

THE EFFECTS OF PULMONARY HYPERTENSION ON OUTCOMES OF MITRAL VALVE SURGERY

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Abstract: *This study aimed to assess the effect of pulmonary hypertension on the outcomes of mitral valve surgery in terms of operative mortality, dependence on inotropic agents, duration of ventilation, length of ICU, and hospital stay. This comparative study was conducted at the Department of Cardiac Surgery, Faisalabad Institute of Cardiology, from January 2018 to July 2018. A total of 138 cases (69 in each group) were included in the study. Patients with mild or moderate PHT were enrolled in group A, and patients with severe PHT were in group B. Required surgery was performed. Outcomes, including operative mortality, duration of mechanical ventilation postoperatively, dependence on inotropic agents in ICU, and length of stay in ICU as well as hospital, were noted in both groups during intensive care stay. Difference between the two groups in terms of mean duration of mechanical ventilation (10.58±2.79 vs. 10.96±3.42 hours; p-value=0.480), mean duration of inotropic support (8.55±2.75 vs. 9.45±3.92 hours, p-value=0.122), mean length of ICU stay (2.97±1.34 vs. 3.32±1.40 days, p-value=0.138) and mean length of hospital stay (12.3±3.8 vs. 12.6±4.1 days, p-value=0.684) was not statistically significant. In patients with severe pulmonary hypertension, mitral valve replacement was found equally safe compared to those with mild to moderate pulmonary hypertension.*

Keywords: Cognitive function, Psychiatric disturbance, open heart surgery

Introduction

Rheumatic Heart Disease (RHD) is quite common in Pakistan. Nearly 5.7 people out of 1000 suffer from RHD (Kumar et al., 2022). A large proportion of the population does not have adequate medical care, sanitation, and nutrition. This results in recurrent rheumatic fever attacks, leading to valvular heart disease development in the early years of life. Due to a lack of awareness, most patients are in the late stages of the disease. During the long course of the disease, it presents with pulmonary hypertension. Initially, pulmonary hypertension is confined to the pulmonary veins, but with disease progression, pulmonary arteries are involved (Muhammed et al., 2020; Xue et al., 2021). Pulmonary hypertension (PHT) is common in subjects with mitral valve disease (Aluru et al., 2022). The PHT is associated with adverse cardiac events during and even after successful cardiac surgery (Nizamitdinovich et al., 2022). Patients with pulmonary hypertension undergoing mitral valve replacement are at risk of poor outcomes, and mortality rates in such patients range from 15%- 31% (Helmert et al., 2021). Other risk factors in such patients include age, left ventricular ejection fraction, functional class, type of

surgery (valvuloplasty versus valve replacement), concomitant coronary artery disease, mitral regurgitation, and mitral valve calcification (Saran et al., 2019). It is a traditional understanding that morbidity and mortality increase significantly if pulmonary hypertension increases above 60 mmHg. However, in recent years the outcome of surgery in these patients has improved remarkably. This is due to improvements in the pharmacological management of pulmonary hypertension and peri-operative management. It is, therefore, pertinent to revisit the risk of surgery in cases of pulmonary hypertension. No local studies are available in this context. Therefore, this study aims to assess the effect of pulmonary hypertension on the outcomes of mitral valve surgery in terms of operative mortality, dependence on inotropic agents, duration of ventilation, length of ICU, and hospital stay.

Methodology

This comparative study was conducted at the Department of Cardiac Surgery, Faisalabad Institute of Cardiology, from January 2018 to July 2018. Both

male and female patients with pulmonary hypertension and undergoing surgery because of isolated mitral valve disease were included in the study. Patients having severe LV dysfunction EF < 35%, preoperative renal or liver failure, and undergoing redo surgery were excluded. A total of 138 cases (69 in each group) were included in the study. Patients were selected through consecutive nonprobability sampling. Informed consent of the included patients was taken. The ethical board of the hospital approved the study. Patients were divided into two groups. Patients with mild or moderate PHT were enrolled in group A, and patients with severe PHT were in group B. Required consultant surgeons performed the surgery.

