Factors Affecting Accidental Extubation of Endotracheal Tube in Critical Care Units: Suggested Nursing Care Protocol

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Abstract

Background: Accidental extubation defined as unwelcome extubations. **Aim:** The study aimed to assess factors affecting accidental extubation of endotracheal tube in critical care units. **Design:** A descriptive exploratory design was utilized to conduct this study. **Setting:** The study was conducted in the ICUs of zagazig University Hospitals which has 70 ICU bed capacities that classified into: emergency ICU consisted of 23 beds, post-operative ICUs consisted of ICUA had 15 beds, ICUB had 10 beds and internal medicine ICU consisted of 22 beds. **Subject:** A convenient sample of all available nurses with total number 50 was recruited in the previously mentioned units. **Data collection tools:** 1) Nurses' self- administered questionnaire, 2) Nurses' practice observational checklists. 3) Ramsy Sedation Scale (RSS) 4) Factors affecting accidental extubation of endotracheal tube. **Results:** The present study revealed that more than half of the nurses had satisfactory level of knowledge regarding endotracheal tube care and level of practice (54%, 52%) respectively. Many factors affecting positively on accidental extubation of endotracheal tube is reported by majority of the nurses under the study namely; patient related factors, nurses related factors and environmental related factors (42%, 68%, 64 %)respectively. **Conclusion**: Based on the current study, it can be concluded that more than half of the study nurses had satisfactory level of knowledge regarding care of endotracheal tube. In addition many factors affecting positively on accidental extubation of endotracheal tube in critical care units as reported by majority of the nurses under the study namely; patient related factors, nurses related factors and environmental related factors **Recommendations:** suggest nurses' care protocol for improving knowledge & practice regarding endotracheal tube care taking into consideration the factors affecting accidental extubation.

Key words: Accidental Extubation, Endoreacheal Tube, Intensive Care Unit.

Introduction

Endotracheal intubation is an essential skill performed by multiple medical specialists to secure a patient's airway as well as provide oxygenation and ventilation. There are multiple techniques available, including the visualization of the vocal cords with a laryngoscope or video laryngoscope, direct placement of the endotracheal tube into the trachea via cricothyrotomy and fiberoptic visualization of the vocal cords via the nasal or oral route **(Adewale, 2009).**

Accidental extubations are one of the most common adverse airway events to occur in ICU. Elective removal of an endotracheal tube is performed as soon as the reason for the intubation has been resolved. If this happens earlier, it is termed an unplanned extubation (UE). It is a serious ICU complication and its outcomes have been used as a monitoring tool for performance improvement and patient safety programmers **(Fontenot et al., 2015).**

Over the years several strategies have been proposed to reduce the risk of unplanned extubation as the introduction in ICUs of the 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 **(Bambi et al., 2015).**

An increase in severity of illness on ICU admission, agitation, less use of sedation with lower Ramsay score during MV intensify the risk of accidental extubation, which usually occurs during the night shift, even with the use of physical restraints, Prolonged minute ventilation recovery time, and lower swallowing score are associated with an increased risk of failed planned extubation **(Rio, 2010).**

Understanding the factors associated with accidental extubation is crucial for identifying patients at risk of this complication and thus for developing interventions to reduce the frequency of this complication. Some aspects such as nurse workload and standardization of procedures such as the method of securing the endotracheal tube and the use of hand restraints have been reported to be useful in reducing the removal of the orotracheal tube **(Chiang et al., 2017).**

Most incidences of accidental extubation are patient-initiated and tend to occur in those exhibiting restlessness and agitation, particularly when combined with inadequate sedation and in those who are being weaned from mechanical ventilation. We recently reported that over 90% of our unplanned extubations occurred in patients who met weaning readiness criteria; 60% did not require re-intubation, another study found only 20% of surgical patients who self-extubated required reintubation **(Lee et al., 2014).**

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 **(Barr et al., 2013).** 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 **(Tanios et al., 2014).**

Significance of the study:

Endotracheal intubation in the intensive care unit (ICU) carries with it a higher morbidity and mortality, likely due to many factors including a lack of physiologic reserve. The incidence of a difficult airway in the ICU may be as high as 23% (related to JMIR Res Protocol 2018), the use of a systematic approach protocol for endotracheal intubation may reduce intubation complications. This was recently demonstrated in a trial utilizing an intubation protocol, whereby immediate life-threatening complications surrounding ICU intubations were reduced ***(Simpson et al., 2012).***

