

Effects of preoperative exercise programme in hospitalised patient's undergoing mitral valve replacement surgery

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ABSTRACT

Objective: to evaluate the effect of preoperative exercise programme in mitral valve replacement surgery in decreasing the incidence of ppcs, increasing the pulmonary function and decreasing the hospital stay. **Methods:** 30 subjects participated in the study. Subjects were randomly assigned into 2 groups: pre-operative exercise program and usual care (n=15 in each group). 3 days pre-operative exercise program was given to the group 1. Outcome measures were ppc, hospital stay and pulmonary function test and 6 minute walk test. **Results:** paired t-test was used for within group comparison of pretest and post test measurement and again t-test was used for between group comparisons of the 2 groups. The result of the study showed that the group receiving preoperative physical therapy had shown significant reduction in hospital stay and ppc although there is no significant change in terms of pft. **Conclusion:** it is recommended that preoperative exercise program should be included as a part of the treatment protocol in the rehabilitation of mitral valve surgery patients.

Key words: preoperative exercise program, preoperative patient education, ppc, hospital stay, mitral valve replacement surgery.

INTRODUCTION

Surgical treatment of rhd patients involves replacement of damaged heart valve with mechanical or bioprosthetic mitral valves. During cardiac surgery, the use of general anesthesia and muscle paralysis, mechanical ventilation and thoracotomy substantially influence lung function.⁶ causing changes in lung volume, diaphragmatic dysfunction, respiratory muscle strength, pattern of ventilation, gas exchange, and the response to carbon dioxide and oxygen concentrations^{1,2,3}. As a consequence of these changes, patients undergoing cardiac surgery

have an increased risk of postoperative pulmonary complications (ppcs), which lead to increased postoperative morbidity and mortality,^{4,5} increased use of medical resources, longer hospital stay,^{4,5,6} and increased health care costs.

as a result of the generally high incidence of these complications (including mortality) and the high costs of hospitalization, efforts have been made during the last decade to identify those patients who have a higher chance of developing such complications^{4,7} and to find ways to prevent their development^{4,7}. Considerable effort has been put into preventing and treating ppcs, but there is no consensus on the most appropriate or effective remedy. Controversy exists concerning the possible overuse and abuse of many of the therapeutic modalities commonly used for the prevention and treatment ppcs.^{8,9}

physical therapy was usually given after the operation, whereas the preferred strategy is to identify, on the basis of known risk factors, and treat patients who might benefit the most from physical therapy before surgery¹⁰. A few studies

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have demonstrated that preoperative physical therapy in cardiac surgery¹¹ has advantages over postoperative care alone¹¹. The effects of these programs in decreasing the incidence of ppcs, increased the pulmonary function and decreased the hospital stay and identifying those patients who might benefit from these programs, i.e. All patients or only high-risk patients, have not been proven indisputably¹².

Objective of the study: to assess the effect of preoperative exercise programme in hospitalized patients undergoing mitral valve replacement surgery.

statement of the question: does preoperative exercise programme prevent ppc, decrease the hospital stay, increase 6 minute walk distance and improve lung function in patients undergoing mitral valve replacement surgery?

METHODS

Thirty patients both males (18) and females (12) with mean age of 41 years were included in the study on the basis of inclusion and exclusion criteria.

Inclusion criteria

1. Patients who were planned for elective MVR.
 2. Age group between 30-60 years, including both genders (male/ female).
 3. Co-operative and motivate
 4. No history of musculoskeletal and neurological disorder
- Exclusion criteria:
5. Emergency surgery,
 6. Left ventricular ejection fraction (LVEF) < 35%
 7. Multiple valve replacement surgery.

Method of assigning subjects: subjects were randomly divided into two groups.

Group-1 (experimental group) received both pre operative exercise programme and post operative cardiac rehabilitation programme.

Preoperative exercise programme: total 30 min daily for 3 days which includes

1. Incentive spirometry : 10 repetitions × 3 sets × twice daily ,
2. Forced expiratory techniques : 5 repetitions × 3 sets × twice daily
4. Patient education (aboutpostoperativecardiac rehabilitation).
5. Post-operative intervention: cardiac rehabilitation

Group-2 (control group) :preoperative intervention: patients in this group were received usual care.⁽²⁾ post-operative intervention: cardiac rehabilitation.

Study design

A different subject pre test and post test design was taken in which the dependent variables (6mwt, pft) were measured 3 days before surgery and on 7th postoperative day.

Dependent variables

Following variables were measured three days before surgery and again on seventh postoperative day.

