

ASSESSMENT OF NURSES' KNOWLEDGE AND PRACTICES REGARDING ENDO  
TRACHEAL TUBE SUCTIONING PROCEDURE AT THE INTENSIVE CARE UNITS

Thesis

Submitted for Partial Fulfillment of the Requirements Master Degree in Critical Care and  
Emergency Nursing

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## Abstract

**Background:** Endotracheal tube suctioning is one of the most common invasive procedures carried out in the ICU. It is an important procedure for adult critically ill patients with artificial airways. However it is not a safe procedure and may lead to short and long term detrimental effects. Therefore, critical care nurses must be aware of the potential risks of this procedure, and make efforts to prevent or minimize the possible complications. **Aim of the study:** to assess nurses' knowledge and practices regarding endotracheal tube suctioning at ICUs of Cairo University Hospitals. **Research design:** A descriptive exploratory research design was utilized. **Sample:** A convenience samples of 60 nurses were included in the current study. **Setting:** This study was carried out at the Intensive Care Units of Cairo University Hospitals. **Tools of data collection:** Three tools were developed by the investigator, tested for clarity, and feasibility: Nurses' personal background questionnaire, ETT suctioning nurses' knowledge self-administered questionnaire, and endotracheal tube suctioning Nurses' practice observational checklist. **Results:** Around two thirds (63.3%) of the studied sample had unsatisfactory knowledge and the great majority (95.5%) had unsatisfactory practice levels with means of  $20.5 \pm SD = 3.26$  and  $28.63 \pm SD = 6.2$  respectively. Unsatisfactory knowledge was found regarding preparation for suctioning (solutions used to dissolve secretions, the recommended suctioning pressure setting, equations used for estimating suction catheter size) and when to aspirate secretions during the suctioning procedure in percentages of 93.3 %, 83.3%, 80% & 70%, respectively. Unsatisfactory practice was found regarding auscultating lung sounds before suctioning, preparing sterile gloves, hyper-oxygenation prior to and post suctioning, wearing sterile gloves and documentation of secretions characteristics in percentage of 91.7%, 96.7%, 63.3%, 95% & 95 % respectively. Knowledge mean scores differed significantly in relation to gender, age category, years of experience in nursing, ICU years of experience and qualifications ( $t=3.43$  at  $P \leq 0.001$ ,  $t=6.74$  at  $P \leq 0.002$ ,  $t=5.197$ , at  $P \leq 0.003$ ,  $t=5.909$  at  $P \leq 0.001$  and  $t=21.17$  at  $P \leq 0.000$ ) respectively. However, no significant statistical difference was found in the total mean practice scores in relation to gender, age category, nursing years of experience, ICU years of experience and qualifications. **Conclusion:** In spite of having vital role in assessment and management of critically ill patients, critical care nurses in the current study had unsatisfactory knowledge and practice regarding endotracheal tube suctioning. **Recommendation:** updating knowledge and practices of ICU nurses through carrying out continuing educational programs about endotracheal tube suctioning; Ongoing monitoring of staff nurses' practice while practicing endotracheal tube suctioning, provision of guidance to correct poor practices; and replication of this study on larger probability sample

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**Key Words:** Assessment, Endotracheal tube suctioning, ICU Nurses' Knowledge, Practices.

Signed:.....

Chairperson of the thesis

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## LIST OF ABBREVIATIONS

AARC	American Association of Respiratory Care
BP	Blood Pressure
CCU	Coronary Care Unit
ETT	Endotracheal Tube
EU	European Union
FIO <sub>2</sub>	Fraction of Inspired Oxygen
Fr	French Size (Medical Tubing Unit of Measurement)
ICP	Intracranial Pressure
ICU	Intensive Care Unit
MRB	Manual Resuscitation Bag
NIV	Non-Invasive Ventilation
NSI	Normal Saline Instillation
OES	Open Endotracheal Suctioning
PEEP	Positive End Expiratory Pressure
RT	Respiratory Therapist
RN	Registered Nurse
SPO <sub>2</sub>	Oxygen Saturation Measured by Pulse Oximeter
VAP	Ventilator Associated Pneumonia
WHO	World Health Organization

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## CHAPTER I

### INTRODUCTION

Critically ill patients may suffer from increased amount of airways' secretions and difficulty in evicting these secretions due to many causes such as existence of artificial airways, disorder in normal function of ciliary cells and defect in coughing reflex. So, these patients need periodical suctioning. Endotracheal tube (ETT) suctioning is one of the major procedures performed in intensive care units (ICUs). The patient may need suctioning procedure from 3 to 24 times in each 24 hours (Ansari, 2012).

Therefore, when patients experience airway obstruction or respiratory failure, endotracheal intubation would be done in order to maintain or regain patency of the airway (Ferreira, 2013). The intubated patient mainly those who are under mechanical ventilation may have inadequate effort in coughing out sputum. When sputum or secretions are retained inside the trachea they may block the airway. ETT suctioning thus plays an important role in clearance of sputum and secretions from the airway, and so avoiding inadequate ventilation or suffocation which is fatal (Tang, 2013).

Endotracheal tube suctioning is a component of bronchial hygiene therapy and mechanical ventilation. It involves mechanical aspiration of pulmonary secretions from a patient who has an artificial airway in place. The suction event consists of the placement of a suction catheter through the artificial airway and the application of negative pressure as the catheter is being withdrawn. Each pass of the suction catheter into the artificial air way is considered a suctioning event (Jose, 2012).

As regards to the frequency with which the procedure should be performed. The current dilemma facing nurses is the overwhelming view that endotracheal tube suctioning should be performed only when indicated as necessary by assessment, to minimize the exposure of the patient to hazards of suctioning. As nurses are accountable for all aspects of their practice, they need to be able to make an informed choice about the frequency with which endotracheal tube suctioning is performed (Antony, 2011).

The need for ETT suctioning is determined by a variety of clinical signs and symptoms, such as coughing, increased inspiratory pressure on the ventilator, and the presence of adventitious sounds (rhonchi, gurgling) during chest auscultation. Suctioning may also be performed periodically to ensure airway patency. However, it is recommended by Chulary & Suzanne (2010), and Pedersen, Nielsen & Egerod (2009) that suctioning procedure must be performed only when necessary or when there is a clinical indication, and never as a routine schedule. The decision to perform suctioning must be based on a comprehensive patient's assessment rather than at regimented frequencies. This assessment should include a review of respiratory characteristics, palpation and auscultation.

Moreover, ETT suctioning is indicated when there is coarse breathing sounds, inability to generate an effective spontaneous cough, visible secretions in the airway, changes in monitored flow and pressure graphics, suspected aspiration of gastric or upper airway secretions, deterioration of arterial blood gas values, the need to maintain the patency and integrity of the artificial airway, presence of pulmonary atelectasis or consolidation (Smith, 2007). Also, it may be required in emergency situations or as a part of patient's planned care (Thomas, 2012).

Endotracheal tube suctioning is a necessary procedure for patients with artificial air way. Most contraindications are relative to the patient's risk of developing adverse reactions or worsening clinical condition as result of the procedure. When ETT suctioning is indicated, there is no absolute contraindication, because the decision to withhold suctioning in order to avoid a possible adverse reaction may in fact be fetal (Subirana, 2007).

The major recommendations are performing suctioning only when necessary, using a suction catheter occluding less than half of the lumen of the endotracheal tube, with the lowest possible suction pressure, inserting the catheter not further than carina, suctioning no longer than 10 sec, avoiding saline lavage, hyper-oxygenating before and after the suction procedure, providing hyperinflation combined with hyper-oxygenation on a non-routine basis and always using aseptic technique (Antony, 2011).

However, ETT suctioning is a potentially harmful procedure that if performed incorrectly may result in life threatening complications and major hazards including hypoxemia, tissue hypoxia, cardiovascular instability, presence of cardiac dysrhythmias and cardiac or respiratory arrest. Additional complications include bleeding, infection, atelectasis, alveolar collapse, bronchoconstriction or bronchospasm, infection, pulmonary bleeding, elevated intracranial pressure (ICP), interruption of mechanical ventilation and may also cause trauma or lesions in the tracheal mucosa (Kelleher & Andrews, 2008).

### Significance of the study

With an increasing demand for intensive care beds, more nurses in acute and high dependency wards will be expected to care competently for patients with tracheal tubes. Tracheal suctioning is an essential aspect of effective airway management. However, ETT suctioning is not a benign procedure. It is a potentially harmful one, and may be associated with risks and life threatening complications if it is not performed correctly. Thus, nurses should remain sensitive to possible hazards and complications, and take all necessary precautions to ensure patients' safety.

Through clinical practice, the investigator noticed certain malpractices regarding ETT suctioning, where critical care nurses didn't follow the procedure's guidelines like: maintenance of measures of infection control in suctioning practices, hand washing before and after the suctioning procedure, hyperoxygenation pre and post ETT suctioning, etc. This could be negatively reflected on the quality of provided nursing care. Therefore, it is necessary to observe nurses' practice of each step of the ETT suctioning procedure against the established standard. Observing nurses' practice can help in determining how well the task is performed and identifying factors that help or hinder procedure achievement.

So, it is imperative that nurses are aware of these risks and are able to practice according to current research recommendations. Therefore, there is a need for such research that investigates nurses' knowledge and practice regarding ETT suctioning in intensive care units. It is hoped that this research will help to provide evidence based data about nurses' knowledge and practice regarding ETT suctioning procedure.

### Aim of the study

The aim of this study is to assess ICU nurses' knowledge and practices regarding endotracheal tube suctioning in the intensive care units at Cairo university hospitals.

### Research Questions

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

Q1: What do ICU nurses' know regarding endotracheal tube suctioning?

Q2: What are ICU nurses' practices regarding endotracheal tube suctioning?



## CHAPTER II

### REVIEW OF LITERATURE

The scope of this literature review is to provide a comprehensive overview about definition of ETT suctioning, indications, contraindications, complications, nursing consideration prior to, during and after ETT suctioning, and finally recommendations, and nursing consideration regarding utilization of infection control.

#### Endotracheal Tube Suctioning

In order to improve standards of care, it is necessary for nurses to be aware of recent research recommendations. This will help in making informed decisions about their own practice, based on the patient's individual requirements (Antony, 2011). Critical care nurses presume responsibility for airway management and associated care for patients who require artificial airways, or endotracheal intubation or tracheostomy, and mechanical ventilation (Sole & Bennett, 2015).

Mechanically ventilated critically ill patients frequently retain tracheobronchial secretions because endotracheal tubes prevent the defense mechanisms of the upper airway such as filtration, humidification, air heating, and impair the cough reflex, thus decrease mucociliary clearance, and, probably, increase mucus production (Ferreira, 2013). Therefore, ETT suctioning is necessary to eliminate retained tracheobronchial secretions (Sole, Bennett & Ashworth, 2015).

Suctioning refers to aspiration of respiratory secretion through endotracheal tube or tracheostomy tube while using negative pressure through a suction device (Thomas, 2012). It is carried out when patients are unable to cough and void pulmonary secretions (Rolls & Elliott, 2008, and Davies, 2011). ETT suctioning is performed to maintain clear airways and optimize respiratory functions (Gardener & Shirland, 2009). If secretions are not cleared, patients may be at risk of infection, atelectasis and alveolar collapse. It is not required to be done regularly but only when needed (Kelsey & Carey, 2008).

#### Methods of Endotracheal Tube Suctioning:

There are two methods of endotracheal tube suctioning based on the selection of catheter: open and closed. Open endotracheal suctioning (OES) method requires disconnecting the patient from the mechanical ventilator and inserting a single use sterile suction catheter into the endotracheal tube, while the closed suctioning method involve attachment of a sterile, closed, inline suction catheter to the ventilator circuit, which permit passage of a suction catheter in the endotracheal tube without disconnecting the patient from the ventilator (AARC, 2010). Closed suction systems were established in the 1990s with the theoretical advantages for the patient of maintaining lung volumes, decreasing suction-induced hypoxemia and reducing ventilator-associated pneumonia (VAP) (Rolls & Jones, 2007).

Open suction techniques are considerably more complex than closed one, especially with the value toward maintenance of a sterile catheter, and causing a significant infection risk both to the individual patient, other patients and medical team as respiratory secretions are aerosolized (Alp & Voss 2006).

Any disconnection or break in the ventilation circuit raises the risk of introducing infective agents which may cause ventilator associated pneumonia (VAP). However, closed suction system remains in-situ in order to reduce airway contamination; its manufacturers advocate 24 hour change to prevent VAP (Darvas 2003). The relative cost of closed suction systems has been a significant barrier to uptake, however recent studies have revealed that the risk of VAP does not rise when in-line suction catheters are changed less often, therefore reducing costs (Thompson 2000; Darvas, 2003; Stoller, Orens et al. 2003).

Compared to the closed suctioning, open suctioning is more likely to prone patients with post ETT suctioning complications. On the other hand, despite of having many disadvantages, open ETT suctioning is still generally used because of the cheaper cost (Lorente, 2006), with similar occurrence rate of ventilator-associated pneumonia (Jongerden, 2007).

### Importance of ETT suctioning

Critically ill patients frequently have an increase in the production of mucous and an impaired ability to clear secretions. The patient may be at risk of infection, atelectasis and alveolar collapse, if secretions are not cleared effectively (Day, 2009). Proper management of the patient with an artificial airway can have an influence on reducing complications such as the development of VAP, length of ICU stay, duration of mechanical ventilation and mortality and morbidity (AACN, 2005; Jelic, 2008).

## Indications

Suctioning is indicated for removal of secretions that can be observed or heard with or without using of stethoscope; subsequent chest physiotherapy; bronchodilators treatments, and a sudden rise or popping of the peak airway pressure in mechanically ventilated patients that is not due to kinking of ventilator tube or patients biting the tube; patient coughing or struggling against the ventilator or pneumothorax (Thomas, 2012). According to the American Association of Respiratory Care (2010) endotracheal tube suctioning should be done when clinically indicated rather than routinely (Table 1),

Table 1: Indication for endotracheal tube suctioning

- ✚ Saw-tooth pattern on flow-volume loop on ventilator monitor
- ✚ Coarse crackles Auscultate over trachea
- ✚ Increased peak inspiratory pressure during volume control ventilation
- ✚ Decreased tidal volume during pressure-controlled ventilation
- ✚ Deterioration in oxygen saturation and/or arterial blood gas values
- ✚ Visible secretions in airway
- ✚ Patient's inability to generate an effective cough
- ✚ Acute respiratory distress
- ✚ Suspected aspiration of gastric or upper airway secretions

Adopted from: American Association for Respiratory Care. (2010). AARC Clinical Practice Guidelines. Endotracheal suctioning of mechanically ventilated patients with artificial airways 2010. *Respiratory care*, 55(6), 758.

As revealed by Guglielminotti (2000), saw tooth pattern on the flow-volume loop waveform together with coarse crackles over the trachea were the mainly indicators of retained secretions and require for suctioning. While the absence of a sawtooth pattern on the ventilator flow-volume loops waveform can be used to exclude retained secretions. Figures (1) show examples of the presence of a saw-tooth pattern and normal patterns on the respiratory waveform.