Airway assessment should include risks of difficult intubation with rescue techniques of aspiration. While assessments to identify difficult intubation have a low positive predictive value an specificity, recognition of patients at particular risk of difficult airway management aids planning and is recommended, even in the most urgent situations, More importantly, identification of the high-risk patient was not followed by an appropriate airway strategy ***(P. Luedike et al., 2015).***

Aim of the study:

This study was aimed to assess factors affecting accidental extubation of endotracheal tube in critical care units through:

1. Assess nurse's performance (knowledge and practice) related factors affecting accidental extubation in critical care units.
2. Assess factors affecting accidental extubation of endotracheal tube.
3. Develop Suggest nursing care protocol regarding endotracheal care.

Research question:

To fulfill the aims of this study the following research questions were formulated:

1- What are the nurse's performances that affect accidental extubation in critical care units?

2- What are the factors affecting accidental extubation in critical care units?

3- What are the suggested nursing care protocol to prevent the accidental extubation?

Research Design:

A descriptive exploratory research design was utilized to conduct this study. Exploratory research is defined as a research used to investigate a problem which is not clearly defined. It is conducted to have a better understanding of the existing problem, but will not provide conclusive results ***(Creswell et al., 2018).***

Setting:

The study was conducted in the ICU_s at Zagazig University Hospitals which has 70 ICU bed capacities that classified into: emergency ICU consisted of 23 beds, post-operative ICU_s consisted of ICU_A had 15 beds, ICU_B had 10 beds and internal medicine ICU consisted of 22 beds. The ICU provides care for different categories of critically ill patients who need comprehensive stabilization. On average, 100 patients are admitted every month.

Subjects:

A convenient sample of all available nurses working at ICU with total number 50 nurses (20 from Emergency ICU, 20 from Postoperative ICU and 10 from Internal medicine ICU) in which the study was conducted.

Tools for data collection:

Tool 1: Nurses self- administered questionnaire:

It was developed by the researcher in an Arabic language based on the review of the relevant recent related literatures ***Ansari et al., (2012); Batiha et al., (2013); Heidari et al., (2017); Mwakanyanga et al., (2018); Amira et al., (2018)***

This questionnaire included four parts as the following:

Part (1): Demographic characteristics of the nurses under the study. This part was used to assess nurse's (age, sex, years of experience, educational level, training courses, polices of the unit and nurse- patient ratio).

Part (2): Nurses knowledge regarding endotracheal tube care: This partwas developed by the researcher based on recent review of literatures **Hughes et al., (2011); Abbasinia et al., (2014); Liu et al., (2015); Schults et al., (2019);** was used to assess nurses' knowledge regarding endotracheal tube care (Definition, ABGs parameters, endotracheal tube, sites of insertion, nursing consideration before, during and after procedures, ventilator parameters, infection control polices, accidental extubation) among critically ill patient at critical care units. It consisted of 65 questions.

It consists of (7) items as the following:

Nurses knowledge regarding endotracheal tube score (24) questions, Nurses knowledge before insertion of endotracheal tube score (6) questions, Nurses knowledge during insertion of endotracheal tube score (8) questions, Nurses knowledge post insertion of endotracheal tube score (10) questions, Nurses knowledge regarding nursing care for patient on mechanical ventilator (7) questions, Nurses knowledge about infection control policies during suction technique (4) questions. Nurses knowledge regarding accidental extubation of endotracheal tube (6) questions.

❖ **Scoring system for knowledge**

The correct response for nurses was given a score of one degree and the incorrect response was given a score of zero. The total score for questionnaire was 65 degrees.

The total level of knowledge was:

- ≥ 80% (≥52 degrees) was considered satisfactory level.
- < 80% (< 52 degrees) was considered unsatisfactory level.

Tool (2) Nurses practice observational checklists:

This part was developed by the researcher based on recent review of literatures ***Davies et al., 2011), (Elbokahary et al., 2015); (Urden et al., 2017); (Shrestha et al., 2018);*** was used to assess nurses' practice in relation to endotracheal tube (Before, during and after procedures) via endotracheal tube care, inflation

and deflation of endotracheal tube and endotracheal tube suctioning.

