

The Impact of Implementing of Standardized Nursing Care toward Patient with a Chest Tube to Reduce Pulmonary Complications after Thoracotomy

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Abstract: Chest drains are commonly used for patients who have undergone thoracic surgery the purpose of chest drains is to maintain cardiorespiratory function and hemodynamic stability by draining the pleural and mediastinal spaces of air, blood or other fluid. The most common complication are postoperative pulmonary complications which include massive lobar collapse due to mucus plugging of a central airway, Atelectasis, and a combination of one or more of these. Pulmonary care is an important part of the postoperative critical care nursing after thoracic surgery. To help in preventing pulmonary complications the patient is encouraged to using of incentive spirometer, breathing and coughing effectively support of incisional wound to maintain normal amount of oxygen in the blood, prevent the smallest part of the lung from collapsing and for effective removal of mucus from the lung. Early mobilization is effective in improving postoperative pulmonary outcomes. **Therefore, the aim** is to identify the Impact of implementing of standardized nursing care toward patient with a chest tube to reduce pulmonary complications after Thoracotomy. **Controlled case study research design** was used to conduct this research. **This study was carried out** at postoperative ICU in Assiut University Hospitals. **The sample of this study** was consisted of 60 patients, admitted to ICU after thoracotomy surgery. **Tool** used in this study consisted of an assessment sheet developed by the researcher for identifying impact of implementing of standard nursing care on prevention of postoperative pulmonary complication. **This tool comprised four main parts: Part I:-** socio-demographic and clinical data **Part II:-** Assessment hemodynamic state. **Part III:-** assessment of respiratory system and pain scale. **Part IV:-** assessment of infection and laboratory tests findings. **The main results:** Findings of the present study revealed that Significance decrease in sputum production ($p < 0.001$) on study group versus control group. Shows highly significant decrease in pain score of study group on the 2nd & 3rd day ($p = 0.005$). Highly significant increase of pao_2 , sao_2 on 2nd day and 3rd day of study group ($p < 0.001$). As regard to white blood count, the mean values of WBC concentration in the study group showed highly significant decrease ($p < 0.001$) in 3rd day of study group. Regarding to length of ICU stay highly significant decreased in study group versus control group ($p < 0.001$). As regard to temperature showed that highly significant decrease in study group versus study group ($p < 0.001$). **Conclusion** applying standard nursing care was more effective to reduce postoperative pulmonary complication after thoracotomy in study group versus control group who received routine hospital care.

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1. Introduction

A thoracotomy is done to remove fluid, blood or air from the thorax, remove tumors of the lung, bronchus, or chest wall, remove all or portion of lung, repair or revise structures contained in the thorax, repair trauma to chest or chest wall, sample a lesion for biopsy and remove foreign objects from the thorax. ¹

Thoracotomy interferes with normal pressure in the thoracic cavity which may cause lungs to collapse and no longer expand so after thoracic surgery draining secretions, air and blood from the thoracic cavity is necessary to allow the lung to expand ².

Chest tube is a drain used to remove air, fluid or blood from the pleural space, restore negative pressure to the pleural space, expand a collapsed or

partially collapsed lung, prevent reflux of drainage back into the chest, prevent cardiac tamponade after open heart surgery, prevent lung collapse after thoracic surgery and promote adequate gas exchange ³. Chest tube are categorized as pleural or mediastinal depending on the location of the tube's tip. The mediastinal chest tube are routinely placed at the conclusion of cardiac operations or other producers performed through a median sternotomy incision, while postoperative pleural drainage are perform through a thoracotomy incision after non cardiothoracic operations ^{4,5}.

Complications following thoracotomy include cardiovascular complications as hypertension, myocardial infarction (MI), right ventricle failure or

cardio herniation, dysrhythmias, hypotension. Respiratory complications as bronchopulmonary fistula, infection, respiratory failure, pulmonary emboli or pulmonary hemorrhage or pain control complications as inadequate pain control, epidural complications, or respiratory depression⁶. Postoperative pulmonary complications are The most form of postoperative morbidity experienced by patients who undergo thoracotomy and frequently occur after thoracic surgical operation .postoperative pulmonary complications include massive lobar collapse due to mucus plugging of a central airway, (pneumonitis), atelectasis and a combination of one or more of these or other less common problems that results in respiratory insufficiency⁷.

Critical care nurse is playing an a very important role in the postoperative care of the patient undergoing thoracotomy includes accurate and frequent assessment of arterial blood gas analysis, pulmonary care (including suctioning while the patient is intubated , coughing and incentive spirometry after extubation), early mobilization and control of pain and shivering for the prevention of Atelectasis which inhibits diffusion of oxygen and carbon dioxide across the alveolar capillary membrane and impairs effective gas exchange. Prolonged operation time causes fluid shifts, potentially increasing the amount of fluid in the pulmonary tissue, thus increasing the possibility of pulmonary complications^{8,9}.

Chest tubes are long, semi-stiff, clear plastic tubes that are inserted into the chest, so that they can drain collections of fluids or air from the space between the pleura. If the lung has been compressed because of this collection, the lung can then re-expand¹⁰. Thoracotomy is the process of making of an a surgical incision into the thoracic cavity. It is done to examine abnormalities, such as tumors, bleeding sites or thoracic injuries to perform a biopsy or to remove diseased lung tissue it's most commonly done to remove part or all of lung^{11,12}.

There are several complications that can develops from chest tube, the most serious complications resulting from chest tube placement is tension Pneumothorax which can develop if there is any obstruction in the chest tube drainage system. Chest tube complication also include bleeding from an injured intercostals artery perforation, perforation of visceral Organs (lung, heart, diaphragm, or intra abdominal organs), perforation of vascular structures such as the aorta or subclavian vessels, intercostals neuralgia due to trauma of neuro- vascular bundles, subcutaneous emphysema, re-expansion pulmonary edema, infection of the drainage site, pneumonia, and empyema. There may be technical problems such as intermittent tube blockage from clotted blood, pus or debris or incorrect positioning of the tube which causes ineffective drainage, a local or generalized infection

from the procedure, pain, impaired gas exchange , dyspnea hemothorax ,local hematoma^{11,13,14}.

Nursing care to reduce pulmonary complications after thoracotomy

The major goals of applying standard nursing care of patient with chest tube aimed to improvement of gas exchange and breathing, improvement airway clearance, Relief of pain and discomfort, increased arm and shoulder mobility, maintenance of adequate fluid volume and nutritional status, understanding of self care procedures and absence of complications¹⁵. Nurses should assess the respiratory status by auscultation of both lungs every 2 hours to assess breath sounds. Assess color (e.g. discoloration of the fingernails or around the lips) to detect signs of hypoxia. Observe for bilateral chest expansion. Because a disruption in the drainage system can cause a Pneumothorax and/or a pleural effusion, assessment of symptoms such as (shortness of breath , decreased breath sounds on one side, decreased breath sounds on one side, lack of movement on that side of the chest.

Critical care nurse should observe signs and symptoms of cough, sputum expectorated (amount and color), hemoptysis, chest pain, dyspnea), patient's cardiopulmonary tolerance while resting, eating, bathing, and walking, breathing pattern ,dyspnea, the patient need to sleep in an upright position or with more than two pillows . If there is a smoking history the critical care nurse should be determined how long has the patient smoked, Does the patient smoke currently, how many packs a day¹⁶.

