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BREATH OF CONFIDENCE: STRATEGIES FOR NURSES' MASTERY IN TRACHEAL INTUBATION AND TRACHEOSTOMY MANAGEMENT

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Abstract: In the realm of critical care nursing, effective management of patients requiring ventilator support is a multifaceted challenge. This study explores the complexities faced by critical care nurses in Sudan, where the demand for mechanical ventilation has surged due to increased chronic illness cases and a growing focus on reducing external healthcare costs. Ventilator support entails addressing various physiological conditions, including those that impede optimal ventilator functionality, and attending to issues such as dyspnea and patient-ventilator desynchrony. During the mechanical ventilation process, patients exhibit diverse responses, necessitating careful monitoring and adjustments to achieve therapeutic goals like enhanced oxygenation, improved ventilation, heightened patient comfort, and the prevention of secondary injuries. While certain technical aspects of ventilator management fall within the purview of respiratory care practitioners, nurses play a crucial role in ensuring holistic patient care. They address common symptoms and responses related to mechanical ventilator support. This study aims to enhance the knowledge and practices of nursing staff concerning endotracheal tube and tracheostomy care.

Keywords: critical care nursing, ventilator support, mechanical ventilation, patient care, respiratory care, Sudan.

1. Introduction

Critical care nurses meet numerous issues related to ventilator support, including physiological conditions that delay optimal ventilator function, dyspnea, and patient-ventilator dyssynchrony. Advanced Critical Care Nursing (2009). During mechanical ventilation process some patient move quickly, while other require alonger period and some do not make it through at all enforcing further nursing attention. Throughout the process, many patient assessments are made and ventilator adjustments executed to accomplish the therapeutic goals of improving oxygenation and ventilation, increasing patient comfort, and minimizing the likelihood of causing secondary injury. Rothschild et al (2005).In Sudan and from every day practice and with evolution of medical services in last decades, and the political decisions to minimize the outside therapeutic services cost, in addition to increasing the number of people with chronic illness, the need for mechanical ventilator was greatly increased, for these reasons the importance of good training to improve the outcome, became with great values. The purpose of the study was to improve knowledge and practice of staff nurses regarding endotracheal tube and tracheostomy care.

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Most of the technical aspects of managing the mechanical ventilator are the responsibility of respiratory care practitioners, but the nurses are responsible for the holistic care of patients, including management of common symptoms and responses to mechanical ventilator support (Grossbach, Chlan& Tracy, 2011)**.**

All body systems are included in the complications of mechanical ventilation, and of particular concern are the mechanical, infectious, and neuropsychological adverse events. Ventilatory management is only one part of the strategy in caring for ventilator-dependent patients. Careful attendance to patients' underlying ailments and prevention of ventilator-related complications, best achieved by a multidisciplinary approach, are crucial elements of that strategy to improve outcome (Adams, 2004)**.**

To care for patients effectively, nurses must be comfortable and confident in their knowledge of basic principles of mechanical ventilator support and must implement appropriate interventions to manage patients' many responses to this common treatment effectively, which can be particularly challenging in nonverbal patients **(**Grossbach, Chlan& Tracy, 2011).

Besides the development of infectious complications, mechanically ventilated patients are also at risk of developing several other complications as lung injury, diaphragmatic dysfunction, and lung infection. On average 7% of patients admitted to intensive-care units (ICUs) suffer from a potentially preventable ventilator-associated pneumonia (VAP) **(**Branson& Hess, 2011)**.**

For the above reasons nurses are in greet need for knowledge about the function and limitations of ventilator and its function , causes of respiratory distress and appropriate management in order to provide high-quality patientcentered care. This study was conducted to design, apply and evaluate the effectiveness of the training program on nurse's knowledge and performance regarding the care of endotracheal tube and tracheostomy in mechanically ventilated patients.