❖ **Scoring system for nurses practice regarding ETT care:**

The researcher observed nurses during procedures that classified into done or not done, if done scored as one if not done was given zero, total score was 88 degrees.

The total level of practice was:

- ≥80% (≥70 degrees) was considered competent level.
- <80% (≤70 degrees) was considered incompetent level.

Tool (3): Sedation scale:

This tool was adopted from ***(Ramsy Sedation Score (RSS)*** to assess sedation, agitation and pain level patient with endotracheal tube and connected with mechanical ventilator and reported by the nurses, which a respondent selects a whole number (1-6) as classified into two parts, if patient a wake (1-3) and if patient a sleep (4-6). The Ramsay Sedation Scale is the most simplistic and allows for a numeric score from 1 to 6, based on responsiveness of the patient

This score ranging from 0 (unresponsive) to 6 (dangerously agitated). A sedation score of 0 is most often therapeutically targeted, as it correlates with an alert and calm patient..

Tool (4) Factors affecting accidental extubation of endotracheal tube:

This part was developed by the researcher in Arabic language based on the review of the relevant recent related literatures ***Gao et al., (2016); Lucchini et al., (2018); Rivera et al., (2019)*** was used to assess factors affecting accidental extubation of endotracheal tubes in critically ill patients as reported by the nurses, it was classified into two choices, agree or disagree. It consisted of 24 choices. Choices was grouped into patient related factors (7 choices), nurses related factors (10 choices) and the environmental related factors (7 choices).

❖ **Scoring system:**

The nurses respond for each question with two answers choices as if the answer is (No) means the factor affecting negatively & it was scored zero, if the answer is (Yes) means the factor affecting positively and it was scored one degree.

The total score classified as the following.

- ≥ 80% of the total factors (≥18 degrees) was considered positive affection on accidental extubation of ETT. ≤80% (≤18 degrees) was considered negative affection on accidental extubation of ETT.

Result:

Table (1): Regarding demographic characteristics of the nurses including in this study revealed that 70% of the nurses, their age ranged from 20<30 years old, 72% are females, 40% of them were Nursing technician, 48% of studied nurses had an experience from <5 years, 60% of studied nurses had received courses about care of the endotracheal tube,68% of studied nurses had not nursing standard and structures in the unit for caring of the endotracheal tube and 56% of studied nurses had Two Nurses- patients ratio.

Table (2): Illustrated that 70% of the studied nurses were satisfactory level of knowledge about endotracheal tube while 30% of them were unsatisfactory level of knowledge.

Table (3): Showed that (52.0%) of the studied nurses had satisfactory level of practice regarding their total level of practice about endotracheal tube care, Inflation and deflation of endotracheal tube and Endotracheal tube suctioning while (48%) of them had unsatisfactory level of practice.

Table (4): Showed that (30.0%) of the nursing had a patient a wake Regarding Ramsay sedation scale and (70.0%) of them had an patients sleep level of Ramsay sedation scale.

Table (5): clarified that majority of the studied nurses (64%) reported that many factors were affecting positively on accidental extubation of the endotracheal tube while (36%)

reported that many factors were affecting negatively on accidental extubation of endotracheal tube.

Table (6): This table represented that, there was statistically significant relations between level of the nurses' qualifications, years of experience, training courses and their total level of knowledge regarding endotracheal tube care ($p<0.05$).

Table (7): This table shows that there were statistically significant relations between the nursing level of practice and their qualification, years of experience and training courses, with p-value ($p<0.05$).

Table (8): it revealed that that there were statistically significant relations between nurse's demographic characteristics and the factors affecting accidental extubation of endotracheal tube ($p<0.05$).

Table (9): reveals that there was highly significant Positive correlation between level of nurses' knowledge, practice and factors affecting the accidental extubation of the endotracheal tube ($P<0.001$).

I: Demographic characteristic of the studied nurses.

Table (1): Frequency and percentages distribution of the studied nurses according to their demographic characteristics (n=50).