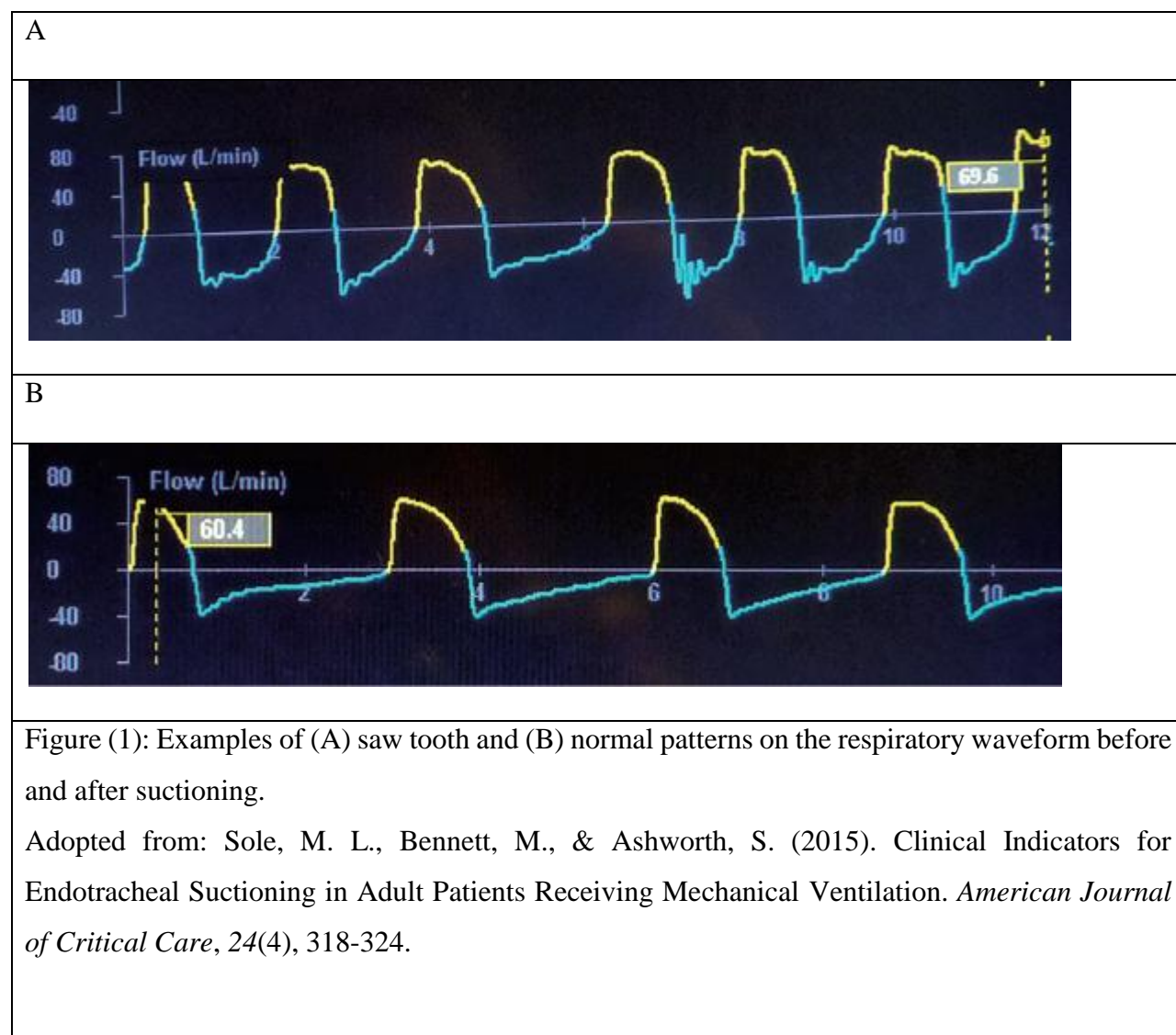
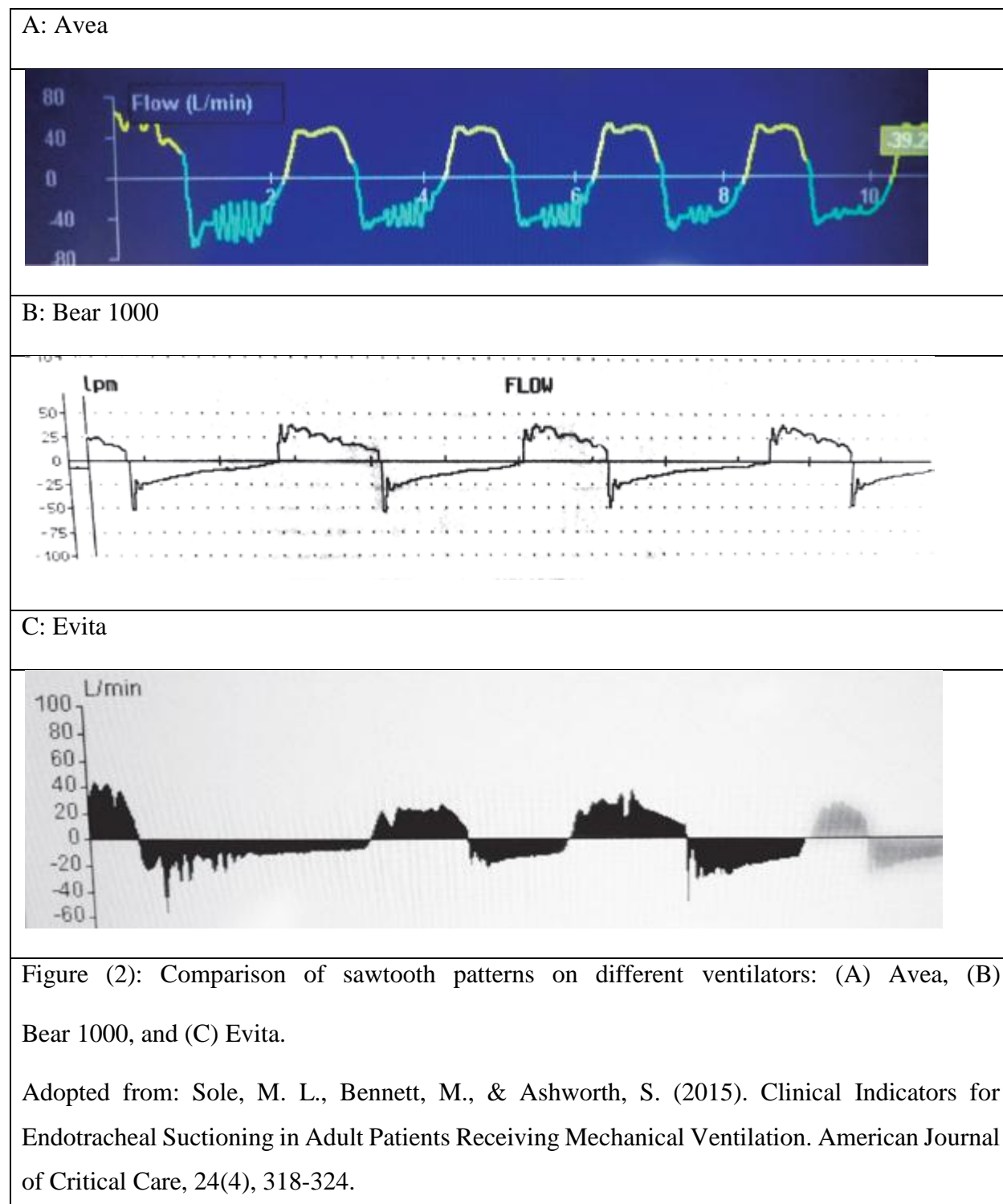


Figure (2) show comparison of sawtooth patterns on different ventilators.



### Contraindications

Most contraindications are related to the patient's risk of developing adverse reactions or deterioration of clinical condition as outcome of the procedure. There is no absolute contraindication to ETT suctioning, because the decision to postpone suctioning in order to avoid a possible adverse reaction may be, in fact fatal (AARC, 2010).

### Complications

Although frequent, endotracheal tube suctioning procedure does carry significant risk for the patient. Suctioning may cause hypoxemia, lead to a loss of lung volume, dysrhythmias, effect cerebral blood flow and introduce pathogens to the lower airway which increase the risk of nosocomial pneumonia. Also the procedure is considered a source of stress to patients and may alter their hemodynamic status (Rolls & Jones, 2007).

As revealed by Thompson, (2000), suctioning is an uncomfortable procedure despite being an essential component of keeping the tracheobronchial tree and the artificial airway free of secretions. A number of possible adverse effects result from ETT suctioning: respiratory (e.g. decrease in lung volumes, hypoxia, alveoli collapse, source of infection and trauma to the trachea); cardiovascular (e.g. bradycardia and hypertension); neurological (e.g. increase in intracranial pressure and diminution in cerebral blood flow).

Major complications of endotracheal tube suctioning include: hypoxia, as a result of an interruption in inspired oxygen flow and partial airway obstruction as the catheter passes into the endotracheal tube. The procedure may also 'suck' oxygen/gas out of the bronchial tree and lead to alveolar collapse. Encouraging deep breathing exercises, probably with an increased concentration of oxygen, if prescribe can reduce this effect. Furthermore using a proper suction catheter size no more than half the internal diameter of the endotracheal tube may be useful. The procedure should be performed quickly and definitely in less than 10 seconds (Antony, 2011).

Trauma is the second main complication. Using 'a traumatic' catheters, which have more than one suction opening, may be minimize direct tracheobronchial trauma. Suction vacuum pressure should also be kept low, at 80 - 150 mmHg. Infection one of the other complications associated with suctioning. Therefore, suction catheters should be sterile and used once only. Moreover other complications of suction include hemodynamic instability related to hypoxia and vagal stimulation. Undesirable fluctuations in intracranial pressure may also occur as a result of a reduction in cerebral venous return (Antony, 2011).



The American Association of Respiratory Care, (2010) summarized ETT suctioning complications to be decrease in dynamic lung compliance and functional residual capacity, atelectasis, hypoxia/hypoxemia, tissue trauma to the tracheal and/or bronchial mucosa, bronchoconstriction /bronchospasm, increased microbial colonization of lower airway, changes in cerebral blood flow and increased intracranial pressure, hypertension, hypotension, and cardiac dysrhythmias. To avoid complications associated with ETT suctioning, there are four aspects recommended by the AARC, (2010), and they are: assessment of patients' needs or indications for suctioning, the size of suction catheter being used, delivery of hyper oxygenation and hyperinflation, and normal saline instillation.

#### Nursing management of a patient undergoing endotracheal tube suctioning

Effective suctioning is an essential aspect of airway management in the critically ill. However, there are many associated risks and complications. Therefore critical care nurses must be aware of following nursing care; prior to suctioning; during suctioning; and post-suctioning for safer suctioning practices. Nursing management prior to suctioning include patient assessment, patient preparation and hyper oxygenation. The nursing management during suctioning includes appropriate catheter selection, depth of insertion, negative pressure, duration of procedure and number of suction passes. The nursing management post-suctioning includes reconnection of oxygen, patient assessment, monitoring oxygen saturation, and providing patient reassurance. In order to improve standards of care, it is imperative that nurses are aware of current research recommendations (Tang, 2013)

More ever, good preparation of patients by communication through explanation of suctioning procedure and appropriate poisoning, preparation of equipments by testing their functioning before use, following aseptic technique to reduce nosocomial infections, maintenance of measures of infection control in suctioning practices and hand washing before and after the suctioning procedure is strongly emphasized. As well, accurate documentation of the procedure time and frequency, sputum characteristics (amount, consistencies, color, odor of secretions) and patients' responses to the procedure are so helpful for evaluation of critical care nurses' implementation of suctioning (Jose, 2012).

#### Nursing management prior to ETT suctioning

Critical care nurses should have the required training and established skills to correctly assess the need for suctioning prior to ETT suctioning, perform the procedure accurately and adequately evaluate the patient condition after the procedure (AARC, 2010). As well, ETT suctioning has to be performed in relation to right standards and codes in order to decrease its adverse effects (Celik and Elbase, 2000). As revealed by Pedersen & Egerod, (2009), performing suctioning by well-trained critical care nurses, after assessing patient's need has better effects and less side effects than performing it habitually at every two hours. In addition, ETT suctioning is useful and effective when applied in the presence of careful patient's evaluation. However, it is expensive, inefficient and wasteful use of valuable resources when applied regularly and without apparent indications.

The decision to suction through a tracheal tube must be made on the basis of the clinical requirement to keep the patency of the tracheobronchial tree. These mean that different patients will have special needs, and endotracheal tube should just be suctioned when clinically indicated by signs which could include: visible or audible secretions (such as sputum, blood or gurgling), respiratory indicators such as desaturation, rising peak inspiratory pressure, decreasing tidal volume, increased respiratory rate, increased work of breathing or coarse breath sounds on auscultation, cardiovascular indicators such as increased heart rate and blood pressure; and the indicators such as: restless or diaphoresis (Rolls & Jones, 2007).

As revealed by Day (2009), performing suctioning should be determined by the patient's requirement, rather than being performed routinely. Physical assessment of the patient as well as auscultation and palpation of the chest and evaluation of the patient's secretion production will indicate the need for suctioning. Observation of airway pressures and pulse oximetry trends and end-tidal carbon dioxide evaluation are also important. Thus, suction only when needed to restrict exposure to possible complications (Couchman, 2007).

### Hyper oxygenation & hyperinflation prior to ETT suctioning

Hyper-oxygenation is the provision of high concentrated oxygen before and after endotracheal tube suctioning. Whereas hyperinflation it is a method to accomplish excessive inflation or expansion of the lungs (Pedersen et al, 2009). The AARC, (2010) suggested that, in preparation for the suctioning procedure, delivery of 100% oxygen in pediatric and adult patients and 10% increase of baseline in neonates for 30– 60 seconds prior to the suctioning event, particularly in patients who have hypoxemia before suctioning. This may be accomplished moreover by adjusting the Fraction of Inspired Oxygen (FIO<sub>2</sub>) setting on the mechanical ventilator, minimizing manual ventilation as it has been found to be ineffective for providing delivered FIO<sub>2</sub> and ensuring that PEEP is maintained.

#### Preparation of equipments

The following equipment and resources should be prepared before ETT suctioning. As recommended by the AARC, (2010). These involve necessary equipments such as vacuum source, calibrated, adjustable regulator, collection bottle and connecting tubing, disposable gloves, sterile for (open suction), clean for (closed suction), sterile suction catheter, or selective main-bronchus suctioning, a curved-tip catheter may be helpful. The information related to the effectiveness of head turning for selective suctioning is inconclusive, sterile water and cup (open suction), goggles, mask, and other appropriate equipment for standard precautions, oxygen source with a calibrated metering device, pulse oximetry, manual resuscitation bag equipped with an oxygen-enrichment device for emergency backup use, stethoscope. As well, optional equipments are needed such as electrocardiograph and sterile sputum container for culture specimen.

Determining the catheter size is another important aspect of preparing equipment. It is recommended to use smaller catheters as much as possible, since suction pressure seems to have less influence on lung volume loss than catheter size. For a specified diameter of the endotracheal tube, the level of negative pressure transmit to the airway is determined by the combination of the catheter size and the suction pressure. The larger the diameter of the catheter size, the lesser the suction pressure through the airways. Diameter of the suction catheter should not exceed one half of the inner diameter of the artificial airway in adults, providing an internal-to-external diameter ratio of 0.5, and 0.5– 0.66 in infants and small children (AARC, 2010). Estimation of the suction catheter size is done through the following formulas: a: suction catheter size = [ETT size (mm) minus 1] multiplied by 2, (this formula will give a slightly larger catheter size), or by: multiplying half of the ETT diameter by 3 (Chaseling, 2014).

Another important aspect is adjusting the suction pressure. Because aspiration of secretion is traumatic, it is necessary to avoid trauma to the mucosa of the lung. The suctioning pressure should never be applied while inserting the catheter, and suction should be applied intermittently as catheter is withdrawn. Rotating the catheter will improve removal of secretion that has adhered to sides of endotracheal tube (Thomas, 2012).

The negative pressure of the unit have to be checked through occluding the end of the suction tubing before attaching it to the suction catheter, and before every suctioning event. Suction pressure must be set as low as possible and so far efficiently clear secretions. Experimental facts to support an appropriate maximum suction level are lacking. Negative pressure of 80–100 mmHg in neonates and less than 150 mmHg in adults has been recommended (AARC, 2010).

#### Nursing management during ETT suctioning Procedure

### Depth of catheter insertion: shallow versus deep

There are also two techniques of suctioning based on the catheter suction depth chosen during the procedure: deep and shallow. Deep suctioning is defined as the insertion of a suction catheter until resistance is met, followed by pulling out of the catheter by 1 centimeter (cm) before application of negative pressure. While shallow suctioning is defined as the insertion of a suction catheter to a preset specific depth, typically the length of the endotracheal tube plus the adapter (Koeppel, 2006).

The suction catheter should be insert to the depth of the carina and then withdrawn by one cm before initiation suctioning (Day, 2009). Care should be taken however as constant contact with the carina can result in ulceration and make hemodynamic changes associated with coughing and vagal stimulation (Couchman, 2007). On the other hand shallow suctioning refers to the catheter being inserted to the point just past the tip of nasopharyngeal or oropharyngeal tube (Kelsey & Carey, 2008).

Deep suctioning is when the suction catheter is inserted up to the point when resistance is met; withdrawal the catheter before suctioning is applied. During the past 10 years, studies using the deep suction technique with animals have shown epithelium damage and inflammation, up till now practice report that many caregivers carry on deep suction. Therefore shallow suctioning is recommended to avoid trauma to the tracheal mucosa. Deep suction has not shown greater benefit than shallow suction and possibly will be associated with additional side effects (American thoracic society, 2010).

### Length of time and frequency of suctioning

Restricting the length of time of the suctioning procedure to less than 10 - 15 seconds decreases the risk of hypoxaemia and atelectasis. Limitation the frequency of passes in a suction event to three or less also helps in reducing associated complications (Couchman, 2007). On the other hand, Kelsey & Carey (2008) revealed that Suction should not take longer than 10 seconds; patients should have a recovery time between every attempt to permit baseline observations to return to normal, and it is recommended that no more than three suction events are attempt at a time.

#### Normal saline instillation

Instillation refers to the administration of normal saline solution directly into the trachea through an artificial airway. In spite of assuming that normal saline instillation might loosen secretions; increase the quantity of secretions removed; and assist in the removal of tenacious secretions, there is lacking evidences to support this hypothesis. Normal saline instillation was found to increase secretion clearance through cough stimulation in adults (Caruso et al., 2009).

Based on evidence based research findings, normal saline and mucus are in fact not soluble for each other. Also, normal saline instillation is irritating, and it may cause a drop in oxygen saturation, delayed improvement of oxygen saturation after suctioning, and a significant increase in heart rate (Overend et al, 2009 and Tang, 2013). The huge bulk of the references used to update this guideline indicate that normal saline instillation is unlikely to be advantageous, and may actually be dangerous (Celik & Kanan, 2006; and Branson, 2007).

Monitoring patients before, during, and after the procedure can be achieved through assessing breathing sounds, skin color, hemodynamic parameters, (oxygen saturation, respiratory rate, and pattern, pulse rate, blood pressure), electrocardiographic recording, if indicated and available, assessing sputum characteristics (color, volume, consistency, and odor), cough characteristics, ventilator parameters, (Peak inspiratory pressure and plateau pressure, Tidal volume, Pressure, flow, and volume graphics, if available, and FIO<sub>2</sub>) (American Thoracic Society, 2010).