1. Forced vital capacity (FVC)
2. Forced expiratory volume in one second (FVC)
3. FEV1/FVC
4. FEF₂₅₋₇₅
5. Six minuit walk distance (6MWD)
6. Rate of perceived exertion (RPE)
7. Postoperative-pulmonary complications (PPCs)
8. Length of hospital stay (LOS)

Protocol

A subjective cardiovascular assessment was done prior to selecting patients for study. Subjects who were found suitable based on inclusion criteria for participation were requested to fill up a consent form seeking their willingness to participate in study. After taking the total cardio-pulmonary assessment the 6mwt & pft will be

performed on 3 days before surgery. After enrolment subjects were randomly (first cum first basis) divided into two groups.

Patient subjective assessment and spirometry measurement 6mwt were obtained, 3 days prior to surgery. All spirometry tests were performed with the patient in sitting position according to its standard guidelines.⁹⁰ the measurements were repeated at least three times and the best recorded results were used as data. The spirometry was again repeated on 7th postoperative day. The following variables were recorded preoperatively and post operatively FVC, FEV₁, FEV₁/FVC, and FEF₂₅₋₇₅%.

Six minute walk test was also conducted preoperatively 3 days before surgery and at the 7th postoperative day.

The ppcs grading and total hospital stay (HOS) were recorded on 7th postoperative day. PPCs were recorded from the postoperative notes on the basis of criteria ²⁶

Hospital stay were recorded from the nursing notes (ICU stay + ward stay) ²⁶

Statistical analysis

Statistical calculation was done by using scientific package for social sciences (windows version-15.0, SPSS chicago. IL, USA).

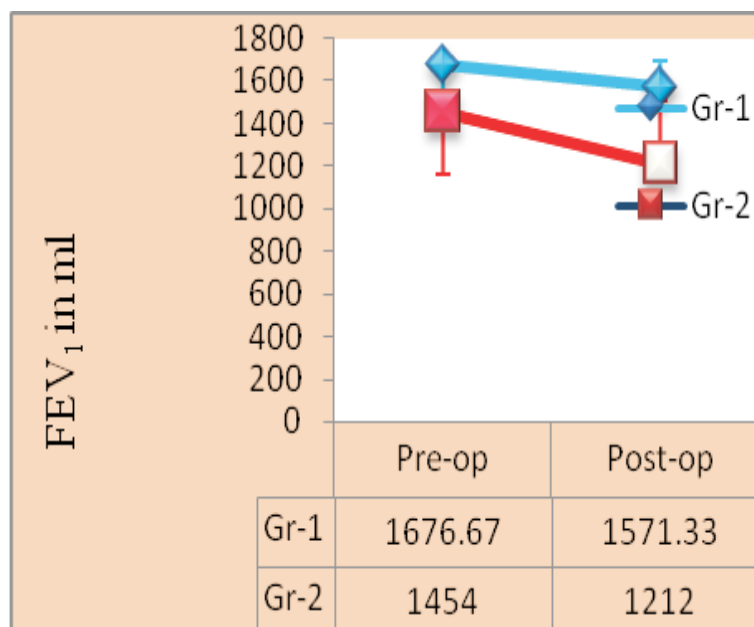
RESULTS

Pre and postoperative between group analysis at baseline between group comparison by independent t- test showed that, there is no significant difference in between groups. At post operative day-7, independent t-test results revealed fev₁ of group a was significantly different than the group b (p = 0.002). Ppc's was also found to be statistically different (p = 0.005). Los was also found to be statistically different (p = 0.000).

FEV₁ between group comparison

The between group comparison was done by independent t-test. The value indicates that there

Figure 1: between group comparison of FEV₁



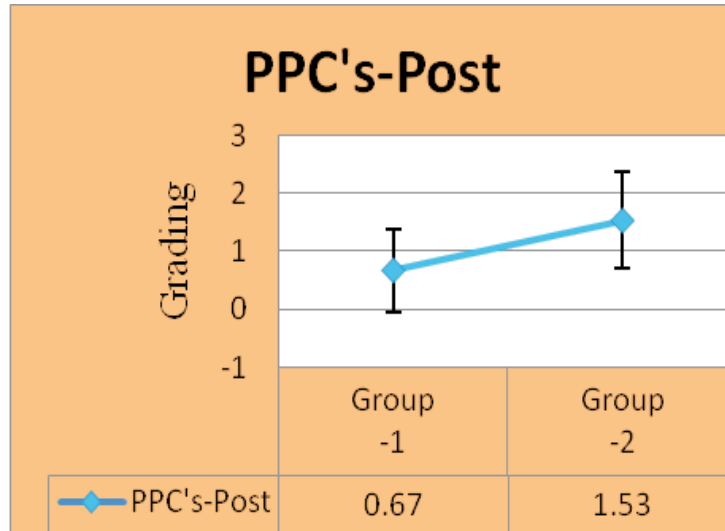
is a statistically significant between group-1 and group-2 (p = 0.02)

Comparison of ppc's between groups the between group comparison was done by independent t-test. The value indicates that there

is a statistically significant between group-1 and group-2 (p = 0.005).