Critical care nurse performed a number of tests to determine the patient's preoperative status and to assess the patient's physical assets and limitations such as (Pulmonary function studies , chest x-ray, electrocardiogram , nutritional assessment determination of blood urea nitrogen and serum creatinine, glucose tolerance or blood glucose, Assessment of serum electrolytes and protein levels, blood volume determinations, and complete blood cell count^{17,18} .

Critical care nurse must ensure that the dressing is intact, clean, and dry. Making sure there are no kinks or leaks. Check that all tubing connections are taped securely. Make sure there are no hanging, assess the character of the drainage; is it bloody, straw-colored, or purulent, assess the rate of drainage , assess increase or decrease in the bubbling , Inspect the suction control chamber. Make sure the water level is where it should be determined by the doctor as order or facility policy¹⁸.

Critical care nursing for reducing infection with chest tubes are varied. Gloves should be worn and hand washing should be done before and after handling the chest drainage system. The chest drainage procedure should be carried out under sterile conditions. The opening into the chest wall provides a

means of access for pathogenic organisms. Cover the wound with an antiseptic ointment and sterile dressing. The water in the chest drainage system must be sterile to prevent the chance of contamination¹³.

The critical care nurse monitors homodynamic status by monitoring the heart rate, rhythm by auscultation and electrocardiography because episodes of major dysrhythmias are common after thoracic and cardiac surgery. In the immediate postoperative period, an arterial line may be maintained to allow frequent monitoring of arterial blood gases, serum electrolytes, hemoglobin and hematocrit values and arterial pressure. Central venous pressure should be monitored to detect early signs of fluid volume disturbances. Early extubation from mechanical ventilation can also lead to earlier removal of arterial lines. Another important component of postoperative assessment is to note the results of the preoperative evaluation of the patient's lung reserve by pulmonary function testing¹⁹.

The critical care nurse must learn patient arm and shoulder exercises performed after thoracic surgery to restore movement, prevent painful stiffening of the shoulder, and improve muscle power²⁰. **So, Significance of this study that** pulmonary complications were the most common complications after Thoracotomy²¹. According to, the statistic in cardiothoracic surgery department in Assiut university hospital number of patient has admitted are 1872 patient in year 2008, (350) cases only have open-heart surgery **Hospital record-Assiut University (2010)**.

Aim of the study

The aims of this study was conducted to identify the Impact of implementing of standardized nursing care toward patient with a chest tube to reduce pulmonary complications after Thoracotomy

2. Patients and Method

Research Design:

The study is perspective randomized case control study research designed

Variables: -

Dependent variable: chest tube and pulmonary complication,

Independent variable: standard nursing care.

Setting of the study:-

This study was carried out in post- operative open heart intensive care unit at Assiut university hospital and started from the first of January 2008 until the end of January 2009.

Sample:-

A convenient sample of sixty patients admitted to post- operative open heart intensive care unit after thoracotomy. They were divided into equal two groups 30 patients for both intervention and control group.

Inclusion criteria:

1. Immediate hours after thoracotomy surgery.
2. Maximum age of 60 year.
3. Normal arterial blood gas value.
4. had at least one chest tube in the immediate postoperative period

Exclusion criteria:

1. Chronic lung disease.
2. Minimum hemoglobin less than 8 gm/dl.

Tool I :-patient assessment sheet

This tool was developed by the researcher after passing through an extensive and relevant review of literature .This tool comprised of six main parts:

Part I: - biosocial-demographic and clinical data"

This part includes assessment the patient's profile data such as (age, level of education, type of surgery)

Part 2: - chest tube assessment"

This part which includes ;number of chest tubes, site of chest tube, duration of chest tube stay, time of chest tube removal, wound assessment.

Part 3: - Assessment hemodynamic state

It is developed by the researcher to assess homodynamic changes and vital signs it includes (temperature, pulse, respirator rate, heart rate , central venous pressure and mean arterial blood pressure) taken for 3 days every hour and using manometer to measure central venous pressure.

Part 4: -Assessment of respiratory system

It is developed by the researcher used to assess signs and symptoms of respiratory infection .It includes respiratory rate, depth, cough ,sputum, breath sounds, characteristics ,character of tracheal secretion .data of mechanical ventilator which include (tidal volume, respiratory rate ,fraction inspired oxygen ,pressure support)

Part 5: -Assessment of pain:-

Visual analog scale (VAS) (used to assess each patient pain intensity .this t tool adopted from (22). VAS are useful in assessing the intensity of pain of patient with chest tube .Visual analog pain scale (VAS) gaded from 0-5 pain score: - No Pain =0 , mild pain=1 ,moderate pain=2,sever pain=3,very sever pain=4Unbearable Pain=5

Part 6: - Assessment of infection and laboratory tests findings

This part include changes in blood pictures, amount, consistency of chest tube, change in temperature in addition to laboratory tests findings refers to complete blood picture, arterial blood gases.

Methods:-

1. Local ethics committee approval was obtained and ethical considerations the nature and purpose of the study was explained to every patient.
2. Official Permission from the faculty of nursing to conduct the study was delivered to the hospital

- authorities in Assiut university hospital and approval to conduct this study was obtained.
3. The tools was developed by the research after reviewing the related literature and revised by 7 experts (3 medical anesthesiologist –anesthesia department –Assiut university ,one medical staff from community health medicine- Assiut university and 3 nursing staffs of critical care nursing- Assiut university)to test the content validity clarity and feasibility and necessary modification was done.
 4. A pilot study was conducted on six patients post thoracotomy admitted to the postoperative intensive care unit (ICU) to test the feasibility and clarity of the tools. These selected patients doesn't included in the main study sample .The necessary modifications was done prior to data collection.
 5. Informed consent was obtained from the head of the postoperative intensive care unit and the patient to carry out these studies.
 6. Observe patient during post-operative period to fulfilling the assessment sheet of Chest tube and nursing role sheet
 7. During post-operative period, universal precaution was applied by the researcher and all nurses.
 8. The studied sample fulfilling the research criteria was randomized assigned to two groups (the study group and control group).
 9. The control group received the routine care of the hospital without intervention from the researcher
 10. The study group received standardized nursing care of chest tube as follows :-
 11. Encourage the patient to assume a comfortable position with good body alignment.
 12. Observe and immediately report rapid shallow breathing, cyanosis, pressure in the chest, symptoms of hemorrhage or significant changes in vital signs.
 13. Assess drainage collection system immediately after insertion and every 4 hours while chest tube is in place for
 - a. fluctuations in the air leak indicator
 - b. air bubbles in the air leak indicator
 - c. suction set at ordered level.
 14. Auscultate lung sounds and assess for rate, rhythm, and depth.
 15. Assess skin color and status of surgical dressing at least q8h.
 16. Assess the pain level.
 17. Make sure that the patient's body doesn't compress the tube.
 18. Monitor characteristics of drainage including color, amount and consistency.
 19. Ensure that the drainage tubing doesn't kink, loop, or interfere with the patient's movements.
 20. Teach patient and encourage him to improve his chest and breathing by coughing and breathing exercises²³.