Introduction to Mechanical Ventilation

Mechanical Artificial Ventilation refers to any methods to deliver volumes of gas into a patient's lungs over an extended period of time to remove metabolically produced carbon dioxide. It is used to provide the pulmonary system with the mechanical power to maintain physiologic ventilation, to manipulate the ventilatory pattern and airway pressures for purposes of improving the efficiency of ventilation and/or oxygenation, and to decrease myocardial work by decreasing the work of breathing (AARC Clinical Practice Guidelines 1992)**.**

Nurses, physicians, and respiratory therapists must understand each patient's specific pulmonary needs and work together to set realistic goals. Positive patient outcomes depend on an understanding of the principles of mechanical ventilation and the patient's care needs as well as open communication among members of the health care team about the goals of therapy, weaning plans, and the patient's tolerance of changes in ventilator settings (Brunner and Suddarth, 2010)**.**

Endotracheal Intubation

The most common tube used to provide an airway intubation for mechanical ventilation is the endotracheal tube. It is inserted via the nasotracheal or orotracheal cavity. Orotracheal intubation is the most common route. The endotracheal tube provides a secure airway when the balloon is inflated and seals. Insertion is moderately complex, but less invasive than a tracheostomy. Despite its many advantages, endotracheal intubation poses significant risk to the patient. Trauma to the nares, lips, teeth, tongue, pharynx, and trachea may occur. The tube may enter the esophagus or extend into only one of the two main stem bronchi; either situation can lead to hypoxemia and hypoventilation. As the tube passes through the pharynx, the gag reflex is triggered and may cause vomiting and potential aspiration of gastric contents. Prolonged intubation efforts may result in severe hypoxemia. Because of these risks, only practitioners who have demonstrated competency are allowed to perform intubation. The bedside nurse may be called upon to assist with intubation and to monitor the patient before, during and after the procedure **(**Alspach, 1998)**.**

Contraindications of Orotracheal and Nasotracheal Intubation

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Orotracheal: Potential for oral surgery, extensive oral trauma is present& when the mouth cannot be opened far enough to achieve insertion of the tube. Nasotracheal**:** Basilar skull fractures, nasal fracture, nasal polyp, epistaxis, coagulopathy, planned thrombolysis.

Tracheostomy

The tracheostomy is a surgically created airway used for patients who need a long-term artificial airway. A tracheostomy is not used for emergency airway management. It is considered for a patient who has been orally intubated for a period of 7 – 10 days and still requires mechanical ventilation or is otherwise unable to maintain a patent airway. A tracheostomy reduces airway resistance, eases communication, facilitates effective oral hygiene and is significantly more comfortable for the patient.

The procedure involves a surgical opening made through the cartilage rings of the trachea. A cuffed tracheostomy tube is inserted into the opening. The cuff is similar to that on the end of an endotracheal tube. Common adult tracheostomy tube sizes range from 6 – 8 mm initially(Alspach, 1998**).**

Airway complications

Upper airway injury from prolonged ETT exposure can occur anywhere along path of the tube and may contribute to weaning failure even after tracheostomy. Upper airway complications that are related to prolonged endotracheal intubation and tracheostomy include the following: nasopharyngeal injury, ulcerations of the nares, lips, mouth, and pharynx, nasal septal injury, sinusitis, otitis, laryngeal injury, arytrenoid adhesion, dislocation, or subluxation, glottic and subglottic stenosis, vocal cords nodules, web formation, fixation, or paralysis, cricoid cartilage abscess, tracheal injury, stoma infection or hemorrhage and granuloma formation **(**Rumbak et al., 1999). Fistula formation, tracheoinnominate or tracheoesophageal tracheal stenosis, dilatation, or malacia the modern low-pressure, high-volume, cuffed ETT and tracheostomy tubes have been successful in reducing, but not eliminating, airway complications Streitz&Shapshay (1991)**;** Brooks, Bartlett &Gazzaniga (1985)Compared with dysphonia and hoarsness, which may persist for days to months after extubation, the development of vocal cord paralysis and subglottic stenosis, which compromises the patient's ventilatory performance, is of greater concern. To minimize laryngotracheal injury from the ETT, most patients on long term mechanically ventilated (LTMV) receive tracheostomies that assure more patient comfort in the long run and allow simple access for pulmonary toilet; however, many complications from tracheostomies can contribute to a patient's death. Tracheal stenosis seems to occur more frequently at the tracheostomy stoma rather than at the cuff site; the latter is prevented by the use of highvolume, low-pressure cuffs(Brooks, Bartlett&Gazzaniga, 1985)