The between group comparison was done by independent t-test. The value indicates that there is a statistically significant between group-1 and group-2 (p = 0.000).

Figure 2: between groups comparison of PPC's Comparison of hospital stay between Groups



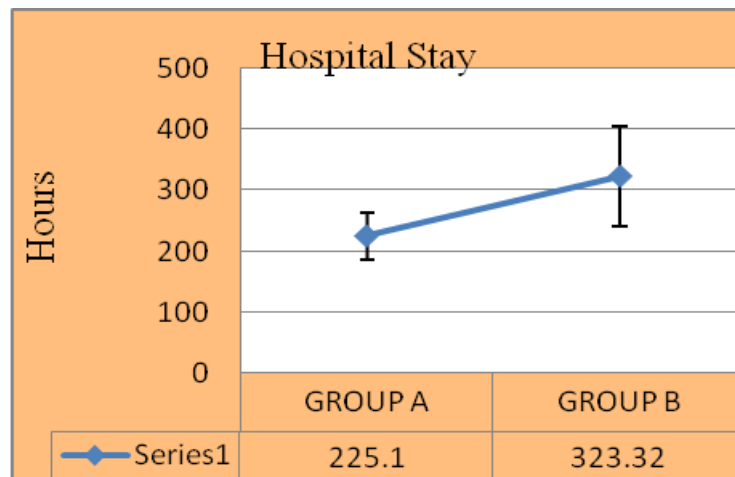
Comparison of FVC, FEV1/FVC, FEF25-75, RPE, 6MWD between groups

The between group comparison was done by independent t-test. The value's indicates that there is no statistically significant between group-1 and group-2, FVC (p = 0.065), FEV1/FVC (p = 0.157), FEF25-75 (p = 0.149), RPE (p = 0.149), 6MWD (p = 0.189).

DISCUSSION

This study was designed to determine the effect of preoperative exercise programme on pulmonary function, PPC's, hospital stay and 6MWD in patients undergoing valve replacement surgery where in the experimental group was given preoperative exercise programme for 3 days

Figure 3: Between groups Comparison of Hospital Stay



and control group was given usual care one day before surgery. The demographic variables (age, height, weight, BMI) of all patients were not found statistically significant(0.560, 0.281, 0.790,

0.689), thus showed both the groups were comparable.

The results from the study revealed that there were significant differences in the length of

Figure 4. Measurement of pulmonary function using spirometer**Figure 6: Patient performing shoulder ROM exercises (Post-operative)****Figure 5: Patient performing incentive spirometer (Post-operative)**

hospital stay and PPC as measured at post operative periods. This study showed that the experimental group is found to be better than control group in terms of reduction of PPC's and hospital stay.

In the present study, a reduction in the hospital stay can be observed among the patients of the Intervention group. The mean hospital stay of experimental group is 225.10 ± 38.42 hours and control group is 323.32 ± 81.42 hours. The mean difference of 98 hours is observed in experimental group, when compared with the control group ($p = 0.000$). A reduction in the hospital stay was

also observed by Stein & Cassara⁹⁴ who reported a reduction in the hospital stay of patients who received physiotherapy in the preoperative and postoperative periods, when compared with the patients who did not perform physiotherapy. Semanoff et al⁹⁵ also reported a reduction in the hospital stay for those patients who received two or more sessions of physiotherapy (ventilatory exercises, cough and precocious mobilization, as well as information about postoperative procedures) in the preoperative period of cardiac surgery. They observed that patients submitted to valve surgery who received information in the