#### Nursing management regarding utilization of infection control during ETT suctioning

Critical care nurses who perform suction should get a standard training and demonstrate competence under supervision. They should make sure that their knowledge and skills are up to date. Nurses should also ensure that they carry out this role compliant with their organization's protocols, policies and guidelines (Antony, 2011).

Endotracheal tube suctioning has a number of probable Occupational Health and Safety problems as well as exposure to aerosolized sputum. Thus, wearing personal protective equipment is necessary when performing this practice (Rolls & Jones, 2007).

Critically ill patient has a risk of introduction of exogenous organisms into the respiratory tract therefore; the suctioning procedure should be done using aseptic techniques to reduce that risk. Prevention of infection is an essential aspect of any clinical practice and consists of using personal protective equipment, hand hygiene, discarding equipment and medical wastes, and isolation of infectious patients. In addition, goggles, gloves and masks must be wearing everywhere there is a danger of droplet formation throughout suctioning (Jose, 2012).



Hand hygiene is an important aspect of infection control/ prevention. All staff nurses must make hand hygiene when entering the patient's bed area; before wearing gloves to perform the suction procedure; after achievement of the suctioning procedure subsequent gloves removal and on leaving the patient bed area (Chaseling, 2014).

#### Nursing management Post ETT suctioning

The outcomes of the suction procedure on the patient have to be evaluated and this should consist of reversal of pre-suctioning clinical signs, assessment of suction yield and potential complications of the suction procedure such as patient distress, hypertension, hypoxia and intracranial hypertension (Rolls & Jones, 2007). Hyper-oxygenation for as a minimum one minute by following the similar method used to pre-oxygenate the patient may be used, particularly in patients who are hypoxemic before and / or during suctioning. The patient should be continuously monitored for hypoxia therefore patient must be connected with pulse oximeter to assess oxygenation during and after the procedure (Kelsey & Carey, 2008).

During the follow-up phase, the assigned nurse must monitor the patient through auscultating breath sounds, measuring heart rate, blood pressure, respiratory rate, and oxygen saturation, recording the patient's tolerance to the procedure, type and amount of secretions removed, and complications, reporting any intolerance of the procedure (changes in vital signs, bleeding, laryngospasm, and upper airway noise), recording amount and consistency of secretions., and assessing need for further suctioning (Lippincott, 2010).

Assessment of patient's outcome after ETT suctioning can be achieved through checking for improvement in breath sounds, decreased airway resistance or increased dynamic compliance; improvement in arterial blood gas values or oxygen saturation (SpO<sub>2</sub>), as reflected by pulse oximetry, and removal of pulmonary secretions (AARC, 2010).

The critical care nurse must document physical assessment of the patient before and after suctioning, indications of suctioning, monitoring of cardiac rate and rhythm, blood pressure, pulse oximetry reading, airway reactivity, tidal volumes, peak airway pressures, or intracranial pressure, patient's tolerance of suctioning procedure, if pre hyper-oxygenation was used, results/product of suctioning including amount, color and viscosity of secretions, and potential complications during or post the suctioning procedure (Chaseling, 2014).

To conclude, In spite of being an important and life saving procedure for critically ill patients, endotracheal tube suctioning is associated with certain complications. Therefore, the critical care nurse plays an important role in preventing such complications.

## CHAPTER III

### Subjects & Method

#### Aim of the study

The aim of the current study was to assess nurses' knowledge and practices regarding endotracheal tube suctioning in the intensive care units at Cairo university hospitals.

#### Research Questions

To fulfill the aim of the current study the following research questions were formulated:

Q1- What do ICU nurses' know regarding endotracheal tube suctioning?

Q2- What are ICU nurses' practices regarding endotracheal tube suctioning?

#### Research Design

A descriptive research design was utilized to carry out the current study. This design is concerned with description of a phenomenon of interest and focuses on a single group or population characteristics without trying to make interference (Schmidt & Brown, 2012).

### Subjects

A convenience sample of 60 nurses was included in the current study, representing all those who work in the selected intensive care units (ICUs) at Cairo University Hospitals, and were willing to participate in the study with the following inclusion criteria; of both gender and different nursing educational backgrounds. The sample size was estimated using G Power (statistical power analysis program).

### Setting

The current study was carried out at four different intensive care units at El-Manial University Hospital which are affiliated to Cairo University hospitals. These units are: the Critical Care Medicine Department. It consists of three Critical Care Units: the first Critical Care Unit is located in the 1<sup>st</sup> floor, it consists of three I.C.U rooms (each one contains 3- 4 beds); one coronary care unit (C.C.U) (consists of three rooms, each one contains 2 - 3 beds), and an examination room (contains 3 beds);the second Critical Care Unit is located at the 2<sup>nd</sup> floor. It consists of I.C.U-14 (contains 14 beds), I.C.U-9 (contains 9 beds), an isolation room (contains 4 beds), a shock room (contains 3 beds), and an examination room (contains one bed), and the third Critical Care Unit is located in the 4<sup>th</sup> floor (contains 20 beds).

The second setting is the emergency ICU which is located in the 1<sup>st</sup> floor, and is affiliated to section (5) “emergency department”, and contains 12 beds; the third setting is Cardiothoracic ICU which is affiliated to El-Manial Specialized University hospital. It is located in the 4th floor and contains 8 beds; and finally the fourth ICU which is affiliated to Section (6). It is located in the 1<sup>st</sup> floor, and contains 18 beds.

### Tools of data collection

Three tools were utilized to collect data pertinent to the current study. They were developed by the investigator and reviewed by a panel of three experts in critical care nursing and critical care medicine specialties. The tools are as follows

1- Nurses' personal background data (Appendix 1) :

This tool includes data related to gender, age, educational level, place of work, years of experience in nursing and in the ICU, and the number of attended training courses about ETT suctioning.

2- Endotracheal Tube Suctioning Nurses' Knowledge Self-Administered Questionnaire, (Appendix 2):

This questionnaire was developed to collect data related to indications of ETT insertion, patients' assessment, and preparation of equipments uses for ETT suctioning, selection of catheter size, knowledge related to implementation of ETT suctioning, hyper oxygenation pre and post ETT suctioning, duration of aspirating secretions and knowledge related to nursing care post ETT suctioning, etc. It consists of 30 questions divided into four domains classified as:

- General knowledge: indications & purpose of ETT suctioning (9 questions from 1-6 & 24, 25 and 30 )
- Preparation for ETT suctioning procedure (9 questions from 7 - 13 & 22 and 26)
- Knowledge related to implementation of ETT suctioning procedure (7 questions from 14 – 18 & 23 and 28)
- Knowledge related to nursing care post ETT suctioning (5 questions 19- 21, 27 and 29)

### Scoring system

The total scores for the knowledge assessment questionnaire was 30; one score was given to each right answer and zero to each wrong answer.

The scoring system was classified as follows;

- Scores less than 22.5 (< 75%) were considered as unsatisfactory knowledge.
- Scores equal or more than 22.5 ( $\geq 75\%$ ) were considered as satisfactory knowledge.

### 3- Endotracheal Tube Suctioning Nurses' Practice Observational Checklist (Appendix 3):

This tool was developed to assess nurses' practice regarding endotracheal tube suctioning. It consists of 55 steps classified under seven main domains:

- Indications of endotracheal tube suctioning (6 items from 1-6).
- Preparation of equipments and supplies (9 items from 7-15).
- Preparing the patient for suctioning procedure (5 items from 16-20)
- Implementation of ETT suctioning (18 items from 21-38)
- Maintenance of asepsis and post suctioning care (7 items from 39-45)
- Evaluation of patient's outcome (3 items from 46-48)
- Documentation of ETT suctioning procedure (7 items from 49-55)

### Scoring system:

- One score was given to (Done) items and zero for (Not Done)
- Scores less than 41.25 (<75%) were considered unsatisfactory.
- Scores equal or more than 41.25 ( $\geq 75\%$ ) were considered satisfactory.

### Tools validity and reliability

Content validity was done to identify the degree to which the used tools measure what was supposed to be measured. The developed tools were examined by a panel of three critical care nursing experts to determine whether the included items were clear and suitable to achieve the aim of the study.

### Pilot study

A pilot study was carried out on seven staff nurses working at Critical Care Medicine Department at El-Manial University Hospital to test feasibility, objectivity, and applicability of the data collection tools. Carrying out the pilot study gave the investigator experience to deal with the included subjects, and the data collection tools. Based on results of the pilot study needed refinements and modifications were done and the pilot study subjects were excluded from the actual study sample.

### Protection of Human Rights

An official permission to conduct the study was obtained from the vice dean of higher education and research–Faculty of Nursing and directors of Intensive Care Units at Cairo University Hospitals. Written consents for staff’ agreements to be included in the study were obtained after explanation of the nature and purpose of the study. Each nurse was free to either participate or not in the current study, and had the right to withdraw from the study at any time without any rational. Also, nurses were informed that obtained data will not be included in any further researches. Confidentiality and anonymity of each subject were assured through coding of all data. Subjects were reported that obtained data will not affect their annual appraisal.

### Procedure

The current study was conducted on two phases: the designation and implementation phase. As regards to the designation phase, it was concerned with construction and preparation of different data collection tools (nurses' background data sheet, nurses’ knowledge self-administered questionnaire and observational checklist); obtaining managerial agreements to carry out the study, where he investigator obtained formal agreements from directors of ICU at Cairo university hospitals. The purpose and nature of the study were explained to gain their acceptance, and support. This stage required about two month's duration and ended by carrying out the pilot study.



Regarding the implementation phase, it was carried out after the preparation phase. Data of the current study were collected over a period of 6 months starting from November 2014 to April 2015. The data were collected from all the nursing staff working in the Intensive Care Units. The investigator visited the selected setting on daily basis. The involved 60 nurses were informed individually about the purpose and nature of the study, and the investigator obtained written consents from those who accepted to share in the study.

They have been contacted by the investigator during the day shifts. The average number of nurses who answered the questionnaire was 2-3 nurses per day. Answering questions of (tool 1& 2) about ETT Suctioning required about 45-60 minutes from each nurse. The investigator was available to answer for any questions or explanations and to check each questionnaire after its completion, to be sure that no missing data was present.

Concerning observation of nurses' practice, it was carried out during the morning and afternoon shifts while their practice of different nursing care skills related to ETT suctioning utilizing tool (3). Participant observation was used, so that nurses did not notice that they were observed during their practice, since the investigator is normally present in the units as a clinical instructor. Two nurses were observed in each shift. Each nurse was observed on three different occasions for 20- 30 minutes per observation, while performing each procedure of the observational checklist. Obtained data were converted into numeric data, and the average of the three observations was calculated.

### Statistical Analysis Data

Upon completion of data collection, data were analyzed using SPSS program version 20; then tabulated. Relevant statistical analysis was used to test the obtained data. Descriptive and inferential statistics were done such as mean and standard deviations; frequency; percentage; and independent t test & analysis of variance (ANOVA).

### Limitation of the study

Findings of this study were limited to a small sample size (60 Nurses), as it was conducted on the nurses who were willing to participate in the study. Therefore, it may not be necessarily representative for the general population of nursing staff in Critical Care Departments. Findings are less amenable to generalization because the sample was selected from one geographical area in Egypt (Cairo University Hospitals). Few Egyptian studies were done in this area of research.

## CHAPTER IV

### Result and data analysis

#### Aim of the study

The aim of the current study is to assess nurses' knowledge and practices regarding endotracheal tube suctioning in the intensive care units at Cairo university hospitals.

#### Research Questions

To achieve the aim of the current study, the following research questions were formulated:

Q1- What do ICU nurses' know regarding endotracheal tube suctioning?

Q2- What are ICU nurses' practices regarding endotracheal tube suctioning?

Statistical findings of the current study are presented in three main sections: Section (1) presents demographic characteristics of the studied sample (table 2 and figure 3 & 4); section (2) is concerned with answering the research questions (tables 3-15 and figure 5 & 6); and section (3) delineates additional correlation findings (tables 16-20).

Section (1): Personal background data of the studied sample. Table (2) and Figure (3 & 4) are related to this section.

Table (2) clarifies that, the age of 35% of the studied sample ranged between 26 and 35 years with a mean of (30.2±6.8). Around half (48.3%) of the studied sample had bachelor nursing degree. About one third of the studied sample had more than ten years of experience in their work place as nurses and in the ICU in percentage of 38.3% & 35%, respectively.

Table (2): Percentage Distribution of the Studied Sample as Regards to Age, Educational Level, Years of Work and ICU Experience (N=60).

Variables	No	%
Age (years)		
16– 25	20	33.3
26-35	21	35
36-45	19	31.7
X±SD	30.2±6.8	
Level of Education		
Bachelor	29	48.3
Technical institute	10	16.7
Diploma (secondary school)	21	35
Work Experience(years)		
Less than One year	4	6.7
One < 5 years	15	25
5 –10years	18	30
>10 years	23	38.3
ICU Experience(years)		
Less than One year	12	20
One < 5 years	12	20
5 – 10 years	15	25
>10 years	21	35

As indicated from figure (3): more than two thirds (68.3%) of the studied sample was females.

Figure (3): Percentage Distribution of the Studied Sample as regards to Gender (N= 60).

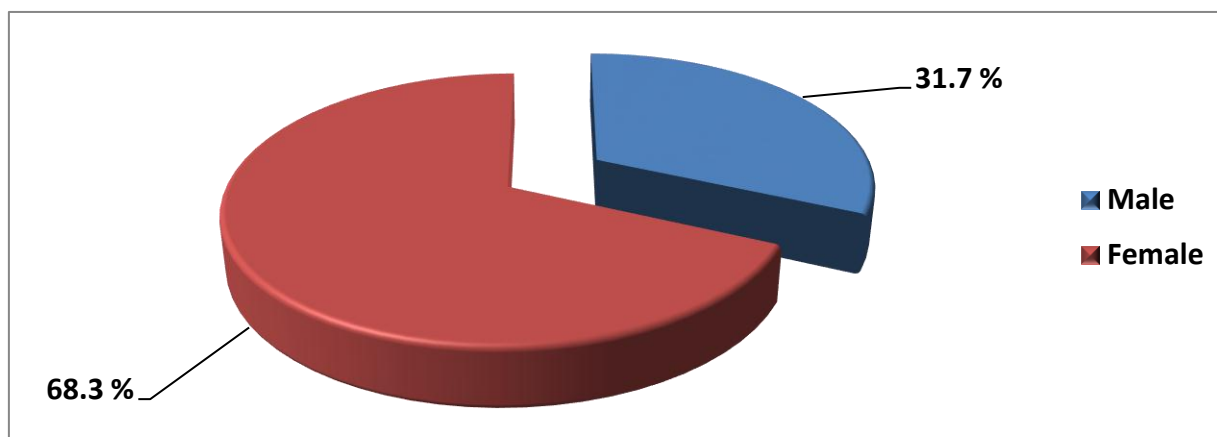
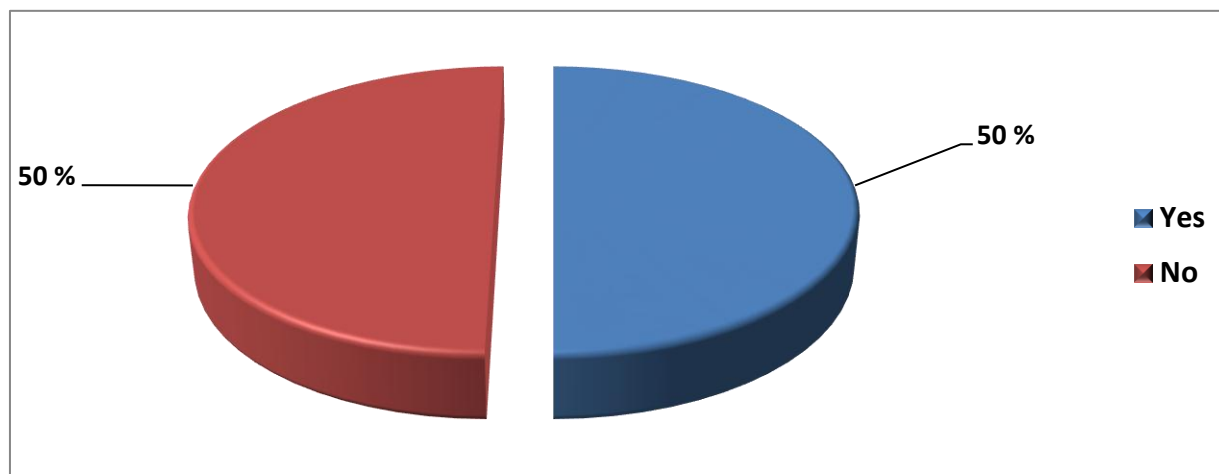


Figure (4) clarifies that 50% of the studied sample attended ICU training programs about ETT suctioning.