In all patients, premedication was done with Tab Midazolam 7.5mg PO at midnight. The operating room IV line was assessed with a 14-16 G cannula. The arterial line passed for invasive blood pressure monitoring. 7 Fr central venous line passed in the internal jugular vein. After induction of anesthesia and aseptic measures, all patients were approached through median sternotomy. Systemic heparinization was done with Inj. Heparin 300 IU/kg intravenously. Ascending aorta, SVC, and IVC were cannulated for initiation of CPB. After establishing CPB, the ascending aorta was cross clamped. Myocardial preservation was done with cold Del-Nido blood cardioplegia and systemic and local hypothermia. The left atrium opened through the posterior approach, and the mitral valve was replaced, with St. Jude mechanical or bioprosthesis of adequate size as per patient requirements, using everted matters 2/0 ethebond sutures. Left atrium closed with 3/0 prolene. The heart was de-aired, and the aortic cross-clamp was removed. After acquiring normothermia, CPB was weaned off with required doses of ionotropes in each patient. Heparin was antagonized using Inj. Protamine 3mg/kg after test dose. The chest was closed in a standard manner after securing hemostasis, and pt shifted to ICU on ventilatory support. In the ICU, outcomes were noted in terms of operative mortality, duration of mechanical ventilation, dependence on inotropic agents, length of ICU, and hospital stay. Outcomes of patients, including operative mortality, duration of mechanical ventilation postoperatively, dependence on inotropic agents in ICU, length of stay in ICU and hospital, were noted in both groups during intensive care stay. The comparison was made, and a conclusion was drawn to establish guidelines for the future.

Data were analyzed using SPSS version 23.0. The quantitative variables have been summarized as Mean ± Standard Deviation. The qualitative variables have been presented as Frequency and percentage. All quantitative variables have been analyzed using the independent sample test, while qualitative variables have been analyzed using the

Chi-square test. P-value has been calculated, and a value less than or equal to 0.05 has been considered significant.

Results

The age of the subjects was 31.2±12.1 years. The majority (73, 52.9%) of the patients were aged below 30 years, 44 (31.9%) patients were aged between 31-45 years, and 21 (15.2%) patients were aged above 45 years. There were 46 (33.3%) male and 92 (66.7%) female patients. Mitral stenosis was the most frequent diagnosis and was seen in 57 (41.3%) patients, while mitral regurgitation and mixed stenosis and regurgitation were noted in 23.2% and 35.5%, respectively. Both groups were comparable in terms of distribution of various ages (p-value=0.927), mean age (p-value=0.906), gender (p-value=0.718), and mitral valve disease (p-value=0.922) groups (Table I).

Difference between the two groups in terms of mean duration of mechanical ventilation (10.58±2.79 vs. 10.96±3.42 hours; p-value=0.480), mean duration of inotropic support (8.55±2.75 vs. 9.45±3.92 hours, p-value=0.122), mean length of ICU stay (2.97±1.34 vs. 3.32±1.40 days, p-value=0.138) and mean length of hospital stay (12.3±3.8 vs. 12.6±4.1 days, p-value=0.684) was not statistically significant. 13 (9.4%) patients died within 30 days of mitral valve replacement. The Frequency of mortality was higher in patients with severe pulmonary hypertension (13.0% vs. 5.8%) compared to those with mild to moderate pulmonary hypertension. However, the observed difference was statistically insignificant (p-value=0.145) (Table II).

Table I Baseline Characteristics of both groups

Characteristics	Group A	Group B	P-value
	n=69		
Age (years)	31.3±12.3	31.0±12.0	0.906
Below 30 years	36 (52.2%)	37 (53.6%)	0.927
31-45 years	23 (33.3%)	21 (30.5%)	
Above 45 years	10 (14.5%)	11 (15.9%)	
Gender			
Male	24 (34.8%)	22 (31.9%)	0.718
Female	45 (65.2%)	47 (68.1%)	
Mitral Valve Disease			
Mitral Stenosis	28 (40.6%)	29 (42.0%)	0.922
Mitral Regurgitation	17 (24.6%)	15 (21.7%)	
Mixed MS + MR	24 (34.8%)	25 (36.3%)	

