



The effect of early chest physiotherapy on occurrence of infection among patients with acute exacerbation of chronic obstructive pulmonary diseases

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Abstract

Infection of the lungs is the most common cause of acute exacerbation of COPD. Is often from a virus, but it may also by bacteria, the lungs react to infection by developing inflammation that makes the airways narrow from muscle swelling.

Aim: Evaluate the effect of early CPT on occurrence of infection among patients with AECOPD.

Design: A quasi experimental research design used to conduct this study. A convenient sample consisted of study group (n=30) and control group (n=30) admitted to chest care unit at Assiut University Hospital & intensive care unit at Sohag University Hospital Tool: I: Patient Assessment: as A: socio-demographic data B: Laboratory investigation II Patient pulmonary assessment as A: Respiratory assessment (respiratory rate, bronchial secretion & breathing sound) B: Clinical pulmonary infection score.

Results: Revealed highly significance in 4th & 7th days in study group compared with control group regarding breathing sound. Regarding occurrence of infection observed highly significance in 7th day in study compared with control groups.

Conclusion: Efficient early CPT among patients with AECOPD significantly success to minimize lung infection.

Recommendation: Applied as a routine care for cases to improve the patient's outcomes.

Keywords: AECOPD, chest physiotherapy and infection

Introduction

Exacerbations of COPD can be precipitated by several factors. The most common causes appear to be respiratory tract infections, viral-predominant, bacteria-predominant, and eosinophil predominant or mixed. Exacerbations may be also - inflammatory, or mediated by a decrease in mean ambient temperatures, air pollution and comorbidities. Poor compliance to maintenance therapy has also been shown to lead to exacerbations. However, in one third of severe COPD exacerbations the cause cannot be identified Global Initiative for Chronic Obstructive Lung Disease, (2017) ^[8].

Increased cough, sputum volume and sputum purulence are key features of AECOPD. Airway clearance techniques involve application of physical forces to enhance removal of sputum from the airway. Commonly used airway clearance techniques are the forced expiration technique (FET, manual chest physiotherapy and positive pressure devices. Assumptions underlying the use of airway clearance techniques are that retained sputum contributes to mucosal injury and airflow obstruction, with longer-term impacts on re-exacerbation, hospitalization and mortality (Osadnik *et al.*, 2014) ^[16].

The most common cause of an exacerbation is infection in the lungs or airways (breathing tubes). This infection is often from a virus, but it may also be caused by bacteria or less common types of organisms. Exacerbations can also occur from inhaling irritating substances from the environment like air pollution, or from severe allergies. The lungs react to infection or irritating substances by developing inflammation that makes the airways narrow from muscle tightness, swelling, and mucus (Suisse *et al.*, 2012) ^[20].

Assess effective airway clearance for patency, inspect the mouth, neck and position of trachea for potential obstruction, assesses presence of secretions by lung auscultation at least every 2 to 4 hours, perform measures to clear the airway of secretions as (suctioning, chest physiotherapy, frequent position change), frequency of suctioning should be determined by patient assessment if excessive secretion are identified by inspection or auscultation technique, suctioning should be performed, auscultate lungs for presence of normal or adventitious lung sounds as wheezing which indicates airway resistance, stridor indicates emergent airway obstruction (Gil, 2016) ^[6].

Maintain aseptic technique with all dressing changes, tube, drains and catheter care, and venous access devices, wash hands encourage fluid intake encourage intake of protein and caloric rich foods, provide internal feeding in patients who are nothing pre mouth, encourage coughing and deep breathing, assess pain characteristics (quality, severity, location, onset, duration and relieving factors) (Lea *et al.*, 2016) [14].

The role of critical care nurse is to assess respirations as note quality, rate, pattern, depth and breathing effort, assess lung sound, presence of adventitious sounds, assess for signs and symptoms of hypoxemia (tachycardia, restlessness, diaphoresis, headache, lethargy and confusion) monitor vital signs, assess for changes in orientation and behavior, monitor arterial blood gases (ABGs), monitor chest x-ray reports, assess color and consistency of sputum (Meg and Judith, 2017) [15].

