IOSR Journal of Nursing and Health Science (IOSR-JNHS)
e-ISSN: 2320–1959.p- ISSN: 2320–1940 Volume 6, Issue 5 Ver. VII. (Sep. -Oct .2017), PP 19-35
www.iosrjournals.org

Effect of Using Different Modalities of Chest Physiotherapy on Prevention of Ventilator Associated Pneumonia

Gehan Fahmy Ali Abd El-hamid, Tarek Mohamed Ali Shams, Abd El-moaty Abd El-moaty Ali, Shaimaa Ahmed Awad

Abstract:
Background *: Mechanical ventilation is a life saving and support intervention but exposes patients to the risk of ventilator associated pneumonia. Chest physiotherapy is an accepted treatment method in the intensive care unit and common preventive strategy to prevent pulmonary complications as VAP.* ***Aim****:To assess the effect of using different modalities of chest physiotherapy on prevention of ventilator associated pneumonia.****Subjects and Methods****: A prospective randomized clinical trial was used to conduct this study on 80 patients, aged between 18-60 years of both sexes, newly admitted to intensive care unit of emergency hospital at Mansoura university hospital from September 2015 to April 2016, data were collected using two tools; the 1st tool was multimodality CPT tool and have two parts; part one to assess socio- demographic data, part two CPT care sheet for both groups, the 2nd tool is the follow up sheet.* ***Results****: The occurrence of VAP at the seventh day of care was observed in only 15% of patients in group B versus 37.5% of patients in group A. It means that there was positive association between using different modalities of CPT and prevention of VAP in both groups.****Conclusion****: Using different modalities of chest physiotherapy had significant positive effect in decreasing VAP by using five types of interventions of CPT.* ***Recommendation****: Raising the awareness of VAP and how to prevent other complications from mechanical ventilator, providing nurses with continuous educational programs with evidence based guidelines to improve their knowledge and practices regarding VAP and CPT, enhancing nurses practices regarding CPT.*

Key words: *Chest Physiotherapy, Ventilator Associated Pneumonia, Mechanical Ventilator, Intensive Care Unit.*

Date of Submission: 25-09-2017 Date of acceptance: 14-10-2017

I. Introduction

Mechanical ventilation (MV) is a life saving and support intervention. It is the most common reason for admission of an adult patient to the Intensive Care Unit (ICU) as a result of primary or secondary respiratory lung pathology. **(Burns, 2005, Dasta et al., 2005, Byrd et al., 2006, Irene et al., 2011).** The nurse who cares for the mechanically ventilated patient must demonstrate competence in order to be able to recognize adverse events and carry out the necessary interventions to decrease the harmful effects of such adverse effects**(Tobin et al., 2001, Alphonso et al., 2004).**

VAP has been implicated as the most common infectious complication occurring in ICU patients, results in prolonged ICU, hospital lengths of stay, prolonged duration of mechanical ventilation and overall increased cost of care **(Ally, 2012, Dana, 2014).** The mortality attributable to VAP has been reported to range between 0 and 50%**(Hiroko, 2011).**

Risk factors for VAP include heart or lung disease, head trauma or other severe neurologic illness and blunt or penetrating trauma as well as modifiable risk factors such as whether the head of the bed is flat (increased risk) or raised and whether the patient had an aspiration event before intubation and prior antibiotic exposure. **(Dudeck et al., 2013).**

Diagnosing VAP requires a high clinical suspicion combined with bedside examination, radiographic examination and microbiologic analysis of respiratory secretions. VAP varies among hospitals and providers but usually requires a new infiltrate on chest x-ray plus two or more other factors. These factors include temperature of >38 °C or <36 °C, a white blood cell count of $>12 \times 10^9$/ml and purulent secretions from the airways **(Dana, 2014).**

Chest physiotherapy (CPT) is a group of physical techniques that improve lung function and help to breathe better. CPT expands the lungs, strengthens breathing muscles, loosens and improves drainage of thick lung secretions. It helps treat diseases as cystic fibrosis and chronic obstructive pulmonary

disease (COPD). It also keeps the lungs clear to prevent pneumonia after surgery and during periods of immobility **(Kathy, 2000).**

Different types of CPT can be used including: Chest percussion helps in loosening lung secretions, vibration helps in breaking up lung secretions, postural drainage (PD) helps in draining of lung secretions, controlled coughing technique helps in breaking up lung secretions easily for suction or expectorate them, deep breathing exercises help in expansion of the lungs and draw more air into all areas of the lungs and incentive spirometry helps in improving lung function by inhaling strongly using a special device and positioning and turning from side to side to help improve lung expansion and drainage of secretions. (**Gosse et al., 2011).**

Other methods include manual hyperinflation (MH), ventilator hyperinflation (VH) to treat of sputum retention and pulmonary collapse, suctioning to clear pulmonary secretions and hyper oxygenation to prevent suction induced hypoxemia**(Gosse et al., 2011, Nicoline and Dewi, 2013).**

The critical care nurse is an integral participant of the multidisciplinary group responsible for the management of patients in ICU. Nurses must be knowledgeable about the function, limitations of ventilator and appropriate management in order to provide high quality patient care. It is essential that nurses thoroughly understand the bases of ventilator support. Critical care nurses encounter numerous issues as CPT in order to provide good chest hygiene care that helps in decreasing VAP and other ventilator related problems. Responsibilities related to ventilator management may vary among acute care settings, but the nurse is usually the first line manager challenged with patient and ventilator related problems.

Significance of the study

VAP is the second most common nosocomial infection after urinary tract infection in ICU with high morbidity and mortality rate. It is also observed to be considerably contributing factor to increase the length of hospital stay and increase health care cost. Best practice and preventive measures like CPT are important aspects of nursing care for patients who receive MV. Nurses have vital role in developing best practice in an attempt to prevent VAP.The purpose of this research study is to show the effectiveness of using different modalities of chest physiotherapy on prevention of VAP, a complication linked with prolonged MV. Improved outcomes will shorten patients ICU length of stay and hospitalization as well as decreasing hospital costs.

Aim of the study

The aim of this study is to assess the effect of using different modalities of chest physiotherapy on prevention of VAP.

Research questions

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

Q1: Does the VAP decrease by applying different modalities of chest physiotherapy?

Q2: Does the implementation of different modalities of chest physiotherapy improve the patient recovery?

II. Subjects and Methods

Research design

A prospective randomized clinical trial was used to conduct this study.

Subjects

This study includes 90 adult patients aged between 18-60 years of both sexes. They were newly admitted to the intensive care units (ICUs) of emergency hospital during the first 24 hours and receiving mechanical ventilation. The patients were divided into two groups: Group A and Group B, 40 patients each and ten patients for pilot study. Group A received three techniques of chest physiotherapy which includes positioning, hyperinflation and suctioning, while group B received the same techniques of group A in addition to vibration and percussion.

Setting

This study turned into conducted at the extensive care devices (ICUs) of MansouraEmergency Health facility. These units are located at the second floor and consists of (3) rooms. The small room capacity is (4) beds, while the other two rooms has a capacity of (8) beds for each. These units receive traumatic and non- traumatic patients.

Sample size calculation

Sample size was calculated using online sample size calculator at level of absolute precision of 1% at alpha error of 5% and study power of 80%. The minimal sample size required for the study is calculated to be 33

patients for each group (group A and group B). To account for possible drop out the sample will be increased to 40 in each group.

Tools of data collection

Two tools were used to collect data pertinent to the current study.

Tool I: Multimodality- chest physiotherapy tool

This tool become advanced by the researcher after reviewing associated literature (**Ntoumenopoulos, 2002, Keabecoe, 2008**) to collect patients profile data and to record the applied chest physiotherapy in the ICU, it includes (34) questions in the form of multiple choice (MCQ) and closed ended questions. This tool included two main parts:

Part one: Assessment sheet, this part included demographic data which included (10) items such as name, age, gender, weight, level of education, marital status, occupation, health habits, date of admission and date of discharge, diagnosis, cause of intubation, surgical, medical history, vital signs, respiratory assessment, Glasgow coma scale (GCS) and MV setting.

Part two: Chest physiotherapy care sheet, it included two types of intervention in which group A received three techniques positioning, suctioning and hyperinflation and group B received the same techniques of group A in addition to vibration and percussion. The researcher provided a plan of intervention through applying scheduling of care every (6) hours during the day in the period of intervention for seven days.

