

# Effects of Pre-Surgical Education and Physical Therapy Training for Dyspnea Prevention in Patients Undergoing Valvular Cardiac Surgery

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## ABSTRACT

**Objective:** To evaluate the Effects of Pre-operative education and physical therapy training for dyspnea prevention in patients undergoing valvular cardiac surgery.

**Methods:** A Prospective RCT was performed on sample size of 40 patients of cardiac valvular disease that were obtain from Faisalabad Institute of cardiology. At the time of admission, all patients were tested by baseline dyspnea index then the subjects were randomly assigned into two groups by computerized random generator. Both groups were having education but treatment group were having additional breathing exercises and functional tasks for 10 minutes in 1st week regularly and 1 hour in 2nd week regularly. Each group were tested again by BDI after the treatment on second post-op day. Tracheal extubation and eye-opening time were also noted as outcome measures of study. Results were compiled on SPSS.20 for finding post-operative dyspnea.

**Results:** Pre-operative and post-operative findings showed that the patients of treatment group performed better than control group as the effects of pre-operative treatment on dyspnea by total baseline dyspnea index is significant ( $p < 0.05$ ) as well as the treatment group had significant reduction in eye-opening and tracheal extubation time in comparison of control group having ( $p < 0.05$ ).

**Conclusion:** The results shows that in patients of valvular cardiac surgery, pre-surgical education and physical therapy training showed significant reduction in post-surgical dyspnea, tracheal extubation and eye-opening time.

**Keywords:** Valvular cardiac surgery, physical therapy training, presurgical education, cardiopulmonary physiotherapy, baseline dyspnea index, rehabilitation.

## INTRODUCTION

Cardiac diseases often cause respiratory distress that is consider as dyspnea. Dyspnea is defined as the unpleasant sensation of breathing. It is the most common symptom in cardiopulmonary diseased patients (1).

The heart of human being is a hollow muscular organ containing 4 compartments i.e., left and right atria, left and right ventricle, which involve in pumping the blood efficiently. Human heart contains four valves, aortic and mitral valve on left side and tricuspid and pulmonary valve on the right side (2).

The prevalence of valvular disease is about 2.5 percent in the developed countries. After the age of 65 years, the valvular heart disease occurred more commonly especially aortic stenosis and mitral regurgitation due to the degenerative causes (3).

The dyspnea prevalence in 15 countries all around the world is 27 percent. Some studies show less prevalence of dyspnea but reason behind this is that many patients neglect to outline dyspnea as they don't consider it worth reporting. Regardless to its prevalence and powerful sensation, dyspnea is often overlooked. Dyspnea can be used for the prediction of morbidity and mortality (4).

The WHO stated that since 2020, the cardiac disease will be the main cause of mortality in entire world. According to its estimation, 25 million people will be suffering from cardiac disease every year. About one-third of population are suffering from heart diseases in US. In Taiwan, heart diseases is the main cause of death from 2008 (5).

Pulmonary complications are a major cause of complications that occur after the cardiac surgery. Pulmonary complications can be lessened by adopting preoperative exercise, surgical, anesthetic and critical care. In addition, Minimally invasive surgery and non-bypass techniques can improve such complications (6).

Cardiac surgery is a highly complicated method, which can cause decrease in lung function and also reduce the strength of inspiratory muscles. After cardiac surgery, number of complications are observed especially in the respiratory system. The inspiratory muscle training and early mobilization is effective to improve functional status and strength of respiratory muscles(7).

After the cardiac surgery, postoperative infection is the most common complication. There are many underlying illnesses or conditions (diabetes mellitus, COPD) that are the risk factors for postoperative pulmonary complication that should be treated or prevented. Inspiratory muscle training is beneficial in reducing the postoperative pulmonary complications after cardiac, upper abdominal and other type of invasive surgery(8).