The nurses implementing chest physiotherapy who plays an important role in management of ventilated patients who are critically ill in intensive care unit (ICU) which is often necessary due to retained secretions following intubation and immobility and it used to minimize pulmonary secretion retention, maximize oxygenation and atelectatic lung segments, recruit collapsed distal lung units and to optimize the matching of ventilation and perfusion, improve changes in breath sounds, Improve vital signs, chest x ray, encourage early weaning, enhance patient, wellbeing, reduce ICU stay and decrease hospital cost (Global Initiative for Chronic Obstructive Lung Disease, 2016) [9].

Significance of the study

Chronic obstructive pulmonary disease (COPD) is a serious pulmonary condition, which is slowly progressive with systemic repercussions; it mainly affects people over 40 years old (Global Initiative for Chronic Obstructive Lung Disease, 2018) [7]. However, COPD is a preventable condition affecting more than 230 million people globally, and is expected to become the world's third largest cause of mortality by 2030 large numbers of patients presenting with exacerbation of previously undiagnosed COPD (Tedd *et al.*, 2015) [21]. Therefore, Statistics of Egyptian Intensive care unit at Assuit University Hospital admitted to Chest care unit is ranged 500 patients in the years of 2016. While in Sohag university hospital in the years of (2015-2016). Revealed that the number of patient admitted Intensive care unit were (50) patients (*Hospital records of patients Sohag University*).

Aim of the study

Evaluate the effect of early chest physiotherapy on occurrence of infection among patients with acute exacerbation COPD.

Patients and methods

Design

A quasi experimental research design used to conduct this study.

Hypotheses: To fulfill the aim of the study the following research hypothesis were formulated:-

Hypotheses (1): Acute exacerbation COPD patients who

were exposed to early chest physiotherapy will exhibit better mean score of clinical pulmonary infection than of the control group.

Hypotheses (2): Acute exacerbation COPD patients who were exposed to early chest physiotherapy will exhibit better mean score of breath sound than of the control group.

Technical design

Setting

The study was conducted at the chest care unit at Assuit University Hospital & intensive care unit at Sohag University Hospital.

Sample

A purposive sample consisted of 60 critically ill adult patients (male and female) who were admitted to chest care unit at Assuit University Hospital & intensive care unit at Shag University Hospital. They were matched & randomly assigned into two equally groups 30 patients (control group & study group) each considering the following:-

Criteria of sample selection

Inclusion criteria

- Mechanical ventilated patients.
- Diagnosed as acute exacerbation of chronic obstructive pulmonary disease.
- Recently admitted within 24hours.
- Both gender (males and females).

Exclusion criteria

Severe head injury, increase intracranial pressure, terminal diseases or inoperable cancer, autoimmune diseases, age more than 60 years.

Tools

Two main tools were developed by the researcher and used in this study.

Tool One: Patient assessment

This tool was developed by the researcher after reviewing the related literature's to assess patient's demographic data and health relevant data it comprised two parts.

Part I: Socio-Demographic Data: This includes patient's age, gender and marital status.

Part 11: Laboratory Investigations: that included: complete blood picture as (white blood cell, blood hemoglobuline level and red blood cell & culture sensitivity test).

Tool Two: Patient's pulmonary assessment tools "this tool consists of two main parts as following

Part 1: Respiratory assessment sheet as: (respiratory rate, color of bronchial secretion, consistency of bronchial secretion, amount of secretion & breathing sound as normal, wheeze and crackles).

Part 2: clinical pulmonary infection score (CPIS) for clinical diagnosis of (VAP) ventilation associated pneumonia.