Demographic data	No.	%
Age (years)		
20	35	70.0
30	13	26.0
≥40	2	4.0
Mean±SD	23.61±4.48	
Gender		
Male	14	28
Female	36	72
Academic Qualifications		
Nursing Diploma	9	18.0
Nursing Technician	20	40.0
Bachelor of Nursing	15	30.0
Postgraduate	6	12.0
Years of experience		
<5 years	24	48.0
5-10 years	18	36.
>10 years	8	16.0
Nursing received training courses on care of the Endotracheal tube		
Yes	30	60.0
No	20	40.0
Is there nursing standard and structures in the unit for caring of the Endotracheal tube?		
Yes	16	32.0
No	34	68.0
Nurses- patients ratio		
One	19	38.0
Two	28	56.0
More	3	6.0

2- Nurses knowledge regarding endotracheal tube care.

Table (2): Frequency and percentages distribution of the studied nurses according to their total level of knowledge about endotracheal tube (n=50).

Items	Satisfactory		Unsatisfactory	
	No.	%	No.	%
total knowledge about endotracheal tube,sites of insertion, vital signs and lab needed to patients				
Mean±SD	43.14±8.20			
total knowledge before,during and after insertion the endotracheal tube				
Mean±SD	40.40±7.68			
total knowledge about care for a ventilator, infection control policies and accidental extubation				
Mean±SD	27.08±5.15			
Total score all practice	26	52	24	48
Mean±SD	36.78±7.01			

3- Nurses practice regarding endotracheal tube care.

Table (3): Frequency and percentage distribution of studied nurses regarding their total level of practice about endotracheal tube (ETT) Care (n=50).

Items	Satisfactory		Unsatisfactory	
	No.	%	No.	%
Endotracheal tube care				
Mean±SD	23.16±5.33			
Inflation and deflation of endotracheal tube				
Mean±SD	18.72±4.31			
Endotracheal tube suctioning				
Mean±SD	29.32±6.74			
Total score all practice	26	52	24	48
Mean±SD	71.20±16.38			

4- Ramsy Sedation Scale.

Table (4): Number and percentage distribution of nurses who applied agitation sedation score according to Ramsay sedation scale (n=50).

Ramsay sedation scale	No.	%
If patient a wake		
1- Anxious or restless or both	9	18
2- Cooperative, orientated and tranquil	2	4
3- Responding to commands	4	8
If patient sleep		
1- Brisk response to stimulus	11	22
2- Sluggish response to stimulus	16	32
3- No response to stimulus	8	16
Patient score		
1.00	9	18
2.00	2	4
3.00	4	8
4.00	11	22
5.00	16	32
6.00	8	16
Level of Ramsay sedation scale		
Patient A Wake	15	30
Patient Sleep	35	70

5-Factors Affecting accidental extubating of the endotracheal tube.

Table (5): Factors affecting accidental extubating of the endotracheal tube.

Factors affecting	Yes		No	
	No.	%	No.	%
Patient related factors:				
Do not fix the endotracheal tube well	48	96	2	4
The installation of the endotracheal tube through the mouth	43	86	7	14
The patient 's agitation with lack of giving of venous tranquilizers	47	94	3	6
Lack of policies for dealing with patients with endotracheal tube	40	80	10	20
Pressure support ventilation	21	42	29	58
Partial mechanical ventilation	29	58	21	42
Volume controlled ventilation	21	42	29	58
Total score				
Nurses related factors:				
Increase the assigned tasks for nurses	45	90	5	10
Number of cases compared to the number of nursing in the departments of critical care (2 patients: each nurse / nurse)	47	94	3	6
Nursing graduates with a lack of experience in the field of nursing care	45	90	5	10
Lack of training courses and workshops on nursing care for patients with endothelial tube	39	78	11	22
Nurses related factors:				
Physical stress resulting from nursing care	32	64	18	36
Pressure from the department supervisor	39	78	11	22
Lack of some of the requirements used to give the highest quality in nursing care	39	78	11	22
Be responsible for training new nursing	39	78	11	22
Inability to control the work situations that require movement and quick action	38	76	12	24
Lack of sense of satisfaction in the nursing staff, which affects the nursing performance	34	68	16	32
Total score				
Environmental related factors:				
Spend a lot of time in the control of equipment and devices	41	82	9	18
Non-arrangement of the work environment	38	76	12	24
The existence of devices with malfunctions	38	76	12	24
The design of the unit is not suitable for the work	36	72	14	28
Combine administrative and technical responsibilities simultaneously	35	70	15	30
Many cases of cardiopulmonary resuscitation which lead to dysfunction in the work system alone	42	84	8	16
The existence of many contradictory devices within the unit	33	66	17	34
Total score				
Total score of Factors affecting	32	64	1	36

Factors affecting	Yes		No	
	No.	%	No.	%
			8	
Mean±SD	41.18±8.01			

Table (6): Relation between nurse's demographic characteristics and their total knowledge regarding endotracheal tube among critical care patients (n=50).