- Teach the patient how to use the incentive Spirometer.
- a- Explain the reason and objective of the incentive spirometer, assess patient level of pain, position the patient in semi-flower's position or in upright position, instruct the patient to hold a pillow or folded blanket over incision.
 - b- Hold the device straight up in front of you, breathe out, instruct the patient to place the mouthpiece in the mouth and Close lips tightly around the mouthpiece, Inhale slowly and deeply through mouth., When feel you cannot breathe in any longer, take the mouthpiece out of mouth. Hold breath for 3-5 seconds then breathe out slowly.
 - c- Breathe normally for a few breaths and let the piston return to the bottom of the chamber, repeat this 10 times then Cough repeat these steps every 2 hours.
- D- Encourage and promote an effective cough every 1- 2 hours during the first 24 hours, assess and monitor the chest drainage (Assess for leaks and patency, monitor amount and character of drainage and document every 2 hours^{24,25}).
- Assist the patient with range of motion exercise for the affected arm and shoulder several times daily.
 - Monitor the patient for the signs and symptoms of potential complications.
 - In both groups the patients were observed by the researcher for signs and symptoms of respiratory complications, arterial blood gas, using incentive spirometer and assessment pain level.

Research implementation (procedure):

This study was carried out in two phases:

Phase I: preparatory phase:

A reviewer of current and past, local and international related literature in the various aspects using books ,articles, periodicals and magazines was done. The proposed study settings were assessed for the number of patients admitted to post-operative care unit had chest tube after thoracotomy.

Phase II: implementation phase:

The control group received the routine care of the hospital without intervention from the researcher. The tools were all filed through interviewing .The purpose of the study was explained to all patients prior the implementation of care .the study was carried out during morning and afternoon shifts for all available patients .

Once the permission was granted to proceed with the proposed study ,the research proposal was submitted to the research committee in Assiut university hospital, name of potential patients who have admitted to the unit and who met the criteria for possible mechanism were obtained daily from the nurses in cardiothoracic unit in the hospital .

In the first postoperative day, after evaluation of the orientation state of the patient to persons, place and time:-

- Each subject was contacted personally by the researcher at that time the purpose and the nature of the study were explained.
- As well as the baseline data were collected such as the patient was asked if there was pain and the site of this pain, this was the baseline of pain assessment
- Patients were trained to perform deep breathing exercises.
- Assessment of respiratory system include Respiratory rate, depth, cough, sputum, pain with berating
- Arterial blood gas (ABG) (pH, pco₂, pao₂, Hco₃ and sao₂).
- All hemodynamic data were recorded by the researcher every hour for three days, such as blood pressure, heart rate, respiration, oxygen saturation, measure central venous pressure.

Patients after thoracotomy receive mechanical ventilation with an effective volume of 15 ml/kg and a minimum of 5 cm H₂O PEEP. No ventilator change were made during the study. Recording hemodynamic data and respiratory variables were recorded every hours before simultaneous arterial and venous blood samples were taken. Instances in which secretions had to be suctioned during stabilization period, there was a waiting period of 30 minutes from the time of suctioning to blood sampling.

- Explaining to patient how to use incentive spirometer.

In second day of operation assess signs and symptoms of complications as (fever, presence of secretion, cough), the use of visual and descriptive scales for pain measurement was explained to those involved in the study, patient's pain was evaluated with visual analog scale (VAS) graded from 0-5 pain score: - No Pain=0 Mild Pain=1, Moderate Pain=2, Severe Pain=3, very severe Pain=4, Unbearable Pain=5. The following data were assessed 24h, 48h, 72h.

In the third postoperative day after meeting the criteria of chest tube removal "drainage had changed from bloody to clear, there had been no evidence of an air leak after 24-48 hours of water seal drainage, fluid was less than 100 ml in the past 8 hours and chest x-ray was acceptable, the decision for chest tube removal was taken by the cardiothoracic surgery resident.

Patient's was notified that chest tube would be removed and explanation of chest tube removal procedure was done with full details to the patient as follows: -You are going to remove your chest tube after few minutes. It will be done while you in semi – setting position in bed. The dressing that is over the chest tube will be removed, you will be asked to take a

deep breath and hold it while counting 1, 2, 3 and then you are told that you can breathe out. After the tube comes out, you will have a bandage put over the area where the chest tube was and that will be the end of the procedure, the procedure is short and you will be given pain medication before chest tube removal, You will feel some sensation while chest tube being removed like burning, sharp, or shooting. You will be asked to describe your pain immediately after chest tube removal **deep breathing exercises before chest tube removal as follows :-**

1. Sit quietly in a comfortable position and close the eyes.
2. Deeply relax all muscles, beginning at the head and progression to the feet.
3. You will perform deep breathing exercises as you have been trained before.
4. Breathe through the nose
5. Hold your breath 1-3 seconds after inhalation then breathe out slowly
6. Be aware of your breathing (Inhale, hold, exhale, hold, exhaleect)

You will be asked to take a deep breath and hold it while counting 1, 2, and 3 then you will be told that you can breathe out.

Statistical analysis:

The collected data were coded, analyzed and tabulated using statistical package and software for social sciences (SPSS /version¹⁷). Descriptive statistical analysis in the form of (frequencies, percentages for qualitative variables) and (means and standard deviations for quantitative variables) were used. Quantitative continuous data were compared using analysis of variance test in case of comparisons between two independent groups. Using chi-square test for non-parametric data to determine significant.

Statistical significant differences were considered when P-value used as follows:-

P > 0.05 non significant *P < 0.05 significant

P < 0.01 moderate significant *P < 0.001 highly significant

3. Results & Analysis of Data

Table 1:- Represent the comparison between study and control groups as regard to socio-demographic data (age and level of education), type of surgery and chest tube assessment. The mean age was (27.75 ± 12.12) in study group and (26.20 ± 17.65) in control group. As regard level of education (46.7%) of patients was literate and (53.3%) were illiterate in study group. While (40%) literate and (60%) of patients were illiterate in control group. As regard type of surgery, the study show that (53.33%) in study group and (53.33%) in control group had operated Mitral valve replacement. Also (40%) in study group and (40%) of patients in control group had operated coronary artery bypass grafting. As regards chest tube assessment

(number of chest tube, site of chest tube, and duration of chest tube stay .It is noticed that (36.67%) of study group and (40%) of patients on control group had 2 chest tube and (63.51%) of patient on study group had 3 chest tube and (60%) of control group . In relation to site of chest tube. it was founded that (86.7%) in study group and (93.3%) in control group had mid-axillary chest tube and (93.3%) in study group and (90%) in control group had anterior-axillary chest tube and behind pectorals-axillary chest tube (80%) in study group and (70%) in control group .In relation to duration of chest tube stay it was found that (90%) had chest tube \leq 3 days in study group and (50%) in control group .It was founded that there is no significance difference between two groups in relation to number of chest tube, site of chest tube ($p>0.05$) .

Table (2)Representing change of vital signs for both groups on admission (1st day, 2nd day and 3rd day) patient on mechanical ventilation so first day show no change on HR, respiration and blood pressure from base line. In the second day after extubation the finding of heart rate found significantly decrease ($p<0.001$) between study group versus control group (104.35 ± 19.42 & 94.32 ± 13.58). There was highly significant decrease in respiration between study group compared to control group ($p< 0.001$). (21.04 ± 2.63 & 30.72 ± 2.62) .while blood pressure show significantly decrease in diastolic BP in study group versus control ($p<0.001$) (70.25 ± 10.35 & 73.93 ± 8.41) & revealed that there is no significance different of mean values c .v .p in study group and control group.

