

REGRESSION OF PULMONARY ARTERIAL HYPERTENSION AND SHORT TERM CLINICAL OUTCOME IN PATIENTS WITH MITRAL VALVE REPLACEMENT

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Contribution

IH & SG conceived the idea, planned the study and drafted the manuscript. AF, SA & MI collected data, did statistical analysis and critically reviewed manuscript. All authors contributed significantly to the submitted manuscript.

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ABSTRACT

Objective: To determine the regression of pulmonary arterial hypertension in patients with Mitral valve disease after mitral valve replacement.

Methodology: This cross sectional study was conducted at Cardiac Surgery department of Punjab Institute of Cardiology from 1st March 2013 to 2014. Patients undergoing Mitral valve replacement for rheumatic valvular disease, aged ≥ 15 to 60 years were selected. Patients with aortic valve disease and coronary artery disease, severe renal impairment (creatinine clearance less than 40 ml/min), moderate to severe left ventricular dysfunction i.e. EF < 40% were excluded from the study. Pre and post 24 hour Echocardiography was performed to measure pulmonary arterial hypertension (mPASP) of >60 mmHg.

Results: Out of 75 patients, 39% were males. Patients mean age was 32.48 ± 13.64 years, mean height of 156.77 ± 20.98 cm and mean weight of 53.96 ± 9.97 kg. Postoperatively LVISD was 9.8 ± 1.4 mm, LVPWD 9.36 ± 1.55 mm, LVIDD 48.2 ± 7.29 mm, and EF was $53.11 \pm 8.23\%$. Right ventricular dysfunction and postoperative stroke were more commonly found in valvular patients as 8% and 6% respectively. Trend towards postoperative arrhythmia was significantly less about 1%. Mortality was found in 5.3% patients. Mean PASP significantly declined by 10.4 mmHg from baseline 53.24 ± 12.6 to 42.84 ± 11.04 mm Hg 24 hours following MVR ($p = 0.001$).

Conclusion: PASP returns to near normal values in the majority of patients with severe pulmonary arterial hypertension after MVR and the decrease is significant.

Key Words: Pulmonary arterial hypertension, Mitral valve replacement, Pulmonary artery systolic pressure

INTRODUCTION

Pulmonary arterial (PA) hypertension (PA) is a serious complication found to be 30% to about 70% of patients with mitral valve diseases, resulting in poor functional capacity and the dismal prognosis.¹⁻⁴ Patients diagnosis with cardiovascular diseases, pulmonary arterial hypertension significantly predict mortality.⁵ PA hypertension is significantly related with worse exercise capacity and increases pulmonary vascular resistance.⁶

Successful surgical relief of the mechanical cause of pulmonary venous hypertension generally reduces PA pressure and promotes regression of the reversible components of pulmonary vascular changes.⁷ Despite successful mitral valve surgery, pulmonary hypertension remained common during the postoperative period, with an overall prevalence of 54% to 64%.^{6,8}

Mitral valve replacement or repair are now routine operative procedures for patients with serious mitral valve disease and, with an operative mortality of $\leq 9\%$ and provide the majority of these patients with an improved length and quality of life.^{9,10} Mitral valve replacement is safe and effective even in patient with severe pulmonary artery hypertension.^{1,8,11,12}

So this study is designed to observe the effectiveness of MVR in the regression of pulmonary arterial systolic pressure and the short term outcomes of MVR in severe pulmonary arterial (PA) hypertension, to know whether MVR technique is safe and effective for patients of PAH also enable us to provide improved mortality and morbidity with PAH in the future.

METHODOLOGY

This cross sectional study included consecutive patients who undergone mitral valve replacement for rheumatic valvular disease, aged ≥ 15 to 60 years presented to Cardiac Surgery Department of Punjab Institute of Cardiology, Lahore over a period of one year from 1st March 2013 to 31st March 2014. Patients with aortic valve disease and coronary artery disease, severe renal impairment (creatinine clearance less than 40 ml/min), moderate to severe left ventricular dysfunction i.e. EF $< 40\%$ were excluded from the study. The selection of valve type and procedure was left to the operator's discretion. Pulmonary arterial hypertension was defined as mean pulmonary arterial pressure with a cut of value (mPASP) of > 60 mmHg, measured by Doppler Echocardiography before and after the procedure (MVR).^{13,15}

Operative technique: MVR was carried out after median sternotomy. Extracorporeal circulation was established via bicaval and aortic cannulation. At the first operations the femoral artery was used for arterial access. Mild general

hypothermia was employed, lowering the patients' temperature to an average of 28°C. The intracardial procedure can be done under ventricular fibrillation with additional topical cooling. Since 1987 crystalloid cardioplegic solutions (Custodiol®) had been used.

