data. It was found that less than half of the studied patients (43.3%) had cardiopulmonary arrest and this main reason for intubation and all of them (100%) had oral intubation. more than half(51.7%) of studied patients intubated in the morning with ETT size 8-8.5. The majority of them (96.7%)had ETT with balloon inflation by minimal occlusive volume method and more than half of patients (58.3%) had the external fixation of ETT by gauze role tap and the tube secured (78.3%). More than half of the studied patient (56.7%) intubated and ventilated from 8-14 days.

Table -3:demonstrates the distribution of the studied critically ill patients according to the monitoring parameter before the time of unplanned extubation.Results of the present studyreveal that the majority of critically ill patients are not agitated, didn't use sedation and physical restraint (81.7%, 95.0%, and 93.3% respectively). As regards nurse to patients'ratio of two thirds of the critically ill patient (66.7 %) areassigned one nurse to care for three patients.

Table -4: presents a distribution of studied critically ill patients according to unplanned extubation data. It was found that less than half (45%) of studied patients are unplanned extubation at night shift. More than half of them alert and had self-extubation (58.3%, 55% respectively). As regards ABG more than two third of studied patients (76.7%) had increase $Paco_2$and the majority of them (96.7%) were low hemoglobin level

Table -5: shows a distribution of the studied critically ill patients according to the data after unplanned extubation. Results of the present study reveal that two third of patients (60%) stable after unplanned extubation and about (40%) of patients unstable after UE. The same table reveals that one third of studied patients suffer from unable to protect the airway and diaphoresis after UE (33.3%).The majority of them (96.6%) didn't use sedation at the time of extubation. More than two third of patients (70%) had increase $Paco_2$ after extubation. About one third of studied critically ill patients (26.7%) had self-extubated with hands and one quarter of them (25%) coughed out the tube.

Table -6: illustrate the distribution of the studied critically ill patients according to outcomes after unplanned extubation. It was found that more than half (60%) of studied critically ill patients left extubated and more than one third (40%) had refractory hypoxemia. The majority of them (85%) had respiratory consequences and more than two third of studied patients(73.3%) had cardiovascular consequences. About 6.7% of studied patients died on the first day from unplanned extubation.

Table -7: shows the distribution of the studied critically ill patients according to respiratory consequences after unplanned extubation. 60% of accidental extubation critically ill studied patients had dyspnea and hypoxia on the

first day.The same table reveals that the statistically significant differences between self-extubation patient and accidental extubation regarding occurrences of aspiration on the first day (P <0.001**)

Table -8: shows the distribution of the studied critically ill patients according to cardiovascular consequences after unplanned extubation. 72% of accidental extubation critically ill studied patients had tachycardia on the first day. The same table reveals that the statistically significant differences self-extubation patient and accidental extubation regarding occurrences of tachycardia on the first day (P <0.001**)

Table 1: Distribution of the studied critically ill patients according to their characteristics (n= 60)

Patient characteristics	Studied patients (n= 60)	
	No.	%
I -Demographic data		
Sex		
- Male	47	78.3
-Female	13	21.7
Age (years)		
- <18	1	1.7
-18<40	29	48.3
- 40 <60	17	28.3
- ≥ 60	13	21.7
II-Health relevant data		
# Admission diagnosis		
- Respiratory	21	35
- Cardiovascular	32	53.3
- Neurological	23	38.3
- Endocrine	26	43.3
- Renal	11	18.3
Gastrointestinal	1	1.7
# Past medical history		
- Pulmonary disease	10	16.7
- Cardiovascular disease	35	58.3
- Endocrine disease	32	53.3
- genitourinary system	8	13.3
Level of consciousness (GCS)		
-<8	6	10.0
-9-12	30	50.0
-13-15	24	40.0
ICU name:	39	65.0
General		
Trauma	21	35.0
ICU Length of stay		
-1-7	24	40.0
-8-14	21	35.0
-15-21	8	13.3
-22-28	1	1.7
>28	6	10.0
# Other invasive devices [$]		
- Oropharyngeal airway	19	31.7
- Peripheral venous line	30	50.0
- Central venous line	52	86.7
# Attached machines	60	100.0
- Monitor &oximetry		
- Ventilator	60	100.0

means multiple categories

Table 2: Distribution of studied critically ill patients according to intubation data (n = 60)

