



## The Efficacy of Chest Physiotherapy on Ventilator Dependency and Length of Stay in Cardio Thoracic Intensive Care Unit: A Randomized Clinical Study

Authors

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### ABSTRACT

**BACKGROUND:** A majority of cardiac surgery is performed for ischemic coronary artery disease. Coronary artery bypass grafting (CABG) surgery is commonly performed via a median sternotomy. A significant reduction in lung volumes were reported in patients after Median Sternotomy performed during cardiac surgery. There is a reduction of FVC, FEV1, PEFR and SPO2 levels. Subsequently, abnormalities in the chest wall mechanics may also occur that may influence the reduced lung function. Chest physiotherapy, Deep breathing exercises, Incentive spirometry are used to improve lung capacity and is been reported to be effective in reducing ventilator dependency, length of hospital stay by improving lung function.

**SPECIFIC OBJECTIVE:** -To determine the effectiveness of chest physiotherapy on ventilator dependency and length of hospital stay in patients with thoracic surgeries.

**DESIGN:** - Pre test – Post test with Comparison group (Quasi experimental design).

**STUDY SETTING:-** Department of Cardio Thoracic and Vascular Surgery, Narayana Medical College Hospitals, Nellore.

**PARTICIPANTS:-** A Group A-15 participants received chest physiotherapy and deep breathing exercises, incentive spirometry (duration of 15-20 minutes /session for 3 sessions/ day) and Group B-15 Participants received deep breathing exercises, incentive spirometry (15 minutes/ session for 3 sessions/day) for 6 days total of 30 patients who underwent thoracic surgeries.

**OUTCOME MEASURES:-** FVC, FEV1, PEFR and SPO2

**RESULTS:-** The patients in chest physiotherapy with incentive spirometry, deep breathing exercises group, showing the mean difference in FVC, FEV1, PEFR and SPO2 levels were 3.81, 2.72, 485.3 and 98.5 respectively. The patients with incentive spirometry, deep breathing exercises alone, showing the mean difference of FVC, FEV1, PEFR and SPO2 levels were 2.26, 1.62, 429.1 and 96.6 respectively. The comparison of paired "t" test value is 2.34. The calculated value is more than the table value, so there is a statistically significant difference between the comparison of Group A and Group B.

**CONCLUSION:** This study reveals that there was significant difference of improvement in FVC, FEV1, PEFR and SPO2 levels following chest physiotherapy with incentive spirometry, deep breathing exercises when compared to deep breathing exercises, incentive spirometry alone in patients undergoing thoracic surgeries.

## INTRODUCTION

Most of the cardiac thoracic surgeries are done for ischemic coronary artery diseases, coronary artery bypass grafting (CABG) is commonly done by using of median sternotomy and the common grafts are long saphenous vein, internal mammary artery. the pulmonary complications are most commonly occurring postoperatively like atelectasis, decreasing in lung volumes and oxygenations. chest physiotherapy is given preoperatively to improve ventilation thus removing secretions from airways and avoiding the development of pulmonary complications and improve early mobilizations. Incentive spirometry is commonly used equipment and breathing exercises also used to improve oxygenation.

Dependency of ventilator support is related to the incidence of morbidity and increase in stay in ICU, and also shows effect on increasing time of hospital stay. So preoperative physiotherapy will increase the lung expansions and assist in early weaning. Soon after extubation physiotherapy is started as early as possible to maintain the bronchial hygiene and preventing the pulmonary complications. Physiotherapy interventions in CABG as deep breathing exercises, coughing splinted huffing and chest manipulations incentive spirometre may reduce the incidence of pulmonary complications.

Chest physiotherapy was initially aimed to improve ventilation by removing secretions from the airways. In an effort to increase lung volume following surgery. The pulmonary complications prevented by early chest physiotherapy mobilizations and positioning, techniques of bronchial hygiene. In order to prevent or diminish postoperative complications Physiotherapy treatment is often prescribed to patients undergoing cardiac surgery, the physiotherapy treatment generally consists of early mobilization, range of motion exercises during the hospital stay. Chest physiotherapy is prescribed to patients undergoing cardiac surgery in order to prevent or

reduce post-operative pulmonary complications. There is an agreement on the value of pre- and post-operative physiotherapy treatment. The value of postoperative chest physiotherapy has recently been established and accepted, but it is still unclear which treatment techniques are the most effective.