Table (3):-Clarifies assessment of respiratory system .There was a highly significance decrease ($p<0.001$) on study group versus control group for pain with breathing and coughing on 2nd and show either moderate significant increase on 3rd day versus 1st day . Also sputum show a highly significance decrease ($p<0.001$) on study group versus control group. As regard Dyspnea, and crackles shows significance decrease ($p< 0.05$) in study group versus control group, regarding to wheezing, orthopnea and Haemoptysis there was no significance difference ($p>0.05$) in study and control group. As regard arterial blood gas changes Post-operative .It shows that there was no significance difference between study group and control group for pH, paco₂, pao₂ and Hco₃ in the first day ($p> 0.05$).while the mean value of pao₂ shows highly significantly increase on and 2nd day and 3rd day of study group ($p< 0.001$) (145.39 ± 41.53 & 92.3 ± 31.59). And show no significance difference on control group .as regard to Hco₃ shows significantly increase on 3rd day in study group (24.31 ± 1.42) ($p< 0.05$) and show no significant change in PH and paco₂ in both groups

Table (4) shows the mean tidal volume among patients postoperative .it was observed that the mean tidal volume on first 24 h (650.00 ± 214.31) of study group was significantly increase than mean tidal

volume ($P<0.05$) (410.00 ± 41.51) in control group .on the other hand, the mean tidal volume (790.00 ± 110.25) in study group was highly significantly increase than in control group (430.25 ± 51.48)

Table (5)Concerning red blood count the mean in study group showed increase ($p< 0.01$) on 3rd day (5.11 ± 0.69) of study group respectively while there was no significance difference at control group ($p> 0.05$). (4.03 ± 1.26). **In relation to hemoglobin concentration (HB)**, the mean values of HB concentration in the study group showed that significantly increase ($p< 0.01$) on 3rd day versus first day 12.18 ± 1.29 . while there was significance decrease at control group 10.92 ± 2.05 . **Regarding hematocrit HCT** finding show that the mean value of (Hct) in the study group showed significantly increase ($p< 0.001$) on 3rd day (41.49 ± 4.53) respectively while there was no significance difference at control group ($p> 0.05$). (33.13 ± 6.69). **Concerning platelets** the mean in study group showed increase ($p< 0.01$) on 3rd day (311.00 ± 71.75) in study group while in control group there is significantly decreased (192.06 ± 80.65). **Concerning** to factors affecting oxygen supply. The mean values showed that highly significance increase ($p< 0.001$) .The mean values for arterial oxygen saturation on 3rd day was (98.77 ± 0.56) in study group and (92.34 ± 1.39) in control group

Table (6) shows mechanical ventilator data there were no significance difference for respiratory rate and positive end-expiratory pressure (PEEP) in study group and control group .As regard to pressure support show there were a significance decrease ($P<0.05$) in study group (8.98 ± 1.98) versus control group. Also friction inspired oxygen showed there was significance difference ($P<0.01$) in study group (45.93 ± 6.98) with no change in control group. In relation to timing of mechanical ventilator it was noticed that (73.3%) of study group and (66.7%) b in control group on mechanical ventilator from 4-6 hours then extubated

Table (7) shows that there was no significant difference in fraction inspired

Oxygen in the first day and show that there were statistically significant decrease in 2nd and 3rd day in study group ($P<0.05$) and compared to control group.

Table (8) Represents comparison between control and study group as regard to pain intensity measurement score through the 1st, 2nd and 3rd day postoperative. No significant deference was found in both groups in first day ($p=0.273$), there was a significant decrease in study group versus control group in the second day ($p=0.028$). And show highly significant decrease in study group on the third day ($p=0.005$) .

Table (9) Is concerned with drugs administered postoperatively results reveals that more than have of patients (60%) not administered drug in study group and (20%) in control group .Also results revealed that

percentage of patient who received sedation or analgesia were (40%) in study group and (80%) in control group.

Table (10) it represent the sequencing effect of nursing care to reduce pulmonary complication .The result revealed that temperature showed that highly significantly decrease in study group versus control group ($p<0.001$) (37.12 ± 0.49 & 38.59 ± 0.42). As regard to white blood count (WBC) the mean values of WBC concentration in the study group showed highly

significantly decreases ($p< 0.001$) in 3rd day (8.95 ± 2.28) while there was significance increase at control group (14.34 ± 4.71) .Also the mean value of length ICU stay were (3.27 ± 1.202 & 5.23 ± 1.75) days with highly significant decrease in study group versus control group ($p< 0.001$). Also the consistency and amount of chest tube show moderate significant decrease in 2nd & 3rd day $P<0.01$ in study group versus control group.

Table (1):-Number and percentage distribution of control and study groups as regards socio- demographic characteristics , surgical procedure and chest tube assessment were recorded in patient chart (n=60)..

Variables	G1 "study group "n=30		G2 "control group " n=30	
	N	%	N	%
A- Patient's profile:-				
1 Age" years"				
• 10-19	7	23.3%	7	23.3%
• 20-39	17	56.67%	10	33.3%
• 40-60	6	20%	13	43.3%
Mean±SD	27.75±12.12		26.20±17.65	
2- level of Education				
• literate	14	46.7%	18	60%
• illiterate	16	53.3%	12	40%
3- Type of surgery				
• Mitral valve replacement	16	53.33%	16	53.33%
• Coronary artery bypass grafting	12	40%	12	40%
• Aortic valve replacement	1	3.3%	1	3.3%
• Double valve replacement	1	3.3%	1	3.3%
B- Assessment of chest tube:-				
1-Number of chest tube				
• 2 tubes	11	(36.67%)	12	(40%)
• 3tubes	19	(63.51%)	18	(60%)
2- Site of tubes :-				
• mid-axillary	26	(86.7%)	28	(93.3%)
• anterior-axillary chest tube	28	(93.3%)	27	(90%)
• behind pectorals-axillary chest tube	24	(80%)	21	(70%)
3- duration of chest tube stay				
• ≤ 3 days	27	(90%) **	15	(50%)
• > 3 days	3	(10%)	15	(50%)

>0.05 non significant *P<0.05 significant **P<0.01 moderate significant ***P<0.001 highly significant

Table (2) postoperative assessment of homodynamic data& Vital signs change for both groups on first day (base line), 2nd day, 3rd day after thoracotomy