Tool II: Follow up tool

This tool was developed by the researcher after reviewing related literature (**Ntoumenopoulos, 2002, Keabecoe, 2008**),it included (19) questions, which were divided into (8) multiple choice questions and (11) closed ended questions. This tool covered two main domains: The first domain evaluated the rate of VAP after applying the different modalities of chest physiotherapy. It evaluated VAP through (CPIS) which included body temperature, chest x-ray of new or worsening infiltrate, sputum, Pao_2/FIO_2, endotracheal tube cultures and white blood cells count. The second domain was the rate of recovery which was evaluated through length of stay in ICU, duration of intubation, MV data changes, peripheral oxygen saturation (Spo_2), hemodynamic parameters indicators included temperature, pulse and blood pressure and arterial blood gases.

III. Methods

Protection of Human Rights

An official permission to conduct the proposed study was obtained from ethical committee of Faculty of Nursing, Mansoura University and the hospital director. Participation in this study become voluntary, every capacity situation become informed about the cause, system, benefits and nature of the observe. Members have beenassured that they have the proper to withdraw from the study at any time with none rational then written sees eye had been obtained. Participants have been informed that the received records will not be covered in any additionalstudies without another consent. Confidentiality and anonymity of every member was confident through coding of all data and all information has taken was protected and did no longer affect their annual appraisal.

Procedure

The current study was carried out through the preparatory phase, pilot studyand field work which showed at appendix II.

Preparatory phase

- This study involved two tools: tool I Multimodality chest physiotherapy tool concerning assessment of mechanical ventilated patient and tool II Follow up tool concerning recovery and rate of VAP.
- Tool I: Multimodality chest physiotherapy tool to assess mechanically ventilated patient. This tool was developed into simple Arabic language by the researcher after reviewing of current literature (**Ntoumenopoulos, 2002,Keabecoe, 2008**).
- Tool II: Follow up tool concerning recovery and rate of VAP for mechanical ventilated patient become advanced with the aid of the researcher after reviewing current literature (**Ntoumenopoulos, 2002, Keabecoe, 2008**).
- Tools were verified for content related validity via 5 specialists in the area of vital Care, Emergency Nursing and Medicine from the Faculties of Nursing and Medicine. Necessary modifications had been performed therefore.
- The overall reliability of the tools was tested using (α) Cronbach test on a sample of 10 subjects and found to be 0.884 and test re test r=0.792

Pilot study

A pilot study was carried out before starting data collection on ten patients to test clarity, feasibility, applicability of the tools and time frame to answer the questionnaire. Based on the findings necessary modifications were done accordingly. Those patients were excluded from the study.

Fieldwork

Once official permissions were obtained to carry out the study, the researcher met the involved patients and their families daily, interviewed with each patient and did the intervention of chest physiotherapy for seven days from the first 24 hours of admission to ICU and MV. The researcher provided the intervention of multimodality chest physiotherapy that included percussion, vibration, positioning, hyperinflation and suctioning for group B and group A received the intervention of suctioning, positioning and hyperinflation. The researcher provided the intervention in the form of sessions four times daily and each session lasted for 20-30 minutes.

The researcher provided chest percussion manually by cupped hands together to provide more force for the chest anterior, laterally and posterior to the back each segment was percussed for a period of 3-5 minutes and followed by vibration over the area. The position during percussion and vibration was provided according to the affected area to promote drainage of the lung segment by achieving an optimal gravitational effect on mucus flow as determined by x-ray and auscultatory findings which percussion and vibration could be given directly and effectively.

Suctioning was done after percussion and vibration according to patient assessment including auscultation of chest and visual inspection of ventilator graphics, mechanical hyper oxygenation by 100% FIO_2 to prevent suction induced hypoxemia and duration was limited to 15 second. The researcher provided turning the patient from side to side every two hours to protect the patient from accumulating of secretions and also keep the head of bed at 30-45 degree up to protect the patient from aspiration and accordingly to the patient condition.

The researcher provided also the technique of mechanical hyperinflation which achieved by altering the ventilator settings to gradually increase tidal volume while maintaining the PEEP level and controlling airway pressure limits. This technique lasted for 20 minutes and the patient was suctioned throughout the procedure of hyperinflation breaths. At the time of providing the intervention the researcher took the demographics data, history from the relatives of the patients or from the patient if conscious and after assessing the patient the researcher answered the questions of tool I.

After providing the intervention the researcher provided evaluation through tool II of follow up during the seven days of intervention through the including CPIS to evaluate the rate of VAP which included temperature, white blood cells count, tracheal secretions, Pao_2/FIO_2 and chest x- ray and also culture from tracheal secretions. The researcher evaluated the rate of recovery through length of stay in ICU, duration of intubation, peripheral oxygen saturation (SPo_2), hemodynamic parameters indicators including temperature, pulse, blood pressure and arterial blood gases.

Statistical analysis

- After the data was collected and transferred into special design formats so as to be suitable for computer feeding, data become analyzed using a non-public laptop with Statistical Package for Social Sciences (SPSS).
- 0.05 level become used as the cut off price for statistical consequence and the subsequent statistical methods have been used:

Descriptive statistics

1. Numbers and percentage:
   Used for describing and summarizing qualitative data.
2. Arithmetic mean, Standard deviation(SD):
   They were used as measures of central tendency and dispersion respectively for normally distributed quantitative data.

Analytical statistics

1. Reliability analysis (Cronbach Alpha):
   It allows studying the properties of measurement scales and items that make them up. The reliability examinationmethod calculates a number of commonly used measures of scale reliability and provides information about the relationships between individual items in the scale. Cronbach Alpha is a model of internal consistency, based on the average inter- item correlation.

2. Paired sample t- test: It was used to compare the means of two variables.

Limitation of the study

- Findings of this study were limited to small number of 4o patients in Emergency hospital at Mansoura University and for short duration: therefore findings may not be representative of the general population of ICU patients in Egypt. This may threaten the external validity of the findings hence another research with large probability sample size is required.

IV. Results

Part I:Sociodemographic characteristics of the studied groups:

Table (1):General characteristics of group A and B

Personal data	Groups				Test of significance χ^2	P value
	A N=40		B N=40			
	No	%	No	%		
Age (years)						
18-29	8	20	9	22.5	0.569	**0.753**
30-44	5	12.5	7	17.5		
45-60	27	67.5	24	60		
Mean±SD						
	45.83±21.56		48.75±16.88		0.277	**0.826**
Gender						
Male	26	65	27	67.5	0.056	**0.813**
Female	14	35	13	32.5		
Weight (Kg)						
60-79	8	20	9	22.5	0.478	**0.788**
80-99	26	65	27	67.5		
100-110	6	15	4	10		
Mean±SD	80.00±13.78		86.25±18.43		0.617	**0.554**
Education						
Illiterate	2	5	1	2.5	2.774	**0.487**
Read\Write	7	17.5	6	15		
Primary Preparatory	1	2.5	1	2.5		
Secondary	1	2.5	2	5		
University	24	60	20	50		
	5	12.5	10	25		
Marital status						
Married	32	80	30	75	0.315	**0.856**
Single	7	17.5	9	22.5		
Widow	1	2.5	1	2.5		
Occupation						
Employee	5	12.5	11	27.5	6.054	**0.048***
Worker	20	50	10	25		
Un employee	15	37.5	19	47.5		
Health habits						
Smoking	8	20	3	7.5	2.640	**0.105**
Not smoking	32	80	37	92.5		

P value was >0.05

Table 1 : Describes the comparison of general characteristics between group A and B in relation to demographic data (age, gender, weight, education, marital status, occupation and health habits). This table reveals that the most common age section in both groups were 45-60 years which in group A was 67.5% and in group B was 60% with mean ±SD 45.83±21.56 in group A compared to group B was 48.75±16.88.

Regarding gender, more than half of the patients were males, as it represents 65% in group A and 67.5% in group B. Regarding weight, most of the studied patients in both groups were 80-99 Kg, as it represents 65% in group A and 67.5% in group B and mean± SD 80.00±13.78 in group A compared to 86.25±18.43 in group B. Regarding educational level, secondary level of education was the most common level in both groups as it represents 60% in group A and 50% in group B, and the least percentage was in illiterate, primary and preparatory level for both groups. Illiteracy represents 2.5%, 5% in group A and B respectively while primary

level of education represents 2.5% in both groups. While preparatory level represents 2.5%, 5%for group A and B respectively.

Regarding the marital status, 80% of group A were married while it represent 75% in group B and the least percentage was widow in both groups 2.5%. Regarding the occupation, 50% of group A were workers, 37.5% were un-employed and 12.5% were employed. On the other hand, 47.5% of group B were un-employed, while 27.5% were employed and 25% were workers. Regarding health habits, 80%, 92.5% were not smoking in group A and B respectively.