Methods

This study was carried out through three main phases as following:

1. The preparatory phase

- An official Permission to conduct the study was obtained from the hospital responsible authorities in the General Intensive Care Unit at Sohag university hospital & chest care unit at Assuit University Hospital after explaining the aim and nature of the study.
- Content validity The tools were tested for content related validity by jury of 6 specialists in the field of critical care nursing and critical care medicine from chest care unit at Assuit University Hospital and intensive care unit at Shag University and the necessary modification were done.
- A pilot study carried out before starting of data collection to test the applicability and clarity of the study tools on 10% the study sample, the purpose of the pilot study was: to ascertain the relevance of the tool, detect any problem might interfere with the process of data collection and to estimate the time needed to complete the study, define the modification required in the tool used, and the necessary modification was done prior to data collection, the studied subjects were excluded from the actual study.
- An approval was obtained from the local ethical committee and the study was followed the common ethical principles in clinical research.
- The tool used in this study was developed based on reviewing the relevant literature.
- Protection of human rights (ethical considerations): Informed consent was obtained from each patient or from the responsible person for the unconscious patients. The investigator emphasized that the participation is voluntary and the confidentiality and anonymity of the subjects were assured through coding the data. Subjects were assured that can they withdraw from the study at any time without any rational.
- Implementation phase Purpose of the study was simply explained to patients and their relatives in case of unconsciousness.
- The researcher started to collect data from patients on first day and once per shift for seven days of admission.
- The study involved 60 patients who admitted to the chest care unit at Assuit University Hospital & general intensive care unit at Sohag University Hospital over a period of 10 months.
- Starting from April 2017 until April 2018. In addition, the following data were collected on first day from patients and from Patient's records tools.

The control group

They received the routine hospital care for critically ill patients without intervention from the researcher.

The study group

The patient received early chest physiotherapy for acute exacerbation of chronic obstructive pulmonary disease & the intervention group was exposed to the following intervention from the first day of admission until the seventh

day of the study during the different three shifts. The researcher assessed critically ill patients of (AECOPD) by used tool two.

Implement the chest physiotherapy procedure for study group

- The measurement of hemodynamic parameters, blood gases and auscultator finding were done to determine breath sounds or any abnormal sounds before starting and after 2 hours of chest physiotherapy.
- The bronchodilator treatments prescribed by physician were given 15-30 minutes before chest physiotherapy.
- Each patient was placed in baseline semi setting position with elevated head of the bed 30 degree for 10 minutes before commencement of study.
- During turning the patient any tubes and connection attached to the patient was observed as ECG monitor, feeding tube, urinary catheter, arterial line and central venous pressure line to avoid pulling, stretching or kinking these tube were avoided.
- Each postural drainage position were maintained for 5 minute and vibration followed by suction.
- Postural drainage positions were modified according to the patient's condition.
- Percussion and vibration were applied over the lung, commonly accepted anatomical landmarks for percussion and vibration includes 10th thoracic vertebra posteriorly and the xiphoid anteriorly with normal respiration.
- Percussion and vibration was avoided over the kidney, spinal column, breasts, floating rib, scapula and sternum.
- Oxygen saturation and heart rate was monitoring.
- Suction was done with a sterile technique. Patient was pre-oxygenated with 100% before suction.
- A suction procured was accomplished before getting in postural drainage and following percussion and vibration the suction time less than 10 seconds to prevent desaturation.
- At the end of the procedure recorded patient data & leaving to the routine nursing intervention.

Evaluation phase

Both groups were evaluated daily during the three shifts using tool two (1st part and 2nd part).

Respiratory parameters as: (respiratory rate, bronchial secretion & breath sound as normal, wheeze and crackles) were assessed every 2 hours of chest physiotherapy.

Laboratory investigations such as (culture sensitivity test & hematological laboratory investigation as total leukocytes count and serum hemoglobin was done at the time of admission and repeated at the 4th, 7th day and when needed.

Measurement of clinical pulmonary infection score daily during the three shifts and to determine the effect of early chest physiotherapy for patients with acute exacerbation of chronic obstructive disease.