Figure (4): Percentage Distribution of the Studied Sample as regards to ICU training program

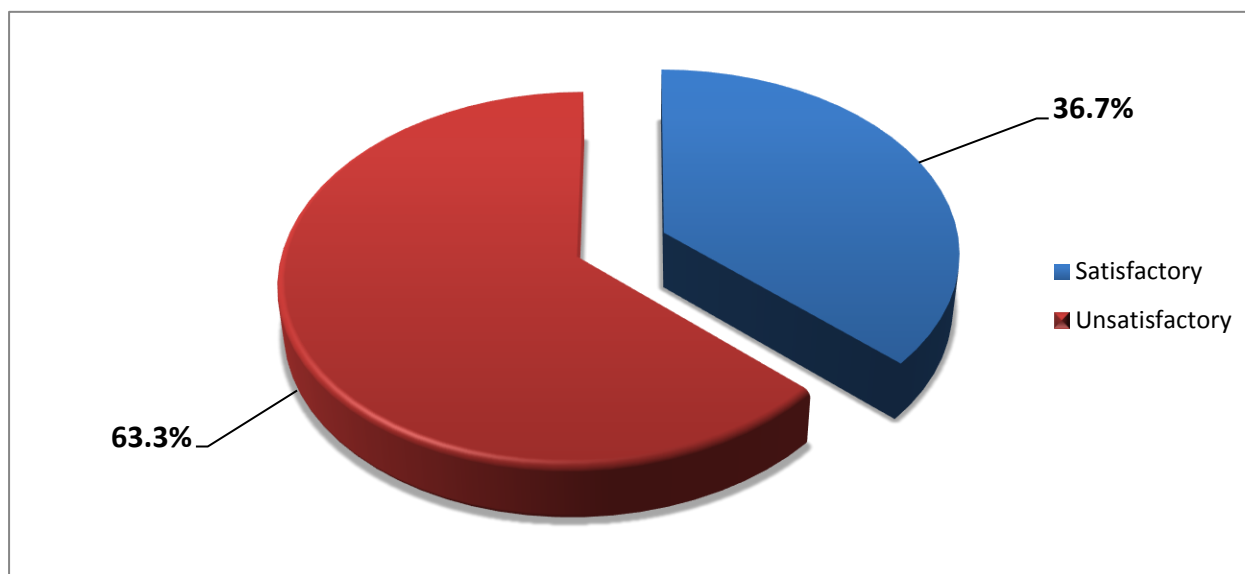
(N= 60).



Section (II): Part one: This section is concerned with answering the first research question which states: What do ICU nurses' know regarding endotracheal tube suctioning? Tables (3-7) and figure (5) are related to this section.

As indicated from figure (5), around two thirds (63.3%) of the studied sample had unsatisfactory knowledge level (<75%), with a mean total knowledge scores of  $20.5 \pm 3.26$ .

Figure (5): Percentage Distribution of the Studied Sample as Regards to Knowledge about Endotracheal Tube Suctioning (N= 60).



As indicated from table (3), the studied sample had unsatisfactory knowledge regarding preparation for ETT suctioning, implementation of ETT suctioning, and post ETT suctioning care in percentage of 80%, 60% and 51.7% respectively with a subtotal mean scores of  $5.13 \pm 1.57$ ,  $5.23 \pm 1.12$  and  $3.33 \pm 0.85$ , respectively. While the studied sample had satisfactory general knowledge about endotracheal tube suctioning in percentage of 68.3% with a subtotal mean score of  $6.81 \pm 1.61$  and a total mean knowledge score of  $20.5 \pm 3.26$ .

Table (3): Percentage Distribution of the Studied Sample as Regards to Total & Subtotal Mean Knowledge Scores (N=60).

Knowledge level, $X \pm SD$ and Percentage	Knowledge level		Subtotal $X \pm SD$
	Satisfactory ( $\geq 75\%$ )	Unsatisfactory ( $< 75\%$ )	

Knowledge assessment domains	No.	%	No.	%	
1. General Knowledge about endotracheal tube suctioning	41	68.3%	19	31.7%	6.81±1.61
2. Preparation for ETT Suctioning	12	20%	48	80%	5.13±1.57
3. Implementation of ETT suctioning	24	40%	36	60%	5.23±1.12
4. Post ETT suctioning care	29	48.3%	31	51.7%	3.33±0.85
Total knowledge score	٢٢	36.7%	٣٨	٦٣.3%	20.5±3.26

As regards to nurses' general knowledge about endotracheal tube suctioning, table (4), clarifies that the majority of the studied sample had satisfactory knowledge about assessing patients' needs for suctioning, indication of ETT insertion, nursing care after ETT insertion, structure anatomy of the respiratory system, indications of connecting a patient to mechanical ventilator, and the relationship between suctioning and the development of ventilator associated pneumonia (VAP) in percentage of 93.3%, 91.7%, 86.7%,83.3%, 83.3% &71.7%, respectively with subtotal mean knowledge scores of 0.93± 0.25, 0.1±0.3, 0.86±0.34, 0.85± 0.36, 0.85±0.36&0.71±0.45 respectively, and a total mean score of 6.81± 1.61.

Knowledge level, X±SD and Percentage	Knowledge level	Subtotal X±SD
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Knowledge assessment domains	Satisfactory		Unsatisfactory		
	No.	%	No.	%	
1. General knowledge about endotracheal tube suctioning :					
1.1. Structure anatomy of the respiratory system.	50	83.3	10	16.7	0.85± 0.36
1.2. Indication of ETT insertion.	55	91.7	5	8.3	0.1± 0.3
1.3. Nursing care after ETT insertion.	52	86.7	8	13.3	0.86± 0.34
1.4. Indications of connecting a patient with the mechanical ventilator.	50	83.3	10	16.7	0.85± 0.36
1.5. Indications of ETT suctioning	40	66.7	20	33.3	0.66±0.47
1.6. ETT suctioning frequency to critically ill patients	35	58.3	25	41.7	0.58±0.49
1.7. Assessing the patient's need for suctioning	56	93.3	4	6.7	0.93± 0.25
1.8. The main purpose of ETT suctioning	28	46.7	32	53.3	0.46±0.5
1.9. The relationship between suctioning and the development of (VAP).	43	71.7	17	28.3	0.71±0.45
Total X±SD	6.81± 1.61				

Table (4):Percentage Distribution, Total and Subtotal Mean Knowledge Scores of the Studied Sample as Regards to General Knowledge about Endotracheal Tube Suctioning(N=60).

Concerning knowledge regarding preparation for ETT suctioning, table (5), the studied sample had satisfactory knowledge about check the function of equipments before suctioning, assessing clinical indicators for ETT suctioning, check the suction vacuum pressure and the patients' position before ETT suctioning in percentage of 100%, 83.3%, 81.7% & 71.7%, respectively, with subtotal mean knowledge scores of 1±0.0, 0.83±0.37, 0.81± 0.39&0.72± 0.45, respectively.

However, the studied sample had unsatisfactory knowledge level about the recommended suction pressure setting, equations used for selection of suction catheter size, and ETT suctioning as a sterile procedure in percentage of 83.3%, 80%&65% with subtotal mean knowledge scores of 0.17±0.37, 0.2±0.4&0.35±0.48respectively, and a total mean score of 5.13±1.57.

Table (5): Percentage Distribution, Total and Subtotal Mean Knowledge Scores of the Studied Sample as Regards to Preparation for ETT Suctioning (N=60).

Knowledge level, $\bar{X} \pm SD$ and Percentage	Knowledge level				Subtotal $\bar{X} \pm SD$
	Satisfactory		Unsatisfactory		
	No.	%	No.	%	
Knowledge assessment domains					
2. Preparation for ETT Suctioning :					
2.1. Assessing clinical indicators for ETT suctioning	50	83.3	10	16.7	0.83 $\pm$ 0.37
2.2. Equipment used for ETT suctioning	33	55	27	45	0.55 $\pm$ 0.5
2.3. Selecting a suction catheter size	30	50	30	50	0.5 $\pm$ 0.5
2.4. Equations used for selection of suction catheter size	12	20	48	80	0.2 $\pm$ 0.4
2.5. The patient position before ETT suctioning	43	71.7	17	28.3	0.72 $\pm$ 0.45
2.6. The recommended suction pressure setting	10	16.7	50	83.3	0.17 $\pm$ 0.37
2.7. ETT suctioning is a sterile procedure.	21	35	39	65	0.35 $\pm$ 0.48
2.8. Check the function of equipments before suctioning	60	100	0	0	1 $\pm$ 0.0
2.9. Check the suction vacuum pressure	49	81.7	11	18.3	0.81 $\pm$ 0.39
Total $\bar{X} \pm SD$	5.13 $\pm$ 1.57				

Regarding knowledge about implementation of the suctioning procedure, table (6) shows that, the studied sample had satisfactory knowledge about when to monitor vital signs, the use of suction catheter in case of touching unsterile surface, disposal of suction catheter after usage, hand washing, hyper oxygenation, in percentage of 100%, 96.7%, 91.7%, 81.7% & 70% with subtotal mean scores of 1 $\pm$ 0.0, 0.96 $\pm$ 0.18, 0.92 $\pm$ 0.28, 0.81 $\pm$ 0.39 & 0.7 $\pm$ 0.46, respectively. However, the studied sample had unsatisfactory knowledge regarding when to aspirate secretions during

suctioning procedure, in percentage of 70% with subtotal mean scores of  $0.3 \pm 0.46$ , and a total mean score of  $5.23 \pm 1.12$ .

Table (6): Percentage Distribution, Total and Subtotal Mean Knowledge Scores of the Studied Sample as Regards to Implementation of ETT Suctioning (N=60).

Knowledge assessment domains	Knowledge level				Subtotal X $\pm$ SD
	Satisfactory		Unsatisfactory		
	No.	%	No.	%	
3. Implementation of ETT suctioning :					
3.1. Hyper oxygenation before ETT suctioning.	42	70	18	30	0.7 $\pm$ 0.46
3.2. When to aspirate secretions during suction procedure.	18	30	42	70	0.3 $\pm$ 0.46
3.3. The duration of aspirating secretions.	32	53.3	28	46.7	0.53 $\pm$ 0.5
3.4. Hand washing.	49	81.7	11	18.3	0.81 $\pm$ 0.39
3.5. Disposal of suction catheter after using it.	55	91.7	5	8.3	0.92 $\pm$ 0.28
3.6. When to monitor vital signs.	60	100	0	0	1 $\pm$ 0.0
3.7. The use of suction catheter in case of touching unsterile surface.	58	96.7	2	3.3	0.96 $\pm$ 0.18
Total X $\pm$ SD	5.23 $\pm$ 1.12				

Concerning nurses' knowledge regarding post endotracheal tube suctioning care, table (7) shows that, the studied sample had satisfactory knowledge about documentation of sputum characteristics, hyper oxygenation after suctioning procedure and complications of suctioning procedure in percentage of 96.7%, 83.3% & 76.6%, with subtotal mean scores of  $0.96 \pm 0.18$ ,  $0.83 \pm 0.37$  &  $0.76 \pm 0.42$ , respectively. However, the studied sample had unsatisfactory knowledge

regarding dissolving of accumulated secretions in percentage of 93.3% with subtotal mean scores of  $0.06 \pm 0.25$  and a total mean score of  $3.33 \pm 0.85$ .

Table (7): Percentage Distribution, Total and Subtotal Mean Knowledge Scores of the Studied Sample as Regards to Post ETT suctioning care (N=60).

Knowledge assessment domains	Knowledge level				Subtotal X $\pm$ SD
	Satisfactory		Unsatisfactory		
	No.	%	No.	%	
4. Post ETT suctioning care :					
4.1.Dissolving of accumulated secretions.	4	6.7	56	93.3	0.06 $\pm$ 0.25
4.2.Complications of ETT suctioning procedure	46	76.6	14	23.3	0.76 $\pm$ 0.42
4.3.Documentation of nursing notes after ETT suctioning.	42	70	18	30	0.7 $\pm$ 0.46
4.4.Hyper oxygenation after suctioning procedure	50	83.3	10	16.7	0.83 $\pm$ 0.37
4.5.Documentation of sputum characteristics.	58	96.7	2	3.3	0.96 $\pm$ 0.18
Total X $\pm$ SD	3.33 $\pm$ 0.85				

Section (2): Part 2: This section is concerned with answering the second research question which states: What are ICU nurses' practices regarding endotracheal tube suctioning? Tables (8-15) and figure (6) are related to this section.

As indicated from figures (6), the great majority (95.5%) of the studied sample had unsatisfactory practice level (less than 75%).

Figure (6): Percentage Distribution of the Studied Sample Regarding Practice Level of Endotracheal Tube Suctioning (N= 60).

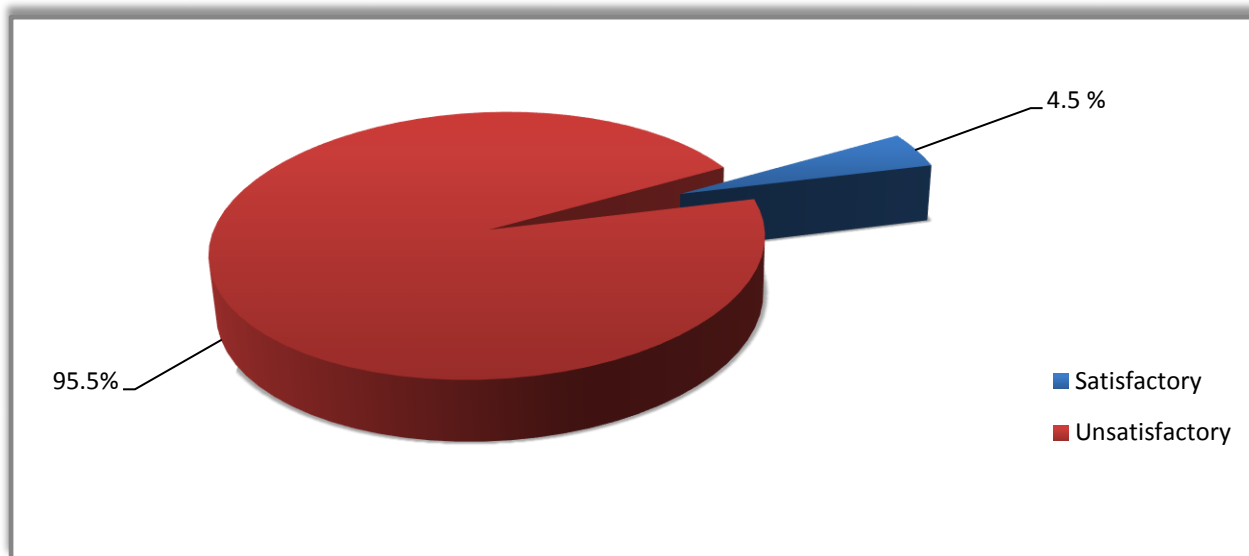


Table (8) clarifies that, the majority of the studied sample had unsatisfactory practice level regarding documentation, assessment for indications of ETT suctioning, preparing the patient for the suctioning procedure, implementation/carrying out suctioning, evaluation of patient's outcome, preparing necessary equipment and supplies, in percentage of 98.3%, 90%, 90%, 86.7, 83.3&76.7%, with subtotal mean scores of  $1.58 \pm 1.44$ ,  $2.1 \pm 1.17$ ,  $2.23 \pm 0.98$ ,  $10.59 \pm 2.35$ ,  $1.18 \pm 0.49$  &  $5.9 \pm 1.02$ , respectively, and a total mean practice scores of  $28.63 \pm 6.2$ .

Table (8): Percentage Distribution of the Studied Sample as Regards to Total and Subtotal Mean Practice Scores (N= 60).

Practice level, $\bar{X} \pm SD$ and Percentage	Practice level	Average subtotal

Practice assessment domains	Satisfactory		Unsatisfactory		X ± SD
	No.	%	No.	%	
1. Assessment for indications of ETT suctioning	6	10	54	90	2.1±1.17
2. Preparing necessary equipment and supplies	14	23	46	76.7	5.9±1.02
3. Preparing the patient for suctioning procedure	6	10	54	90	2.23±0.98
4. Intervention & implementation of endotracheal suctioning	8	13	52	86.7	10.59±2.35
5. Maintenance of asepsis & post suctioning care	37	61.7	23	38.3	5.06±1.01
6. Evaluation of patient's outcome	10	16.7	50	83.3	1.18±0.49
7. Documentation	1	1.7	59	98.3	1.58±1.44
Average total X±SD	28.63±6.2				

As regards assessment for indications of ETT suctioning, table (9), shows that, the most frequently not done practices were, auscultation of lung sounds, auscultating gurgling sound during respiration, checking physician's order and patient's care plan for ETT suctioning & observing change at patient skin color, in percentage of 91.7%, 78.3%, 76.7% & 76.7%, with subtotal mean scores of 0.08+0.27, 0.21+0.41, 0.23+0.42 & 0.23+0.42, respectively. However, the most frequently done practices were, determine decreased oxygen saturation less than 95% in percentage of 71.7%, with a subtotal mean score of 0.73+ 0.44 and a total mean score of 2.1+1.17.

Table (9): Percentage Distribution, Total and Subtotal Mean Practice Scores of the Studied Sample as Regards Assessment for Indications of ETT Suctioning (N= 60).