As shown in this table, there were no statistically significant differences between the two groups regarding age, gender, weight, education, marital status but the difference was significant regarding occupation (P= 0.048) which result from randomized collection.

Part II: It is concerned with pre care assessment such as chest assessment, sputum, chest x- ray, GCS, mechanical ventilation modes for both groups.

Table (2): Pre- care chest assessment and respiratory problems of group A and B

Chest assessment	Groups				Test of significance χ^2	P value
	GroupA N=40		**Group B N=40**			
	No	**%**	**No**	**%**		
Pattern of respiration						
Normal	21	52.5	20	50	0.050	**0.823**
Tachypnea	16	40	18	45	0.205	**0.651**
Wheezes	8	20	1	2.5	6.135	**0.013***
Bradypnea	0	0	2	5	2.051	**0.152**
Crackles	1	2.5	0	0	1.013	**0.314**
Dyspnea	2	5	0	0	2.051	**0.152**
Auscultation of breath sounds						
Normal	32	80	39	97.5	6.135	**0.013***
Wheezes	8	20	1	2.5		
Sputum						
Present	31	77.5	26	65	1.53	**0.217**
Absent	9	22.5	14	35		
Sputum color						
No	9	22.5	14	35	3.25	**0.197**
Purulent	29	72.5	26	65		
Mixed with blood	2	5	0	0		
Sputum consistency						
No	9	22.5	14	35	1.82	**0.403**
Thick	26	65	19	47.5		
Watery	5	12.5	7	17.5		
Chest x-ray						
Clear	32	80	37	92.5	5.27	**0.153**
Pneumonia	6	15	1	2.5		
Pneumothorax	1	2.5	2	5		
Atelectasis	1	2.5	0	0		

P value was >0.05

Table 2: Illustrates the characteristics of group A and B in relation to pre care chest assessment. It shows that group A 52.5% had normal pattern of respiration, 40% had tachypnea, 20% had wheezes, 5% had dyspnea and 2.5% had crackles. While in group B, 50%had normal pattern of respiration, 45% had tachypnea, 2.5% had wheezes and 5% had bradypnea.

Auscultation of adventitious breath sounds shows that 80% had normal breath sounds in group A and 20% had wheezes. On the other hand, 97.5% of group B had normal breath sounds and 2.5% had wheezes. It was found that there were no statistically significant differences between the two groups as regards to normal breathing, tachypnea, bradypnea, crackles and dyspnea but the difference was significant regarding wheezes (P= 0.013)

As regards to sputum color, the majority of patients had purulent sputum as it represents 72.5% in group A and 65% in group B. While 22.5% of group A had no sputum compared to 35% in group B. 5% of group A had sputum mixed with blood.

As regards to consistency of sputum, it was found that 65% of group A had thick sputum, 12.5% had watery sputum and 22.5% not having sputum. While in group B 47.5% had thick sputum, 17.5% had watery sputum and 35% not having sputum. Chest x-ray revealed that 80% of group A had clear chest, 15% had pneumonia, 2.5% had pneumothorax and atelectasis. While in group B the majority had clear chest 92.5%, 5% had pneumothorax and 2.5% had pneumonia.

As shown in this table, there were no statistically significant differences between the two groups regarding the respiratory problems at pre care assessment.

N.B: Selection is not mutually 100% exclusive towards pattern in both groups which affect in increase number and percentage.

Table (3): Conscious state at the pre-care assessment in group A and B.

Glasgow coma scale	Groups				Significance test χ^2	P value
	Group A N=40		**Group B N=40**			
	No	**%**	**No**	**%**		
Unconscious(3-8)	17	42.5	11	27.5	4.286	**0.117**
Semiconscious(9-12)	20	50	20	50		
Conscious(13-15)	3	7.5	9	22.5		

P value was >0.05

Table 3: Demonstrates the frequency of conscious state of patients at the pre care assessment in group A and B. It shows that 50% of group A was semiconscious (9-12), 42.5%was unconscious (3-8) and 7.5% was conscious (13-15). While half of group B was semiconscious (9-12), 27.5% was unconscious (3-8) and 22.5% was conscious (13-15).

As shown in this table, there were no statistically significant differences between the two groups regarding the frequency of unconscious, semiconscious and conscious states.

Table (4): Mechanical ventilation modes at the pre-care chest assessment in group A and B.

MV modes	Groups				Significance test χ^2	P value
	Group A N=40		**Group B N=40**			
	No	**%**	**No**	**%**		
SIMV	19	47.5	16	40	15.680	**0.001***
CMV	19	47.5	8	20		
SPONT	2	5	15	37.5		
CPAP	0	0	1	2.5		

P value was <0.05

Table 4: Illustrates the MV modes at the pre care assessment in group A and B. It shows that 47.5% of group A was put on CMV, SIMV mode and 5% was put on spontaneous mode. While in group B 40% was put on SIMV mode, 37.5% was put on spontaneous mode, 20% was put on CMV mode and 2.5% was put on CPAP.

As shown in this table, there were highly statistical significant differences of all modes of MV between group A and B.

Part III: Is concerned with VAP evaluation through CPIS points and microbiological findings of endotracheal tube cultures after CPT in group A and B.

Table (5): Post care assessment of Ventilator Associated Pneumonia through Clinical Pulmonary Infection Score points.

CPIS points	Range	Score	Group A		Group B		Significance test χ^2	P value
			No	**%**	**No**	**%**		
Body temperature	≥36.5-≤38.4	0	25	62.5	34	85	5.230	**0.022***
	≥38.5-≤38.9	1	15	37.5	6	15		
	≥39 or≤36	2	0	0	0	0		
WBC	4.000-11.000	0	23	57.5	30	75	3.309	**0.191**
	<4.000->11.000	1	16	40	10	25		
	<4.000->11.000 band forms	2	1	2.5	0	0		
Tracheal secretions	rare	0	1	2.5	1	2.5	2.053	**0.358**
	abundant	1	37	92.5	39	97.5		
	Abundant purulent	2	2	5	0	0		
Oxygenations or Pao_2/FIO_2	240 or ARDS	0	3	7.5	7	17.5	1.829	**0.176**
	240 and no evidence of ARDS	2	37	92.5	33	82.5		

Chest x- ray	No infiltrate	0	3	7.5	10	25	4.501	**0.034***
	diffused	1	37	92.5	30	75		
	localized	2	0	0	0	0		
VAP	absent	≥5	25	62.5	34	85	5.230	**0.022***
	present	≤5	15	37.5	6	15		
Mean±SD			4.63±1.19		3.78±1.12		3.287	**0.002***

P value was <0.05

Table 5: Illustrates the post care assessment of VAP through comparison of CPIS parameters between group A and B at the seventh day through five points including (body temperature, WBC, tracheal secretions, oxygenations Pao_2/FIO_2 and chest x-ray). Regarding body temperature in group A 62.5% were between (≥36.5- ≤38.4) and 37.5% were between (≥38.5- ≤38.9). While in group B, 85% were between (≥36.5- ≤38.4) and 15% were between (≥38.5- ≤38.9). The difference was statistically significant.

Regarding WBC, 57.5% in group A were between (4.000-11.000) which is the normal range, 40% were between (<4.000- >11.000) and 2.5% were between (<4.000- >11.000 band forms). In group B 75% were between (4.000-11.000) which is the normal range and 25% were between (<4.000->11.000). Regarding Tracheal secretions 92.5% in group A had abundant secretions, 5% abundant purulent and 2.5% had rare secretions. While in group B 97.5% had abundant secretions and 2.5% had rare secretions.

Regarding Oxygenations, 92.5% in group A were 240 and no evidence of ARDS and 7.5% were 240 or ARDS. While in group B 82.5% of the sample were 240 and no evidence of ARDS and 17.5% were 240 or ARDS. In relation to Chest x- ray group A 92.5% had diffused and 7.5% with no infiltrate. In which group B 75% had diffused in group B and 25% with no infiltrate.

Patients evaluation towards VAP revealed that 62.5% of group A didn't had VAP and 37.5% had VAP. While 85% of group B didn't had VAP and 15% had VAP which means that there were positive association between using different modalities of CPT and prevention of VAP.There were reduction in CPIS score more prominent in group B 3.78±1.12 compared togroup A 4.63±1.19 and there were statistically significant difference toward CPIS score in both groups

As shown in this table, there were statistically significant differences between the two groups regarding the body temperature (P= 0.022), chest X-ray findings (P= 0.034) and frequency of VAP (P= 0.022) whereas there were no significant differences between WBCs count, tracheal secretion and oxygenation or PaO_2/FIO_2.