Intubation data	(n = 60)	
	No	**%**
Reasons for ET intubation [$]		
Cardiopulmonary arrest	26	43.3
acute respiratory failure	18	30.0
airway management	22	36.7
airway obstruction	5	8.3
airway protection	13	21.7
refractory hypoxemia	5	8.3
sedation	3	5.0
Type of intubation		
Oral	60	100
Nasal	0	0
Time of intubation	31	51.7
Morning		
Evening	19	31.7
Night	10	16.7
Size of ETT	18	30.0
7-7.5cm		
8-8.5 cm	31	51.7
8.5 – 9 cm	11	18.3
Method of tracheal balloon inflation		
Minimal occlusive volume	58	96.7
Minimal leak volume	2	3.3
Method of tube fixation		
Adhesive tape	25	41.7
Gauze role tap	35	58.3
Securing of tube		
Secured	47	78.3
Tight	3	5.0
Loose	10	16.7
Condition of tap	33	55.0
Moist		
Dry	27	45.0
No of day patient intubated and ventilated		
1-7 days	22	36.7
8-14 days	34	56.7
15-21 day	3	5.0
22-28 day	1	1.7

Table 3: Distribution of the studied critically ill patients according to monitoring parameter before the time of unplanned extubation (n = 60)

Monitoring parameter	(n=50)	
	No	**%**
Patient agitated		
- Yes	11	18.3
- No	49	81.7
Patient on sedation		
- Yes	3	5.0
- No	57	95.0
Use of physical restraint		
- Yes	4	6.7
- No	56	93.3
Presence of pain	2	3.3
- Yes		
- No	58	96.7
Patient to nurse ratio		
- 1:1	8	13.3
- 1:2	12	20.0
- 1:3	40	66.7

Table 4: Distribution of studied critically ill patients according to unplanned extubation data (n = 60)

Unplanned extubation data	No	%
Time of extubation		
• morning	10	16.7
• evening	23	38.3
• night	27	45.0
type of extubation		
• accidental	25	41.7
• self-extubation	35	58.3
level of consciousness		
• <8 (comatose)	6	10.0
• 9-12 (arousal)	21	35.0
• 13-15(alert)	33	55.0
Last ABG		
• acidosis	15	25.0
• alkalosis	8	13.3
• decrease Pao2	32	53.3
• increase Paco2	46	76.7
• Normal	3	5.0
• compensated	23	38.3
• decompensated	24	40.0
• partially compensated	13	21.7
Lab investigations		
• Low hemoglobin level	58	96.7
• decrease sodium level	14	23.3
• increase sodium level	16	26.7
• decreased calcium level	5	8.3
• increase blood urea	17	28.3
• increase creatinine level	15	25.0
• Increase blood glucose	32	53.3

Table 5: Distribution of the studied critically ill patients according to the data after unplanned extubation (n=60)

Patient data after unplanned extubation	No	%
patient condition after unplanned extubation		
•Stable	36	60.0
•Unstable	24	40.0
# **if unstable**		
•unable to protect the airway	20	33.3
•Diaphoresis	20	33.3
•Use of accessory muscles	18	30.0
•Fever	16	26.7
•Anxiety	15	25.0
level of consciousness (GCS)		
•<8 (comatose)	6	10.0
•9-12 (arousal)	20	33.3
•13-15(alert)	34	56.7
Ramsey sedation scale		
•Under sedation	2	3.3
use of sedation at the time of extubation		
•Yes	2	3.3
•No	58	96.6
Restrained at unplanned extubation		
•Yes bilateral wrist restraints	5	8.3
•NO	43	71.7
ABG after unplanned extubation		
•acidosis	11	18.3
•alkalosis	10	16.7
•decrease Pao2	38	63.3
•increase Paco2	42	70.0
Circumstances Surrounding Unplanned Extubation		
•Patient being repositioned	14	23.3
•Patient being transferred	3	5.0
•Patient self-extubated with hand(s)	16	26.7
•Patient maneuvered extubation with tongue	10	16.7
•Patient coughed out a tube	15	25.0
•The nursing procedure being performed	2	3.3
staff in the room at a time of unplanned extubation		
•Yes	10	16.7
•NO	50	83.3

Table 6: Distribution of the studied critically ill patients according to outcomes after unplanned endotracheal extubation (N=60).