Concerning nurses' practices regarding preparing necessary equipment and supplies, table

Observational checklist domains	X $\pm$ SD and Percentage		Not Done		Done complete		Average subtotal X $\pm$ SD
	No	%	No	%	No	%	
1. Assessment for indications of ETT suctioning:							
1.1. Check physician's order and patient care plan for ETT suctioning.	46	76.7	14	23.3	0.23 $\pm$ 0.42		
1.2. Auscultation lungs sound	55	91.7	5	8.3	0.08 $\pm$ 0.27		
1.3. Observing change of patient skin color	46	76.7	14	23.3	0.23 $\pm$ 0.42		
1.4. Auscultation of gurgling sound during respiration	47	78.3	13	21.7	0.21 $\pm$ 0.41		
1.5. Checking vital signs	26	43.3	34	56.7	0.56 $\pm$ 0.49		
1.6. Confirm decreased oxygen saturation (less than 95%)	17	28.3	43	71.7	0.73 $\pm$ 0.44		
Total X $\pm$ SD	2.1 $\pm$ 1.17						

(10), shows that, the most frequently not done practices were, preparing sterile gloves, stethoscope and protective face mask in percentage of 96.7%, 85% & 71.7%, with subtotal mean scores of 0.03 $\pm$  0.18, 0.15 $\pm$  0.36 & 0.28 $\pm$  0.45, respectively. However, the most frequently done practices were, preparing portable or central suction machine with tubing and collection container and suction pressure gauge, clean gloves, appropriate sterile catheter size 12-18 Fr in percentage of 100%, 100% & 96.7%, with subtotal mean scores of 1 $\pm$  0.00, 1 $\pm$  0.00 & 0.98 $\pm$ 0.12, respectively and a total mean score of 5.9 $\pm$ 1.02.

Table (10): Percentage Distribution, Total and Subtotal Mean Practice Scores of the Studied Sample as Regards to Preparing Necessary Equipment and Supplies (N= 60).

As Regards to nurses' practices regarding preparing the patient for suctioning procedure,

table (11) shows that, the most frequently not done practices were, providing appropriate

Observational checklist domains	X+SD and Percentage		Not Done		Done		Average subtotal X ± SD
	No	%	No.	%	No.	%	
2. Preparing necessary equipment and supplies							
2.1. Portable or central suction machine with tubing , collection container and suction pressure gauge	0	0	60	100	1+ 0.00		
2.2. Sterile, disposable container.	24	40	36	60	0.6+ 0.49		
2.3. Appropriate sterile catheter size 12-18 Fr	2	3.3	58	96.7	0.98+ 0.12		
2.4. Sterile gloves	58	96.7	2	3.3	0.03+ 0.18		
2.5. clean gloves	0	0	60	100	1+ 0.00		
2.6. Sterile normal saline or sterile water	5	8.3	55	91.7	0.91+ 0.27		
2.7. Stethoscope	51	85	9	15	0.15+ 0.36		
2.8. protective face mask	43	71.7	17	28.3	0.28+ 0.45		
2.9. Ambu bag, oxygen unit and tubing	4	6.7	56	93.3	0.933+ 0.25		
Total X+SD			5.9+1.02				

explanation and pre oxygenation of the patient, in percentage of 83.3% & 61.7%, with subtotal mean scores of 0.16+0.37 & 0.38+ 0.49 respectively. However, the most frequently done practices were, patient position during ETT suctioning, in percentage of 71.7%, with subtotal mean scores of 0.7+ 0.46, respectively and a total mean score of 2.23+0.98.

Table (11): Percentage Distribution, Total and Subtotal Mean Practice Scores of the Studied Sample as Regards to Preparing the Patient for Suctioning Procedure (N= 60).

Percentage Observational checklist domains	X±SD and		Not Done		Done complete		Average subtotal X ± SD
	No	%	No	%	No	%	



3. Preparing the patient for suctioning procedure					
3.1. Providing appropriate explanation	50	83.3	10	16.7	016±0.37
3.2. Maintaining patient's privacy.	30	50	30	50	0.5± 0.5
3.3. Lowering side rails on working side of the bed.	32	53.3	28	46.7	0.46± 0.5
3.4. Patient position during ETT suctioning	17	28.3	43	71.7	0.7± 0.46
3.5. Pre oxygenation of the patient	37	61.7	23	38.3	0.38± 0.49
Total X+SD	2.23±0.98				

Concerning nurses' practices regarding implementation of endotracheal suctioning, table (12) shows that, the most frequently not done practices were, wear sterile gloves; keep dominant hand sterile & other hand clean, remove clean gloves and discard it in biohazard waste bin & place a towel or water proof pad across the patient's chest in percentage of 95%, 85% & 83.3%, with subtotal mean scores of  $0.05 \pm 0.22$ ,  $0.15 \pm 0.36$  &  $0.16 \pm 0.37$  respectively.

However, the most frequently done practices were, wear clean gloves, re-connect oxygen delivery device/ mechanical ventilator, attach distal end of catheter to tubing on suction machine and open sterile suction catheter in percentage of 98.3%, 98.3%, 96.7% & 90%, with subtotal mean scores of  $0.98 \pm 0.12$ ,  $0.98 \pm 0.12$ ,  $0.9 \pm 0.18$  &  $0.9 \pm 0.3$ , respectively and a total mean score of  $10.59 \pm 2.35$ .

Table (12): Percentage Distribution, Total and Subtotal Mean Practice Scores of the Studied Sample as Regards to Implementation of Endotracheal Suctioning (N= 60).

Observational checklist domains	X±SD and Percentage		Not Done		Done complete		Average subtotal X ± SD
	No	%	No	%	No	%	
4. implementation of Endotracheal suctioning							

○ Wash hands	35	58.3	25	41.7	0.43± 0.49
○ Wear protective face mask	42	70	18	30	0.3± 0.46
○ Wear clean gloves	1	1.7	59	98.3	0.98± 0.12
○ Place a towel or water proof pad across the patient's chest	50	83.3	10	16.7	0.16±0. 37
○ Turn suction on to appropriate pressure.	26	43.3	34	56.7	0.56± 0.49
○ Open sterile suction catheter	6	10	54	90	0.9±0.3
○ Set up sterile container; pour sterile saline or sterile water into it.	24	40	36	60	0.6±0.49
○ Remove clean gloves and discard it in biohazard waste bin.	51	85	9	15	0.15± 0.36
○ Wear sterile gloves; keep dominant hand sterile & other hand clean.	57	95	3	5	0.05± 0.22
○ Attach distal end of catheter to tubing on suction machine.	2	3.3	58	96.7	0.9±0.18
○ Insertion of the suction catheter.	8	13.3	52	86.7	0.86±0.34
○ Assess heart rate between suctioning.	42	70	18	30	0.3±0.46
○ Observe oxygen saturation.	17	28.3	43	71.7	0.71±0.45
○ Withdrawing the catheter slowly while applying intermittent suction.	21	35	39	65	0.65±0.48
○ Re-connect oxygen delivery device/ mechanical ventilator.	1	1.7	59	98.3	0.98± 0.12
○ Hyperoxygenation post ETT suctioning with 100 % oxygen	38	63.3	22	36.7	0.37± 0.48
○ Rinse catheter & catheter tubing with normal saline until clear.	13	21.7	47	78.3	0.78± 0.41
○ Repeat the steps if excessive secretions exist.	15	25	45	75	0.75± 0.43
Total X+SD	10.59±2.35				

As regards to maintenance of asepsis & post suctioning care, table (13) shows that, the most frequently done practices were, disconnecting the catheter from connecting tube, turning off suction device and discarding suction catheter in biohazard waste bin, in percentage of 90%, 88.3% & 83.3%, with subtotal mean scores of 0.9±0.3, 0.88± 0.32 & 0.83± 0.37 respectively, and a total mean score of 5.06±1.01.

Table (13): Percentage Distribution, Total and Subtotal Mean Practice Scores of the Studied Sample as Regards to Maintenance of Asepsis & Post Suctioning Care (N= 60).

Observational checklist domains	X $\pm$ SD and Percentage		Not Done		Done complete		Average subtotal X $\pm$ SD
	No	%	No	%	No	%	
5. Maintenance of asepsis & post suctioning care							
○ Performing oral and nasal suctioning (if needed).	21	35	39	65			0.65 $\pm$ 0.48
○ Disconnecting the catheter from connecting tube.	6	10	54	90			0.9 $\pm$ 0.3
○ Discarding suction catheter in biohazard waste bin.	10	16.7	50	83.3			0.83 $\pm$ 0.37
○ Removing gloves & face mask & discard it in biohazard waste	16	26.7	44	73.3			0.73 $\pm$ 0.44
○ Turning off suction device.	7	11.7	53	88.3			0.88 $\pm$ 0.32
○ Reposition the patient in comfortable position.	27	45	33	55			0.55 $\pm$ 0.5
○ Wash hands.	29	48.3	31	51.7			0.52 $\pm$ 0.5
Total X+SD			5.06 $\pm$ 1.01				

Concerning nurses' practice regarding evaluation of patient's outcome, table (14) shows that, the most frequently not done practices were, auscultating breath sound and comparing it with the pre-suctioning data, checking the respiratory rate & depth within normal range in percentage of 95% & 75%, with subtotal mean scores of 0.05 $\pm$ 0.22 & 0.25 $\pm$ 0.44, respectively. However, the most frequently done practices were, ensuring that oxygen saturation ranges from 95% - 100%, in percentage of 88.3%, with subtotal mean scores of 0.88 $\pm$  0.32, and a total mean score of 1.18 $\pm$ 0.49.

Table (14): Percentage Distribution, Total and Subtotal Mean Practice Scores of the Studied Sample as Regards to Evaluation of Patient's Outcome (N= 60).

Observational checklist domains	X $\pm$ SD and Percentage		Not Done		Done complete		Average subtotal X $\pm$ SD
	No	%	No	%	No	%	
6. Evaluation of patient's outcome							
a. Checking the respiratory rate & depth within normal range	45	75	15	25	0.25 $\pm$ 0.44		
b. Auscultating breath sound and comparing it with the pre-suctioning data.	57	95	3	5	0.05 $\pm$ 0.22		
c. Ensuring that oxygen saturation ranges from 95% - 100%	7	11.7	53	88.3	0.88 $\pm$ 0.32		
Total X+SD	1.18 $\pm$ 0.49						

As regards to documentation of ETT suctioning procedure, table (15) shows that, the most frequently not done practices were, documentation of odor of secretions, consistency of secretions and patient's response to suctioning, in percentage of 95%, 91.7% & 91.7%, with subtotal mean scores of 0.05 $\pm$  0.22, 0.08 $\pm$ 0.27 & 0.08 $\pm$ 0.27, respectively, and a total mean score of 1.58 $\pm$ 1.44.

Table (15): Percentage Distribution, Total and Subtotal Mean Practice Scores of the Studied Sample as Regards to Documentation of ETT Suctioning Procedure (N= 60).

Observational checklist domains	X $\pm$ SD and Percentage		Done complete		Average subtotal X $\pm$ SD
	No	%	No	%	
7. Documentation					
7.1. Document procedure time in nursing progress notes	19	31.7	41	68.3	0.68 $\pm$ 0.46
7.2.					
7.2.1. Document amount of secretions	50	83.3	10	16.7	016 $\pm$ 0.37
7.2.2. Document color of secretions	50	83.3	10	16.7	016 $\pm$ 0.37
7.2.3. Document odor of secretions	57	95	3	5	0.05 $\pm$ 0.22
7.2.4. Document consistency of secretions	55	91.7	5	8.3	0.08 $\pm$ 0.27
7.3. Document the patient's response to suctioning	55	91.7	5	8.3	0.08 $\pm$ 0.27
7.4. Recording frequency of suctioning.	37	61.7	23	38.3	0.38 $\pm$ 0.49
Total X+SD	1.58 $\pm$ 1.44				

Section (III): This section presents additional and correlation findings. Tables (16-20) are related to this section.

As clarified from table (16), there is high significant statistical difference in the mean knowledge scores in relation to gender ( $t=3.43$  at  $P \leq 0.001$ ) with tendency of male nurses to have higher mean scores than females ( $22.47 \pm 1.83$  as compared to  $19.6 \pm 3.4$ ). However, the mean knowledge scores didn't differ significantly in relation to attending ICU training program ( $t=0.118$ , at  $P \leq 0.907$ ).

Table (16): Comparison of the Studied Sample Total Mean Knowledge Scores in Relation to Gender and ICU Training Program (N = 60).

Items	X $\pm$ SD	t-test	P. value
Gender			
Male	22.47 $\pm$ 1.83	3.43	0.001**
Female	19.6 $\pm$ 3.4		
ICU training program			
Yes	20.46 $\pm$ 2.7	0.118	0.907
No	20.56 $\pm$ 3.7		

\*\* Significant at  $P \leq 0.05$ .

Ns: No significant statistical difference.

Table (17), shows there is high significant statistical difference in the mean knowledge scores in relation to age category, nursing years of experience, ICU years of experience and qualifications ( $t=6.74$  at  $P \leq 0.002$ ), ( $t=5.197$ , at  $P \leq 0.003$ ), ( $t=5.909$  at  $P \leq 0.001$ ) & ( $t=21.17$  at  $P \leq 0.000$ ) respectively. Higher mean knowledge scores were found among the group aged from 16 – 25 years, had one < 5 years of experience in nursing and in ICU, and had bachelor degree with means  $\pm$ SDs of 21.95 $\pm$ 3.59, 22.86 $\pm$ 3.9, 22.66 $\pm$ 4.20 and 23.38 $\pm$ 2.64 respectively.

Table (17): One Way ANOVA for Knowledge Scores in Relation to Age Category, Nursing Years of Experience, ICU Years of Experience and Qualifications of the Studied Sample (N=60).

Items	X $\pm$ SD	F	P value
Age category		6.74	0.002**
16 – 25	21.95 $\pm$ 3.59		
26-35	20.95 $\pm$ 2.62		
36-45	18.53 $\pm$ 2.65		
Nursing Years of Experience		5.197	0.003**
Less than One year	20 $\pm$ 1.15		
One < 5 years	22.86 $\pm$ 3.9		
5 - 10 years	20.6 $\pm$ 2.56		
>10 years	19 $\pm$ 2.71		
ICU years of Experience		5.909	0.001**
Less than One year	22.66 $\pm$ 4.20		
One < 5 years	22 $\pm$ 2.35		
5 - 10 years	19.9 $\pm$ 2.21		
>10 years	18.8 $\pm$ 2.76		
Qualifications		21.17	0.000**
Bachelor	23.38 $\pm$ 2.64		
Technical institute	18.5 $\pm$ 2.54		
Diploma (secondary school)	19.13 $\pm$ 2.41		

\*\* Significant at  $P \leq 0.05$

Ns: No significant statistical difference.

Table (18) shows that no significance statistical difference in the mean practice scores in relation to gender, and ICU training program ( $t = 0.827$ , at  $P \leq 0.412$ ), and ( $t = -0.545$  at  $P \leq 0.588$ ) respectively.

Table (18): Comparison of Mean Practice Scores in Relation to Gender and ICU Training Program of the Studied Sample (N = 60).

Items	X $\pm$ SD	t-test	P. value
Gender		0.827	

Male	29.61±1.2		0.412
Female	28.18±1.0		Ns
ICU training program		0.545	0.588
Yes	29.07±7.17		
No	28.20±5.13		

Ns: No significant statistical difference

As seen from table (19), there is no significant statistical difference in the mean practice scores in relation to age category, nursing years of experience, ICU years of experience and qualifications (F= 0.359, at  $P \leq 0.700$ , F= 0.337 at  $P \leq 0.799$ , F= 0.283 at  $P \leq 0.837$  and F= 1.855 at  $P \leq 0.166$ ), respectively.

Table (19): One Way ANOVA for Mean Practice Scores in Relation To Age Category, Nursing Years of Experience, ICU Years of Experience and Qualifications of the Studied Sample(N=60).

Items	X <sub>±</sub> SD	F	P value
Age category		0.359	0.700 Ns
16 – 25	28.71±6.35		



26-35	29.39±5.53		
36-45	27.71±6.91		
Nursing Years of Experience			
Less than One year	26.33±2.89	0.337	0.799 Ns
One < 5 years	28.13±4.77		
5 - 10 years	29.55±6.03		
>10 years	28.65±7.58		
ICU years of Experience			
Less than One year	27.13±3.19	0.283	0.837 Ns
One < 5 years	29.0±5.47		
5 - 10 years	28.9±6.38		
>10 years	29.0±7.81		
Qualifications			
Bachelor	30.36±5.16	1.855	0.166 Ns
Technical institute	25.93±3.93		
Diploma (secondary school)	28.32±7.21		

Ns: No significant statistical difference.

Table (20) reveals that there is significant statistical negative correlation between age and total mean knowledge scores ( $r = 0.000$ ,  $P = -0.470$ ). However no significant statistical correlation was found between age and total mean practice scores.

Table (20): Relationship between Age, Total Mean Knowledge and Practice Scores of the Studied Sample (N=60)

Variables		Total mean knowledge scores	Total mean practice scores
Total mean knowledge scores	Pearson Correlation Sig. (2-tailed)		
Total mean practice scores	Pearson Correlation Sig. (2-tailed)	0.143 0.276 Ns	
Age	Pearson Correlation Sig. (2-tailed)	-0.470 0.000**	-0.028 0.833 Ns

\*\* Correlation is significant at the 0.01 level (2-tailed).

Ns: No significant Correlation.

## CHAPTER V

### Discussion

The present chapter covers interpretation and discussion of results obtained from the current study; Findings are presented in two main sections; the first section describes the studied sample as regards to demographic characteristics, and the second section which is concerned with answering research questions.

### Aim of the Study

The current study aimed to assess ICU nurses' knowledge and practice regarding endotracheal tube suctioning in the intensive care units at Cairo university hospitals.

### Research Questions

To achieve the aim of the current study, the following research questions were formulated:

Q1- What do ICU nurses' know regarding endotracheal tube suctioning?

Q2- What are ICU nurses' practices regarding endotracheal tube suctioning?