Airway patency

Endotracheal suctioning provides opportunity to assess the secretions but also to support the patient by removing secretions. Endotracheal suctioning in itself however is potentially hazardous to the patient and should be performed with care. The frequency of suctioning should be determined by the patient's need, rather than performed routinely. Physical assessment of the patient including auscultation and palpation of the chest, and review of the patient's secretion production over recent hours will indicate the need for suctioning **(**Day, Farnell & Wilson-Barnett, 2002**).**

A patient suctioned using a closed technique without hyperoxygenation did not demonstrate a significant difference in partial pressure of oxygen or oxygen saturation. The majority of subjects however had an FiO2 of less 50% or less, a positive end expiratory pressure (PEEP) of 8 cm H2O or less and a mean pre-suction PaO2 of 95.49 mmHg, suggesting they may not have been at high risk of developing hypoxemia. Consideration of the patient's status prior to suctioning including: PEEP; FiO2; PaO2; heart rate (HR); mean arterial pressure (MAP); and observation of the patient's response to suctioning, provide useful data to guide suctioning practices which promote patient safety by minimizing the adverse effects caused by hypoxemia **(**Demir&Dramali,2005**).**

Instillation of normal saline via the endotracheal tube prior to suctioning is a common practice in some intensive care units. The theory behind this practice is that the saline loosens and thins secretions and stimulates the cough reflex thus facilitating removal of secretions. While the theory may seem plausible, two reviews of the literature

do not support the technique and suggests that it may actually be harmful to the patient **(**Day, Farnell & WilsonBarnett, 2002**).**

Complications are also associated with the suctioning procedure itself for which general recommendations based on limited studies and accepted practice have been made. The size of catheter used should be less than one-half the diameter of the artificial airway to minimize the risk of atelectasis the suction catheter should be inserted to the depth of the carina and then withdrawn by 1 cm prior to commencing suctioning Day, Farnell & Wilson-Barnett (2002).

Care should be taken however as persistent contact with the carina can result in ulceration and induce hemodynamic changes associated with coughing and vagal stimulation. Limiting the duration of the suctioning procedure to less than 10-15 s reduces the risk of hypoxemia and atelectasis. Restricting the number of passes in a suction episode to three or less also assists in minimizing complications. A further consideration is the degree of negative pressure applied during the procedure. Evidence is lacking to suggest an exact maximum pressure to be applied, however pressures of 200mmHg or greater have been associated with tracheal damage. Recommendations for acceptable suction pressure in the literature range from 80 to 170mmHg **(**Day, Farnell & Wilson-Barnett, 2002**).**

It is important also to use of open versus closed suction systems. The latter are reported to have the advantages of minimizinghypoxemia, maintaining PEEP and reducing contamination. It's found that a closed system presented no additional complications for the patient although it may not decrease complications associated with suctioning **(**Zeitoun, Leite De Barros&Diccini, 2003**).**

Although the closed suction systems offer no advantage in the prevention of VAP. However, the closed nature of the systems and ability to leave the system in situ greater than 24 h, reduces breaks to the ventilation circuit and thus the possibility of contamination from the environment **(**Kollef, 1999**).**

Objective

General objective: His general objective of this study was to assess the effectiveness of the training program on nurses' knowledge and Performance regarding the care of Endo Tracheal Tube (ETT) and tracheostomy in mechanically ventilated patients.

Specific objectives:-

1. To assess nurse's knowledge regarding complications of mechanical ventilator.
2. To assess nurse's skills regarding: infection control, and suctioning procedures.
3. To assess the effectiveness of training program on nurse's knowledge and performance.

2. Methodology

2.1. Study design

A hospital base semi - Quasi experimental study was conducted in ICU nursing staff, prospective pre- and post-test design