Incentive spirometry is used frequently as a component of postoperative pulmonary management. Studies evaluating the effectiveness of incentive spirometry in patients who have had cardiac surgery, however, have been unable to demonstrate the superiority of incentive spirometry (IS) over breathing exercise, early mobilization, or intermittent positive pressure breathing. In contrast, Oulton et al compared the use of physical therapy alone with the use of physical therapy and each of two incentive spirometers and found that the group using an device requiring a preset volume goal had superior results<sup>2</sup>.

## NEED FOR THE STUDY

Soon after the advent of open heart procedures, the contribution of Post-operative pulmonary complications and morbidity and mortality after median sternotomy was recognized and they were considered as major factors influencing the morbidity and mortality. Post-operative pulmonary complications was known to be due to distinct operative factors, but pain was considered as one of the most important factor influencing in post-operative pulmonary dysfunction and in developing a restrictive ventilatory pattern. Chest physiotherapy has been shown to be effective in the post-operative periods of various surgeries like CABG, Lung surgeries to improve the pulmonary function. Providing chest physiotherapy after thoracic surgeries has effect on pulmonary function is of good importance<sup>6</sup>.

## AIM OF THE STUDY

The aim of the study is to find out efficacy of Chest physiotherapy on ventilator dependence the length of stay in cardio thoracic intensive care unit

after thoracic surgeries in preventing pulmonary complications positive using on variables (forced vital capacity FVC and forced expiratory volume in one second - FEV<sub>1</sub>), respiratory muscle strength (RMS) and oxygen saturation (SatO<sub>2</sub>) in patients undergone thoracic surgeries.

## **METHODOLOGY**

### **STUDY DESIGN**

A comparative study (Quasi experimental design) involving pre and post test analysis with two groups -Group A and Group B.

### **SAMPLING METHOD**

Simple random sampling technique.

### **SAMPLE SIZE**

There were total of 30 subjects, 15 subjects in Group A and 15 subjects in Group B were studied.

### **SETTING OF SAMPLING**

All the study subjects were recruited from cardio thoracic Intensive care unit of Narayana Super Speciality Hospital, Nellore.

### **SAMPLING CTITERIA**

#### **Inclusion criteria**

- Both male and female subjects, Age group ranged between (40-70) years
- Subjects selected with all cardio thoracic surgeries
- All of the subjects did not receive any physiotherapy exercise protocol
- Subjects with Left ventricular ejection fraction between 40 and 75%.

#### **Exclusion criteria:**

- Subjects with age less than 20 years and above 60 years.
- Subjects weight exceeding ideal weight by more than 20%.
- Subjects who are severely ill
- Subjects with high LV dysfunction
- Subjects with post operative respiratory treatment exceeding 20 hours.
- Subjects who were incubated longer than 72 hours following arrival in the cardiovascular intensive care unit

**TOOLS:** PFT values, Pulse oxymetry, Stethoscope, Incentive spirometer

**DURATION OF THE STUDY:-** 2 months

### **DATA COLLECTION PROCEDURE**

30 subjects were selected on the basis of inclusion and exclusion criteria. All the study subjects were divided equally into two groups, that is group A and group B. Each group consisted of 15 subjects, the study procedures were explained to the relatives of the clients and informed consent was obtained prior to study. Before starting the training session, pre - test scores were measured by using a PFT values. And Subjects in Group A (n=15) received chest physiotherapy, deep breathing exercises, and incentive spirometer. Subjects in Group B (n=15) received only deep breathing exercises and incentive spirometer along with routine care.

At the end of each session post test scores of both groups were taken by using respiratory assessment tool.

### **PROCEDURE**

Before started the main study, ethical clearance was obtained from the ethical committee of Narayana Super Speciality Hospital, Nellore. All subjects who fulfilled the inclusion criteria were explained about the study and a written consent was taken. Study subjects were randomly allocated and assigned into experimental and control group and each group being assigned with 15 subjects.

#### **Interventions**

Group A received chest vibration, percussion, shaking, deep breathing exercises, and incentive spirometer from day1 to day6. Duration of the session was 15-20 minutes. Group A was under gone chest physiotherapy along with positioning from mechanical ventilated to extubation and to till discharge where as group B was with only positioning. Soon after the extubation Group A was adding incentive spirometry and deep breathing exercises along with chest physiotherapy and Group B was adding incentive spirometry and deep breathing exercises alone. At

end of the day post test was conducted to the both groups by using the PFT, PEFR and SP02.