Demographic data	Total knowledge				Chi-square test	
	Satisfied (n=27)		Unsatisfied (n=23)			
	No.	%	No.	%	x^2	p-value
Sex						
Male	8	29.6%	6	26.1%	0.038	0.82
Female	19	70.4%	17	73.9%		
Age (years)						
<25 years	9	33.3%	11	47.8%		
25- <30 years	13	48.1%	9	39.1%	0.575	0.749
<=30 years	5	18.5%	3	13.0%		
Qualification						
Nursing Diploma	2	7.4%	7	30.4%		
Nursing Technician	9	33.3%	11	47.8%	18.445	0.013*
Bachelor of Nursing	11	40.7%	4	17.4%		
Postgraduate	5	18.5%	1	4.3%		
Years of experience (years)						
<5 years	9	33.3%	15	65.2%		
5-10 years	12	44.4%	6	26.1%	10.578	0.029*
>10 years	6	22.2%	2	8.7%		
Training courses						
Yes	22	81.5%	8	34.8%	13.889	0.012*
No	5	18.5%	15	65.2%		
Is there a manual in the unit of nursing regulations and procedures for the nursing care of the larynx?						
Yes	11	40.7%	5	21.7%	7.585	0.042*
No	16	59.3%	18	78.3%		
How many patients do you take care of in one day						
One	13	48.1%	6	26.1%		
Two	13	48.1%	15	65.2%	1.646	0.556
More	1	3.7%	2	8.7%		

p-value>0.05 NS; *p-value <0.05 S; **p-value

Table (7): Relation between nurses' demographic characteristics and their total level of practice regarding endotracheal tube care among critical ill patients (n=50).

Demographic data	Level of Practice				Chi-square test	
	Satisfied (n=26)		Unsatisfied (n=24)			
	No.	%	No.	%	x^2	p-value
Sex						
Male	6	23.1%	8	33.3%	1.188	0.276
Female	20	76.9%	16	66.7%		
Age (years)						
<25 years	9	34.6%	11	45.8%	1.015	0.602
25- <30 years	12	46.2%	10	41.7%		
<=30 years	5	19.2%	3	12.5%		
Qualification						
Nursing Diploma	3	11.5%	6	25.0%	6.777	0.047*
Nursing Technician	9	34.6%	11	45.8%		
Bachelor of Nursing	10	38.5%	5	20.8%		
Postgraduate	4	15.4%	2	8.3%		
Years of experience (years)						
<5 years	9	34.6%	15	62.5%	7.841	0.036*
5-10 years	10	38.5%	8	33.3%		
>10 years	7	26.9%	1	4.2%		
Training courses						
Yes	17	65.4%	13	54.2%	6.693	0.034*
No	9	34.6%	11	45.8%		
Is there a manual in the unit of nursing regulations and procedures for the nursing care of the larynx?						
Yes	10	38.5%	6	25.0%	1.688	0.194
No	16	61.5%	18	75.0%		
How many patients do you take care of in one day						
One	9	34.6%	10	41.7%	1.59	0.452
Two	16	61.5%	12	50.0%		
More	1	3.8%	2	8.3%		

p-value>0.05 NS; *p-value

Table (8): Relation between nurses demographic characteristics and factors affecting accidental extubation of endotracheal tube among critical ill patients as reported by the studied nurses (n=50).