Item	G1 "study group "n=30	G2 "control group " n=30
Heart rate (beat \ min) 1 st day	104.35 ± 19.42	107.52± 14.31
Heart rate (beat \ min) 2 nd day	94.32 ±13.58**	110.42 ±14.31
Heart rate (beat \ min) 3 rd day	93.25 ± 14.32**	107.53 ± 12.51
Respiration (c\min) 1st day	22.53± 4.25	24.31± 4.81
Respiration (c\min) 2nd day	20.47 ±3.18*	26.71 ±5.31
Respiration (c\min) 3rd day	21.04± 2.63***	30.72± 2.62
Systolic Bl.P (mm.Hg) 1 st day	119.10± 21.69	119.57± 20.91
Systolic Bl.P (mm.Hg) 2 nd day	123.65 ±20.22	132.45 ±15.25
Systolic Bl.P (mm.Hg) 3 rd day	119.65± 14.91	134.52± 12.73
Diastolic Bl.P (mm.Hg) 1 st day	75.83 ± 9.61	78.39 ± 7.42
Diastolic Bl.P (mm.Hg) 2 nd day	70.25 ±10.35**	77.92 ±5.41
Diastolic Bl.P (mm.Hg) 3 rd day	66.75 ± 8.41	67.83 ± 8.60
C.V.P 1 st day	5.29± 1.38	5.72± 1.89
C.V.P 2 nd day	5.43 ±2.01	5.69±2.48
C.V.P 3 rd day	5.75± 2.85	5.84± 2.97

N .s . P >0.05 non significant *P<0.05 significant **P<0.01 moderate significant ***P<0.001 highly significant

Table (3):-postoperative assessment of respiratory system in both groups:

Item	G1 "study group "n=30			G2 "control group " n=30		
	1 st day	2 nd day	3 rd day	1 st day	2 nd day	3 rd day
- Pain with breathing	12(40%)	13 (43.3%)*	** 8(26.7%)	17(56.7%)	26(86.7%)	20(66.7%)
-Wheezing	4(13.3%)	2 (6.7%)	1(3.3%)	0	2(6.7%)	3(10.0%)
- Dyspnea	6(20.0%)	2 (6.7%)*	1(3.3%)	9(30%)	7(23.3%)	3(10.0%)
-Orthopnea	1(3.3%)	0	1(3.3%)	3(10.0%)	1(3.3%)	1(3.3%)
-Coughing	2(6.7%) **	1(3.3%) ***	1(3.3%)	1(3.3%)	10(33.7%)	20(66.7%)
-Sputum	2(6.7%)	1(3.3%)	1(3.3%) ***	2(6.7%)	1(3.3%)	18(60.0%)
-Hemoptysis	1(3.3%)	0	0	0	0	5(16.7%)
-Crackle	1(3.3%)*	0	0	1(3.3%)	1(3.3%)	4(13.3%)
B-Arterial blood gases						
PH	7.35± 0.04	7.37 ± 0.03	7.42 ± 0.038	7.36± 0.04	7.40± 0.05	7.37 ± 0.06
Paco ₂	38.91 ± 3.01	39.02±2.41	38.35 ± 1.93	37.53± 4.01	37.25 ± 4.35	37.25 ± 4.35
Pao ₂	92.24± 27.61	145.39± 41.53***	92.31 ±31.59***	86.57± 29.69	210.51± 95.31	133.92 ±39.52
Hco ₃	22.65± 2.35	23.90 ±2.74	24.31± 1.42*	21.72± 2.68	23.93 ±3.52	22.71± 4.51

N .s .P >0.05 non significant *P<0.05 significant **P<0.01 moderate significant ***P<0.001 highly significant

Table (4) means tidal volume among patients "using incentive spirometer" 2nd & 3rd day postoperative:-

Variables	G1 "study group "n=30	G2 "control group " n=30
Tidal volume 24 hrs	650.00 ± 214.31*	410.00 ± 41.51
Tidal volume 48 hrs	790.00 ±110.25***	430.25 ±51.48

N .s .P >0.05 non significant *P<0.05 significant **P<0.01 moderate significant ***P<0.001 highly significant

Table (5) factors affecting oxygen supply among study & control group

Variables	G1 "study group "n=30	G2 "control group " n=30
RBC 1 st day	4.54± 0.36	3.99± 0.85
RBC 3 rd day	5.11 ±0.69**	4.03 ±1.26
Hg 1 st day	11.62 ± 1.27	15.97 ± 3.41
Hg 3 rd day	12.18 ±1.29**	10.92 ±2.05
HCT 1 st day	46.67± 4.43	34.32± 5.71
HCT 3 rd day	41.49 ±4.53*	33.13 ±6.69
Platelets 1 st day	197.88 ± 58.26	287.63 ± 82.62
Platelets 3 rd day	311.00 ± 71.75**	192.06 ± 80.65
Sao ₂ 1 st day	98.72 ±2.51	98.63 ±1.43
Sao ₂ 2 nd day	99.24 ± 0.38*	97.25 ± 1.95
Sao ₂ 3 rd day	98.77 ± 0.56***	92.34 ± 1.39

N .s .P >0.05 non significant *P<0.05 significant **P<0.01 moderate significant ***P<0.001 highly significant

Table (6) mechanical ventilator setting for both groups (study & control) in the postoperative time (n=60).

Variable	G1 "study group "n=30	G2 "control group " n=30
1- Tidal volume (ml)Vt	582.41±137.29	563.91±112.51
2- Respiratory rate (per/min)	10.39 ± 2.38	9.02 ± 2.03
3-Fraction inspired oxygen	45.93 ± 6.98**	59.58 ± 7.03
4-Positive end expiratory pressure (cm.H ₂ O)	4.63 ± 1.98	4.72 ± 1.58
5- pressure support (p s)	8.98 ± 1.98*	7.02 ± 2.01
*timing mechanical ventilator :-		
• 4-6 hours	22 (73.3%)	20 (66.7%)
• 6-12 hours	8 (26.67%)	10 (33.3%)

N .s .P >0.05 non significant *P<0.05 significant **P<0.01 moderate significant ***P<0.001 highly significant

Table (7) sequencing effect of nursing care on fraction inspired oxygen

Variable	G1 "study group "n=30	G2 "control group " n=30
Fio2 immediate postoperative	56.23 ± 10.25	57.31 ± 11.05
Fio2 2 nd day	40.93 ± 7.41*	45.98 ± 9.25
Fio2 3 rd day	32.01 ± 6.42*	42.53 ± 8.02

N .s .P >0.05 non significant *P<0.05 significant **P<0.01 moderate significant ***P<0.001 highly significant

Table (8) comparison between the study and control group as regard pain assessment using descriptive and visual analog pain intensity score

Pain intensity scale	1 st day		2 nd day		3 rd day	
	G1 N %	G2 N %	G1 N %	G2 N %	G1 N %	G2 N %
1- No Pain	14 (46.7%)	5 (16.7%)	17(56.66%)	6(20.0%)	28(93.3%)	16 (53.3%)
2- Mild Pain	9 (30%)	11 (36.7%)	8 (26.67%)	13 (43.3%)	1 (3.3%)	10 (33.3%)
3- moderate Pain	6 (20%)	4 (13.3%)	3 (10%)	7 (23.3%)	1 (3.3%)	2 (6.7%)
4- sever Pain	1 (3.3%)	10 (33.3%)	2 (6.67%)	4 (13.4%)	0.0	1 (3.3%)
p-value	p=0.273		p=0.028 *		p=0.0005***	

N .s .P >0.05 non significant *P<0.05 significant **P<0.01 moderate significant ***P<0.001 highly significant

Table (9) Drugs being administered to the patient with chest tube postoperative

Variable	G1 "study group "n=30	G2 "control group " n=30
1- No drugs	18 (60%)	6 (20%)
2- sedation or analgesia	12 (40%)	24 (80%)
Total	30	30