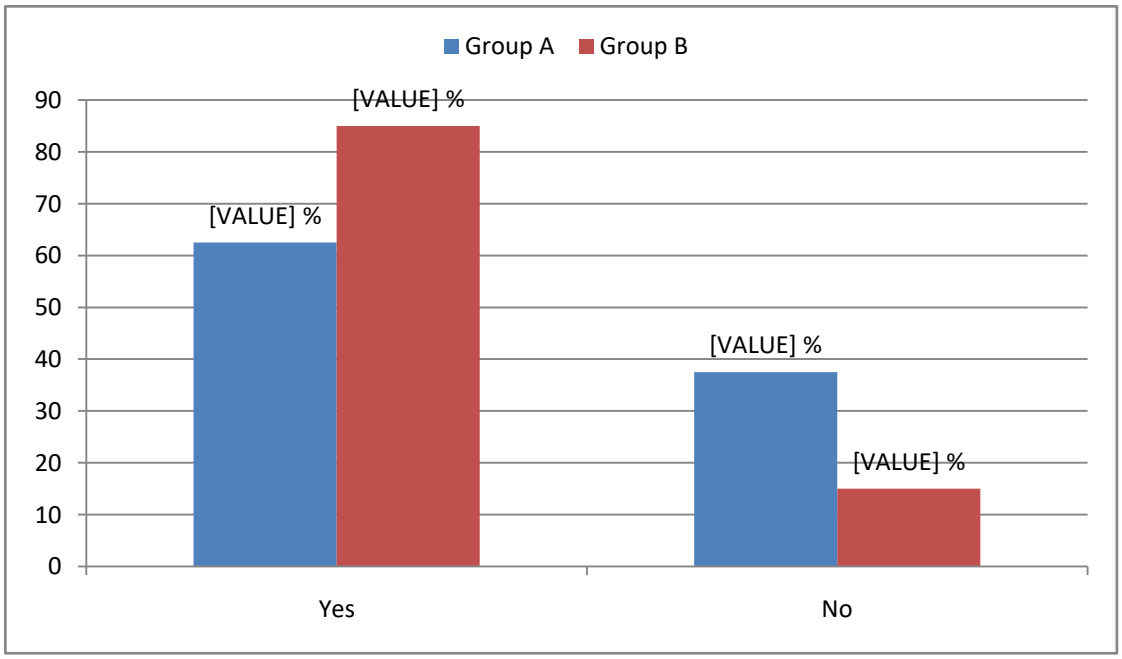

Figure (1): Incidence of VAP according to CPIS after CPT care in group A and B.

Figure 1: Demonstrates the frequency of VAP at the seventh day of care based on CPIS points in group A and B. As shown in this figure, VAP was observed in only 15% of patients in group B versus 37.5% of

patients in group A. It means that there were positive association between using different modalities of CPT and prevention of VAP in both groups.

Table (6): Microbiological findings of endotracheal tube cultures after CPT care in group A and B

Microbiology	Group A		Group B		Significance test χ^2	P value
	No	**%**	**No**	**%**		
negative	24	60	32	80	3.810	**0.051***
positive	16	40	8	20		

P value =0.05

Table 6: Demonstrates the microbiological findings of ETT cultures after CPT care in group A and B. As shown in this table, positive microbiology findings denoting VAP were found in 40% of patients in group A and 20% of patients in group B. The difference was statistically significant between the two groups.

Part IV: Is concerned with outcome and recovery in terms of : length of stay, duration of intubation, difference between before and after care toward MV modes.

Table (7): Length of stay in ICU for group A and B.

Outcome	Group A		Group B		Significance test χ^2	P value
	No	**%**	**No**	**%**		
Length of stay in ICU Still in ICU Up to 7day	 37 3	 92.5 7.5	 32 8	 80 20	2.64	**0.1045**

P value was >0.05

Table 7: Illustrates the length of stay in ICU for group A and B. It was more prolonged in group A compared to group B. 92.5% in group A, 80% in group B were still in ICU while 7.5% in group A and 20% in group B stayed up to 7 days. There was no statistical significant difference regarding length of stay (P >0.05).

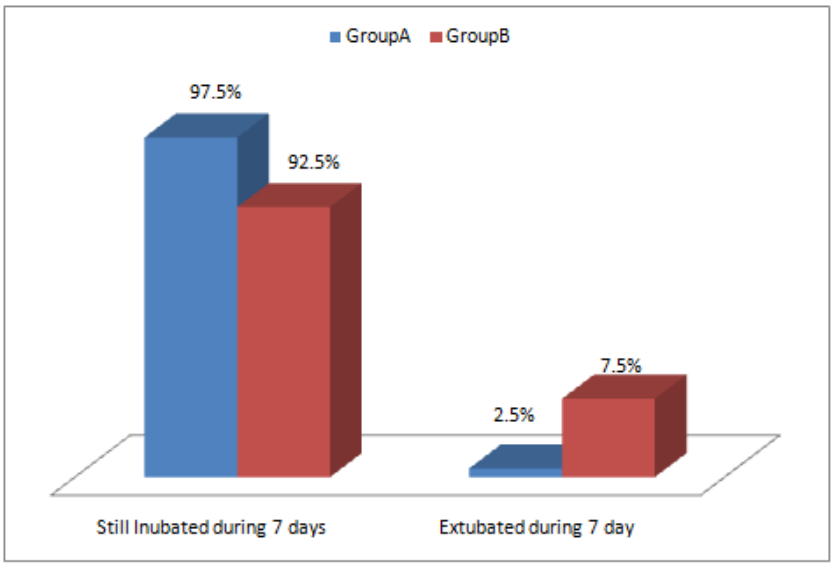

Figure (2): Duration of intubation for group A and B.

Figure 2: It clarifies the duration of intubation for both groups. The majority of the studied patients were still intubated during the seventh day in group A and B(92.5% - 97.5%). While 2.5% of group A and 7.5% in group B were extubated during the seventh day.There were highly statistical significant differences between the two groups as regards the duration of intubation (P value <0.05).

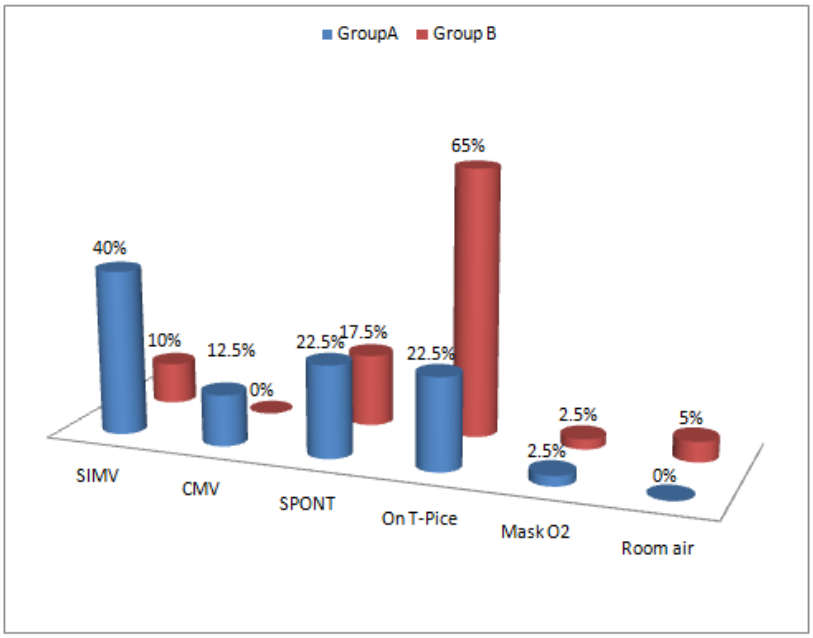

Figure (3):The frequency of MV modes after CPT for group A and group B.

Figure 3: It clarifies the frequency of MV modes data after care for group A and group B. It shows that 40% in group A was on SIMV mode, 22.5% was on spontaneous mode and also weaned from MV and become on T- pice, 12.5% was on CMV mode and 2.5% was on mask oxygen. On the other hand, more than half of group B become on T- pice 65%, 17.5% was put on spontaneous mode, 10% was put on SIMV mode, 5% was put on room air or extubated and 2.5% was put on mask oxygen.

It can be observed from the same figure that the intervention of five types of care had great effect on group B in increasing the opportunities for weaning from the MV which shows that 65% was being on T-Pice, 17.5% was put on spontaneous mode, 5% of patients were extubated from endotracheal tube and being on room air and 2.5% was put on mask oxygen. While in group A, three types of care hadn't the same effect on the patients where 40%was put on SIMV mode, 22.5%was weaned from MV and become on T-Pice, 22.5% was put on spontaneous mode, 12.5%was put on CMV mode and 2.5%of patients were put on mask oxygen.