### Section I: demographic characteristics of the studied sample

The current study revealed that more than half of the studied nurses were females. This finding is in agreement with that of Rushdy, Moursy & Elfeky, (2015), who conducted a study about critical care nurses' knowledge and practices regarding care of patients connected to intra- aortic balloon pump at Cairo university hospitals and revealed that more than half of the studied nurses were females. Also Ansari, (2012) conducted a study about the gap between knowledge and

practice in standard endotracheal suctioning among ICU nurses, and found that the great majority were females. These findings are in agreement with that of Rashdan, (2007) who conducted a study about implications for advancement of Egyptian nursing, and revealed that nursing in Egypt is primarily a female dominant occupation and very few men are admitted to nursing programs.

As regards to the age, around two thirds of the studied sample was young adults (less than forty years old). In this regards Ansari, (2012) found half of the studied nurses to be approximately in same age groups of the current study's subjects. As revealed by Maville & Huerta, (2012), a young adult is generally a person in the age range of 20 to 40 year. A young adulthood can be considered as a period of stabilization in which the individual makes career decision and becomes more adaptable and responsive to challenges. Thus from the investigator's point of view, nurses in this age group are characterized by being aware of the impact of medical care on the patients' progress; sensitive to their fears; honestly explain medical procedures and expected outcomes.

Concerning years of experiences, around one third of the studied sample had more than ten years of experience in their work place as nurses and in the ICU. This finding is in agreement with that of Abdullah & Ismail (2014) who studied ICU nurses' knowledge and practices regarding Administration of Medications via Nasogastric Tube among Critically Ill Patients at Cairo university hospitals and revealed that half of the studied sample had more than ten years of work experience in the ICU.

As regards to qualifications, the current study revealed that about one half of the studied sample had bachelor degree in nursing. This finding is in agreement with that of Abd El- kader & Ali, (2012) who studied critical care nurses' knowledge and practice of fever management at a

university hospital and revealed that more than two thirds of the studied sample had bachelor degree. However, this finding is contradicted by El Feky, & Ali, (2013), who studied nurses' practices and perception of delirium in the intensive care units of selected university hospitals in Egypt. And Abudahi, Fekry, & Abdel-Wahab, (2012) who studied relationship between perceived organizational climate and conflict management strategies among nurses in Cairo university hospital and revealed the dominance of diploma nurses.

Differences in educational background "from the investigator's point of view" may be related to having different types of nursing education in Egypt. Traditionally, the most common type of nursing education was secondary school/ nursing diploma. Variation in patients' diagnosis and increased acuity of illness require highly qualified nurses who can deal with critically ill patients.

#### Section (2): Answering the research questions:

As regards to the first research question, what do ICU nurses' know regarding endotracheal tube suctioning? The current study revealed that more than half of the studied sample had unsatisfactory knowledge level about endotracheal suctioning. On the same line with this finding was that of Day & Griffiths, (2009), who conducted a study of effect of performance feedback on tracheal suctioning knowledge and skills: randomized controlled trial and revealed a low level of knowledge among many participants.

As well, Sharma, Sarin & Bala, (2014), who studied Effectiveness of "endotracheal suctioning protocol" in terms of knowledge and practices of nursing personnel. And revealed

nurses demonstrated a poor level of knowledge regarding tracheal suctioning. On the same line was Hadian & Pishva, (2010), who carried out a study to assess critical care nurses level of knowledge and performance regarding endotracheal suctioning, and revealed a low knowledge level.

In an attempt to identify areas of knowledge deficit among the majority of the current study sample who had unsatisfactory knowledge, it was found to be specifically related to how to dissolve accumulated secretions, the recommended suction pressure setting, equations used for selecting the suction catheter size, when to aspirate secretions during the procedure and if ETT suctioning as a sterile procedure or not. The reasons for lack of knowledge about ETT suctioning "from the investigator's point of view" may be related to unavailability of hospital policy or standard guidelines regarding this important procedure, lack of continuing educational programs or sessions about ETT suctioning, lack of supervision and lack of continuous evaluation of nurses' practice.

This point of view is supported by Sharma, Sarin & Bala, (2014), who concluded that a poor level of knowledge for many subjects was reflected in practice, and suggested that nurses require support, education, and training relating to this important issue. As well, findings of Sayed, Youssef, Alshekhepy, & Elfeky, (2015), who conducted a study about Nurses' Knowledge and Practices regarding detection and management of acute drug poisoning at Cairo university hospitals, and attributed low level of nurses' knowledge to lack of training, absence of continuous supervision and evaluation.

In spite of, having unsatisfactory general knowledge level about ETT suctioning, the studied sample had satisfactory specific knowledge regarding assessing function of equipments before suction, when to monitor vital signs, the use of suction catheter in case of touching unsterile

surface, documentation of sputum characteristics and assessing the patient's need for suctioning. Thus, there is a need to emphasize and empower what nurses know and provide them with the needed knowledge necessary to improve their practice and so, patient' care.

Comparison of mean knowledge scores in relation to gender, the current study findings revealed a high significant statistical difference with tendency of male nurses to have higher mean scores than females. However, the mean knowledge scores didn't differ significantly in relation to attending ICU training programs. This finding is in line with that of Qaddumi & Khawaldeh (2014) who studied pressure ulcer prevention knowledge among Jordanian nurses: a cross-sectional study, and revealed a significant relationship between nurses' knowledge and gender. However, the present study is inconsistent with findings of Abdullah & Ismail, (2014) who revealed no significant statistical difference in knowledge scores in relation to gender.

The rationale of having male nurses to obtain higher mean scores than females "from the investigator's point of view", may be due to having the majority of males to be of young age and most of them had university nursing education. In attempt to identify the rationale of having no significant statistical difference in the mean knowledge scores in relation to attending ICU training program, it may be related to attending courses that were not specifically related to ETT suctioning procedure, but were about certain issues attributed to nursing management of critically ill patients.

Also, the current study revealed significant statistical differences in mean knowledge scores in relation to age category, nursing years of experience, and ICU years of experience and qualifications, with tendency of young adults to have higher mean knowledge scores than other age group categories. Nurses who have less than five years and those with less than one year of experience in nursing and ICU were found to have higher mean knowledge scores than other

categories. Also bachelor degree nurses were found to have higher mean knowledge scores than those with others qualifications.

These findings are in agreement with that of Abdullah & Ismail (2014), who revealed a higher tendency of bachelor degree nurses to have higher mean knowledge scores and those who have less than one year of experience got higher mean knowledge scores than others, with significant statistical differences. Also Rushdy, Moursy & Elfeky, (2015), revealed a significant statistical difference between mean knowledge score and the degree of nursing education.

Concerning age category, the current study revealed a significant statistical difference in nurses' knowledge regarding ETT suctioning in relation to age. Young adult nurses (less than 25 years) had higher mean knowledge score than old age nurses. This may be due to the fact that new graduate nurses could have fresh knowledge, and intact memory. Also nurses who have experience from (one < 5 years) and (less than one year) in nursing and ICU respectively, were found to have higher mean knowledge scores than others categories. However knowledge of more experienced nurses was found to be based on opinions and tradition rather than on evidence based guidelines. This means that, when the years of experience increase the level of knowledge decrease. Findings of the current study are inconsistency with that Sharma, Sarin & Bala, (2014), and Ansari (2012) who found no relation between working experience and level of knowledge.



Consequently, a high significant statistical difference was found between academic qualification of the participants and their mean knowledge scores, where the bachelor degree nurses got higher mean knowledge scores. This finding is in agreement with that of Rushdy, Moursy & Elfeky, (2015), who found a significant statistical difference between mean knowledge score and level of education. These findings may be due to having the bachelor degree nurses to be new graduates, with years of experience of less than one year and so having fresh knowledge.

Concerning the second research question, what are ICU nurses' practices regarding endotracheal tube suctioning? The current study revealed that, the majority of the studied sample had unsatisfactory practice level. Assessment of nurses' practice was done before, during and after endotracheal suctioning and revealed that the majority of the studied nurses didn't do the following: wash hands before suctioning, auscultate the lungs' sounds, wear sterile gloves, provide appropriate explanation, hyper-oxygenate prior to and after ETT suctioning, auscultate and compare breathing sounds after suctioning with auscultated sounds before suctioning, document amount, characteristics of secretions and patient's response to suctioning.

The current study findings are in agreement with that of Jansson & Kyngäs (2013), who conducted a study about evaluation of endotracheal tube suctioning practices of critical care nurses and revealed that significant practice discrepancies observed in critical care nurses' practice of ETT suctioning as compared to the recommended guidelines prior to and during ETT suctioning events. The most significant discrepancies were observed in areas of infection control (e.g., hand

hygiene), assessment of patient's needs for suctioning, hyper oxygenation before suctioning procedure and the level of negative pressure used to clear secretions.

Also, Subirana (2007), observed technical discrepancies in ETT suctioning practices prior to suctioning (e.g., assessment techniques for the need to ETT suctioning, and hyper oxygenation), during suctioning (e.g., the level of negative pressure used to clear secretions), and ETT suctioning events, which were related to the potential risk of hypoxemia and hemodynamic alternations, infections, barotraumas, bronchospasms and atelectasis.

On the same line with the current study findings was that of Kelleher & Andrews (2008), who conducted an observational study on the open-system endotracheal suctioning practices of critical care nurses, and revealed that nurses' practice deficiencies were related to hyper oxygenation prior to and post ETT suctioning practices as well as in maintaining adequate suctioning pressure. Such findings are important as they have direct implications for patient safety and reflect negatively on nursing care. As well, Sharma, Sarin & Bala, (2014), who found that, the major practical deficiencies regarding endotracheal suctioning were related to hand disinfection prior to and post ETT suctioning events plus infection control practices.

Findings of the present study are in concordance with that of Ansari (2012), who revealed that, despite having acceptable knowledge nurses' performance in endotracheal suctioning, is poor. Also, Ania (2003) carried out a study to evaluate practical competence and scientific knowledge of the nurses, on tracheal suctioning procedures, and revealed that, nurses have scientific knowledge of the suctioning procedure that is better than their practice competence.

The reasons of low practice level in the current study may be related "from the investigator's point of view" to increased number of patients and work load, lack of continuous education and supervision regarding ETT suctioning. In addition, nurses' practices were based on traditions and imitations rather than on education and training. This point of view is supported by Hadian & Pishva (2010), who conducted a study about the effect of instructing the principles of endotracheal tube suctioning on knowledge and performance of nursing staff working in intensive care units and concluded that; the difference between knowledge and practice before education may be related to several factors. Such as, work overload, large patient population, lack of resources and lack of motivation. Therefore continuous education and supervision could increase the level of knowledge and practice.

As well Kelleher (2008) and De Wandel & Blot (2010), revealed that unacceptable nurses' practice levels may be due to lack of knowledge and directions, poor self-efficacy, time-related barriers. The routine practice of nurses regarding ETT suctioning may have been learned from each other without ever actually understanding the rationale for its use.

Unexpectedly, the majority of the studied nurses had satisfactory practice levels regarding, reconnecting the patient with oxygen delivery device / mechanical ventilator, discarding suction catheters in biohazard waste bin and ensuring that oxygen saturation ranged from 95% - 100% post suctioning. This could reflect nurses' familiarity with certain basic aspects of care during ETT suctioning, in spite of having unsatisfactory knowledge and practice levels in general.

The current study revealed that nurses' practice level didn't differ significantly in relation to nurses' gender, qualifications, ICU experience and nursing years of experience. On the same line with the current study was that of Sharma, Sarin & Bala, (2014), and revealed no statistically

significant association between practical and age, previous area of experience, years of experience in ICU, total years of experience and any attended in-service education courses.

As well, Ansari (2012), revealed no significant statistical relation between age, type of ICU, working experience and other basic variables and performance scores. Also, this finding is consistent with that of Vinayaka, (2012), who conducted a study to assess the effectiveness of structured teaching program on knowledge and practice regarding ETT suctioning among pediatric ICU staff nurses and discovered no significant association between age, educational qualification and years of experience with mean practice scores.

On the other hand, Choudhry, Fletcher & Soumerai (2005), conducted a systematic review to assess the relationship between clinical experience and quality of health care and showed a negative association between increasing experience and practice. In addition, Hill, (2010) conducted a study on improving quality and patient's safety and revealed that the years of experience had a positive impact on the quality of care provided.

Nurses should be familiar with the updated recommendation of ETT suctioning procedure. Nurses are also required to pay attention to the basic nursing skills such as vital signs, how to monitor patients closely, and how to prevent complications associated with ETT suctioning. So, nurses not only need to have knowledge about ETT suctioning but are also required to care with professional practice to ensure improving quality and patient's safety.

A study done by Çelik & Elbas, (2000), demonstrated that correct performance of nurses in endotracheal suctioning can minimize undesirable side effects. By utilizing scientific recommendations in their performance nurses can, improve the quality of care and decrease

periods of hospitalization and patients' expenses. So a quality nursing care can be effective on preventing unnecessary deaths and medical interventions.

Based on findings of the current study, it can be concluded that, critical care nurses assigned for caring of intubated patients who are in need for ETT suctioning should be well equipped with adequate knowledge to adapt to the ever changing clinical situations. These because patients requiring ETT suctioning have very special needs and require care by nurses with specialist skills, knowledge and attitudes.

## CHAPTER VI

### Summary, Conclusion and Recommendation

This chapter summarizes findings of the current study, discusses nursing implications and ends with recommendation for further study.

#### Summary:

Endotracheal suctioning, one of the most common invasive procedures carried out in an intensive care unit (ICU), Tracheal suction is an important procedure in the management of adults with artificial airways. It is not a safe procedure and may lead to short and long term detrimental effects and in fact it is one of the most frequent interventions in nursing and the most important responsibility of nurses in intensive care units. All intensive care nurses need to be aware of the potential risk of this procedure, and to make efforts to prevent or minimize these risks. Competent

suctioning practice aids in the prevention of associated complications and therefore helps to improve patient outcomes. Therefore, the aim of the current study was to assess nurses' knowledge and practices regarding endotracheal tube suctioning procedure at selected intensive care units.

To achieve the aim of the current study, the following research questions were formulated:

Q1- What do ICU nurses' know regarding endotracheal tube suctioning?

Q2- What are ICU nurses' practices regarding endotracheal tube suctioning?

A descriptive exploratory research design was utilized in the current study. A sample of convenience of 60 nurses was included, and the study was conducted at intensive care units (ICUs) of Cairo University Hospitals.

Three tools were developed by the investigator and utilized to collect data pertinent to the current study: nurses' personal background sheet, nurses' knowledge self-administered questionnaire regarding ETT suctioning procedure and Nurses' practices observational checklist to assess their performance of endotracheal tube suctioning procedure. All tools were revised by a panel of three nursing experts in the field of Critical Care and Emergency Nursing Specialty for their content validity and then piloted by the investigator.

The current study was conducted on two phases: the designation and implementation phase.

Statistical findings of the current study revealed the following:

- Concerning personal background data of the studied sample;

- More than more than two thirds (68.3%) of the studied sample are females, had bachelor nursing degree and 35 % in the age group of 26 -35.
  - About one third of the studied sample had more than ten years of experience in in their work place as nurses and in the ICU in percentage of 38.3% & 35%, respectively.
- 
- As regards to knowledge assessment, the current study revealed that;
    - More than half (63.3%) of the studied sample had unsatisfactory knowledge level, regarding ETT suctioning with a mean score  $20.5 \pm SD = 3.26$ .
    - The incorrectly answered questions were about (dissolving of accumulated secretions, the recommended suction pressure setting, equations used for selection of suction catheter size, when to aspirate secretions during suction procedure and ETT suctioning is a sterile procedure).in percentages of 93.3 %, 83.3%, 80%, 70% & 65%, respectively.
    - In spite of having unsatisfactory knowledge level, the studied sample had got correct answers regarding ETT suctioning, the studied sample had satisfactory specific knowledge about function of equipments before suction, when to monitor vital signs, the use of suction catheter in case of touching unsterile surface, documentation of sputum characteristics and assessing the patient's need for suctioning., in percentages of (100 %, 100%, 96.7%, 96.7% & 93.3%), respectively.

- A significance statistical difference was found in the total mean knowledge scores in relation to gender, age category, nursing years of experience, ICU years of experience and qualifications, ( $t=3.43$  at  $P \leq 0.001$ ), ( $t=6.74$  at  $P \leq 0.002$ ), ( $t=5.197$ , at  $P \leq 0.003$ ), ( $t=5.909$  at  $P \leq 0.001$ ) & ( $t=21.17$  at  $P \leq 0.000$ ) respectively. Otherwise, no significance statistical difference was found in the total mean knowledge scores in relation to, attending ICU training program ( $t=0.118$ , at  $P \leq 0.907$ ).
- As regards to nurses' practice, the current study revealed that;
  - The great majority (95.5 %) of the studied sample had unsatisfactory practice level regarding ETT suctioning.
  - The most frequently not done practices were auscultating the lungs sound before suctioning, preparing sterile gloves, provide appropriate explanation, hyperoxygenation prior to suctioning, wearing sterile gloves, hyperoxygenation post ETT suctioning, auscultate and compare breathing sounds with auscultated sounds before suctioning, documentation of amount, characteristics of secretions and patient's response to suctioning in percentage of (91.7%, 96.7%, 83.3%, 61.7%, 95%, 63.3%, 95%, 95% & 91.7%), respectively.
  - No significance statistical difference was found in the total mean practice scores in relation to gender, age category, nursing years of experience, ICU years of experience and qualifications, ( $t= 0.827$ , at  $P \leq 0.412$ ), ( $F= 0.359$ , at  $P \leq 0.700$ ), ( $F= 0.337$  at  $P \leq 0.799$ ), ( $F= 0.283$  at  $P \leq 0. 0.837$ ) and ( $F= 1.855$  at  $P \leq 0.166$ ), respectively.