Statistical analysis

The collected data were coded entered to SPSS 20.0 statistical software package and then analysis. The data presented using frequencies and percentages descriptive

statistics in the form of for qualitative variables, while means and standard deviations used for quantitative variables. Chi-square test was used for non-parametric data to determine significant. Quantitative continuous data were compared using analysis of variance test in case of comparisons between two independent groups. Tests of

significance were considered as follows: $P > 0.05$ non-significant $*P < 0.05$ significant $**P < 0.01$ moderate significant $***P < 0.001$ highly significant.

Results

Table 1: Comparison between the study & control groups as regard socio-demographic data.

Variables	Study Group N=30		Control Group N=30		P value
	N	%	N	%	
Age	53.63±7.425		51.93±8.034		0.913
30<40	1	3.3	2	6.7	
40<50	5	16.7	5	16.7	
50<60	16	53.3	14	46.7	
More than 60	8	26.7	9	30.0	
Gender					0.611
Male	21	70.0	21	70.0	
Female	9	30.0	9	30.0	
Marital status					0.506
Single	3	10.0	6	20.0	
Married	19	63.3	19	63.3	
Divorced	1	3.3	0	0.0	
Widow	7	23.3	5	16.7	

Table 2: Comparison between the study & control groups as regard respiratory rate& mean values in both groups.

Respiratory rate	Days	Study group	Control group	P value
		N=30	N=30	
	1 st	12.24 ± 2.89	11.79 ± 1.74	0.363
	4 th	12.37 ± 3.48	11.69 ± 1.14	0.221
	7 th	12.75 ± 2.49	11.45 ± 1.06	0.023*

Table 3: Comparison between the study & control groups as regard to hematological laboratory investigation& mean values in both groups.

Laboratory Investigation	Days	Study group N=30	Control group N=30	P value
		Mean ± S.D	Mean ± S.D	
CBC	WBCS	1 st	5.57±112.57	0.315
		4 rd	16.6±10.46	0.307
		7 th	14.27±7.43	0.694
	Hb	1 st	12.6 ±2.37	0.610
		4 rd	1.16 ±1.78	0.697
		7 th	1.18 ±1.72	0.365
	RBCS	1 st	5.089 ±.690	0.095
		4 rd	4.87 ±.619	0.263
		7 th	4.82±.697	0.874

Table 4: Comparison between the study & control groups in relation to respiratory assessment for (Color of Bronchial Secretion).

Secretion/Days	Clear				Yellowish				Greenish				P value
	Study group		Control group		Study group		Control group		Study group		Control group		
	N	%	N	%	N	%	N	%	N	%	N	%	
1 st	11	36.7	6	20.0	13	43.3	14	46.7	6	20.0	10	33.3	0.285
4 th	18	60.0	4	13.3	8	26.7	12	40.0	4	13.3	14	46.7	0.000***
7 th	22	73.3	10	33.3	6	20.0	12	40.0	2	6.6	8	26.7	0.006**

Table 5: Comparison between the study & control groups in relation to respiratory assessment for (amount of secretion).

Secretions/Days	Small				Moderate				Large				P value
	Study group		Control group		Study group		Control group		Study group		Control group		
	N	%	N	%	N	%	N	%	N	%	N	%	
1 st	19	63.3	14	46.7	2	6.67	14	46.7	—	—	—	—	0.05
4 th	11	36.7	—	—	7	23.3	18	60.0	10	33.3	—	—	0.000***
7 th	6	13.3	4	20.0	9	30.0	16	53.3	15	50.0	10	33.3	0.001***