Demographic data	Total Level of factors affecting the accidental extubation of the endotrachealtube				Chi-square test	
	Positive affect		Negative affect			
	No.	%	No.	%	x^2	p-value
Sex						
Male	10	31.3%	4	22.2%	0.466	0.495
Female	22	68.8%	14	77.8%		
Age (years)						
<25 years	12	37.5%	8	44.4%	0.56	0.756
25- <30 years	14	43.8%	8	44.4%		
<=30 years	6	18.8%	2	11.1%		
Qualification						
Nursing Diploma	4	12.5%	5	27.8%	8.837	0.018*
Nursing Technician	11	34.4%	9	50.0%		
Bachelor of Nursing	12	37.5%	3	16.7%		
Postgraduate	5	15.6%	1	5.6%		
Years of experience (years)						
<5 years	12	37.5%	12	66.7%	6.487	0.026*
5-10 years	13	40.6%	5	27.8%		
>10 years	7	21.9%	1	5.6%		
Training courses						
Yes	24	75.0%	6	33.3%	8.333	0.004*
No	8	25.0%	12	66.7%		
Is there a manual in the unit of nursing regulations and procedures for the nursing care of the larynx?						
Yes	13	40.6%	3	16.7%	4.039	0.048*
No	19	59.4%	15	83.3%		
How many patients do you take care of in one day						
One	15	46.9%	4	22.2%	3.173	0.205
Two	15	46.9%	13	72.2%		
More	2	6.3%	1	5.6%		

p-value>0.05 NS; *p-value

Table (9): Correlation between nurses total score of knowledge, practice and score of factors affecting accidental extubation of the endotracheal tube (n=50).

	Total score of knowledge	
	R	p-value
Total practice	0.693	<0.001**
Total factors	0.622	0.021*

Spearman's rank correlation coefficient (Rs); *p-value <0.05 S; **p-value <0.001

Discussion:

Several risk factors can increase the likelihood of extubation by accident or patient action. Inadequate securement of the tube can increase the risk for removal or dislodgement. Lack of physical restraints, inadequate patient sedation, or patient agitation or restlessness in the setting of an inadequately secured ETT also increase the risk for tube dislodgement or removal. Other risk factors that have been linked to unplanned extubation in the intensive care setting include emergency surgery, presence of nosocomial infection, delirium or confusion, congestive heart failure, and lack of a clear plan for extubation **(Piriyapatsom et al., 2016).**

Absence of clear extubation or weaning policies and procedures also has been associated with an increased risk for unplanned extubations. Other human factors, such as fatigue, inadequate staffing patterns in the ICU, and level of nursing experience have been linked to unplanned or accidental extubation. Nursing workloads and higher nurse-to-patient ratios also have been shown to contribute to unplanned extubation. Not surprisingly, the incidence of unplanned extubation is higher during evening and night shifts **(Kwon et al., 2017).**

Accidental extubation can lead to a large variety of complications, sudden removal of an ETT with the tracheal cuff still inflated can potentially cause injury to the vocal cords. If an intubated patient has a large secretion burden, aspiration of these secretions after an unplanned extubation can lead to aspiration pneumonia. If inadequate ventilation occurs after unplanned extubation, hypoxemia and potentially hemodynamic instability, hypotension, brain damage, cardiac arrest, and even death may result **(Aydogan et al., 2017).**

The discussion of the finding covered six main parts:

Concerning part one regarding the studied nurses' demographic characteristics, the result of this study reveals that majority of the studied nurses were females and two third of studied nurses were at age group between (20-30) years old. From the investigator point of view, it might be related to school nurses graduate large number of females than males, it could be also related to studying of nursing in Egyptian universities that were exclusive for females only till soon few years ago. These finding were in agreement with **(Mohamed, 2017)** who conducted study about "Effect of Educational Program on Nurses' Knowledge Regarding Care of Adult Patients with Endotracheal Tube "clarified as regarding nurses' age, it was showed that more than half of the studied nurses were twenty years old to less than twenty-five years old, While more than half of studied nurses were female.

Regarding the qualification level, the current study revealed that less than half of nurses were nursing technician, this study contraindicated with **Haider Mohammed Majeed, (2017)** who conducted a study entitled "Assessment of knowledge and practices of intensive care unit nurses about endotracheal suctioning for adult patients in Baghdad teaching hospitals, Iraq" was represented that more than half of studied nurses were from nursing knowledge.

As regarding years of experience, the current study revealed that less than half of the nurses under the study were having less than five years of experience and more than half of them had received training courses about endotracheal tube care. In investigator point of view this finding might be due to most of the nurses under the study were recently graduated, able to tolerate the working load and working stress, severity of patient conditions, hours of work and occupational hazards that facing them in ICU, The current study finding were agree with **Mwakanyanga, (2018)** Who conducted a study about "Intensive care nurses' knowledge and practice on endotracheal suctioning of the intubated patient: A quantitative cross-sectional observational study" mentioned that less than quadrant of studied nurses had worked in ICU between 1 and 5 years experiences and three fifth of participate nurses attended training courses about endotracheal tube care.