Conclusion:

Based on findings of the current study, it can be concluded that, although nurses have vital role in assessment and management of critically ill patients, they had unsatisfactory knowledge and practice regarding ETT suctioning procedure. These finding are challenging to the practice of critical care nurses regarding ETT suctioning procedure where nurses are required to have evidence based knowledge and practice which enable them to provide lifesaving interventions to prevent complications associated with this life saving procedure.

However, unexpectedly nurses were found to have specific knowledge and practices regarding certain items concerned with ETT suctioning. Thus, there is a need to emphasize and maintain what nurses know and can do, improve what they don't know and can't do and provide them with the required evidence based knowledge and skills necessary for ETT suctioning procedure.

Recommendations:

Based on findings of the present study, the followings are recommended:

1. Updating knowledge and practice of ICU nurses through carrying out continuing/ periodic training educational programs about ETT suctioning.
2. Ongoing monitoring of staff nurses' practice by head and charge nurses while performing ETT suctioning and provision of guidance to correct poor practices and to ensure that patient safety is being guaranteed.
3. Availability of written guidelines, booklets, policies regarding ETT suctioning procedure.
4. The need for nurses to consider not only the immediate clinical status of the ventilated patient, but also the short and longer term risks associated with endotracheal tube suctioning.
5. Establishment of continuing educational programs including evidence based guidelines to improve nurses' knowledge and practice regarding endotracheal tube suction.
6. Unit protocols and guidelines should be updated to reflect the change from set routine to individual clinical need in regards to endotracheal tube suction.

7. Teaching interventions to improve nurses' knowledge and competence in the care of patients requiring ETT suctioning is indicated particularly with regard to auscultation skills, hyper oxygenation practices, suctioning pressures.

- Recommendations for further researches:

1. Replication of the study on a larger probability sample from different geographical locations in Egypt.
2. Future studies are recommended to:
  - Compare nurses' practice of ETT suctioning procedure in different work settings in relation to educational background.
  - Study the impact of a training program on critical care nurses' knowledge and practice regarding ETT suctioning.
  - Study complications associated with ETT suctioning among critically ill patients.
  - Explore factors that hinder nurses' practice regarding ETT suctioning procedure.
  - Implementation and evaluation of evidence-based practice guidelines for open endotracheal suctioning in mechanically-ventilated adult patients.

## CHAPTER VII

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## AppendixA1-1

### 1) Nurses' Personal Back Ground Sheet:

Code Number:

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**1. Gender:**  Male  Female

**2. Age category:**  16-25  26- 35  36 -45  46 – 60

Age: .....

**3. Educational level:**

Bachelor of Nursing  Technical Institute Diploma  
 Secondary Nursing School Diploma

**4. Years of experience in the field of nursing: .....**

Less than one year  from to 1- Less than 5 years  
 From 5 to 10 years  More than 10 years

**5. Years of experience in the intensive care unit (ICU): .....**

Less than one year  from to 1- Less than 5 years  
 From 5 to 10 years  More than 10 years

**- Attending ICU educational programs:**

Yes  NO



**Code number:****Appendix B****Endotracheal Tube Suctioning Nurses' Knowledge Self-Administered Questionnaire**

**Please read each of the following questions carefully and encircle the best answer, there is only one correct answer.**

**I. General Knowledge about endotracheal tube suctioning**

1. **The respiratory system start with which of the following parts?**
  - a. Oral cavity
  - b. Larynx
  - c. Trachea
  - d. Lungs and alveoli
  - e. Pharynx
  
2. **Endotracheal tube ( ETT ) insertion is indicated to:**
  - a. Prevent of gastric juice aspiration
  - b. Facilitate tracheal suctioning
  - c. Supply the body with high concentrated oxygen
  - d. Connect the patient with mechanical ventilator
  - e. All of the above
  
3. **Which of the following is one of the nursing cares after ETT insertion?**
  - a. Auscultate chest sound for bilateral air entry.
  - b. Fixation of ETT using gauze or blaster.
  - c. Putting oral air way to prevent biting of ETT
  - d. Oral and ETT suctioning to prevent accumulation of secretions
  - e. All of the above.

4. **Which of the following is an indication to connect the patient with mechanical ventilator?**
- a. Loss of consciousness.
  - b. Brain and spinal injury.
  - c. Respiratory system disorder.
  - d. During surgical operations.
  - e. All of the above.
5. **All of the following are indications of ETT suctioning EXCEPT :**
- a. Opening the air way and increasing oxygen saturation
  - b. Obtaining sputum sample
  - c. Accumulation of respiratory secretions
  - d. Increase the incidence of respiratory infection
  - e. All of the above
6. **When ETT suctioning should be done to critically ill patients**
- a. As a routine schedule.
  - b. When necessary.
  - c. Every 4 hours.
  - d. every 6 to 8 hours

## **II. Preparation for ETT Suctioning**

7. **The patient must be assessed for the need of ETT suctioning through:**
- a. Auscultate the chest so und for snoring, crackles and rattle
  - b. Noticing cyanosis in lips , nails and skin
  - c. Presence of excessive secretions at the mouse and around the tube
  - d. Decreased oxygen saturation because of difficulty breathing
  - e. All of the above

8. **All of the following are equipments used for ETT suctioning EXCEPT:**

- a. Sterile suction catheter with different size
- b. Portable or central vacuum machine
- c. Syringe with 10 cc normal saline
- d. Sterile gloves
- e. Sodium Bicarbonate solution

9. **While selecting the size of the suction catheter , it should be :**

- a. Less than half of the internal diameter of the ETT
- b. More than half of the internal diameter of the ETT
- c. Any available size
- d. Equal to the internal diameter of the ETT
- e. None of the above

10. **Which of the following equations can be used for selection of suction catheter size?**

- a. Size of the suction catheter = ( size of ETT – 1) x 2
- b. Size of the suction catheter = ( size of ETT – 2) x 2
- c. Size of the suction catheter = ( size of ETT – 3) x 2
- d. Size of the suction catheter = ( size of ETT – 4) x 2
- e. Size of the suction catheter = ( size of ETT – 5) x 2

11. **Before ETT suctioning the patient should be kept in which of the following positions :**

- a. Semi sitting
- b. Supine
- c. Side lying
- d. Prone
- e. All of the above

**12. What is the recommended suction pressure setting?**

- a. 130 – 160 mmhg
- b. 100 – 120 mmhg
- c. 120 – 150 mmhg
- d. 150 – 200 mmhg
- e. 200 – 250 mmhg

**13. Insertion of the suction catheter into the endotracheal tube is :**

- a. A sterile procedure
- b. A clean procedure
- c. A clean or a sterile procedure
- d. None of the above

### **III. Implementation of ETT suctioning**

**14. Hyper oxygenation of the patient before starting ETT suctioning helps to:**

- a. Avoid the incidence of hypoxemia
- b. Easy remove accumulated secretions
- c. Decrease the risk of respiratory infection
- d. Improve the patient's conscious level
- e. None of the above

**15. During suction procedure, when aspiration of secretions should be applied:**

- a. During withdrawal of the suction catheter only
- b. During insertion of the suction catheter only
- c. Either during insertion or withdrawal of the catheter
- d. Only if the patient coughs
- e. All of the above

16. **The duration of aspiration of secretions should NOT be more than:**

- a. 20 seconds
- b. 15 seconds
- c. 30 seconds
- d. 60 seconds

17. **when performing ETT suctioning, when hand washing should be done:**

- a. Before ETT suctioning
- b. After ETT suctioning
- c. Before and after ETT suctioning
- d. At any time
- e. None of the above

18. **What is recommended from the nurse as regards to the suction catheter?**

- a. Dispose it immediately after one single use
- b. It can be cleaned and reused
- c. It can be used without being cleaned
- d. It can be used once every shift
- e. All of the above

#### **IV. Post ETT suctioning care**

19. **Which of the following actions the nurse should do, in case of found accumulated thick secretions post ETT suctioning?**

- a. Using normal saline to dissolve that thick secretions
- b. Using ringer to dissolve that thick secretions
- c. Using sodium bicarbonate to dissolve that thick secretions
- d. Using dextrose 5 % to dissolve that thick secretions
- e. None of the above

**20. Which of the following are possible complications of the suction procedure?**

1. Decreased oxygen level
2. Damage to mucosal membrane
3. Abnormal heart beats
4. Improved the conscious level
5. Elevated of body temperature

**Answers**

- |               |               |
|---------------|---------------|
| a) 1, 2 and 4 | b) 2, 4 and 5 |
| c) 2, 3 and 4 | d) 1, 2 and 3 |
| e) 1, 4 and 5 |               |

**21. Which of the following should be documented in the nursing notes after ETT suctioning?**

- a. Color, amount and thickness of the secretions
- b. General condition of the patient
- c. Psychological condition of the patient
- d. Temperature degree of the patient
- e. All of the above

**V. True /false questions**

22. The nurse must be sure about quality functioning equipment before suction ( )
23. Vital signs (pulse rate, respiratory rate) should be monitored before and during the suctioning procedure ( )
24. The nurse is not responsible for assessing the patient's need for suctioning ( )
25. The main indications of suctioning is restlessness of the patient ( )
26. It is not necessary to check the pressure of the suction unit before suctioning ( )
27. Hyper oxygenation is very important before and after suctioning procedure ( )
28. The suction catheter can be used even if it touches unclean surface ( )
29. The nurse document amount, odor and color of secretion to evaluate patient's condition( )
30. Incidence of mechanical ventilator associated pneumonia is not related to suctioning Procedure ( )

Code number:

Appendix C**Endotracheal Tube Suctioning Nurses' Practice Observational Check List:****(This sheet is going to be filled out by the researcher)**

No	Steps	1 <sup>st</sup> observation		2 <sup>nd</sup> observation		3 <sup>rd</sup> observation	
		done	Not done	done	Not done	done	Not done
<b>1.</b>	<b>Assessment of signs and symptoms requiring endotracheal tube suctioning</b>						
1.1.	Check physician's order and patient care plan for ETT suctioning.						
1.2.	Auscultate lungs sound						
1.3.	Observe change at patient skin color						
1.4.	Auscultate gurgling sound during respiration						
1.5.	Checking vital signs						
1.6.	Determine decreased oxygen saturation (less than 95%)						
<b>2.</b>	<b>Prepare necessary equipment and supplies</b>						
2.1.	Portable or central suction machine with tubing , collection container and suction pressure gauge						
2.2.	Sterile , disposable container						
2.3.	Appropriate sterile catheter size 12-18f						
2.4.	Sterile gloves						
2.5.	clean gloves						
2.6.	Sterile normal saline or sterile water						
2.7.	Stethoscope						
2.8.	protective face mask						
2.9.	Ambu bag, oxygen unit and tubing						
<b>3.</b>	<b>Prepare the patient for suctioning procedure</b>						
3.1.	Provide appropriate explanation						
3.2.	Maintain patient's privacy.						
3.3.	Lower side rails on working side of the bed.						
3.4.	Put the conscious patient at semi-fowlers position with head turned facing the nurse, Place the unconscious patient in lateral position facing toward nurse						
3.5.	Pre oxygenate the patient by administering oxygen at 100% if the patient on ventilator or using Ambu - bag for (1-2) minutes						



No	Steps	1 <sup>st</sup> observation		2 <sup>nd</sup> observation		3 <sup>rd</sup> observation	
		done	Not done	done	Not done	done	Not done
<b>4.</b>	<b>Intervention &amp; implementation of Endotracheal suctioning</b>						
4.1.	Wash hands						
4.2.	Wear protective face mask						
4.3.	Wear clean gloves						
4.4.	Place a towel or water proof pad acrosses the patient's chest						
4.5.	Turn suction on to appropriate pressure for central suction pressure (100 -120) mmhg or for portable suction (10 -15) mmhg.						
4.6.	Open sterile suction catheter						
4.7.	Set up sterile container, touching only outside surface, pour sterile saline or sterile water into it.						
4.8.	Remove clean gloves and discard it in biohazard waste bin						
4.9.	Wear sterile gloves. Keep dominant hand sterile and the other hand clean.						
4.10.	Attach distal end of catheter to tubing on suction machine, Hold the connecting tubing with non-dominant hand and the suction catheter with dominant hand						
4.11.	Insert the catheter using the sterile dominant hand gently and quickly into the patient's ETT (without applying suction), until you feel resistance, cough is stimulated, or secretions are located.						
4.12.	Assess heart rate between suctioning.						
4.13.	Observe oxygen saturation						
4.14.	Withdraw the catheter slowly while applying intermittent suction and rotating the catheter not more than 10 – 15 seconds.						
4.15.	Re-connect oxygen delivery device/ mechanical ventilator						
4.16.	Hyperventilate the patient with 100 % oxygen concentration using Ambu -bag or sigh device on mechanical ventilator with non-dominant hand.						
4.17.	Rinse catheter and catheter tubing with normal saline until clear.						
4.18.	Repeat the steps if excessive secretions exist						
<b>5.</b>	<b>Maintenance of asepsis &amp; post suctioning care</b>						
5.1.	If necessary, perform oral and nasal suctioning using separate catheter and don't reinsert catheter back into endotracheal tube again.						
5.2.	Disconnect the catheter from connecting tube, roll around the finger of the dominant hand						

No	Steps	1 <sup>st</sup> observation		2 <sup>nd</sup> observation		3 <sup>rd</sup> observation	
		done	Not done	done	Not done	Not done	done
5.3.	Discard suction catheter in biohazard waste bin.						
5.4.	Remove gloves & face mask and discard it in biohazard waste bin						
5.5.	Turn off suction device						
5.6.	Reposition the patient in comfortable position						
5.7.	Wash hands						
<b>6.</b>	<b>Evaluation of patient's outcome</b>						
6.1.	Check respiratory rate & depth within normal range						
6.2.	Auscultate breath sound and compare to the pre-suctioning data.						
6.3.	Ensure that oxygen saturation ranges from 95% - 100%						
<b>7.</b>	<b>Documentation</b>						
7.1.	Document procedure time in nursing progress notes						
7.2.	Record the following data:						
	7.2.1 Amount of secretions						
	7.2.2 Color of secretions						
	7.2.3 Odor of secretions						
	7.2.4 Consistency of secretions						
7.3.	Document the patient's response to the suction						
7.4.	Record frequency of suctioning						
<b>Total</b>							

ASSESSMENT OF NURSES' KNOWLEDGE AND PRACTICES REGARDING ENDO  
TRACHEAL TUBE SUCTIONING PROCEDURE AT THE INTENSIVE CARE UNITS

تقييم معلومات و ممارسات التمريض عن إجراء التنشيط من الأنبوبة الحنجرية بوحدات العناية المركزة

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Thesis Proposal

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## Introduction

Endotracheal suctioning (ETS) is an essential aspect of air way management in critically ill mechanically ventilated patients. It is one of the most common invasive and frequent nursing interventions performed by nurses working in the intensive care units (ICUs) (Sole, 2003). It is performed to remove pulmonary secretions; maintain airway patency; promote oxygenation and optimize respiratory function (Thomas, 2012).

Moreover, ETS is indicated when there is coarse breathing sounds, inability to generate an effective spontaneous cough, visible secretions in the airway, changes in monitored flow and pressure graphics, suspected aspiration of gastric or upper airway secretions, deterioration of arterial blood gas values, the need to maintain the patency and integrity of the artificial airway, presence of pulmonary atelectasis or consolidation (Smith, 2007). Also, it may be required in emergency situations or as a part of patient's planned care (Thomas, 2012).

The need for ETS is determined by a variety of clinical signs and symptoms, such as coughing, increased inspiratory pressure on the ventilator, and the presence of adventitious sounds (rhonchi, gurgling) during chest auscultation. Suctioning may also be performed periodically to ensure airway patency. However, suctioning procedure is recommended by Chulary& Suzanne (2010), and Pedersen, Nielsen &Egerod (2009) to be performed only when necessary or when there is a clinical indication and never as a routine schedule.

However, ETS was found to have significant clinical side effects which can negatively impact the stability of the critically ill mechanical ventilated patient. Therefore, it requires nursing assessment and appropriate intervention to minimize the associated complications (Davies, Monterosso & Leslie, 2011). As well, the suctioning procedure should be completed using aseptic techniques to minimize the potential for introduction of exogenous organisms into the respiratory tract. This can be achieved through; minimizing or preventing interruption of the ventilator circuit to avoid pressure drops that may lead to complications in the critically ill patients (Jose, 2012).

#### Significance of the study

Endotracheal suctioning is not a benign procedure. It is potentially harmful procedure, if it is not performed appropriately or correctly, it might result in life threatening complications for patients such as hypoxia, atelectasis and pneumonia. Therefore, it requires sensitivity to possible hazards and complications and taking all necessary precautions to ensure patients' safety. However, it has been noticed by the researcher during working in the intensive care units that, there are certain malpractices regarding ETT suctioning, where nurses didn't follow the guidelines of suctioning procedure; the principles of aseptic techniques while handling the suction catheter; the guidelines of suctioning pressure limitation; the time of performing suctioning procedure which exceeded 10 seconds; and didn't hyper oxygenate before and after the suctioning procedure.