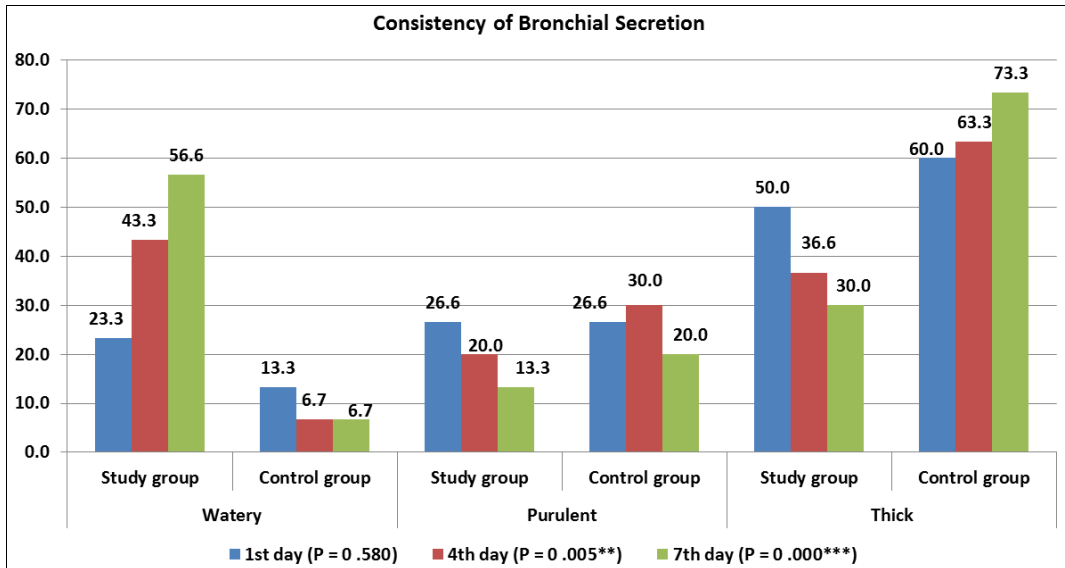


Fig 1: Comparison between the studied groups in relation to respiratory assessment for (Consistency of Bronchial Secretion).

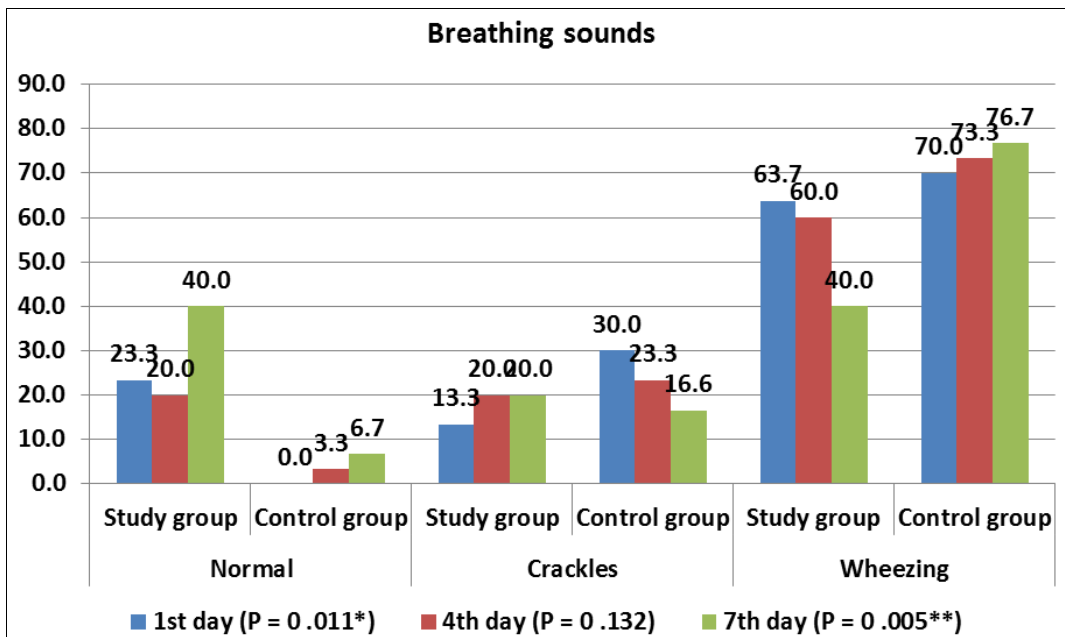


Fig 2: Comparison between the studied groups in relation to respiratory assessment for (Breathing sounds).