Intervention protocol

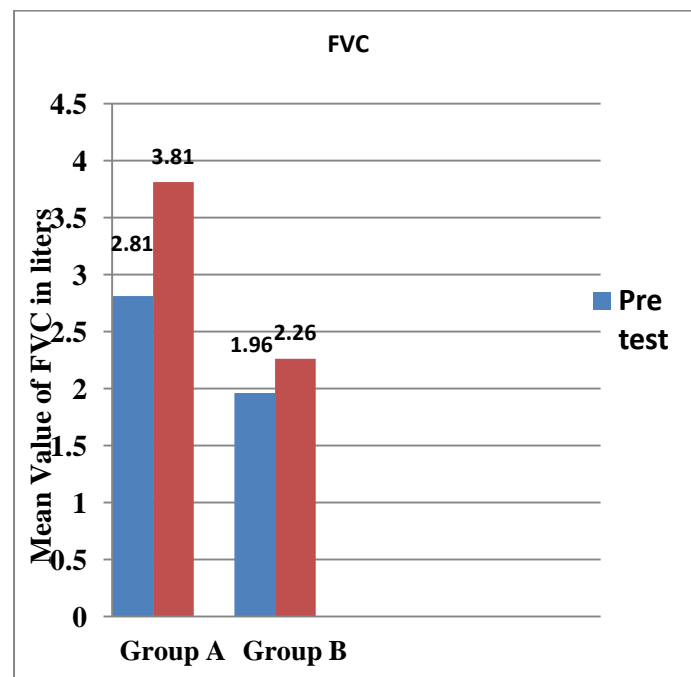
Duration per session: 15-20 minutes/ session for Group A and B