2.2. Study setting

Governmental hospitals cardiac surgery intensive care units were: Sudan Heart Center, Ahmed Gasim Cardiac Surgery Center and Alshaab Cardiac and Thoracic Surgery Teaching Hospital Sudan Heart center: Governmental cardiac center, owned and directed by the Sudanese Army, located in Khartoum state, Khartoum locality. It provides medical and surgical care for patients with heart diseases, both adult and pediatric clients. It composed of cardiac medicine and cardiac surgery department, divided into, Outpatient unit content (6) beds, Cath lab unit content (9) beds ,ICU content (8) beds, CCU content (8) beds , word male of (15) beds and female of (15) beds ,Operation room ,Lab ,and X ray department. It receive about 50–100 heart cases daily for deferent cardiac problems and about 2-3 open heart surgery carried daily for 5 days per week. Alshaab cardiac and thoracic surgery teaching hospital: Is the second biggest governmental teaching hospital in Sudan , located in a midtown of , there is all medical and surgical department, theater room where a cardiac surgery carried and has emergency department .It considered as an important teaching area for many medical faculties in Sudan. Ahmed Gasim

cardiac surgery center: This center is located in Khartoum northbahri locality. It composed mainly of cardiac medicine ,cardiac surgery, and renal department, the cardiac section is divided into, Cath lab unit content (10) beds ,ICU content (10),CCU content (10) beds , word male of (18) beds and female of (18) beds ,Operation room ,Lab ,and X ray department.

2.3. The study population:

Qualified nursing staffs who are Bsc, Msc& PhD holders in nursing, working in ICU at the mentioned study settings during the study period were included in this study.

2.4. Inclusion criteria for nurses

More than six months in ICU, Permanent nurses staff, Anyone who fulfill the above criteria and accept to participate.

2.5. Procedures and Sample Size

The sample size was calculated according to use the all entire population as the sample. Using A census according to Glenn(2014**)**to achieve a desirable level of precision.

2.6. Variables under Study:

Nurse's knowledge regarding

General information about the endotracheal tube (ETT) and tracheostomy Complications**.** The confirmation of ETT placement. Prevention of Ventilator associated pneumonia (VAP)

Nurses' Practice regarding: Infection control, Suctioning an Endotracheal Tube, Suctioning Tracheal Tube, General systematic Nursing care.

2.7. Data collection tools

In this (pre-/post program) the instruments used for data collections were:

Self-administered closed ended questions questionnaire and checklist was developed by the researcher depending on available literature and validate by expertise in ETT and tracheostomy care in mechanically ventilated patient.

Scale System:

According to likert scale system the response for the questions was ranged as the following: Very weak, Weak, Intermediate, Good and Very good. An observational checklist was developed by the researcher to assess nurse's practice regarding mechanically ventilated individuals care guided by Art and Science of Nursing Care: 7th edition and the base of literature review.

The observational check list includes three domains

Infection control (6 points).Suctioning of an Endotracheal Tube (17 points).Suctioning of Tracheotomy Tube (20 points) both the questionnaire and the observational checklist format were carried out by the researcher and corrected by specialist in research tools.

2.8. Pilot Study

A pilot study was carried before embarking on the actual study (data collection). Determination of reliability of the questionnaire was based on the test-retest method A pilot study was carried out on 10 nurses working in cardiac centers to test feasibility, objectivity, and applicability of the data collection tools. The pretest was obtained by evaluating 10 critical care nurses in Mawada hospital and Royal care international hospital (both in Khartoum state). Test retest was repeated after one week according to the knowledge and skill test tool. Reliability of the instrument determined through the use of Pearson correlation coefficient by using Alpha cronbach test ($r = 0.62$) for nurses level of knowledge and ($r = 0.88$) for nurses' practices. The level of the P value was ($P = 0.04$) which indicates statistical acceptable for the format.

2.9. Data collection technique

The data was collected in three phases before implementation of training program (pretest data), pretest for the existing knowledge for nurses was carried out prior to the intervention using self-administrative questionnaire format; time offered was 15 minutes for each participant, which was considered enough time for the participant

to answer the questions. Then each of responders was observed by checklists for their skills. Close supervision to the participants while applying the standard of end tracheal tube and tracheotomy care in mechanically ventilated patients during the study period. After collection of pretest data the responders were received the training program, the training was continued for four months. Same data collection was repeated immediately after training program and then repeated again after two months as follow up phase.

2.10. The data analysis:

The data was coded and transferred into a specially designed formats so as to be suitable for computer feeding by using the software Statistical Package for Social Science (SPSS) version 20, following data entry, checking and verification process were carried out to avoid any errors during data entry. Frequency analysis, cross tabulation, and manual revision were all used to detect any errors. Descriptive measures include: count, percentage, and arithmetic mean. Statistical test include: chi square test and T test was used for quantitative variables, 95% confidence interval of the difference was used to measure the statistical significant of each variables pre and post intervention.