Patient outcomes after unplanned extubation	**No**	**%**
• Reintubation time	24	40.0
• Left extubated	36	60.0
• Reason for reintubation • Irreversible Tachypnea	14	23.3
• Inability to Manage Secretions	20	33.3
• Refractory Hypoxemia	24	40.0
• Hypercapnia	21	35.0
• Dyspnea	22	36.7
• Patient Anxiety	14	23.3
• Hypoventilation	9	15.0
Respiratory consequence		
• Absent	9	15.0
• Present	51	85.0
Cardiovascular consequence		
• Absent	16	26.7
• Present	44	73.3
Duration of mechanical ventilation		
• Short	30	50
• Long	30	50
ICU LOS		
• Short	30	50
• long	30	50
Death		
• first day	4	6.7

Table 7: Distribution of the studied critically ill patients according to respiratoryconsequence after unplanned endotracheal extubation (N=60)

Respiratory and Cardiovascular consequence	Self extubation (n=35)		Accidental extubation (n=25)		P value
	No	**%**	**No**	**%**	
Respiratory consequences					
Aspiration					<0.001**
First Day • Present • Absent	0 35	0.0 100%	10 15	40 60	
Dyspnea					
First Day • Present • Absent	12 23	34.3 65.71	15 10	60 40	0.218
Hypoxia					
First Day • Present • Absent	6 29	17.1 82.85	15 10	60 40	0.285
Second Day • Present • Absent	0 35	0.0 100	3 22	12 88	
Bronchospasm					
First Day • Present	11 24	31.4 68.57	9 16	36 64	0.829

• Absent					
Second Day • Present • Absent	3 32	8.6 91.4	3 22	12 88	
Horsenss					
First Day • Present • Absent	24 11	68.6 31.42	9 16	36 64	0.267
Second Day • Present • Absent	3 32	8.6 91.4	3 22	12 88	

Table 8: Distribution of the studied critically ill patients according to cardiovascular consequence after unplanned endotracheal extubation (N=60)

Cardiovascular consequences	Self-extubation (N=35)		Accidental extubation (N=25)		P value
	No	%	No	%	
Bradycardia					
First Day • Present • Absent	3 32	8.6 91.4	0 25	0.0 100	0.367
The Second Day • Present • Absent	11 24	31.4 68.6	5 20	20 80	0.489
Tachycardia					
First Day • Present • Absent	22 13	62.9 37.14	18 7	72 28	0.0001**
Cardiac arrhythmia					
First Day • Present • Absent	9 26	25.7 74.28	9 16	36 64	0.568

4. Discussion

Endotracheal intubation with mechanical ventilation (MV) support is an important intervention for managing critically ill patients with respiratory problems such as acute respiratory failure and pulmonary embolism in the intensive care unit (ICU)[16]. After the patient respiratory problem has stabilized and successfully weaned from MV, removal of the endotracheal tube (extubation) is scheduled. Pain is an unpleasant sensory and emotional experience[17] .The favorable level of sedation and control of pain are two important aspects of nursing care in patients undergoing mechanical ventilation in the Intensive Care Units (ICUs)[18]. However, 2–16% of patients on MV undergo potentially life-threatening unplanned extubation (UE), which is defined as an accidental or a patient self-removal of an endotracheal tube[19]. UE can cause several serious complications: aspiration pneumonia, bronchospasm, arrhythmia, respiratory failure, or even sudden cardiac arrest[20]. Therefore the aim of this study to assess the effect of accidental and self-extubation on mechanical ventilated patients' outcomes

Results of the current study revealed thatthe higher incidence of UE in male sex patients and aged between 18 to less than 40 years. Degrootet al (2011) [21] supported the current study result; they found that a higher incidence of UE in male patients but aged between 46 and 75 years.The GCS scale is widely used in ICUs and has been developed to facilitate the assessment and classification of the severity of the brain dysfunction. The increased level of consciousness is an evident risk factor for the UE. The present study indicated that half of the critically ill patientshad GCS 9-12 and most of them alert during the occurrence of UE. These findings are in the line with another study conducted by Chuang etal (2015) [22] which suggested the presence of restlessness, increased consciousness and/ or insufficient sedation associated with a Glasgow Coma Scale (GCS) score greater than or equal to 9 increase the incidence rate of the UE.