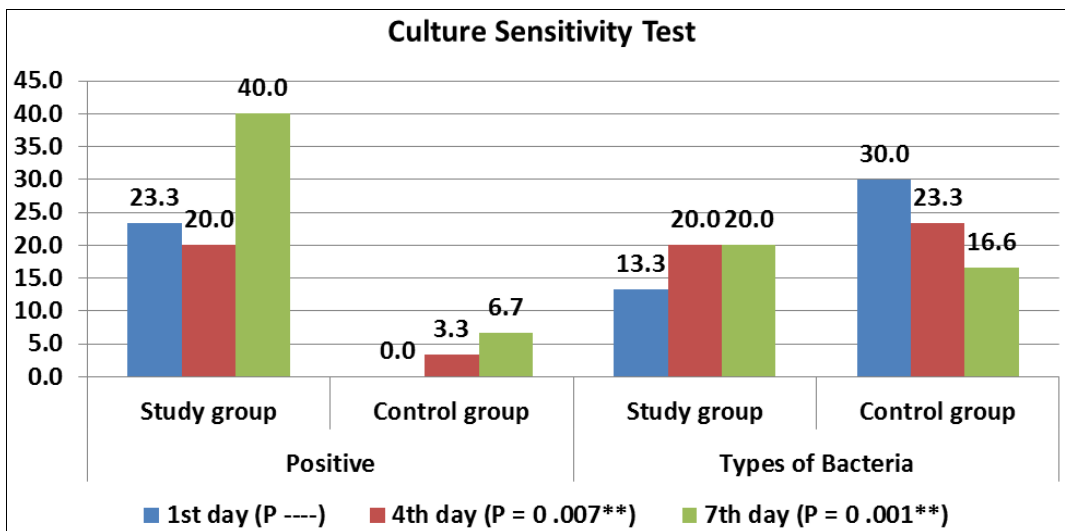


Fig 3: Comparison between the studied groups in relation for (Culture Sensitivity Test).

Table 6: Comparison between the study & control groups in relation for (Clinical Pulmonary infection Score).

Days	Variables	G1 "Study Group "n=30		G2 "Control Group "n=30		P value
		N	%	N	%	
1 st	No VAP	18	60.0	12	40.0	0.191
	VAP	12	40.0	18	60.0	
	Mean ±S.D	5.67±1.971		6.37±2.125		
4 th	No VAP	21	70.0	14	46.7	0.053
	VAP	9	30.0	16	53.3	
	Mean ±S.D	5.70±2.152		6.83±2.291		
7 th	No VAP	26	86.7	8	26.7	0.000***
	VAP	4	13.3	22	73.3	
	Mean ±S.D	4.53±1.167		7.30±2.003		

Table (1): Showed the mean value of age was (53.63±7.425) for the study group and (51.93±8.034) for the control group respectively. There were no statistical differences between both groups $p \geq 0.05$.

Table (2): Showed comparison between both study & control groups as regard respiratory rate which the results revealed that no significant difference ($p \geq 0.05$) in study & control groups in first and four days. While in seven days observe significance difference among study group comparing with control group after 2 hours of CPT with $p = (0.023)$.

Table (3): As regard to hematological laboratory investigation the result revealed that no significance difference regarding complete blood picture there was at 1st, 4rd & 7th days between both groups $p \geq 0.05$.

Table (4): Shows comparison between both groups in relation to color of bronchial secretion, the result revealed that founded that (36.7%) of study group had clear secretion versus (20.0%) in the control group in the first day with no significance difference, which significance highly in the study group compared with control group in the 4th & 7th days.

As regard the yellowish /secretion it founded that (26.7%) of study group had yellowish secretion versus (40.0%) in the control group in the four day with highly significance ($P = 0.000$). As regard greenish secretion it founded that (13.3%) of study group had greenish secretion versus (46.7%) in the control group in the four day with highly significance difference, there no significance difference between both groups in the first day but highly significance in 4th & 7th days.