Mean and Standard Deviation also was used to compare between nurse's knowledge. Graphical presentation include par graph. The level of significance selected for this study will be P value equal to or less than 0.05.

2.11. Ethical considerations

The privacy and dignity of nurse was protected, the study was explained to the participants in clean simple words, participants were notified by the aims , methods , expected outcome , benefits and result of the study, participants in this study were assured confidentiality through identification coding and reports of data. Participants were participated voluntarily and had a right to ask, to discontinue, and to refuse to answer any question of the study.Letter from University was obtained to the study areas. Approval from the ministry of health in Khartoum state was obtained. Approval from administrative authorities of the study areas was obtained. For the reasons of special situation of the study as ICU the data was collected during the rest time.

3. Results

Table 1: Demographic data of the participant

Variable		Values	Frequency	Percent
	Age	20 – 30	28	56.00
		30 – 40	22	44.00
		40 – 50	00	00.00
		>50 years	00	00.00
	Nursing qualification	Bachelor	37	74.00
		Msc	13	26.00
		PhD	00	00.00
	Gender	Male	17	34.00
		Female	33	66.00
	Experience	<1 year	09	18.00
		1 – 5	25	50.00
		5 – 10	13	26.00
		>10 years	03	60.00
	Training courses	Never	25	50.00
		Once a time	20	40.00

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		Twice	05	10.00
		3 or more	00	00.00
	Area of training courses	National	24	96.00
		Regional	00	00.00
		International	01	40.00

Table (2): **A comparison between nurse's knowledge pre, post I and post II regarding ETT and Tracheotomy tube**

Pre test					**Post test I**					**P ost test II**				
V. weak	weak	Intermed	Good	V. good	V. weak	Weak	Intermed	Good	V. good	V. weak	weak	Intermed	Good	V. good
01 02%	11 22%	19 38%	14 28%	05 10%	00 00%	09 18%	13 26%	23 46%	05 10%	00 00%	06 12%	10 20%	27 54%	07 14%

T. test	**Paired Differences**					t	df	Sig .(t-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% confidence interval of the difference				
				Lower	Upper			
	.2000	.63278	.08949	-.43983	-.28317	-4.905	49	.005

Table (3): **A comparison between nurse's knowledge pre, post I and post II test regarding complications of Tracheostomy**

Pre test	**Post test I**	**Post test II**

V. weak	weak	Intermed	Good	V. good	V. weak	weak	Intermed	Good	V. good	V. weak	weak	Intermed	Good	V. good
02 04%	03 06%	08 16%	29 58%	08 16%	02 04%	02 04%	03 06%	31 62%	12 24%	01 02%	01 02%	03 06%	33 66%	12 24%

T. test	Paired Differences					t	df	Sig .(t-tailed)
	Mean	Std. Deviation	Std . Error Mean	95% confidence interval of the difference				
				Lower	Upper			
	.22000	.54548	.07714	.3752	.6498	4.852	49	.006

Table (4): **A comparison between nurse's knowledge pre, post I and post II test regardingConfirmation of ETT placement.**

Pre test					**Post test I**					**P ost test II**				
V. weak	weak	Intermed	Good	V. good	V. weak	weak	Intermed	Good	V. good	V. weak	weak	Intermed	Good	V. good
02 04%	05 10%	10 20%	25 50%	08 16%	02 04%	03 06%	05 10%	32 64%	08 16%	02 04%	04 08%	08 16%	28 56%	08 16%

T. test	Paired Differences					t	df	Sig .(t-tailed)
	Mean	Std. Deviation	Std . Error Mean	95% confidence interval of the difference				
				Lower	Upper			
	-.18000	.48192	.06815	-.31696	-.04304	-2.641	49	.011

Table (5): **A comparison between nurse's knowledge pre and post test I.**

	Participants Knowledge about	**Pre test**		**Post test I**	
		Mean	Std . Deviation	Mean	Std . Deviation

1	The end tracheal tube (ETT) and Tracheostomy .	3.2200	.974990	3.4800	.908910
2	Complications of Tracheostomy	3.7600	.938080	3.9800	.914510
3	The confirmation of ETT placement	3.6400	1.00529	3.8200	.918960