No. of sessions per day: 3sessions

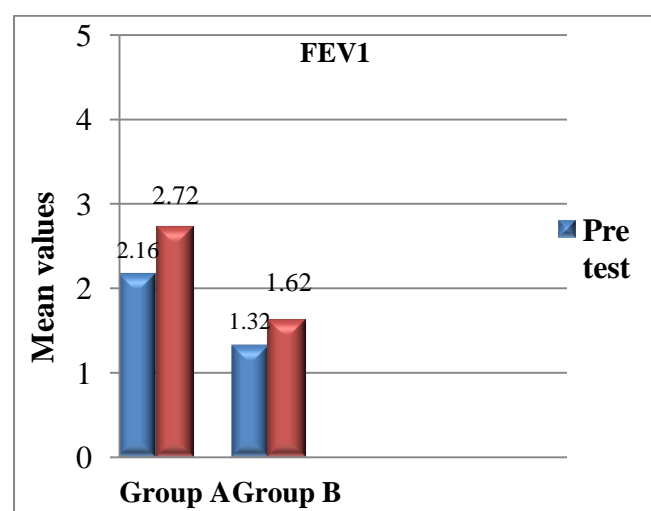
Duration of the study : 2 months

Outcome measures: FVC, FEV1, PEFR, SPO2

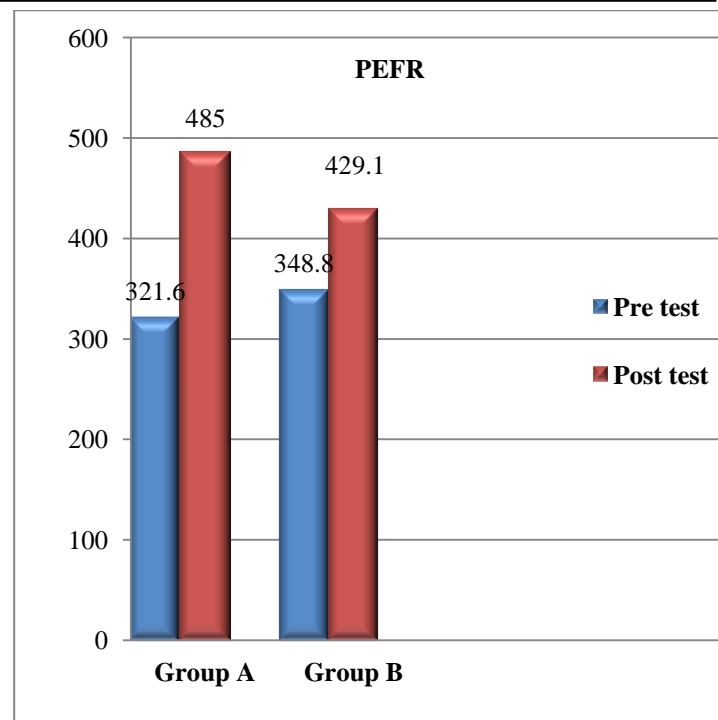
## DATA ANALYSIS AND INTERPRETATION



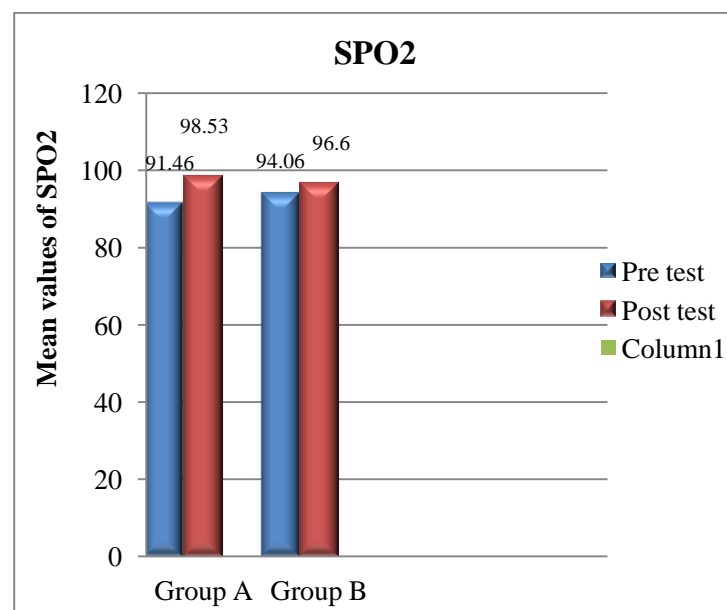
**Figure 1:** Pre Test and Post Test Mean Values of Forced Vital Capacity (FVC) For Group A and Group B



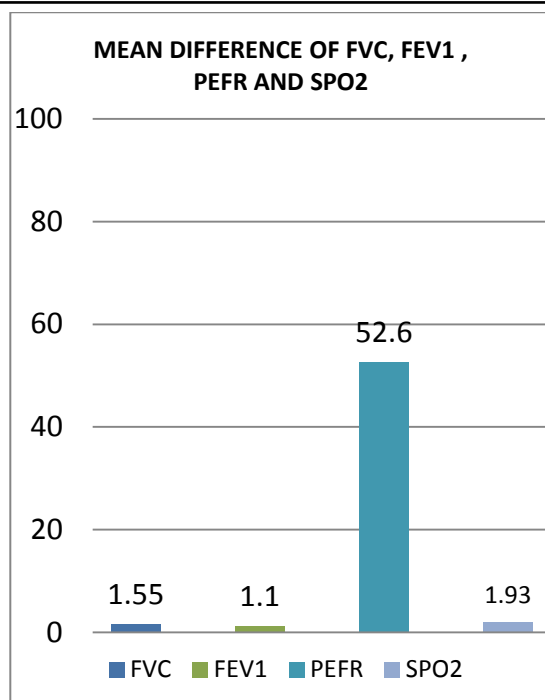
**Figure 2** Pre Test and Post Test Mean Values Of Forced Expiratory Volume in One Second (FEV1) For Group A and Group B



**Figure 3:** Pre Test and Post Test Mean Values of Peak Expiratory Flow Rate (PEFR) For Group A and Group B



**Figure 4:** Pre Test and Post Test Mean Values of Oxygen Saturation (SPO2) For Group A and Group B



**Figure 5:** Post Test Mean Difference of FVC, FEV1 and PEFR and SPO2 between Group A and Group B (n=30)

## RESULT

The study was conducted in 30 patients were selected based on the inclusion criteria among 30 patients 15 patients were assigned to Group A (Chest physiotherapy, deep breathing exercises, incentive spirometry). 15 patients were assigned to Group B (Deep Breathing exercises, incentive spirometry). PFT values were used to assess the patient's ventilator dependency level. The purpose of the study was explained. The data was analyzed by using the descriptive and inferential statistics and tabulated according the objectives and hypothesis of the study. The findings were discussed based on the demographic characteristics and objectives of the study.

## STUDY RESULTS:

### FORCED VITAL CAPACITY

- The mean value of pre intervention in Group A, who received chest physiotherapy (percussion, vibration) with deep breathing exercises, incentive spirometry is 2.81, whereas post intervention value increased to 3.81. The paired 't' value is 5.0 ( $p < 0.001$ ).

- The mean value of pre intervention in Group B, who received deep breathing exercises, incentive spirometry alone, is 1.96, whereas post intervention value increased to 2.26. The paired 't' value is 0.001 ( $p < 0.001$ ).