Table (5): Shows comparison between both groups in relation to amount of secretion, the result revealed that more than (60.0%) of the study group has small amount versus (46.7%) of control group that had decline to the least amount in both group at 7th day, with highly significant decrease in study group comparing with control group. As regard the moderate amount it was founded that (6.67%) of the study group versus (46.7%) in the control group that decline to (53.3%) in 7th day in control group so the study group subject reported larger amount of secretion compared to moderate amount among control group subject with statically significant difference ($p = 0.001$).

Figure (1): Shows comparison between both groups in

relation to consistency of bronchial secretion, the result revealed that founded (23.33%) of study group had watery secretion versus (13.3%) in the control group in the 1st day with no significance difference, which moderate significance in the study group (43.3% Vs. 6.7%) in control group in the 4th day. While in 7th day there is highly significance difference in study group (56.6%) compared with control group (6.7%). As regard to purulent secretion it founded that (13.3%) of study group had purulent secretion versus (20.0%) in the control group in the 7th day with moderate significance ($P = 0.005$). As regard to thick secretion it founded that (30.0%) of study group had thick secretion versus (73.3%) in the control group in the 7th day with highly significance difference ($P = 0.000$) there is no significance difference between both groups in the first day but highly significance in 4th & 7th days.

Figure (2): Showed comparison between both groups in relation to breath sound, the result revealed that significant difference ($p = 0.01$) in normal breath sound (23.33%) in first day. While in seven days (40.0% vs. 6.7%) of the study group comparing to control group had normal sound with highly significant difference ($p = 0.005$). As regarding abnormal breath sound as (Crackles, wheezing) findings that (13.33%) in study group compared to (30.0%) in the control group and (40.0%) in study group compared to (76.7%) in the control group with highly significant different ($p = 0.005$).

Figure (3): Showed comparison between both study & control groups in relation for culture sensitivity test, the result revealed that no significant difference between both groups in first day but (36.67%) in study group had positive comparing with (56.6%) in the control group. The result revealed that a statistical highly significant difference was found between both groups ($p = 0.007$) in four day. While in seven day (40.0%) of the study group had positive vs. (80.0%) of the control group.

Table (6): Show comparison between both study & control group in relation for clinical pulmonary infection score, the result revealed that no significant difference between both groups in first day (5.67±1.971) in study group vs. (6.37±2.125) in control group with (40.0%) in study group comparing with (60%) in the control group. While the result revealed that no significant difference between both groups in four day which (30.0%) with (5.70±2.152) of the study group had positive ventilation associated pneumonia vs. (53.3%) (6.83±2.291) had positive ventilation associated

pneumonia in the control group with p value= (0.053). While the result revealed that a highly significant difference was found between both groups in seven day with (p=0.000) with mean &SD (4.53±1.167 vs7.30±2.003) between both groups.

Discussion

Based on the results of the present study, the patient's socio demographic data between the study and control groups were comparable and no significant differences were founded, these finding was agreeing with the study done by (Abd-Elwanees *et al.*, 2014) ^[11] who reported that there were no significance differences in the age, gender, and other demographic data. As regard to age and gender, the present study revealed that no statistically significant difference in both the study and control groups. This finding came in line with the study done by (Kaiqin, 2018) ^[13] who conduct his study on 289 cases that age distribution, was no statistical significance between male patients and female patients, whom were mainly in 70-89 years old.

Regarding investigations, the present study revealed that, no significant difference regarding WBC between the two groups this is in contrast with study done by (Salahuddin *et al.*, 2010) ^[18] who revealed that WBC statistically higher significant difference.

As regard hemoglobin and total leukocyte count level the present study revealed that no significant difference in both groups, this is in line with (Ittyachen *et al.*, 2016) ^[11] who revealed that no significant difference in hemoglobin and total leukocyte count level in both groups, total count was raised which indicates that infection is the most common cause of exacerbation in patients of COPD.

The current study revealed that highly statistical significant difference in four and seven day after CPT in the mean heart of study compared to control group. While in first day after CPT the heart rate within normal in both groups. This improvement of hemodynamic could be explained by the improvement in lung mechanics as well as parameters of the performing CPT that suppress abnormally elevated symptomatic activity this finding is in contrast with the study done by (Costa *et al.*, 2011) ^[4] who finding that there were no significant differences between the two groups regarding the hemodynamic parameters (HR and MAP).