N .s .P >0.05 non significant *P<0.05 significant **P<0.01 moderate significant ***P<0.001 highly significant

Table (10) sequencing effect of standard nursing care to reduce pulmonary complication in both groups:-

Item	G1 "study group " n=30	G2 "control group " n=30	
Temperature (c) 1 st day	37.65 ± 0.56	37.82 ± 0.32	
Temperature (c) 2 nd day	37.75 ± 0.32*	38.12 ± 0.42	
Temperature (c) 3 rd day	37.12 ± 0.49***	38.59 ± 0.42	
WBC 1 st day	9.93 ± 3.52	10.15 ± 5.05	
WBC 3 rd day	8.95 ± 2.28***	14.34 ± 4.71	
ICU stay Mean ± S.D (min -max)	3.27 ± 1.21 (2.00- 7.00)***	5.23 ± 1.75 (3.00 - 12.00)	
Amount 1 st day	866.67 ± 279.31	901.67 ± 270.21	
Amount 2 nd day	378.33 ± 124.34**	616.67 ± 208.58	
Amount 3 rd day	170.37 ± 66.88**	318.97 ± 94.42	
Consistency of chest tube :1st day	bloody watery	19 (63.51%) 11 (36.67%)	18 (60%) 12 (40%)
Consistency of chest tube :2 nd day	bloody watery	14 (46.7%) ** 16 (53.3%)	25 (83.3%) 5 (16.7%)
Consistency of chest tube :3ed day	bloody watery	1(3.3%) 22(73.3%) **	8 (26.7%) 22(73.3%)

N .s .P >0.05 non significant *P<0.05 significant **P<0.01 moderate significant ***P<0.001 highly significant

4. Discussion

Thoracotomy is a surgery to open the chest wall. The surgery allows access to the lungs, throat, aorta, heart, and diaphragm. Depending on the disease location, a thoracotomy may be done on the right or left side of the chest. Sometimes, a small thoracotomy can be done in the front part of the chest Athanassiadi et al²⁶.

A chest tube is inserted after thoracic surgery to ensure that fluid and air drain from the chest cavity, To reduce severe cardiac and respiratory complications related to the abnormal accumulation of air and fluids, chest tube need to remain in place as long as necessary keeping chest tube in place, however, is associated with increased pain and discomfort for the patient, mechanical irritation of the heart and pericardium, and

an increased incidence of infection Abramov et al²⁷ Fibla et al²⁸.

There may be technical problems such as intermittent tube blockage from clotted blood, pus or debris or incorrect positioning of the tube, which causes ineffective drainage, a local or generalized infection from the procedure, pain, impaired gas exchange, dyspnea, hemothorax, local hematoma Townsend et al²⁹.

The critical care nurses play an important and vital role in early postoperative period aimed to promoting of oxygenation and caring for maintenance of adequate ventilation and prevention of pulmonary complications. It is guided by the type of procedure done and postoperative assessment Naughton et al³⁰.

The provision of adequate pulmonary hygiene is one of the most important components of nursing care on the postoperative unit. Postoperative lung function and respiratory mechanisms may be substantially impaired by the adverse effect of anesthetic agent, the thoracic incision and surgical manipulation. Deep breathing exercises are very important and essential immediately after extubation. It improves the sputum exploration, decrease pain and enhance ventilation Kwiatkowski³¹.

The study results revealed that better improvement in heart rate, systolic and diastolic blood pressure, respiration and C.V.P in 2nd, 3rd day on study group versus control group. Matte P et al³² reported that the patient's vital signs must be monitored closely and respiratory function assessed for signs of improvement. Observations should include breath sounds and equality of chest movements, respiration rate, pattern, depth and effort associated with breathing if any deterioration or distress is detected, the medical team must be notified at once and another chest X-ray should be ordered.

Pinsky³³ mentioned that it is important that the intensive care (ICU) nurse undertakes comprehensive cardiovascular assessment of the patient to determine adequacy of cardiac output. This involves assessment of heart rate and rhythm, blood pressure and central venous pressure

Seidel et al³⁴ mentioned that measurement of vital signs includes obtaining temperature, blood pressure, pulse rate, and respiratory rate. Temperature in the thoracotomy patient may provide a picture of how much work the patient must do to maintain the current hemodynamic status.

The findings of present study revealed that there is statistically significant decrease in the duration of chest tube stay in the study group versus control group.

Farahmand et al³⁵ and Okur et al³⁶ are in line with the current study they founded that the mean time to removal of chest drains were lower in study group versus control group. Singapore Lau C K et al³⁷ founded that their is statistically significant decrease

were detected in time to removal study versus control group

Thys³⁸ reported that Placement of chest tube after open chest procedures allows for drainage of air and blood, restoring of normal negative pressure and rexpansion of the collapsed lung.

American heart association³⁹ stated that bacteria can enter around the tube and cause an infection around lung, the longer chest tube stay in the chest, the greater risk of infection McHale & MCCHal, et al⁴⁰ mentioned that placement of a chest tube for more than 3 days increase risk of infection.

As regard to factors affecting oxygen supply between study and control group. The present study revealed that significant increase in mean arterial oxygen saturation & mean value of hemoglobin, red blood cells, platelets in study group versus control group.

Segal et al⁴¹ mentioned that the nurse should monitor the level of hemoglobin and hematocrit at regular intervals during the postoperative period. Hemoglobin reflects oxygen carrying power of blood. When its level is reduced, oxygenation is reduced and tissue repair is altered resulting delayed healing. If hematocrit level is decreased, healing process is also affected due to affection of volume of whole blood. Mohammed⁴² reported that, hemoglobin (Hb) creates oxygen carrying molecules in erythrocytes that impart the characteristic color of red blood cells enabling blood to transport 30 to 100 times more oxygen than it could otherwise. It has four sites to which oxygen attaches in an easily reversible chemical bond, called oxyhemoglobin. Saturation is the percentage of hemoglobin bonding site occupied by oxygen and is an important parameter to monitor. Roberta et al⁴³ added that monitoring of hemoglobin provides information's about the oxygen carrying capacity of the blood. ABG monitoring provides a comprehensive picture of oxygenation, ventilation and acid base balance. It also used to initiate therapy and monitor effectiveness of therapy.

In order to detect the effect of standard nursing care on hemodynamic parameter and gas exchange in the early postoperative period after thoracotomy the current study included different assessment, measuring ventilator setting, drugs being administered to patient postoperatively and factors affecting oxygen supply were performed.

As regards to ventilator setting data the result revealed that there were no significance difference for respiratory rate and positive end-expiratory pressure (PEEP) in study group and control group, mean pressure support there were a significance decrease (P<0.05) in study group versus control group. While Hudak et al⁴⁴, reported that the use of (5 H₂O cm) of positive in expiratory pressure PEEP is used to decrease atelectasis and postoperative bleeding.

Bronwyn et al⁴⁵ reported that monitoring data from the ventilator also aid in understanding of the patient's respiratory status and the appropriateness of the ventilator settings. Respiratory rate, tidal volume, minute volume and airway pressure as absolute values reflect the current delivery of ventilatory support .when analyzed such data can provide information about the status of lung function and the patient's respiratory effort. Byrd et al⁴⁶ reported that the critical care nurse must check the patient ventilator system every hour .This check include airway pressure (inspiratory &expiratory) and fraction of inspired O₂ (FIO₂) and tidal volume.