Table (6): **Skill (3) a comparison between nurse's skills, pre, posts I and post II regarding Suctioning anendotracheal tube.**

Nursing skills	**Pre - test**		**Post test**			
			Post test I		**Post test II**	
	Done	**Not done**	**Done**	**Not done**	**Done**	**Not done**
Assess depth and rate of respirations; auscultate breath sounds	17(34%)	33(66%)	33(66%)	17(34%)	15(30%)	35(70%)
Assemble supplies on bedside table	40(80%)	10(20%)	46(92%)	04(8%)	48(96%)	02(04%)
Wash hands	27(54%)	23(46%)	39(78%)	11(22%)	40(80%)	10(20%)
Connect suction tube to source of negative pressure	50(100%)	00(00%)	50(100%)	00(00%)	50(100%)	00(00%)
Administer oxygen or use Ambubag before beginning procedure	31(62%)	19(38%)	36(72%)	14(28%)	40(80%)	10(20%)
Confirm the placement of ETT	14(28%)	36(72%)	32(64%)	18(36%)	38(76%)	12(24%)
Apply sterile glove to your dominant hand	23(46%)	27(54%)	36(72%)	14(28%)	40(80%)	10(20%)
Open sterile suction catheter	17(34%)	33(66%)	33(66%)	17(34%)	43(86%)	07(14%)
Insert the catheter into the trachea without suction	27(54%)	23(46%)	38(76%)	12(24%)	40(80%)	10(20%)
Apply suction intermittently while gently rotating the	24(48%)	26(52%)	36(72%)	14(28%)	38(76%)	12(24%)

catheter and removing it						
Wrap the disposable suction catheter around your sterile, dominant hand while withdrawing it	02 (04%)	48(96%)	23(46%)	27(54%)	20(40%)	30(60%)
Suction for no more than 10 seconds	25(50%)	25(50%)	33(66%)	17(34%)	35(70%)	15(30%)
Administer oxygen using an Ambu bag	43(86%)	07(14%)	45(90%)	05(10%)	50(100%)	00(00%)
Assess airway and repeat suctioning as necessary	14(28%)	36(72%)	34(68%)	16(32%)	40(80%)	10(20%)
Remove gloves and discard	50(100%)	00(00%)	50(100%)	00(00%)	50(100%)	00(00%)
Wash hands	50(100%)	00(00%)	50(100%)	00(00%)	50(100%)	00(00%)
Record the procedure and client's tolerance of the procedure, including amount and consistency of secretions	00(00%)	50(100%)	22(44%)	28(56%)	32(64%)	18(36%)
Total freq	461	389	598	252	669	181
Total %	54.0%	46.0%	70.4%	29.6%	78.7%	21.3%
Mean	27.1	22.9	35.2	14.8	39.4	10.6

Table (7): Cross tabulation of qualification Vs participant's skills regarding ETT and Tracheostomy

		Confirm placement of the tube by listening over the chest wall			p.value
Nursing Certificates	Bsc	04(10.8%)	33(89.2%)	37	.000
	Msc	10(76.9%)	03(23.1%)	13	
	PhD	00		00	
		Ongoing ETT assessment and Cuff status			
Nursing Certificates	Bsc	01(2.7%)	36(97.2%)	37	.000
	Msc	11(84.6%)	02(15.4%)	13	
	PhD	00	00	00	

Final result of nurse's knowledge

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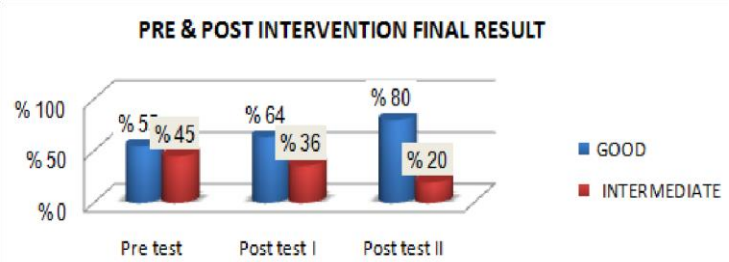

Figure (1)

4. Discussion

The increasing in mechanical ventilation uses in the last decades makes great importance for training in this machine and such types of patient. The problems can be summaries into two main issues as different ventilators machines and different patient co-existing problems and needs. These complexities of machines and patients responses give another excitation, making great needs for training and protocol to organize the patient care, being as a road map to perform good management and good outcomes. To make this road map is not an easy thing that it needs to study many and many issues related to the machine and care of patient as the present study which tried to study the effect of training program in nursing knowledge and performance regarding endotracheal tube and tracheostomy care in mechanically ventilated patient.