There were highly statistical significant differences regarding all MV modes between group A and B (P <0.05) suggesting that higher number of patients in group B were weaned from the ventilator compared to group A.

Table (8): Comparison of Mechanical Ventilation modes before and after CPT in group A and B.

MV modes in group A	**Before care**		**After care**		**Significance test** χ^2	**P value**
	No	**%**	**No**	**%**		
SIMV	19	47.5	16	40		
CMV	19	47.5	5	12.5		
SPONT	2	5	9	22.5		
CPAP	0	0	0	0	22.88	.0001*
T-Pice	0	0	9	22.5		
Mask O_2	0	0	1	2.5		
Room air(extubated)	0	0	0	0		
MV modes in group B	**Before care**		**After care**			
	No	**%**	**No**	**%**		
SIMV	16	40	4	10		
CMV	8	20	0	0		
SPONT	15	37.5	7	17.5		
CPAP	1	2.5	0	0		
T-pice	0	0	26	65	48.11	0.000*
Mask O_2	0	0	1	2.5		
Room air(extubated)	0	0	2	5		

P value <0.05

Table 8: Illustrates the comparison of MV modes before and after CPT in group A and B. Group A reveals that the 3 types of care (suctioning, positioning and hyperinflation) affect the change of mode where

SIMV mode before care was 47.5% and after care was 40%, CMV mode before care was 47.5% and after care was 22.5%. After care 22.5%was on T-Pice and 2.5% was on mask oxygen.

While the comparison between before and after care in group B reveals that the five types of care (percussion, vibration, suctioning, positioning and hyperinflation) had great effect on the change of mode where SIMV mode before care was 40% and after care was 10%, CMV mode before care was 20% and after care was 0%, spontaneous mode before care was 37.5% and after care was 17.5%, CPAP before care was 2.5% and after care was 0%. After care 65%was on T-Pice, 2.5%was on mask oxygen and 5%was extubated or on room air.

It can be observed from the table that the intervention of five types of care of chest physiotherapy had great effect on the recovery and progress of MV modes toward the patients on group B where the percentage of T-Pice or the weaned patient from MV was 65% and the extubated patient percentage was 7.5% (5% on room air and 2.5% on mask oxygen).There were highly statistical significant difference between MV modes before and after providing CPT care in both groups A and B ($P < 0.05$). There were positive association between using different modalities of CPT and weaning from MV for both groups.

V. Discussion

In the current study, the total number of the studied sample was 40 patients. Regarding the socio-demographic data, more than half of the patients in group A 67.5% aged were 45-60 years compared to 60% in group B, the mean age in group A was 45.83±21.56 compared to group B was 48.75±16.88. Regarding gender, near two thirds of the patients in group A 65% were males compared to 67.5% in group B. There were no statistically significant differences between the two groups regarding to age and gender.

Moreover, our study findings are in the line with study by **Renu, (2011)** who studied the impact of multimodality chest physiotherapy on the rate of recovery, prevention of VAP on 101 patients. In this study, the majority of patients were males 73.6%, the mean age was 49.4±16.13 for the patients versus 49.7±16.21for control group.

Our study findings are in agreement with that of **Orhan et al., (2016)** who searched for the best pulmonary physiotherapy method in 30 ICU patients. In this study, 66.6% of patients and 60% of the control group were males with no statistically significant differences between the two groups. The mean age was 73.1±11.9 in patients versus 74.7±11.5 in the control group with no statistically significant differences.

Also, our results agree with that of another study by **Antonio et al.,(2012)** who studies the effectiveness of chest physiotherapy on reducing hospitalization and mechanical ventilation, length of stay, pulmonary infection and mortality rate in ICU patients. The female: male ratio of patients in this study was 27:46 in group A, versus 25:48 in group B. the mean age was 54.51±18.4 in group A, versus 50.25±18.9 in group B.

These results have been in accordance with that stated in several studies. **Hunter (2006), Hyllienmarket al., (2007), Ahmed (2008)** said that, common of the observe sample were men and highlighted that mangender is reflected as an independent threatinfluence for progress of VAP in the ICU. This outcome was in line with that of **Chastre and Fagon,(2006), Kollef et al., (2007)and Aysha (2016)** who identified that maximum suffers with VAP were in age cluster of 15- 55 year. Our results are contradictory with that of **El Solha et al., (2002)** and **Michalopoulos and Geroulanos, (2003)** who determined that maximum suffers with VAP are old age and highlighted that phasemore than sixty doing as independent hazardinfluence for the progress of VAP contamination.

Regarding the weight, near two thirds of the patients in group A 65% were 80 -99 Kg compared to 67.5% in group B respectively which the mean weight in group A was 80.00±13.78 compared to group B was 86.25±18.43. Regarding to level of education, about half of the patients in group A 60% had secondary level of education compared to 50% in group B. There were no statistically significant differences between the two groups regarding weight and level of education.

Furthermore, a study by **Mehtap et al., (2009)** showed that, the mean weight was 68.6 ± 8.7 in the intervention group and 72.3± 3.4 in the control group. The two groups were similar and clinically comparable.

Our findings are supported by **Aysha Z et al., (2016)** who searched for evaluating the influence of applying nursing cautionprogrammer on the rate of VAP in the ICU. In-group I (control group or pre intervention group), II (studied group) and III (follow up group) respectively. The level of education was also less than university for all groups.

Regarding the occupation, approximately half of the patients in group A 50% were workers, 37.5% were unemployed and 12.5% were employed compared to group B which more than one third of the patients 47.5% were unemployed, 25% were workers and 27.5% were employed. There were statistically significant differences between the groups regarding the occupation which resulting from randomization. Regarding health habits, near two thirds of the patients in group A 80% were non-smokers compared to 92.5% in group B with no statistically significant differences between the two groups.

Our findings are supported by **Aysha Z et al., (2016)** who searched for evaluating the influence of applying nursing cautionprogrammer on the rate of VAP in the ICU. In-group I (control group or pre intervention group), II (studied group) and III (follow up group) respectively. 35% of patients in the three groups (I, II, III) were admitted from neurosurgery section. Regarding the smoking past, there were no significant difference amongstautomatically ventilated suffers, it was observed that, 60% and 55% were smokers in group I and II respectively while in group III 65% were non-smokers. Regarding the occupation, 55%, 60%, and 65% were worker in-group I, II and III respectively.

On the other hand, the study results disagree with that of **Chaster and Fagon, (2006)** who cited that there were significant differences amongst the studied automatically ventilated suffers as regards the smoking past and added that smoking is a contributed threatcause for VAP contamination amongst the ones ventilated suffers.

Our findings are also supported by that of **Ntoumenopoulos et al.,(2002)** who studied the impact of chest physiotherapy on ventilator- associated pneumonia in 60 patients. Smoking was reported in 4(19) in intervention group versus 11(30.6) in the control group (p=0.37).

Regarding the pre care chest assessment, it was found that half of the patients in group A 52.5% had normal respiratory pattern compared to 50% in group B, the majority of the patients in group A 80% had normal breath sound compared to 97.5% in group B and near two thirds of the patients in group A 72.5% had purulent sputum compared to 65% in group B. Assessment of chest X- ray showed that the majority of the patients in group A 80% had clear chest compared to 92.5% in group B because the patients were randomly chosen from newly admission to ICU. There were no statistically significant differences between the two groups regarding the respiratory problems at pre care assessment.

This findings disagree with **Hariedy N et al., (2015)** who delineated that, nearly half of study group expectorated larger amount of secretion compared to moderate amount among control group with statically significant difference between the both groups (p=0.05 to 0.01). Regarding color ,viscosity, breath sound, higher percentage of study group had clear loose sputum and normal breath sound as compared to the control group with significant difference between both groups (p=0.05 to 0.01).

Regarding GCS, 42.5%was unconscious in group A compared to 27.5% in group B and half of the patients of both groups 50% were semiconscious. There were no statistically significant differences between the two groups regarding conscious state. These findings disagree with **Hariedy N et al., (2015)** who found that, all patients had GCS more than 13. A significant statistical difference (p=0.05 to 0.01) found between the two group.

Regarding MV modes before care, it was noticed that more than one third of the patients in group A 47.5% were put on SIMV mode compared to 40% in group B, nearly half of the patients in group A 47.5% were put on CMV mode compared to 20% in group B. The less common mode was spontaneous mode in group A 5% ; however it accounts for 37.5% of group B which is highly statistically significant difference because of randomized collection of the sample.