The endotracheal tube fixation can be carriedout using different materials such as tapes or plasters,through different methods of tape fixation, or by usingthe tube's support devices of the tube.The lack of a strong endotracheal tube fixation(for example with a single thin tape) was significantlyassociated with a greater incidence of UE. The finding of the present study revealed that the majority of critically ill patients had ETT with balloon inflation by minimal occlusive volume method and more than half of patients had the external fixation of ETT by moist gauze role tap.

Buckley et al(2016)[23] supported the findings of the current study, they demonstrated how the use of Haider Tube-Guard compared to the adhesive tape and gauze role tap reduces the displacements of the endotracheal tube and decreasing the risk of UE. While the adhesive tape sticks to the surface of the patient face, the anchoragesof the tube of Haider Tube-Guard are fixed to the maxilla and jaw thus reducing the movements of the endotracheal tube.

Physical restraints are used in ICUs to maintain ongoing invasive therapies when patients are unable to understand the need for such therapies. The result of the present study reveals that the majority of critically ill patients' are not agitated, didn't use sedation and physical restraint during the occurrence of UE. This finding is congruent with the studies of Bambi et al (2015)[24], which revealed that the use of physicalrestraints is associated with a higher UE incidence and considered this factor associated with increased risk 3.11 times for UE.

Critical care nurses are the key persons that deal with patients with life-threatening situations[17]. Nursing care is an important factor that contributesto the patient's UE risk. One of the most relevantUE risk factors seems to be the nurse's absence at thebedside and then by a reduced surveillance of the patientduring the UE episode. The result of the present study reveals that the majority of unplanned extubation occurs in the absence of staff in the patient room. Tanios et al(2010)[25]supported the finding of the current study, they reported that in 59% of UE patientswere without caregivers at the bedside. Therefore the nurse/patient ratio is another factor increased the risk of UE. The present study indicated that two thirds of the UE critically ill patients are assigned onenurse care for three patients.These findings are in the line with another study conducted byTanioset al (2010)[25] which suggested the health care operators consider a nurse: patient ratio greaterthan or equal to 1:3 as a UE risk factor.

Moreover, UE incidence seems to occur with acertain rhythm activity during the morning shift, within one hour before and one hour after the shiftchanges and during the night shift. The result of the current study revealed that less than half of studied patients are unplanned extubation at night shift. Bouza et al (2010)[26] supported the finding of the current study they reported that half of UE occur during nurses' shift changes between7:00 and 8:30 a.m. and p.m. when patients are lessmonitor and UEs occurred more frequently during night shifts than during day or evening shifts.

Regardless of the type and cause of the UE, there are adverse outcomes for both patients and hospitals. Results of the current study revealed that more than half of studied critically ill patients left extubated and more than one third had refractory hypoxemia. The majority of them had respiratory consequences. These findings are in the line with another study conducted byLee JH et al (2014)[16]which suggested the UE can result inserious outcomes such as respiratory distress, hypoxia,cardiac arrest, and death. Despite the emergent nature of UE, not all patientsexperience immediate reintubation. Many instances ofUE occur during patient weaning trials or in preparation for planned extubation. However, the outcome of the patients who suffered self-extubation is better than those with accidental extubation

Results of the present study revealed that the statistically significant differences between self-extubation and accidental extubation patients regarding occurrences of aspiration and tachycardia on the first day. Bhattacharya (2010)[27] supported the finding of the current study they reported that the severity of the outcome in patients who accidental removal of tube is very poor and needs more aggressive management than patients with self-extubation due to difference in susceptibilityof the patients and time duration of detection of an incident before irreversible sequel are likely to occur.

Unplanned extubation (UE) is a frequent event after endotracheal intubation with mechanical ventilation (MV) to support critically ill patients with respiratory failure in the intensive care unit (ICU) and is associated with increased morbidity and mortality rate. UE can negatively influence a patient's prognosis. Patient education can be effective in the prevention and control of the UE[28]. Accordingly, appropriate steps must be taken to prevent UE. Further studies are needed to identify the risk factors and causes of UE as well as the prevention methods.

5. Recommendations

- Provide continuing education regarding the care of a patient with an ET tube
- Increase nurse staffing and assess tube securement during bedside report and prior to procedures
- Develop standard procedures/protocolsfor oral care, tube fixation and transport Integration of sedation protocols mayaid in decreasing UE and restraintuse
- 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 the prevalence of UE in high-risk patients

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