For the severe valvular heart diseases that cannot be treated by the medicine, valvular surgery is an effective treatment. Valvular heart surgery can prolong the life of valvular heart diseased patient and also improves the QOL. After this surgery, functioning of the muscles that are involved in respiration is compromised. Furthermore, the anesthesia which is given during operation also affects the efficiency of cough and ventilatory functioning, which may lead to the pulmonary complications. The most common

pulmonary complications after the valvular surgery are atelectasis, Pneumonia, bronchitis, pneumothorax, bronchospasm and increased chronic lung disease. Individualized exercise prescription performed before surgery reduce the pulmonary complications and also reduce the length of stay in hospital (9).

Cardiovascular diseases are one of the leading causes of the death so the services provided to the patient should be affordable. Preoperative treatment applied to patients include DBE, inspiratory muscle training, early mobilization and awareness etc. The aim of these exercises is to reduce PPCs and length of stay in hospital (10).

Diaphragmatic breathing causes the diaphragmatic contraction, deep respiratory inspiration and expiration and also the belly expansion, as a result of which the frequency of respiration decreases and the volume of gases in blood increases. Diaphragmatic breathing is positively associated with the meditations. It is physiologically evident that there is a reduction in BP, increase in HR variability and oxygenation, enhance the functioning of the lungs, improvement in cardio respiratory fitness and also the strength of respiratory muscle by even a single breathing practice. Breathing training of 15 minutes for two weeks on daily basis promotes mean forced expiratory volume in 1 second & expiratory flow rate on peak(11).

The respiratory phase-driven variations in stroke volume, venous filling, peripheral blood flow and cardiac output cause variations in heart rate and blood pressure. At rest, there is increase in venous return during inhalation is equal to increase in the cardiac output& heart rate, which also affects the arterial blood pressure. It is known since long that heart rate increases during inhalation whereas arterial blood pressure decreases during expiration and vice versa. The variations in CVS may cause alteration in the respiration. The effects that are produced by the respiration on cardiovascular system are stronger and long lasting (12).

Physical therapy performed before surgery improve the patient's functional & physiological capacities and prepare the patients for surgical stress and lessen the risks of medical problems that can be caused by the surgery (13).

Although the valvular cardiac surgery is the common surgery throughout the world, Valvular cardiac surgery patients are the neglected population in rehabilitation. There has been limited study and literature available on the outcomes of pre-surgical education and physical therapy training for heart valve surgical patients. This study was conducted to determine the effect of pre-operative education and physical therapy training on dyspnea in patients undergoing valvular cardiac surgery.

## METHODOLOGY

An experimental study of RCT was performed on both male and female in age range of 18 to 50 years on sample size of 40 diagnosed patients of cardiac valvular disease. Two groups from sample were formed naming Group A and Group B, informed consent of each was taken. The duration of study was 4 months for the collection and analysis of data along with interpretation of results. The

inclusion criteria include patients of aortic valve repair/replacement for aortic regurgitation or stenosis, mitral valve repair/replacement for mitral regurgitation or stenosis, or other cardiac valvular procedure, patients with NYHA class 1 to 3 and with  $\geq 2$  week surgical waiting list time, while patients with past history of CABG and other cardiac surgeries, pregnancy, Severe heart failure, diagnosed unstable angina, diagnosed neurological illness, diagnosed respiratory diseases, hospital acquired pneumonia and patient who were not able to perform prehabilitation program were excluded. Baseline dyspnea index (BDI), tracheal extubation time and eye-opening time were used as a measurement tool.

**The Null Hypothesis was defined as:** "There is no effect of pre-surgical education and physical therapy training on dyspnea in patients undergoing valvular cardiac surgery."