Similar findings were reported by Kelleher & Andrews (2008) who indicated that critical care nurses varied in their endotracheal suction practices, where they did not adhere to the best practices suctioning recommendations and consequently provided lower quality endotracheal suctioning treatment than expected.

As well, Day, Farnell & Wilson-Barnett (2002), and Day (2009) found poor levels of knowledge about endotracheal suctioning among the studied nurses. The authors revealed that suctioning was performed against many of the research recommendations. Many nurses were unaware of recommended practice and a number demonstrated potentially unsafe practice. Nurses were found to practice suctioning based on ritual and tradition as opposed to empirical evidence and many nurses have failed to demonstrate acceptable level of competence and some of their observed practices were potentially unsafe. On the same line, Ansari (2012) revealed that; despite having acceptable knowledge, nurses' performance in endotracheal suctioning was poor.

Consequently, Ania, Martínez & Asiain (2003), and Kelleher & Andrew (2008) reported a noticeable gap between nurses' knowledge and performance of endotracheal suctioning, where nurses' knowledge was not reflected in their performance. Thus the quality of nursing care was lower than expected. Therefore, it is necessary to observe each step of the ETS procedure against pre established standard to measure nurses performance and to ensure that it was done correctly. Observing nurses' performance of the suctioning procedure can help in determining how well the task is performed and identify factors that help or hinder procedure achievement, nurses' technical implementation of procedure provides patients with needed safe therapeutic nursing intervention. However, direct observation of nurses' clinical performance regarding ETS was found to be rarely paid attention.

Therefore, there is a need for such research that investigates nurses' knowledge and performance regarding endotracheal suctioning in Intensive care units. It is hoped that this research will help to provide evidence based data about nurses' knowledge and practice regarding endotracheal suctioning procedure.

### Aim of the study

The aim of this study is to assess ICU nurses' knowledge and practice regarding endotracheal tube suctioning in the intensive care units at Cairo university hospitals.

### Research Questions

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

Q1- What do ICU nurses' know regarding endotracheal tube suctioning?

Q2- What are ICU nurses' practices regarding endotracheal tube suctioning?

### Research Design

A descriptive exploratory research design will be utilized in the current study.

### Setting

The current study will be conducted at four selected adult intensive care units affiliated to Cairo university hospitals.

### Sample

A convenience sample of 60 nurses will be included in the current study, representing all those who are working in the selected intensive care units (ICUs) of Cairo University Hospitals, and are willing to participate in the study with the following inclusion criteria; Both sex and

different nursing educational backgrounds; Bachelor, technical nursing institute diploma and Secondary Nursing School Diploma.

#### Tools for data collection

Three tools will be utilized to collect data pertinent to the current study. These tools will be developed by the investigator after extensive review of related literature then, will be reviewed by a panel of expert professors in the field of Critical Care and Emergency Nursing Specialty.

These tools are as follows:

1- Back ground data tool it will cover data about nurse's age, gender, years of experiences, level of education and number of attended training courses about endotracheal suctioning, etc.

2- Nurses' knowledge assessment tool. It will cover data regarding knowledge about patient's assessment, signs and symptoms requiring suctioning, steps of suctioning, complications associated with endotracheal suctioning procedure, measures of utilizing principles of asepsis during suctioning procedure and evaluating patients' outcomes, etc.

#### Scoring system:

One score will be given to each right answer and zero to the wrong answer. Scores of less than 75% will be considered as unsatisfactory knowledge level, however scores of 75% - 100 % are considered satisfactory.



3- Nurses' practices observational checklist to assess their performance of endotracheal tube suctioning procedure. This tool will be consisted of nurses' assessment for the indications of suctioning, preparing the required equipments, maintaining and following principles of asepsis during the procedure, hyper oxygenation before and after ETS, evaluation and outcomes.

Scoring system:

One score will be given to each correct performance and zero will be given to each wrong or not done performance .The total scores of this sheet will be 100. Scores less than 75% will be considered unsatisfactory, however, scores between 75% - 100% will be considered satisfactory.

Content validity

Content validity of the study tools will be reviewed by a panel of three expert professors in the field of Critical Care and Emergency Nursing Specialty.

Pilot study

A pilot study will be conducted on 10% of the sample; to ensure objectivity, clarity, feasibility and reliability of the study tools, and determine the time required to fill the different data collection tools. So that necessary modifications will be done and to determine the time required fulfilling the sheet. According to the modifications required, pilot study sample will be either included or excluded from the actual study.

Ethical consideration

Primary approval will be obtained from the ethical committee at the Faculty of Nursing – Cairo University. Before conducting the study, final approval will be obtained after finishing data

collection. Participation in this study is entirely voluntary; each subject has the right to withdraw from the study when he or she wants.

Informed consent will be obtained from the subjects. Anonymity and confidentiality are assured through coding the data, subjects will be assured that this data will not be reused in another research without their permission, data collected will be used in the purpose for the research only and the entire needed sample in the study will be followed until been analyzed.

All information taken about the nurses' knowledge and practices will be protected and will not affect their annual appraisal by any mean. Sharing in the study is volunteer and the benefit of the study will be attained through formulating a database about this problem which might raise awareness of all health professionals and be incorporated in the future plan of care for such group of patients.

### Procedure

Once permission is granted to proceed in the proposed study, nurses who will agree to participate will be interviewed individually by the investigator to explain the nature and purpose

of the study. A written consent will be obtained from nurses and the data collection tools will be filled out starting with socio demographic data sheet (tool I), followed by (Tool II) which is concerned with assessment of nurses' knowledge regarding endotracheal suctioning procedure. This tool will be completed by the included nurses. The researcher will be available at the time of filling the knowledge assessment questionnaire to answer any question. Then, nurses' practices will be observed in three different times during their performance of endotracheal suctioning procedure utilizing (Tool III).

### Data analysis

The collected data will be scored, tabulated and analyzed by personal computer using statistical package for the social sciences (SPSS) program version 20. Descriptive as well as inferential statistics will be utilized to analyze data pertinent to the current study. Level of significant will be set at  $P \leq 0.05$ .

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## المقدمة:

إن التنشيط من الأنبوبة الحنجرية هو إحدى الإجراءات التمريضية الهامة و الأكثر شيوعا بوحدة العناية المركزة لإزالة الإفرازات من الممر الهوائي و الانبوبة الحنجرية مما يساعد على تحسن وظائف الجهاز التنفسي و الاجهزة الحيوية الاخرى. فعلى الرغم من أن التنشيط من القصبة الهوائية ليس إجراءً آمناً أو سهلاً ويمكن أن يؤدي إلى آثار ضارة على المدى القصير والطويل، فإنه واحد من أكثر التدخلات المتكررة في العناية التمريضية ومن أهم مسؤوليات الممرضين/ الممرضات في وحدات العناية المركزة، لذا يجب على جميع الممرضين و الممرضات العاملين بوحدة العناية المركزة أن يكون لديهم العلم و الخبرة الكافية التي تمكنهم من إجراء هذا التداخل بكفاءة لتجنب الأخطاء التي قد تؤدي الى مضاعفات و مخاطر كثيرة.

## الهدف من الدراسة:

أجريت هذه الدراسة بهدف:

تقييم معلومات وممارسات الممرضين/ الممرضات عن التنشيط من الأنبوبة الحنجرية في بعض وحدات العناية المركزة بمستشفيات جامعة القاهرة.

## الأسئلة البحثية:

لتحقيق الهدف من هذه الدراسة، تمت صياغة الأسئلة البحثية التالية:

- ما هو مستوي معلومات فريق التمريض عن التنشيط من الانبوبة الحنجرية بوحدة العناية المركزة بمستشفيات جامعة القاهرة؟

- ما هو مستوي ممارسات فريق التمريض عن التنشيط من الانبوبة الحنجرية بوحدة العناية المركزة بمستشفيات جامعة القاهرة؟

## العينة و مكان الدراسة:

لتحقيق الهدف من الدراسة اختيرت عينة متاحة اشتملت على ٦٠ ممرض وممرضين العاملين بأربعة وحدات للعناية المركزة بمستشفيات جامعة القاهرة ( وحدات طب الحالات الحرجة الوحدة الاولى و الثانية أ.د/ شريف مختار، و الوحدة الثالثة وحدة أ.د/ حسام موافي / وحدة رعاية القلب و الصدر الدور الثالث / رعاية قسم ٥ بالدور الاول / و رعاية قسم ٦ بالدور الاول)، و قد تم اختيار جميع أعضاء فريق التمريض العاملين بهذه الوحدات في الفترة الصباحية و فترة بعد الظهر و الموافقين على الاشتراك في الدراسة بعد أن تم شرح الدراسة والهدف من اجرائها وأن المشاركة فيها تطوعية ولن تؤثر علي عملهم، وتقييمهم أو علاقتهم برؤسائهم. و قد استغرق جمع البيانات مدة ستة أشهر بداية من نوفمبر ٢٠١٤ حتى أبريل ٢٠١٥ ، و تبعه تحليل إحصائي لتلك البيانات.

## أدوات الدراسة:

تم اعداد ثلاث أدوات بحثية بواسطة الباحث ومراجعتها عن طريق لجنة مكونة من ثلاثة من الأساتذة الخبراء في مجال تمريض الحالات الحرجة والطوارئ وهذه الأدوات علي النحو التالي :

- أداة (١): استمارة البيانات الديموجرافية لأعضاء هيئة التمريض.
- أداة (٢): استمارة تقييم معلومات فريق التمريض عن التنشيط من الانبوبة الحنجرية.
- أداة (٣): استمارة ملاحظة أداء فريق التمريض أثناء التنشيط من الانبوبة الحنجرية.

#### إجراءات الدراسة:

بعد الحصول على الموافقات الرسمية لإجراء الدراسة، تم مقابلة الممرضين المشاركين في هذه الدراسة كل منهم علي حدا ، و تم شرح الدراسة والهدف من اجرائها و الحصول على الموافقة للمشاركة في الدراسة، و بعد ذلك تم شرح استمارات تقييم الأداء خلال فترات العمل الصباحية و فترة بعد الظهر، وقد قاموا بملء أداة (١ و ٢) أثناء تواجد الباحث. كما قام الباحث بملاحظة أداء كل ممرض/ ممرضة بواسطة أداة (٣) وملاحظة كيفية إجراء التنشيط من الانبوبة الحنجرية وذلك ثلاث مرات في أوقات مختلفة.

قام الباحث بعمل دراسة استطلاعية بغرض إختبار مدى الإعتماد والثقة في أدوات البحث لإستخدامها في جمع البيانات، و كذلك لتحديد الوقت اللازم لملئ أدوات الدراسة ١، ٢، ٣.

#### نتائج الدراسة:

- شكلت النساء (الممرضات) أكثر من ثلثي عينة الدراسة (٦٨,٣ %) ، و كذلك نفس النسبة كانوا حاصلين على بكالوريوس تمريض، و كانت أعمار غالبية العينة نفس النسبة من ٢٦ - ٣٥ عام.
- تراوحت سنوات الخبرة لدي 38.3 % في العمل بالعباية المركزة أكثر من ١٠ سنوات، و ٢٥% ما بين ٥ - ١٠ سنوات.
- حصل (٦٣,٣%) من المشاركين من أعضاء فريق التمريض في الدراسة على مستوى غير مرضى من المعلومات المتعلقة بمدى معلومات فريق التمريض عن التنشيط من الانبوبة الحنجرية.
- كانت الإجابات الغير صحيحة حول التحضير وإجراء التنشيط من الانبوبة الحنجرية و الرعاية التمريضية بعد إجراء التنشيط من الانبوبة الحنجرية (إذابة الإفرازات المتركمة، ضغط التنشيط الموصى به، المعادلات المستخدمة لاختيار مفاص او حجم أنبوبة التنشيط) بنسبة ٩٣,٣%، ٨٣,٣%، ٨٠% على التوالي.
- علي الرغم من حصول هذه النسبة من أعضاء فريق التمريض على مستوى غير مرضى من المعلومات الا انهم اجابوا بطريقة صحيحة علي الاسئلة المتعلقة بمراجعة أو إختبار وظائف المعدات قبل التنشيط، و ملاحظة العلامات

الحيوية، عدم استخدام قسطرة التنشيط إذا لمست سطح غير معقم، وأهمية توثيق خصائص البلغم لتقييم حالة المريض، ودور الممرضات بشأن تقييم حاجة المريض للتنشيط بالنسب المئوية (١٠٠٪، ١٠٠٪، ٩٦,٧٪، ٩٦,٧٪ و ٩٣,٣٪) على التوالي.

- كان هناك إختلاف ذو دلالة إحصائية فى متوسط درجات المعرفة بالنسبة للنوع (ذكر/ أنثى)، و الفئة العمرية، و عدد سنوات الخبرة فى التمريض، و عدد سنوات الخبرة فى العناية المركزة، و المؤهل الدراسي ( $t = 3,43$  عند  $P \leq 0.001$ ) ، ( $t = 6,74$  عند  $P \leq 0.002$ ) ، ( $t = 5,197$  عند  $P \leq 0.003$ ) ، ( $t = 5,909$  عند  $P \leq 0.001$ ) ، ( $t = 21,17$  عند  $P \leq 0.000$ ) ترتيباً على التوالي.
- حصل (٩٥,٥%) من المشاركين من أعضاء فريق التمريض فى الدراسة مستوى غير مرضى من الممارسات المتعلقة بمدى أداء فريق التمريض أثناء التنشيط من الانبوبة الحنجرية.
- كانت الممارسات التى لم تفعل فى معظم الأحيان هى تقييم حالة الرنتين عن طريق السماع قبل التنشيط، وإعداد القفازات المعقمة، و إعطاء اكسجين ١٠٠% قبل التنشيط، و كذلك بعد التنشيط من الانبوبة الحنجرية، و الاستماع إلى صوت التنفس ومقارنة مع ما قبل التنشيط، و توثيق خصائص الإفرازات، و مدى استجابة المريض للتنشيط بالنسب المئوية (٩١,٧٪، ٩٦,٧٪، ٦١,٧٪، ٦٣,٣٪، ٩٥٪، ٩٥٪ و ٩١,٧٪) على التوالي.
- لم يختلف متوسط درجات الأداء أو الممارسات إختلاف ذو دلالة إحصائية بالنسبة للبيانات الديموجرافية.

#### الخلاصة:

استناداً إلى نتائج الدراسة الحالية، يمكن استنتاج ما يلي:

على الرغم من أن الممرضين/ الممرضات لهم دور حيوي فى تقييم و علاج المرضى ذوي الحالات الحرجة، إلا أنه كانت معظم درجات المعرفة و الأداء أو الممارسات المتعلقة بإجراء التنشيط من الأنبوبة الحنجرية غير مرضية. وبالتالي هناك حاجة إلى التأكيد على ما يعرفونه، و تزويدهم بالمعرفة والمهارات المطلوبة اللازمة لإجراء التنشيط من الأنبوبة الحنجرية.

#### التوصيات:

بناء على النتائج التي توصلت إليها هذه الدراسة، يوصى بما يلي:



- تحديث معرفة وممارسات ممرضين/ ممرضات العناية المركزة من خلال تنفيذ البرامج التعليمية المستمرة حول التنشيط من الانبوبة الحنجرية.
- تقديم دورات تدريبية بصفة دورية لتحسين الممارسات حول تقييم مؤشرات التنشيط من الأنبوبة الحنجرية، وإعطاء أكسجين ١٠٠% قبل و بعد التنشيط، بالإضافة الى تقييم نتائج المرضى بعد التنشيط من الأنبوبة الحنجرية.
- المتابعة المستمرة للممارسات الممرضين/ الممرضات من قبل مشرفة تمريض العناية المركزة عند رعاية المرضى الذين يخضعون للتنشيط من الأنبوبة الحنجرية وتقديم التوجيه المناسب لتصحيح الممارسات الخاطئة وضمان سلامة المرضى.
- توافر الإرشادات المكتوبة والكتيبات والسياسات المتعلقة بإجراء التنشيط من الانبوبة الحنجرية.
- إنشاء برامج تعليمية مستمرة لإمداد الممرضين/ الممرضات بالمعرفة و الممارسات القائمة على الدليل المتعلقة بالتنشيط من الانبوبة الحنجرية.

#### توصيات لمزيد من الدراسات:

- تكرار الدراسة على عينة أكبر وفي مناطق مختلفة بجمهورية مصر العربية.
- إجراء المزيد من الأبحاث تجاه:
  - ❖ مقارنة ممارسات التمريض لإجراء التنشيط من الانبوبة الحنجرية مع إختلاف بيئة العمل.
  - ❖ دراسة تأثير برنامج تدريبي لممرضين/ ممرضات العناية المركزة على المعرفة والممارسات المتعلقة بالتنشيط من الانبوبة الحنجرية.
  - ❖ دراسة المضاعفات المرتبطة بالتنشيط من الانبوبة الحنجرية بين مرضى الحالات الحرجة.
  - ❖ استكشاف العوامل التي تعيق ممارسة الممرضين/ الممرضات بشأن إجراء التنشيط من الانبوبة الحنجرية.
  - ❖ تطبيق وتقييم المبادئ التوجيهية للممارسات القائمة على الدليل المتعلقة بالتنشيط المفتوح من الانبوبة الحنجرية للمرضى البالغين المتصلين بجهاز التنفس الصناعي.

تقييم معلومات و ممارسات التمريض عن إجراء التنشيط من الأنبوبة الحنجرية بوحدات العناية المركزة

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توطئة للحصول على درجة الماجستير فى تمريض الحالات الحرجة والطوارئ

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