As regarding units policies and standard for endotracheal tube care protocols and Nurse-Patient ratio in the same shift, The current study revealed that more than two thirds of the nurses under the study had not nursing standard and structures in the unit for caring of the Endotracheal tube and more half of them had Two critical patients to one nurse in the same shift, From the investigator point of view, this finding might be due to there weren't standard and protocols at ICUs for endotracheal tube care, patients most critical, working load, stress that can lead to turn over of nurses. This study was agreed with **Prince, (2018)** who conducted a study about (Using Ultrasound Guided Peripheral Intravenous Catheters In Difficult Access Patients) who revealed that examined the need for central line placement during the Implementation of USGPIV program consisted of training emergency department technicians and residents (physicians), and practicing the technique on patients with known difficult peripheral access or those having two or more failed attempts by experienced emergency department staff (nurse or tech).

Concerning part two regarding nurses' knowledge regarding endotracheal tube:

Regarding the nurses level of knowledge related to endotracheal tube, the findings of the present study showed that two third of them had satisfactory level of knowledge about endotracheal tube, sites of insertion, vital signs and labs needed to patients, the current study finding were dis-agree with **Mpasa, (2020).** Who conducted a study about " Improving nurses' knowledge of managing endotracheal tube cuff pressure in intensive care units: A quasi-experimental study", the mean knowledge score of the post-test participants was 6.29 in the number of respondents with a knowledge score of 40 out of 100 or better.

Regarding the nurses level of knowledge related to endotracheal tube, the findings of the present study showed less than half of the studied nurses had unsatisfactory level of knowledge about care related to (pre, during and post) insertion of endotracheal tube, this study was agreed with **(Shariful Islam, 2010)** who conducted a study about "Nurses' Knowledge, Attitude, and Practice Regarding Pressure Ulcer.

Prevention for Hospitalized Patients at Rajshahi Medical College Hospital in Bangladesh" and revealed that the nurses' knowledge regarding pressure ulcer prevention was at a very low level (M = 57.79%, SD = 9.20) with minimum and maximum scores of 27,27% and 86.36%,respectively.

Regarding the nurses level of knowledge related to endotracheal tube the present study showed that less than half of the studied nurses had unsatisfactory level of knowledge related to care for a ventilator, infection control policies and accidental extubation, this study was agreed with **Sadia Sadaf, (2018)** who conducted a study about" Nurse" knowledge and practice regarding prevention of surgical site infection at Allied Hospital Faisalabad "and revealed a low nurses'" level of knowledge regarding the prevention of surgical site infection.

Concerning Part three regarding Nurses practice regarding endotracheal tube care:

Regarding the nurses practice related to endotracheal tube care, the present result showed that more than two thirds of the study

nurses had satisfactory level of practice regarding endotracheal tube care. This study disagree with **(Jordan, 2012)** who conducted study about" Endotracheal tube cuff pressure management in adult critical care units" and reported that 69% of respondents indicated that they did not perform deflation and re-inflation of the ETT cuff before and after suctioning, a significant proportion indicated that they did still perform this out -dated practice. Differences between public v. private sector CCU nurses were not statistically significant (p=0.420) and contrasted with **(Debra Michelle Shelby, 2014)**, who conducted a study about "Knowledge, Attitudes, and Practice of Primary Care Nurse Practitioners Regarding Skin Cancer Assessments: Validity and Reliability of a New Instrument "and revealed that 42.9% of the nurses had high levels of practice regarding pressure ulcer prevention.

Concerning Part four regarding factors affecting accidental extubation of endotracheal tube and application of Ramsy Sedation Scale

Regarding the factors affecting accidental extubation of endotracheal tube the present study showed that more than two thirds of the study nurses had positive effect on factors affecting accidental extubation of endotracheal tube in critical care units that majority of nurses under the study reported that many factors affecting positively on accidental extubation of endotracheal tube. First, patient related factors. Second, nurses related factors. Third, environmental related factors. This study agrees with **Hiwot Kassa, (2014)** who conducted study about "Assessment of knowledge, attitude and practice and associated factors towards palliative care among nurses working in selected hospitals" and revealed that nearly half of the participant nurses strongly agreed that PC was given only for dying patients. More than half of the respondents strongly disagreed to withdrawing their involvement with patients who are at the verge of death.