Capovilla et al⁴⁷ Monitoring of gas exchange is an important aspect of caring for a mechanically ventilated patient .Arterial blood gas (ABG) analysis is the gold standard level . Burns,⁴⁸ mentioned that purpose of mechanical ventilation after thoracotomy is to maintain alveolar ventilation, exchange of fresh gas between the lungs and ambient via changing airway pressure and prevent atelectasis.

As stated by Caron et al⁴⁹ the nurse must assess the patient for readiness for early extubation. Extubation should be considered when the patient is arousable, able to follow commands, hem-dynamically stable, and initiating spontaneous ventilations without excessive respiratory effort. Laboratory analysis of arterial blood gases and specific ventilatory parameters must be completed prior to extubation.

Zevola et al⁵⁰ reported that Patient who had cardiothoracic surgery were intubated and received mechanical ventilation for extended periods ,often up to 24 hours or more .Early extubation from mechanical ventilation reduce adverse effect of prolonged intubations .After extubation patient continue to require supplemental oxygen therapy via nasal cannula or face mask.

As regard to drugs administered postoperatively results showed that more than half of the patients (60%) not administered drug in study group and (20%) in control group .Also results revealed that percentage of patient who received sedation or analgesia were (40%) in study group and (80%) in control group

This finding are consistent with Kolsi et al⁵¹ who stated in a study to determine the effects of drainage with a Redon versus a conventional drain on postoperative pain and blood loss after valve replacements. Postoperatively, there was a lower demand for analgesics in study Group rather than control group Abramov et al⁵² founded that postoperatively demand for analgesics was lower in study group versus control group.

As regard to effect of nursing care on gas exchange , all patients in this study had end tracheal tubes in place mechanical ventilatory support with fraction of inspired oxygen (FIO₂) of more than 60% consequently ,the statistical decrease were found for

study group versus control. Smeltzer & Bare,⁵³ reported that fraction of inspired oxygen, the concentration of oxygen delivered are dependent on patient need and evaluated by arterial blood gas. As explained by Bonnie, et al⁵⁴, successful weaning from the mechanical ventilation is supplemented by intensive pulmonary care, the fio₂ then is gradually reduce until the pao₂ is in the 70 to 100 mm hg range, while the patient is in the breathing room air .

As regard to using incentive spirometer the present study showed better improvement of mean tidal volume in the study group rather than in control group. the significantly improvement in tidal volume related to study group compared to control group postoperatively may be attributed to the effect of incentive spirometer and breathing &coughing exercise in regular basis.

This results of this study are in line with Chiang et al⁵⁵ who reported that the use of incentive spirometer significantly increase chest wall expansion . This finding concides with Westerahl et al⁵⁶ show that the patients performing deep breathing exercises using incentive spirometer after coronary artery bypass grafting had significantly small atelectasis areas and better pulmonary function on the fourth postoperative day. Lawrence et al⁵⁷ reported that using incentive spirometer is a good evidence indicates that lung expansion intervention reduce pulmonary risk. Freitas et al⁵⁸.mentioned that incentive spirometry is a handheld mechanical device developed to encourage sustained maximal inspirations, encourage re-inflation of lung tissue and thus prevent or resolve atelectasis.

Agostini et al⁵⁹. Reported that after thoracic surgery incentive spirometry is a relatively good measure of lung function following thoracotomy and also suggest that incentive spirometry may be useful to assess respiratory recovery in the days after thoracic surgery

Incentive spirometer also referred to as sustained maximal inspiration device it used to improve pulmonary ventilation, counteract the effect of anesthesia or hypo ventilation, loosen respiratory secretions, facilitate respiratory gaseous exchange and expand collapsed alveoli Pullen, et al⁶⁰

The present study showed that pain intensity measurement score through the1st, 2nd and 3rd postoperative day. Shows that was a significant decrease in study group versus control group in the 2nd &3rd day.

The current study agree with Mirmohammad-Sadeghi et al⁶¹ who founded that the pain level was lower in first 24 hours post-operative in both group, and the difference in the pain level between the 2 groups evaluated 30 hours post-operative. Madhavi Singh et al⁶² founded that the pain scores were significantly lower in study group versus control group the median pain scores in the control. Juan et al⁶³

founded that visual analog scale is low in the 1st day in both groups the decreased progressively in the 2nd, 3rd day in study group versus control group. Marret *et al*⁶⁴ founded that pains scale values post thoracotomy were significantly lower in study group than control group.

Okur *et al*³⁶ found that in the study aimed to investigate whether using two tubes after a pulmonary lobectomy is more effective than using a single tube. The mean values of postoperative pain assessed on the visual analogue scale (VAS) in the early (second day) period were lower in the single tube group and increased in the double-tube group.

Mueller *et al*⁶⁵ found that patients who had a chest tube in place on the second postoperative day had significantly higher pain levels than did patients who had their chest tubes removed on the first day. Lynch⁶⁶ and Wein *et al*⁶⁷ stated that pain is considered the fifth vital signs, it must be assessed regularly.

Gordonet *al*⁶⁸ added that pain assessment is an important part of the quality of nursing care because the patient's bedside, the ICU nurse plays a unique and important role in pain assessment and management. Puntillo *et al*⁶⁹ added that mechanical ventilation should not be a barrier for ICU nurses to assess patient pain level.

Smeltzer & Bare,²³ reported that Pain after a thoracotomy may be severe, depending on the type of incision and the patient's reaction to and ability to cope with pain. Deep inspiration is very painful after thoracotomy. Pain can lead to postoperative complications if it reduces the patient's ability to make deep breathing and coughing, and if it further limits chest excursions so that ventilation becomes ineffective.

Miller⁷⁰ reported that Patients often experience acute pain after thoracic surgery. Postoperative pain can keep patients from participating in expected activities such as deep breathing exercises and getting out of bed, which faster wellness and prevent postoperative complications. Adequate pain assessment and understanding of pain are essential components for providing satisfactory pain control and optimizing postoperative recovery.

As regard to effect of critical nursing care on pulmonary gas exchange among patients of postoperative thoracotomy, results of the current study revealed to be good. The current study show that the study group has better PH & lower paco₂ and higher pao₂, saO₂ compared to control group in the 2nd, 3rd day versus 1st day. Several factors may be relevance to improvement of arterial blood gases and respiratory function in study group are possible factor in that deep breathing and coughing, using incentive spirometry regularly may a barrier against the development of postoperative pulmonary complication, increase the area for respiratory exchanges of co₂ and o₂.

The current study is in line with Abd-Elkaream⁷¹ founded better improvement in the mean of saO₂ saturation, pao₂ and respiratory rate in study group compared with study group.

Pottery and perry⁷² mentioned that when the patient inhales and cough the volume of air moving in his lungs increased. the alveoli open, promoting good oxygen carbon dioxide exchange resulting improvement in pao₂ and saO₂.