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Table II Comparison of outcome measures

Characteristics	Group A n=69	Group B n=69	P- value
Duration of Mechanical Ventilation (hours)	10.58±2.79	10.96±3.42	0.480
Duration of Inotropic Support (hours)	8.55±2.75	9.45±3.92	0.122
Length of ICU Stay (days)	2.97±1.34	3.32±1.40	0.138
Length of Hospital Stay (days)	12.3±3.8	12.6±4.1	0.684
Mortality n (%)	4 (5.8%)	9 (13.0%)	0.145

Discussion

The current study evaluated the effect of pulmonary hypertension on mitral valve surgery outcomes. The mean age of the patients was 31.2±12.1 years. This was in line with a previous study which also reported similar mean age of 33.8±12.2 years among patients presenting with rheumatic heart disease (Riaz et al., 2018). Another also reported a comparable mean age of 29.4±2.9 years among such patients (Peters et al., 2020). However, other studies report a relatively higher mean age of 34±10.3 years (Mohammad et al., 2018) and 42.6±12.6 years (Noubiap et al., 2020). In the present study, we observed a female predominance with a male-to-female ratio of 1:2. A similar female predominance has been observed in previous studies, which reported a male-to-female ratio of 1:2.5 (Jiang et al., 2017). We observed that mitral stenosis was the most frequent diagnosis and was seen in 57 (41.3%) patients, while mitral regurgitation and mixed stenosis and regurgitation were noted in 23.2% and 35.5% cases, respectively. A similar frequency of mitral stenosis (44.0%), regurgitation (22.0%), and mixed stenosis and regurgitation (34.0%) has been reported by a previous study (Tumpa and Hasan, 2021).

In the present study, there was no statistically significant difference between patients with mild to moderate PHT and severe PHT in terms of mean duration of mechanical ventilation, mean duration of inotropic support, mean length of ICU stay, mean length of hospital stay, and Frequency of mortality. In a previous study, the author reported a similar insignificant difference between patients with mild to moderate and severe pulmonary artery hypertension in the mean duration of mechanical ventilation (10.65±5.84 vs. 10.86±4.90 hours, p-value=0.78), mean stay in ICU (2.27±0.73 vs. 2.42±1.23 days, p-value=0.29) and mean hospital stay (12.44±5.35 vs.

12.63±6.41 days, p-value=0.8) in line with the present study. The author didn't observe any mortality in either group (Bendjaballah et al., 2017). Similarly, another study also reported insignificant difference between patients with mild to moderate and severe pulmonary artery hypertension in terms of mean duration of inotropic support (3.6±2.6 vs. 5.1±2.2 days; p-value=0.55), hospital stay (8±4 vs. 12±7 days; p-value=0.078) and 30 days mortality (3.5% vs. 16.6%; p-value=0.41). The author, however, reported a significantly longer mean duration of mechanical ventilation in patients with severe pulmonary hypertension (21.5±11.7 vs. 32.2±21.4 hours; p-value=0.04) (Mohamed Mohamed Ali et al., 2021). A study conducted on patients with rheumatic heart disease reported insignificant difference in the mean duration of inotropic support (6.7±1.9 vs. 7.25±3.7 hours; p-value>0.05) and hospital stay (8.15±0.87 vs. 8.8±0.76 days; p-value>0.05) (Mohammad et al., 2018). The present study found that mitral valve replacement was equally safe in patients with rheumatic heart disease and severe pulmonary hypertension compared to those with mild to moderate pulmonary hypertension. A lot of this credit goes to development in pharmacological management as well as improved peri-operative care. Thus, severe pulmonary hypertension must not be a contraindication for mitral valve surgery in the future. The limitation of this study is that data were collected from a single center; a more extensive multi-center study is recommended for further detailed analysis.

Conclusion

In patients with severe pulmonary hypertension, mitral valve replacement was found equally safe compared to those with mild to moderate pulmonary hypertension.

Conflict of interest

The authors declared absence of conflict of interest.

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