A study by **Renu, (2011)** revealed that, in the studied patients the mean GCS ± SD before care was 6.8±1.7, 68.6% were put on MV mode SIMV and VC was 43.7%. Moreover **Ntoumenopoulous(2002)** reported that the mean GCS ± SD at admission was 8.6± 4.9 in the intervention group and 9.2 ± 5.2 in the control group.

Regarding post care assessment of VAP through CPIS points at the seventh day, fever was found in more than one third of the patients in group A 37.5% compared to 15% in group B which was statistically significant respectively. Regarding WBC count, it was normal in more than half of the patients in group A 57.5% compared to 75% in group B respectively. As regards to tracheal secretions, the majority of the patients in group A 92.5% had abundant secretions compared to 97.5% in group B. There was no statistically significance differences in WBC count and tracheal secretion for both groups.

Regarding oxygenation, there were no statistically significant difference between the two groups. As regards chest x- ray, the majority of patients in group A 92.5% had diffuse infiltrate compared to 75% in group B and 7.5% had normal chest x-ray with no infiltrate compared to 25% in group B which was statistically significant. Regarding CPIS score, it was 4.63±1.19 in group A compared to group B was 3.78±1.12 which was statistically significant difference between the two groups p=0.002.

A study by **Potter and Perry, (2011)** reported that, assessing signs and symptoms of infections as presence of fever ,reviewing laboratory data such as increase WBCs, positive blood or sputum cultures which assist in making the correct nursing diagnoses. **De Jong et al., (2008)** reported that sputum specimens are often part of the respiratory assessment. Because healthy patients do not produce sputum, obtaining a specimen requires the patient to cough to expelmucus from the lungs**.**

Keller and Brimacombe, (2007) stated that maintenance of airway secretion clearance, or airway hygiene, is important for the preservation of airway patency and the prevention of respiratory tract infection.

Lindgren and Ames, (2005) added that other methods that are commonly used to detect response to infection are measurement of white blood cell count, C-reactive protein (CRP) level .

This study finding disagree with **Hariedy N et al., (2015)** who revealed that, higher number of patient who received regular CPT and RM gave large amount of secretions while patients who received routine nursing care gave moderate amount of secretions and there were highly statistical significance difference between both groups p=0.001. This difference is due to effect of chest physiotherapy which mobilizes the respiratory secretions from central to peripheral airway and increases the amount of trachobroncial mucus cleared from the respiratory tract.

This finding disagree with **Hariedy N, et al., (2015)** who illustrated that the ratio of partial pressure of arterial oxygen to fraction of inspired oxygen Pao_2/fio_2 demonstrates oxygenation status . It was increased in study group after 30 min of CPT and RM compared to 12h in control group. The variance between two groups was statistically significant p=0.001.

Also, the findings of this study are not in line with **Hariedy N et al.,(2015)** who stated that, chest x-ray findings on discharge were complete resolution in 73.3 % of study group compared to 33.3% in the control group P = 0.001.

Moreover, the results of the current study are in line with a study by **Munro et al., (2009)** showed that, statistically significant decreasing in CPIS (p=0.02) on day 3 in suffers who did not have pneumonia at baseline.

The current study findings are in agreement with the results of **Renu (2011)** who reported that the CPIS Score at the end of intubation/discharge from ICU was higher in the control group 5.2 ± 2.17 who received only manual hyperinflation (MH) and suctioning as compared to the study group 3.7 ± 1.43 who received positioning and chest wall vibrations in addition to MH plus suctioning suggesting a decrease in the occurrence of VAP with twice-daily multimodality CPT. In addition, CPIS Score reduction was more prominent in the study group 3.9 ± 1.69 with significant reduction P = 0.000 when compared with the baseline data in both the groups.

The current study revealed that, the incidence of VAP after CPT care was more than one third of patients in group A 37.5% compared to15% in group B which was statistically significant. The microbiological findings of ETT cultures after CPT care showed that, more than one third of patients in group A 40% had VAP compared to 20% in group B. There were highly statistical significant differences in group A and B regarding VAP results.

Furthermore, the results of the current study are in agreement with **Antonio et al., (2012)** who reported that, pneumonia rate was lower in group A given PT care for 24h/day which consisted of at least 4 visits (morning, afternoon, evening and night) compared to group B with only 6h/day which consisted in only one visit regardless of the patients individual need for this care.

These findings are consistent with that of **Ntoumenopoulous, (2002)** who found that the frequency of VAP was significantly higher in the control group who didn't receive chest physiotherapy 39% (14/36) compared to the intervention group or CPT group twice daily which consisted of (positioning, vibration and suctioning) 8% (2/24).

These findings agreed with **Orhan et al., (2016)** found that endotracheal tube culture was positive in 13.3% at initial and in 53.3% at 72nd hours in patients receiving the routine pulmonary rehabilitation whereas it decreased from 60% at initial to 40% at 72 hours in patients receiving high frequency chest wall oscillation in addition to the pulmonary rehabilitation technique.

Furthermore, theresults of the current study are in line with **Hariedy N et al., (2015)** who reported that sputum cultures, 60.0 % of study group had negative culture of respiratory secretion compared to 46.7% in the control group p = 0.01.

Moreover, our study findings arein line with **Munro et al., (2009)** who found that there was 28% decreasing p=0.006 in the incidence rate of ventilator-associated pneumonia on day 3 in suffers who did not have pneumonia at baseline.

According to the researcher point of view, the reduction of VAP in more than half of patients in both groups may be resulted from increased secretion clearance through percussion and vibration, protecting the patient from aspiration through elevating the bed by 45, suctioning and maintaining good postural drainage according to the affected side of lung. Preventing lung collapse, re expanding collapsed alveoli, improving oxygenation and lung compliance through mechanical hyperinflation.

Also, in a study by **Yogesh et al., (2013),** reported that a total of 29 VAP episodes were identified using CPIS score ≥6 during the study period. From these 29 VAP episodes diagnosed by CPIS score of ≥6, only 18 patient's tracheal aspirate were positive for microorganism. The incidence rate expressed as the total number of VAP episodes per 1000 ventilation days using CPIS score and tracheal aspirate culture was 36.7(29/789) and 22.87(18/789) respectively in this cohort, but overall ICU VAP rate in neurological patients using CPIS score and tracheal aspirate culture was 15.19 (29/1909) and 9.42(18/1909) respectively. Four patients were found to have early VAP ≤5 days of MV and the rest had late VAP.

The current study findings are in disagreement with **Aysha Z, et al(2016)** who found that, occurance of VAP according to clinical pulmonary infection score among automatically ventilated suffers in three studied groups (I, II, III) was 75% in group I found that the majority of suffers compared to 35% and 20% in group II and group III respectively. Furthermore, there had been a significant variances among three studied groups (I, II, III) concerning all CPIS parameters as P = 0.001.

Also, this study findings are in the line with **Grap et al., (2011)** who illustrated that the development of VAP was measured by the use of CPIS. Scores range from 0 to 12, with VAP diagnosis made with a score of ≥ 6. Patients were enrolled for 72 hours after intubation or until extubation. In subjects without pneumonia at baseline, 55.6% of the control group developed VAP by 48 or 72 hours versus 33.3% of the intervention group.

Concerning the length of stay, our results revealed that at the 7^{th} day 92.5% in group A, 80% in group B still in ICU while 7.5% was up to seven days in group A compared to 20% in group B and the difference was insignificant. Regarding the duration of intubation, the current study revealed that at the 7^{th} day the majority of the studied patients were still intubated during the seventh day for group A and B 92.5% - 97.5%. While 2.5% of group A was extubated during the seventh day compared to 7.5% in group B. There were highly statistical significant variancesamong the two groups as regards the duration of intubation.

According to the researcher point of view, the outcome not estimated effectively because the intervention were provided and evaluated in seven days so the researcher not have the time to observe and measure the outcome accurately which more percentage were still in ICU.

The results of our study are in line with **Renu (2011)** found no significant difference regarding the days of stay in ICU 13.9 ± 9.77 and days of intubation 8.7± 5.6 in the study group compared to the control group 11.3 ± 5.73 and 8.5 ± 5.21 respectively. However, he reported significantly higher number of successful weaning in the study group 31 (62% compared to the control group 16 (31.37%).

Furthermore, in the same line with our results, a study by **Ntoumenopoulous, (2002)** revealed that, the length of stay in ICU in the control group 5.8 (2.6 – 25) days was not significantly different from that in the study group 5.6 (2 -35) days p=0.89.