Urden⁷³ and Kjaergaard⁷⁴ mentioned that Postoperative management includes accurate and frequent physical assessment, arterial blood gas analysis, continuous pulse oximetry, pulmonary care (including suctioning while the patient is intubated and coughing and incentive spirometry after extubation), early mobilization, and control of pain. Diabe Abdel-Fattah⁷⁵ emphasized that the importance of encouraging the patient to cough frequently, breath deeply and repositioning the patient every 2 hours for early re-expansion of the lung and facilitate drainage.

In the present study the assessment of respiratory system showed that there was a highly significance decrease pain with breathing and coughing, sputum production, dyspnea, and crackles on study group versus control group in the 2nd, 3rd day versus 1st day.

Celli *et al*⁷⁶ mentioned that patient should be assessed for respiratory rate, rhythm depth, clarity and presence of adventitious sounds including (crackles, rhonchi or friction rub) to ensure that air enters the alveoli. Bonde *et al*⁷⁷ founded that significant deference between groups in incidence of postoperative sputum retention which decreased in study group.

Lesley *et al*⁷⁸ found that Pain with breathing were lower on earlier postoperative days in study group during Coughing, moving or turning in bed, getting up, deep breathing or using the incentive spirometry.

Diabe Abdel-Fattah⁷⁵ emphasized that prophylactic chest physiotherapy should be initiated after chest tube insertion 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, five to six times per hour.

Smeltzer & Bare²³ reported that retained secretions are a threat to the thoracotomy patient after surgery. If the secretions are retained, airway obstruction occurs. This, in turn, causes the air in the alveoli distal to the obstruction to become absorbed and the affected portion of the lung to collapse. Atelectasis, pneumonia, and respiratory failure may result.

Smeltzer & Bare²⁰ reported that Coughing technique is another measure used in maintaining a patent airway. The patient is encouraged to cough effectively; ineffective coughing results in exhaustion and retention of secretions the patient should cough at

least every hour during the first 24 hours and when necessary thereafter. If audible crackles are present, it may be necessary to use chest percussion with the cough routine until the lungs are clear. After helping the patient to cough, the nurse should listen to both lungs, anteriorly and posteriorly, to determine whether there are any changes in breath sounds. Diminished breath sounds may indicate collapsed or hypoventilated alveoli.

Concerning to the effect of implementation of standard nursing care clearance of pulmonary complication has shown in the study group as compared to patients in control group which had increase body temperature, white blood count Also length of ICU hospital stay show significant increase. Also the consistency and amount of chest tube show significant increase in 2nd & 3rd day in control group versus study group.

Munro⁷⁹ mentioned that assessment of temperature is a basic important parameter to monitor .as an elevated temperature are signal that the patient response to infection. Gaini et al⁸⁰ reported that other method that are commonly used to detect response to infection are measurement of white blood cell count . Lindgren et al⁸¹ added that ventilated patients after thoracotomy have a significant risk of developing nasocomial infection as a result of suppressed immune function and the presence of artificial tube

Miller,⁷⁰ stated that patient who were undergoing cardiac surgery need to stay for 3-5 days in ICU postoperative

Tang et al⁸² emphasized that elevation of the head of the bed and effective hand hygiene are strategies for minimizing the duration of ICU stay .such strategies with application of standard nursing care prevent development of nasocomial infection

Mirmohammad-Sadeghi et al⁶¹ founded that in a study to assess the impact of the chest tube removal time following coronary artery bypass grafting surgery on the clinical outcome of the patients the mean time of intensive care unit stay was longer in the second group.

Avery⁸⁴ and Light⁸⁵ mentioned that the fluid level in the underwater seal drain should be checked regularly and the level of drainage marked on the bottle each time, as therapeutic decisions are based on the quantity of drainage and its color and consistency. Lawrence et al⁵⁷ reported that an important role of the nurse is to assess the chest tubes regularly every 2 hours for patency, fluctuation, a mount , consistency & character of drainage

Chest infection was not observed in study group after teaching using breathing, coughing exercises & incentive spirometry in the study group However, in control group 18 patient from 30 patient with the incidence 60% developed chest infection on 3rd day (coughing with sputum).they showed symptoms of respiratory pulmonary complication such as elevation

of temperature above 38 c ,increase pulse rate ,respiratory rate. Altered breath sounds, restlessness and change in sputum these elevation in vital signs are used as one of the indicator of respiratory infection. Pottery and perry⁷².

This results are in line with Gosselink⁸⁷ emphasized that rate of postoperative sputum retention are 30% of patient, temperature >38, increase WBC , sputum production. Varela et al⁸⁸. Stated that postoperative pulmonary complications are known to significantly increase intensive care bed days, hospital length of stay.

Several studied Wynne⁸⁹ and Pasquina⁹⁰ mentioned that Postoperative pulmonary complications are commonly Diagnosed by certain Criteria often include measures of oxygenation (such as PaO₂ or SpO₂), fever, white cell count, and presence of pulmonary infection (e.g. abnormal sputum production or changes in chest radiograph or changes in auscultation findings are often used as an outcome measure to assess the effectiveness of different postoperative interventions following thoracic surgery.

Reeve et al⁹¹ reported that following major surgery of the thorax there is overwhelming reduction of the vital capacity up to 55% of lung volume associated with postoperative pulmonary complications results from presence of chest drain associated with clinical manifestation such as slowing of mucociliary clearance and abnormal gas exchange, respiratory infection. Ganzale , et al⁹² found that physiotherapy are positively interfering with pain ,respiration & oxygen saturation and also reduce the postoperative pulmonary complications

The critical care nurse plays vital role in maintaining client normal respiration such as positioning to allow maximum chest expansion These enhance breathing and expectoration, as well as allowing full lung expansion and possibly preventing complications of prolonged immobilization, encouraging frequent position change ,encouraging deep breathing and coughing Keen et al⁹³ Joseph , et al⁹⁴

The prevention of postoperative complications should be on of the nurse's primary goals in caring for surgical patient .vigorous pulmonary care is necessary in the postoperative period after thoracic surgery to prevent complications, deep breathing and effective coughing technique .the most important activities that the postoperative thoracotomy patient can perform .The patient is informed that he will do breath & cough at least every one to two hours during the first 48 hours. It is very important because it help to re-expand collapsed lung tissue, move tracheobronchial secretions, improve pulmonary circulation and prevent stiffness of the lung Takaoka⁹⁵; Gardner⁹⁶ and Gordan⁹⁷

Critical care nurse are responsible for assessing life threatening conditions, instituting appropriate intervention and evaluation the outcomes of these interventions, critical care nurse also provide assessment and early recognition and management of complications while fostering healing and recovery Udwadia¹⁰

In addition to the previously discussed factor, absence of proper preoperative instructions regarding this maneuvers and its effect on minimizing postoperative pulmonary complications, fear of pain and heavy sedation postoperatively could provide a plausible explanation for these findings.

Based on the above mentioned discussion, it is apparent those 72 hours following thoracotomy, subjects in the study group showed better arterial blood gas and less respiratory distress and overall better pulmonary function

Conclusion

In conclusion from the above results postoperative breathing exercises using incentive spirometer as a prophylactic for patient after thoracotomy surgery.

Based on the finding of the current study, the following recommendations are suggested: Deep breathing by using incentive spirometer, investigate pain management among patient with chest tube should be made in a regular manner, repeat this research on a large sample size and in multicenters for generalization and Identify risk factors that contribute to increase the incidence of complications.

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12/20/2011