preoperative period were discharged eight days before those who were not treated with respiratory physiotherapy in the preoperative period. Additionally, Celli et al.¹³ reported a reduction in the hospital stay in the group who received guidance on ventilatory exercises (9.6 ± 3.2 days in hospital) in relation to a Control Group (13 ± 5 days in hospital). In a study performed by Healy et al.¹⁴ with 321 patients, in which 181 received instructions (ventilatory exercises with deep inspiration, coughing, specific explanations about the surgery in the preoperative and postoperative periods) and 140 patients who did not receive any kind of intervention, the hospital stay was reduced by three to four days for the group of instructed patients. The decrease in hospital stay can be explained on the basis of reduction in anxiety¹⁵ and adverse psychological¹⁵ results by the administration of pre-op exercise and education. There is also a reduction in the PPC's by the pre-op exercise which in turn leads to reduction in the hospital stay. In the present study the incidence of postoperative pulmonary complications was investigated and analysed. A reduction in the PPC's can be observed among the patients of the Intervention Group, when compared with the control group ($p = 0.05$). Eight patients of the investigation group and thirteen patients of the control group developed some kind of postoperative pulmonary complications. Additionally it was seen that patients of the control group had a greater incidence of postoperative pulmonary complications. There is a statistically significant difference between groups. Six patients in the intervention group and four patients in the control group developed grade-I postoperative pulmonary complications according to our PPC's criteria. Two patients in the intervention group and eight patients in the control group developed grade-II postoperative pulmonary complications according to our PPC's criteria. One patient in the control group developed grade-III postoperative pulmonary complications and none of the patients in the intervention group developed grade-III postoperative pulmonary complications. One patient in the intervention group and four patients in the control group developed clinically significant postoperative pulmonary complications according to this PPC's criteria. The results of this study are supported by Heray et al

¹⁷ also reported a reduction in PPC's (pneumonia) for those patients received pre and post operative cardiopulmonary rehabilitation when compared with the patients who received usual care. The reason for the same as given by him is that the pre-op lung expansion exercises leads to an increase in the mobility of the diaphragm¹⁶. Exercise during pre-op period also leads to reduction of the dysfunction of respiratory muscle caused by the effect of surgery. This dysfunction could lead to a reduction in the VC, TV and TLC²³. It also helps the patient in doing the post-op exercises effectively as they remember how to do it¹⁸. The effect of all these things in conjunction can explain the reduction in PPC. The proper ventilation in the lung will also reduce the incidence of atelectasis.

In the present study the reduction of the pulmonary volumes can be observed in both the Intervention and Control Groups especially from the preoperative period to the 7th postoperative day. A significant difference can be observed in terms of FEV1 among the patients of intervention group, when compared with the control group ($p = 0.02$). There is no significant difference in terms of FVC (0.065), FEV₁/FVC (0.157), FEF₂₅₋₇₅ (0.149). A similar result was reported by Meyers et al.²² the pulmonary volumes (FEV1, FVC) reduced in the postoperative period¹⁹ with a maximum decrease on the 1st postoperative day, returning to close to the preoperative levels by the 5th postoperative day²². This decreased from the preoperative period to the 1st postoperative day but there was an improvement, but without total recovery to the preoperative values by the 6th postoperative day in the Intervention and Control Groups. These tests depend on the understanding of the exercises to be performed and on the desire of the patient to collaborate in making an effort to perform the movements²⁰. Thus, it is accepted that factors, such as, pain, alterations in the ventilatory mechanics⁷ due to the sternotomy^{19,21} on the pulmonary function.

The 6 MWT is not routinely used for the assessment of functional capacity of patients who are waiting for cardiac surgery. In this present study a reduction in the six minute walk distance from preoperative to postoperative day 7 can be observed in both the groups. The mean difference of six minute walk distance from preoperative to

postoperative day 7 in intervention group is 15 meters, and in control group is 21 meters. This study shows that there is no statistically significant difference between Group A and Group B in terms of 6 MWD. This shows that there is a no effects of preoperative exercise programme (3 days) on 6 Minuit walk distance in patients following mitral valve replacement surgery.

CLINICAL RELEVANCE

The result of this study suggest that preoperative exercises programme and education about postoperative exercises should be includes as the part of the rehabilitation of the patients undergoing valve replacement surgery to avoid PPC's, reducing the length of hospital stay. These exercises are also proven to be safe.

This intervention will in turn to reduce the expenditure due to prolonged hospital stay and the expenditure in treating PPC's.

LIMITATION OF THE STUDY

One of the limitation of this study is the small sample size. There is also a shorter duration of protocol for the preoperative exercise regime as majority of the patients are not admitted earlier than three days prior to the mitral valve replacement surgery.

FUTURE RESEARCH

Future research is needed to observe the effect of preoperative exercise regime in mitral valve replacement surgery patients with a larger sample size and for a longer period of time.

CONCLUSION

The preoperative exercise programme has been shown to be more effective than the usual care in the rehabilitation of the patients undergoing mitral valve replacement surgery in reducing hospital

stay and PPC's. Therefore the experimental hypothesis is accepted.

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