Moreover, the results of the current study also disagree with that of **Patman et al., (2009)** revealed that, in adults with ABI regular respiratory physiotherapy in addition to routine medical/nursing care does not appear to prevent VAP, or reduce length of MV or ICU stay.

Additionally, these findings are agreed with **Antonio et al., (2012)** found no differences in the length of stay in ICU or mortality between the intervention group (CPT group) and the control group.However, he concluded that chest physiotherapy is effective in reducing mechanical ventilation support need, number of hospitalization days, incidence pulmonary infection rate and mortality in intensive care patients.

Furthermore, this finding agree with a study by **Ghazal S, (2013)** confirmed that, control patients had a longer period of ventilator dependency than the intervention patients and this difference was statistically significant P < 0.05.

Furthermore, the results are in line with **Templeton and Palazzo, (2007)** conducted on 180 critically ill suffers requiring mechanical ventilation for more than 48 hours revealed a significant prolongation of median time to become ventilator-free among patients receiving physiotherapy p=0.047. The time taken for 50% of patients (median time) to become ventilator-free was 15 and 11 days, respectively, for physiotherapy and control groups. There were no differences between groups in ICU or hospital mortality rates, or length of ICU stay.

Regarding the frequency of MV modes after care, the current study revealed that significantly 7.5% of patients were weaned from the ventilator in group B versus 2.5% in group A. On the other hand, more than half of patients 65% in group B were on T-Pice, 17.5% were on SPONT mode compared to group A 22.5% were on T –Pice and 22.5% were on SPONT mode. There were highly statistical significant differences regarding all MV modes between group A and B.

Brower, (2013) are in line with the current study who found that highly statistical significant difference between study and control groups P < 0.01 after 10 minutes and two hours after a recruitment maneuver. He concluded that recruitment maneuvers improved oxygen saturation and fiO_2 from baseline measurements. Similarly, **Bonnie et al., (2007)** illustrated that effectivestopping from the automaticairing is enhanced by in depthrespiratorycaution, the fio_2 then is progressively reduce till the pao_2 is inside the 70 to 100 mm hg range, however the affected person is in the inhalation room air.

These findings were in agreements with studies by **Carolyn et al., (2007),Ali**, **(2013) and Mohamed, (2013)** who stated that, the progress of VAP leads to late weaning from MV and accelerated ICU duration of stay.

Concerning the comparison of MV modes before and after CPT for both groups. Regarding group A of 3 types of care (suctioning, positioning and hyperinflation), nearly half of patients 47.5% before care were put on SIMV, CMV mode and the less common mode was SPONT mode 5% compared to after care which SIMV

mode was 40%, CMV mode decreased to 12.5%, SPONT mode increased to 22.5%, T-Pice was 22.5% and 2.5% were success in weaning and become on mask oxygen.

Regarding group B of 5 types of care (percussion, vibration, suctioning, positioning and hyperinflation), more than one third of patients 40% before care were put on SIMV mode, 20%were put on CMV mode, 37.5% were put on SPONT mode, 2.5% were put on CPAP mode compared to after care more than half were put on T-Pice 65%, 17.5% were put on SPONT mode, the less common mode was SIMV mode 10%, 7.5% were success in weaning from MV completely and divided to 2.5% on mask oxygen and 5% were on room air without any source of oxygen. There were highly statistically significant difference between MV modes before and after providing CPT care in groups A and B. Suggesting that the intervention of five types of chest physiotherapy care had great effect on changes and progress in weaning from mechanical ventilation.

The study findings are in agreement with the results of **Juliana et al., (2012)** who revealed that, the duration of MV was shorter in the RP (respiratory physiotherapy) group than in the control group from day 2 on, where 37.5% of the RP patients had already been weaned and disconnected from the endotracheal tube. Statistical analyses identified significant differences between the two groups on days 2 and 3 $p < 0.01$ for both, as well as on days 4 and 5 $p < 0.05$ for both. Similarly, the length of ICU stay was shorter in the RP group than in the control group from day 3 on, where 25% of the RP individuals $p < 0.05$ had already been discharged from the ICU. This proportion increased to 31% on days 4 and 5 $p < 0.01$. The intervention had a positive effect on the duration of MV, as well as on the ICU discharge rate.

Furthermore, in a study by **Aysha Z et al., (2016)** the outcome of weaning attempts showed that 75% of suffers in group III and 50% of the suffers in group II have been success, and the patients absolutely weaned from automaticrespirators. In group I, 75% of patients stopping from automaticairing did not succeed and common 70% of them are not weaned from respirator. Furthermore, it was detected that there were statistically significant variancesamong the study groups regarding days of automaticairing with p value 0.020. Outcomesrevealed that the extent of automaticairing/days of studied subject (I, II, III) fluctuatedamong 6-30 day with a mean 15.65±6.77 for suffers in group I and 5-30 day with a mean 13.15±8.14 for suffers within group II at the same time as it extended from 7-15 with a mean 9.90±2.57 for studied suffers in-group III.

VI. Conclusion

According to the findings of the current study, it can be concluded that using different modalities of chest physiotherapy had significant positive effect in decreasing VAP by using five types of interventions of CPT.

Recommendations

According to the current study findings the following are recommended.:

1) Raising the awareness of measures for preventing VAP and how to prevent other complications from MV.
2) Providing nurses with continuous educational programs with evidence based guidelines to improve their knowledge and practices regarding VAP and CPT.
3) Following up nurses practices in relation to CPT.
4) Providing nurses with periodic sessions to improve their practices regarding CPT.
5) Establishing collaborative interaction between nurses and other health team members as they are working in amulti-discplinary system to improve the health services provided to patients with MV.
6) VAP assessment should be included partially in the patients assessment sheet.
7) Supporting critical care units with printed universal guidelines illustrated simple in posters and bookies related to VAP prevention by using different modalities of CPT for the patients in MV.
8) A future research to assess the effect and efficacy of CPT on reduction of VAP.
9) Replication of the study on a larger sample from different geographical areas in Egypt is needed.

References

[1] **Ahmed A (2008):** Impact of closed suction system versus open suction system on the development of ventilator associated pneumonia. Un published Doctoral Dissertation, Faculty of Nursing, Alexandria University.

[2] **Ali N(2013):** Critical Care Nurses' Knowledge and Compliance with Ventilator Associated Pneumonia Bundle at Cairo University Hospitals Journal of Education and Practice.Vol.4, No.15, 2013 available at www.iiste.org ISSN 2222-1735 (Paper) ISSN 2222-288X

[3] **Ally T (2012)** "Knowledge and practice of Intensive Care Nurses on prevention of Ventilator Associated Pneumonia at MUHI Mbili National Hospital" MSC nursing (critical care and trauma) Disseration Muhimbili University of health and Allied sciences November Dares Salaam, Tanzania 23th junewww.mnh.or.tz dpgs@muhas.ac.tz

[4] **Alphonso A, Quinones, Mishra, Archana, Hussain and Erfan, et al (2004)** "A study to Evaluate the Competency of ICU personnel in Mechanical Ventilation". Respiratory clinical study" Focus, Journal for respiratory care and sleep medicine USA, Jun 22, 1571.

[5] **Antonio A, Suleima R, Susi A and Elias F (2012)** "Chest Physiotherapy Effectiveness to reduce Hospitalization and Mechanical Ventilation length of stay, pulmonary infection rate and mortality in Intensive Care Unit" Respiratory medicine Jan;107(1):Pp68-74.

[6] **Aysha Z, Alaa El-din S, Attia N and Akab M (2016) :** Efficacy of implementing nursing care protocol on the incidence of VAP in ICU at Tanta Emergency Hospital. Journal of American science; 12(2).

[7] **Bonnie R, Linda S, Melody K and Michael J (2007):** Risk factors for pneumonia, and colonization of respiratory tract and stomach in mechanically ventilated ICU patients. Am J Respir Crit Care Med, 154:Pp1339-1346 .

[8] **Brower RG, Morris A, MacIntyre N, Matthay M, Hayden D and Thompson T, et al.(2013):** ARDS Clinical Trials Network. Effects of recruitment maneuvers in patients with acute lung injury and acute respiratory distress syndrome ventilated with high positive end-expiratory pressure. Critical Care Medicine, 31(11):Pp2592–7.

[9] **Burnss S (2005)** " Mechanical Ventilation of patients with Acute Respiratory Distress Syndrome and Requiring Weaning". Critical Care Nursing August 25(4):Pp14-23.