### FEV1

- The mean value of pre intervention in Group A, who received chest physiotherapy (percussion, vibration) deep breathing exercises, incentive spirometry, is 2.16, whereas post intervention value increased to 2.72. The paired 't' value is 0.002 ( $p < 0.001$ ).
- The mean value of pre intervention in Group B, who received deep breathing exercises, incentive spirometry alone, is 1.32, whereas post intervention value reduced to 1.62. The paired 't' value is 0.001 ( $p < 0.001$ ).

### PEFR

- The mean value of pre intervention in Group A, who received chest physiotherapy (percussion, vibration) deep breathing exercises, incentive spirometry, is 321.6, whereas post intervention value increased to 485.3. The paired 't' value is 4.58 ( $p < 0.01$ ).
- The mean value of pre intervention in Group B, who received deep breathing exercises, incentive spirometry alone, is 348.8, whereas post intervention value reduced to 429.13. The paired 't' value is 9.39 ( $p < 0.01$ ).

### SPO2

- The mean value of pre intervention in Group A, who received chest physiotherapy (percussion, vibration) deep breathing exercises, incentive spirometry, is 91.4, whereas post intervention value increased to 98.5. The paired 't' value is 1.50 ( $p < 0.01$ ).
- The mean value of pre intervention in Group B, who received deep breathing exercises, incentive spirometry alone, is



94.06, whereas post intervention value reduced to 96.6. The paired 't' value is 6.54 ( $p < 0.01$ ).

### MAIN FINDINGS

- The improvement of FVC in Group A (3.81) is higher than Group B (2.26).
- The improvement of FEV1 in Group A (2.72) is higher than Group B (1.62).
- The improvement of PEFR in Group A (485.3) is higher than Group B (429.1).
- The improvement of SPO2 levels in Group A (98.5) is higher than Group B (96.6).
- The mean difference of FVC, Pain and Atelectasis between Group A and Group B is 0.42, 1.87 and 0.53 respectively and their corresponding independent 't' value is 5.73, 4.88 ( $p < 0.01$ ) and 2.13 ( $p < 0.05$ ) respectively.

### DISCUSSION

From the above data it is clearly understood that a combination of chest physiotherapy along with deep breathing exercises and incentive spirometer is much more efficient than deep breathing exercises, incentive spirometry alone to improve the FVC, FEV1, PEFR and SPO2 in patients to reduce the ventilator dependency and length of hospital stay.

The present study mainly focused on providing chest physiotherapy along with Deep Breathing exercises, Incentive Spirometry in order to improve the FVC, FEV1, PEFR and SPO2 levels. Patients in both groups have shown a significant improvement in FVC, FEV1, PEFR and SPO2, but Chest Physiotherapy along with Deep breathing exercises and incentive spirometry group showed a better improvement when compared to group with Deep Breathing exercises, incentive spirometry alone. One important finding of this study was that, patient who received Chest physiotherapy along with deep breathing exercises and incentive spirometry had a better and early mobility and also had a better ventilatory pattern and ability to cough when compared with other group.

R Gosselink, conducted a study on "efficacy of chest Physiotherapy in the cardio thoracic intensive care unit to reduce ventilator dependency and reduce duration of hospital stay". It concluded that chest physiotherapy is more effective in improving lung functions and early extubation of the patients<sup>24</sup>. Malkoç did a study on total of 510 patients who were hospitalised in the ICU were included in the study. The results shows that the length of stay in the ICU was significantly lower in the intervention group than in the control group ( $P < 0.05$ ). So physiotherapy has a great impact on ventilatory dependency and length of stay in the ICU<sup>25</sup>.

In this current study provided Deep breathing exercises, incentive spirometry for both groups and the Chest physiotherapy was added only to one group to compare the results. Some duration Chest physiotherapy was applied to find its effect on FVC, FEV1, PEFR and SPO2 in patients to reduce the ventilator dependency and length of hospital stay. The results of my study showed that there is a significant improvement in FVC, FEV1, PEFR and SPO2 following Chest physiotherapy with deep breathing exercises, incentive spirometry when compared to deep breathing exercises, incentive spirometry alone.

### CONCLUSION

This study concluded that Chest physiotherapy with deep breathing exercises, incentive spirometry and breathing exercises, incentive spirometry alone to improve the FVC, FEV1, PEFR and SPO2 in patient's undergone thoracic surgeries and ventilator dependency, length of hospital stay.

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