According Ramsy Sedation Scale more than two thirds of the nurses under the study had a patient sleep regarding Ramsay sedation scale and more than half of them had a patient wake level of Ramsay sedation scale, this study agree with this study agree with **Ismail, (2013)** who conducted the study about "Unplanned versus planned extubation in respiratory Intensive care unit, predictors of outcome"the Ramsay score in unplanned self-inflected and accidental extubation also was in lower levels (1.38 ±. 56, 1.38 ±.75) respectively.

Concerning part five regarding Relation and correlation between nurse's demographic characteristics and their total knowledge, practice and factors affecting accidental extubation of endotracheal tube

The study reveals that there were statistically significant relations between the nursing level of knowledge and their demographic characteristics. This means that many of them had satisfactory level of knowledge regarding their age, gender, qualification, years of experience, training courses. This result was disagree with **Mageed,2017** "who conducted research about "Assessment of knowledge and practices of intensive care unit nurses about endotracheal suctioning for adult patients in Baghdad teaching hospitals, Iraq" and revealed that nurses have best practical level than knowledge level and their no significant relationship significant nurse's demographic characteristics and levels of knowledge and practice.

The study reveals that there were statistical significant relations between the nursing level of practice and their demographic characteristics. This result was agree with **(Teshager Woldegioris,2019)** "who conducted research about "Nurses' Knowledge and Practice Regarding Prevention of Surgical Site Infection in Bahir Dar, Northwest Ethiopia" and was revealed that there were associated significantly with the nurse's practice in preventing surgical sites infection.

The study reveals that that there was statistical significant relations between nurses demographic characteristics and the factors affecting accidental extubation of endotracheal tube, this study was agreed with (Rehab Mohamed, 2020) who conducted a study about " Factors affecting nurses staff commitment at general hospital at Damietta city " and revealed that less than two thirds of nursing staff had

identification with their organization this finding is related to nurses' conviction that the image and reputation of the hospital are important items for them.

Concerning Part six regarding Correlation between nurse's total score of knowledge, practice and factors affecting accidental extubation of the endotracheal tube.

The study reveals that there was highly significant Positive correlation between level of nurses' knowledge, practice and factors affecting the accidental extubation of the endotracheal tube, this study agree with **El-Gawab, (2017)** who conducted a study of " Quality of nursing care on patients with tracheostomy" and revealed that there was a statistically significant positive correlation between total knowledge and total nurse' practice.

In summary, the research question which stated that what are the factors affecting accidental extubation of endotracheal tube at critical care units? The findings and discussion of the results declares that, there is need to focus on development of nursing staff knowledge and practice, so effort should be directed towards enhancing creativity, nurses must have access to update information, learning resources and continuous educational opportunities. The nurses should be more observer and seek to prevent accidental extubation of endotracheal tube through knowledge, implementing the established standards of providing safe endotracheal tube care without complications which must be updated periodically and reducing factors affecting accidental extubation of endotracheal tube.

Conclusion:

The result of current study concluded that, less than two thirds of the study nurses had satisfactory level of knowledge regarding care of endotracheal tube. While more than two thirds of the study nurses had satisfactory level of practice regarding care of endotracheal tube. More than two thirds of the study nurses had positive effect on factors affecting accidental extubation of endotracheal tube in critical care units. In addition, there were statistical significant relations between the nursing total level of knowledge, level of practice related to endotracheal tube care, socio-demographic characteristics and the factors affecting accidental extubation of endotracheal tube.

Recommendations:

Based on the current study findings, the following recommendations are suggested:

I. In services:

1. Continuous evaluation for nurses' level of knowledge and practice is essential to identify their needs in ICU about endotracheal tube care and prevention of accidental extubation of the endotracheal tube.
2. Designing nurse's educational program to improve nurse's knowledge about accidental extubation of the endotracheal tube. In addition to procedure book should be available in ICU as a reference for all nurses.
3. Further research studies are recommended to evaluate the effect of training program of nurse's performance regarding endotracheal tube care and prevention of accidental extubation of the endotracheal tube.

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