[10] **Byrd R, Roy T and Kosseifi S (2006)**: "Ventilation Mechanical"http: //www.eMedicine.com/med/topics 3370. 354(17):Pp1775-1786

[11] **Carolyn L, Tyner T, Lisa B,Saunders S and Center for Disease Control and Prevention (2007):** Nurses' implementation of guidelines for ventilator associated pneumonia from the centers of disease control and prevention American journal of critical care. January; 16(1): Pp28-38. www.ajcconline.org retrieved date 9/12/2012.

[12] **Chastre J and Fagon J (2006):** Ventilator-associated pneumonia. Am J Respir Crit Care Med. 2006; 165(7): Pp867-903.

[13] **Dana M (2014)** "Preventing Ventilator Associated Pneumonia Educating Emergency Room Nurses". Master of Science in Nursing. Paper 40. http://digital commons.ric.edu/School of nursing/40.Rhode Island College 401-456-8380

[14] **Dasta J, Mclaughlin T and Mody S (2005)** "Daily cost of an Intensive Care Unit day: The Contribution of Mechanical Ventilation". Critical Care Medicine 33(6): Pp1266-1271.

[15] **De Jonghe B, Lacherade J, Sharshar T and Outin H (2008):** Intensive care unit acquired weakness: risk factors and prevention. Critical Care Medicine;37(10 suppl):S309-15.

[16] **Dudeck M, Weiner L, Allen K, Malpied P, Peterson K and Polleck D, et al (2013)** "National Health Care Safety (NHSN)" : Report data summary, device –associated module, American Journal Infection Control 41: Pp1148-1166.

[17] **El-Solha A, Aquilina A, Dhillon R, Fadi R, Patricia N and Joan D (2002):** Impact of invasive strategy on management of antimicrobial treatment failure in institutionalized older adult people with severe pneumonia American journal respiratory Critical Care. Med; 166: Pp1038–43.

[18] **Ghazal S (2013):** The effect of physiotherapy on weaning and length of stay of mechanically ventilated patients in intensive care units. Vol (35) No(4). Tishreen University Journal for research and scientific studies . Health sciences series.

[19] **Gosselink K, Clerckx B, Robbeets C, Vanhullebusch T, Vanpee G and Segers J (2011)** " Physiotherapy in Intensive Care Unit". Nethelands Journal of Critical Care volume 15 NO 2 April Pp 66.

[20] **Grap M, Munro C, HamiltonV, Elswick R, Sessler C and Ward R (2011)**: Early, single chlorhexidine application reduces ventilatorassociated pneumonia in trauma patients. Heart &Lung, 40(5), Pp115-122.

[21] **Hariedy N, Mohamed W, Mohamed M, Abdel Aziz M and Morsy K (2015):**Chest Physiotherapy and Recruitment Maneuvers: Effects on Lung Mechanics and Pulmonary Complications among Mechanically Ventilated Patients with acute lung injury.IOSR Journal of Nursing and Health Science (IOSR-JNHS) e-ISSN: 2320–1959.p- ISSN: 2320–1940 Volume 4, Issue 4 Ver. II (Jul. - Aug. 2015), Pp 17-32 www.iosrjournals.org.

[22] **Hiroko k (2011)** "Ventilator Associated Pneumonia barriers and facilitators prevention of provider guideline adherence ".Dispub=3493680 university of California, San Francisco.188 pages;3493680.

[23] **Hunter J (2006):** Review: Ventilator associated pneumonia. Post grade Med J.2006; 82(965) Pp172-178.

[24] **Hyllienmark P, Gårdlund B, Persson J and Ekdahl K (2007**). Nosocomial pneumonia in the ICU: A prospective cohort study. Scandinavian Journal of Infectious Diseases, 39(8):Pp 676-682. Retrieved from Health Source: Nursing/Academic Edition. 45.

[25] **Irene G, Chan L and Tracy M (2011)** " Over view of Mechanical Ventilation support and management of patients at ventilation related response".Critical carenurse , Jun;31 (3):Pp30- 44. ISSN:Pp2161-0932 an open access journal.

[26] **Julian S, Elisiane T, Carlos F, Heloisa W, Laercio M and Analucia G (2012):** Mannual hyperinflation combined with expiratory rib cage compression for reduction of length of stay in ICU in critically ill patients on MV. J Bras Pneumol 38 (4):Pp 477-486.

[27] **Kathy S (2000)** "Physiotherapy in Intensive Care Unit towards an evidence based practice". Chest vol.118, no6, Pp1801-13.

[28] **Keabecoe W (2008):** A pilot study of extubation from mechanical ventilation and the effect of chest physiotherapy in the intervention .Johannesburg, chapter 3 Pp 20-23, chapter 4 Pp 24-26.

[29] **Keller C and Brimacombe J(2007):** Bronchial mucus transport velocity in paralyzed anesthetized patients a comparison of the laryngeal mask airway and cuffed tracheal tube. Anesthangly; 86(6):1280-1282.

[30] **Kollef M, Silver P and Trovillion E(2007):** Guidelines for the management of adults with hospital- acquired, ventilator-associated, and healthcare- associated pneumonia. Am J Respir Crit Care Med; 171(4):Pp 388-416.

[31] **Lindgren A and Ames N (2005) :** Caring for patients on mechanical ventilation: What research indicates is best practice.AJN;105(5):50-61.

[32] **Mehtap M , Karadibak D and Yildirim Y (2009):** The effect of physiotherapy on ventilatory dependency and the length of stay in an intensive care unit International Journal of Rehabilitation Research, 32 (1):Pp85–88 .

[33] **Michalopoulos A and Geroulanos S (2003):** Ventilator associated pneumonia in critically ill patients' prevention and treatment.Turk journal Medical Sciences, 33:P p 215-222.

[34] **Minhee S, Margaret H and Choi-Kwon S (2011):** Effect of CPT on the respiratory mechanics and elimination of sputum in paralyzed and mechanical ventilated patient with acute lung injury. A pilot study Asian nursing research March, vol 5 (1) :Pp 60-69.

[35] **Mohamed K (2013):** Compliance with VAP bundle implementation and its effectiveness on surgical and medical sub-population in adult ICU, Egyptian Journal of Chest Diseases and Tuberculosis, volume 63, issue 1, pages 9-14.

[36] **Munro C, Grap M, Jones D, McClish D and Sessler C (2009) :** Chlorhexidine, tooth brushing and preventing ventilator associated pneumonia in critically ill adults. American Journal of Critical Care, 18(5), 428-437.

[37] **Nicoline A and Dewi N (2013)** "Airway clearance in the Intensive Care Unit ". European Medical Journal Respiratory. 1:135-139 Indonesia SebelasMaret University.

[38] **Ntoumenopoulos G, Presneill J, Mc Elholum and Cade J (2002)** "Chest Physiotherapy for prevention of Ventilator Associated Pneumonia". Intensive Care Medicine, Julvol 28 (7),Pp850-856.

[39] **Orhan B, Ufuk K, Ilke K, Nurel E, Baris G and Fethi A, et al, (2016)** " What is the best pulmonary physiotherapy method in ICU?" Canadian Res Journal volume, Article ID 4752467. 5pags.

[40] **Patman S, Jenkins S and Stiller K (2009)** " Physiotherapy doesn't prevent or hasten recovery from Ventilator Associated Pneumonia in patient with Acquired Brain Injury". Intensive care med feb;35(2):258-265.

[41] **Potter and Perry (2011):** Basic Nursing chapter 25 respiratory abnormalities (acute lung injury) 6th edition, Mosby, Missouri, p.p 265-278.
[42] **Renu P and Gaude G (2011)** "Effect of Multimodality Chest physiotherapy on the rate of recovery, prevention of Ventilator Associated Pneumonia". May;65(5):175-185.
[43] **Templeton M and Palazzo M (2007)** " Chest Physiotherapy prolongs duration of Ventilation in the Criticallyill ventilated for more than 48 hrs". Intensive Care Medicine Nov:33 (11),1938-45.
[44] **Tobin M, Jubran A and Laghi F (2001)** "Patient Ventilator Interaction" American journal of Respiratory and Critical Care Medicine April 163 (5):1059-1063.
[45] **Yogesh H, Manimala R, Jyotinarayan S, Aanchal B, Betham S and Pulla S(2013):** Detection of ventilator associated pneumonia, using clinical pulmonary infection score (CPIS) in critically ill neurological patients. journal of Anesthesiology and Clinical Science, 2:20. http://dx.doi.org/10.7243/2049-9752-2-20.

Gehan Fahmy Ali Abd El-hamid. "Effect of Using Different Modalities of Chest Physiotherapy on Prevention of Ventilator Associated Pneumonia." IOSR Journal of Nursing and Health .Science (IOSR-JNHS) , vol. 6, no. 5, 2017, pp. 19–35