**The Alternative Hypothesis was defined as:** "There is effect of pre-surgical education and physical therapy training on dyspnea in patients undergoing valvular cardiac surgery"

Baseline assessment were taken after general description of research protocols that include the baseline dyspnea index (BDI) for dyspnea measurement. Post treatment assessment were taken by BDI on second day after operation. General education and counseling were given to patients of both treatment and control group. The patients in treatment group additionally performed diaphragmatic breathing, pursed lip breathing and deep breathing exercises, meditations and functional tasks regularly for two weeks. For first week, treatment group was given pursed lip breathing (5 minutes) & Diaphragmatic breathing (5 minutes) once a day, while in second week, treatment group was given deep breathing, medication stress management, pursed lip breathing and diaphragmatic breathing for one hour with rest intervals according to patient condition, once a day along with the functional task that include in and out of bed with 2-5 repetitions, 3-5 times per week. Data was analyzed with SPSS version 20 and Independent sample T-test was used for between group analysis to find out the effectiveness of pre-operative treatment. The P value of  $<0.05$  or  $0.05$  was considered statistically significant.

## RESULTS

A total 40 participants recruited to this study with 52.50 % (n=21) females and 47.50 % (n=19) males. Mean age of the patients was  $X = 34.63 \pm 10.982$ . The minimum age of participant was 18years and maximum age was 50 years. Out of total 40 participants, 27 were the patient of MVR, 4 were the patients of AVR and 9 were the patients of DVR. The Table-I summarizes the overall results of BDI of both groups. The results of this study demonstrated that there was significant improvement in treatment group as pre-treatment total baseline dyspnea index grades of experimental group (Mean $\pm$  SD) ( $5.80 \pm 1.673$ ) while after treatment were improved to ( $10.5789 \pm 1.16980$ ). Pre-surgical physical therapy proved to be effective in term of greater reduction in mean value of tracheal extubation time of control group ( $6.90 \pm 1.447$ ) to experimental group ( $5.21 \pm 1.512$ ) as well as mean value of eye-opening time in control group ( $5.70 \pm 1.380$ ) was reduced to ( $4.11 \pm 1.524$ ) of experimental group.

Table 1: pre Treatment and post Treatment change in BDI with p value

Measure	Group	Pre-Treatment	Post- Treatment	P. Value
	Control	5.80±1.542	6.9500±1.57196	0.000
	Experimental	5.80±1.673	10.5789±1.67980	0.000

Table 2: Statistical analysis for tracheal extubation and eye-opening time with p value

Measure	Group	Mean	Std. Deviation	P. Value
Tracheal extubation time	Control	6.90	1.447	0.0001
	Experimental	5.21	1.512	0.001
Eye opening time	Control	5.70	1.380	0.002
	Experimental	4.11	1.524	0.002

Analysis was done using independent sample t test which showed significant results of all experimental groups with p value less than 0.005 ( $P < 0.05$ ). There was greater reduction in dyspnea in valvular cardiac surgery patients along with early tracheal extubation and eye-opening time due to pre-operative education and physical therapy training.

## DISCUSSION

This study was principally designed to determine the effectiveness of pre-operative physical therapy on valvular cardiac surgery patients. The present study showed significant prevention in post-operative dyspnea in treatment group through the duration of two weeks, in whom supervised exercises has been performed before surgery on regular bases. Early eye opening and tracheal extubation also occurred because of pre surgical education and physiotherapy training. Alternative hypothesis is true and accepted in study. Similar kind of findings have been reported by Snowden, Haines (14) who concluded their research with the statement that preoperative treatment reduce the post-surgical complications, reduce the tracheal extubation time and length of hospital stay in cardiac surgery patients. But in their study, they include different cardiac diseases, CABG and valvular cardiac surgery patients as well as their focus is on all post-operative complications, not specifically dyspnea.

Rosenfeldt, Braun (15) documented that the preoperative treatment in the hospital setting for two weeks is not enough to provide any benefits in cardiac surgery patients. According to his study, future researches for longer duration and on high-risk patients may provide significant improvement in quality of life.

Hulzebos, Smit (16) has also stated the same results that the pre-surgical physiotherapy decreases the risk of post-surgical pulmonary complications and hospital stay in cardiac surgery patients but there is no evidence on prolonged mechanical ventilation and causes of mortality.

## CONCLUSION

It is concluded that pre-surgical physical therapy exercise program, supervised by physiotherapist along with education of patients is effective in significant reduction of post-surgical dyspnea, tracheal extubating and eye-opening time in valvular cardiac surgery patients.

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