The current study revealed that the majority of study group had normal breath sound compared with control group & the result revealed that abnormal breath sound as crackles and wheezing findings highly significance difference in study group compared to control group.

The result was supported by (Wiegand *et al.*, 2010) who mentioned that abnormal breath sounds might indicate presence of chest infection need more assessment and intervention. Also in seven day there was a highly significance difference of crackles and wheezing on study group versus control group after 2 hours CPT, (Park *et al.*, 2009) ^[17] mentioned that CPT is used to mobilize and remove secretions in airways in order to improve lung function and facilitate gas exchange.

(Stiller, 2010) ^[19] reported that chest physiotherapy (CPT) is a technique used to mobilize or loose secretions in the lungs and respiratory tract. This is especially helpful for patients with large amount of secretions or infective cough. Also document that chest physiotherapy consists of external

mechanical maneuvers, such as chest Percussion, postural drainage, vibration, to augment mobilization and clearance of airway secretions, diaphragmatic breathing with pursed lips, coughing and controlled coughing.

(Graham & Bradley, 2012) ^[10] concluded that chest physiotherapy should be directed at a specific lobe or segment and should be continued until auscultation reveals signs of improvement such as increased air entry and reduction of adventitial breath sounds.

The current study revealed that the study group subject reported larger amount of secretion compared to moderate amount among control group subject with statically significant difference, that reported highest number of patient who receives regular CPT gave large amount of secretions while patients who receive routine nursing care gave moderate amount of secretions & there were highly statistical significance difference between both groups, this difference is due to effect of chest physiotherapy which mobilizes the respiratory secretions from central to peripheral airway & increases the amount of tracheobronchial mucus cleared from the respiratory tract.

As regard to color of bronchial secretions the present study revealed that present statistical significant difference were founded between study & control group after CPT, the study done by (Jaber *et al.*, 2010) ^[12] reported that lung secretions should be assessed for color, consistency and volume, Auscultation of breath sounds across the lung. As regards to sputum cultures findings, had positive respiratory secretion culture of control group highly in four day compared to study group respectively (p=0.001) in seven day.

(Boten, 2010) ^[3] added that prophylactic chest physiotherapy should be initiated a to prevent respiratory complications rather than to wait until an atelectasis or retained secretion occur, turning coughing and breathing exercises should be started at least every 2 hours, deep breathing should be encouraged more frequently. Noteworthy majority of patients with acute exacerbation of COPD may be successfully managed with NIV. It has been shown to improve various physiological parameters such as work of breathing, respiratory rate, severity of breathlessness, pH, PaCO₂, and so on. More importantly, it also reduces frequency of VAP, duration of stay in ICU, and hospital and mortality (Vijay *et al.*, 2014) ^[22].

(Andrea *et al.*, 2010) ^[2] perform three methods of chest physical therapy in patients with an acute exacerbation. They found that sputum production increased significantly 30 minutes after the beginning of treatment with all techniques, but during the 1 hour after the end of treatment, it was significantly larger these findings are emphasized.

(Ganeswara *et al.*, 2012) ^[5] who stated that CPT is effective in clearing secretions from the lungs of patients with copious secretions and postural drainage is successful in helping to drain secretions from the lungs.

Conclusion

Based on the findings of the present study, it can be concluded that early chest physiotherapy for acute exacerbation of chronic obstructive pulmonary disease patients significantly success to minimize lung infection.

Recommendations

- Early chest physiotherapy must be applied as a routine

care for cases of acute exacerbation COPD admitted to chest care unit to improve the patient's outcomes.

- Implementing early chest physiotherapy after acute exacerbation of chronic obstructive pulmonary and helping to drain secretions from the lungs.
- Replication of this study on a large sample in the different geographic location at the Arab republic of Egypt for generalization.

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