The present study was carried among 50 ICU nursesstaff, 56% of them was aged between 20-30 years old and 44% were of 30-40 years old, 74% was of bachelor degree and just 26% of them was of Msc holders which mean all of the participants was of young age group and this can help in ongoing training program.

A 66% of the participants were female 34% of them was male. 18% of participants were of experience less than one year, 50% of them were of 1-5 experience years, 26% were 5-10years and just 6% were of more than 10 years of experience.

A 50% never received training courses in endotracheal tube and tracheostomy care in mechanically ventilated patient. 40% received it as once a time and 10% received it twice , 96% of whom received such teaching program was received it in a national area and one participant by 04% was received it in international area and this result represent the need for conduction of this program and update the knowledge and skills of the nurses frequently.

The knowledge of the participant regarding ETT and tracheostomy was intermediate pre intervention by 38% then the result improved to becomes good in post intervention I by 46% and get elevation by 54% in post intervention II, these finding reflects the hazard of being as a bedside nurse for MVIs without or with short knowledge about the tools which connecting the patient to mechanical ventilator and airway management. The improvement in these finding from pre to post intervention in two phases reflects the good effect of teaching program: the association was clearly significant as the P.value was equal to .005 table4.

Suctioning an endotracheal tube showed the final result of 54% in pre intervention the result which increased to 70.4% in post intervention I and 78.7% in post test II. The best performance was for connected suction tube to the source of negative pressure by 100% through all three phases of the study, but the worst performance was to nurse's records for procedures and patient tolerance including amount and consistency of the secretion by zero percent in pre intervention and which increased to 44% in post intervention I and 64% in posttest II.

Wrap the disposable suctioning catheter around the sterile dominant hand while withdrawing it, was just 04% pre intervention and being 23% in post intervention I and unfortunately this evidence was decreased to 20% in post test II. This result may be due to the alternative style which may also keep the sterility of the tube other than wrap it around the sterile hand. This alternative technique was clearly observed during nurse's performance as to withdraw the tube in longitudinal way without touch any surfaces. But the wrap is more secure.

Administer oxygen using AMBU bag or manual hyperventilation before suction, the result was 86% pre intervention and increased to 90% in post intervention I and being 100% in post test II and this positive outcomes was pleasure agree with many studies reflect the importance of manual hyperventilation before suction in

prevention of VAP, for example, Chio and jones: effects of manual hyperventilation and suctioning on respiratory mechanics. This study showed that the manual hyperventilation plus suctioning improved the measured respiratory mechanics and improved the static lung compliance **(**Hodgson et al,.2000**).**

Nurse's recording of procedures was the worst score in this domain which was zero percent in pre intervention and gets increase by 44% in post intervention I and reach up to 64% in post II. This result was strange because all three study setting had specific nursing documentation forms either separately or co with patient's follow up and observational forms. But the nurse's auditing system was not found and no one pay attention for nurse's documentation as important issue.

Confirm the placement of the tube by listening over the chest of the patient and ongoing ETT assessment and cuff status. P. value was 0.000.

Also there was a clinical importance for relationship between nursing experience and provide of oral care to the client. P. value was 0.106.

Provide skin care was of both clinically importance and statistically significant evidence with the nursing experience. P. value was 0.000.

5. Recommendation:

1- Great emphasis is to be directed towards the educational aspects on MVIs care by providing educational posters , guidelines , pamphlets , manual and modern educational facilities.

2- Collaboration between institutions and federal ministry of health to formalize a protocol with chick list as a tool that help ensure consistent application of key elements of evidence – based practice in MVIs nursing care.

3- ICU nurses to be included in workshops and regular conference, locally, regionally and internationally, to be aware on what is going on in MVIs nursing care.

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