Demographical and clinical characteristics regarding procedure and peri-operative endpoints were collected prospectively.

Primary end point was to find out the regression in PASP. While secondary. Secondary end points included mortality and morbidity; The in-hospital mortality (defined as any death occurring during hospital stay after operation) and morbidity i.e. postoperative arrhythmia defined as (ventricular rate - tachycardia > 100 / Bradycardia < 60 , QRS complex - Narrow is < 0.12 ms / Broad > 0.12 ms, regularity of the QRS complex and P-wave negative in aVR usually identifies sinus rhythm, P waves are absent in atrial fibrillation).

Postoperative stroke diagnosis was made if there was evidence of new neurological deficit with morphological substrate within 24 hours and delayed stroke greater than 24 hours postoperatively confirmed by computed tomography or nuclear magnetic resonance. Right ventricular dysfunction define as tricuspid annular plane systolic excursion by M-mode TAPSE with a cut-off point ≤ 16 mm or FAC ($< 35\%$).^{16,17}

Statistical analysis was performed with SPSS Version 21.0. Continuous characteristics etc. were reported as mean \pm SD (Standard deviation) and mean difference was compared using Student's t-test. Categorical characteristics were reported as frequencies and percentages. Chi-Square Statistics or Fisher's Exact Test was applied to observe the association of categorical variables. A $p \leq 0.05$ was considered significant.

RESULTS

Out of 75 patients, 39% were males while 61% were females. Patients who underwent MVR were 96% and 3% of patients underwent MVR+TVR; 1% underwent MVR+AVR procedures. Patients mean age was 32.48 ± 13.64 years, mean height 156.77 ± 20.98 cms, mean weight 53.96 ± 9.97 kg. Hypertension was more common co-morbid condition as compared to diabetes mellitus 50% and 22%. CPB time was 66.39 ± 20.816 min, Cross Clamp time was 48.65 ± 14.3 min and total hospital stay was 19.45 ± 15.043 days (Table 1).

Postoperatively LVISD was 9.8 ± 1.4 mm, LVPWD 9.36 ± 1.55 mm, LVIDD 48.2 ± 7.29 mm, and EF was $53.11 \pm 8.23\%$ (Table 2).

Right ventricular dysfunction and postoperative stroke were more commonly found in valvular patients as 8% and 6%.

Table 1: Demographic Variables of Study Population (n=75)

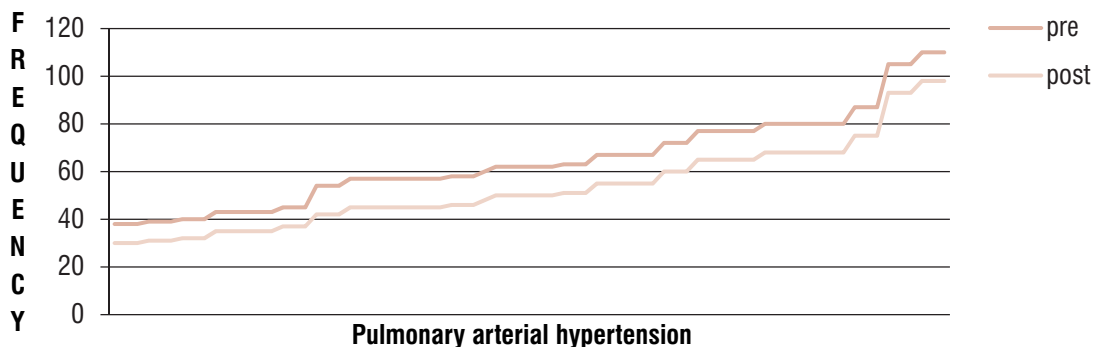
Variables		
Gender	Male	39%
	Female	61%
Age		32.48±13.64 years
Height		156.77±20.98 cm
Weight		53.96±9.97 kg
Diagnosis	MS	56(74%)
	MR	11(14.7%)
	MS+MR	(10.7%)
Operation	MVR	96%
	MVR+AVR	1%
	MVR+TVR	3%
X clamp time		48.65±14.3
Bypass time		66.39±20.816
Hospital stay		19.45±15.043

Table 2: Post-Operative Echocardiographic Parameters and Clinical Outcome (n=75)

Post-operative LVISD	9.8±1.4
Post-operative LVPWD	9.36±1.55
Post-operative LVIDD	48.2±7.29
Post-operative EF	53.11±8.23
Postoperative arrhythmia	1%
Postoperative stroke	6%
Right ventricular dysfunction	8%
Death	4(5.3%)

Figure 1: Pre and Post-Operative Pulmonary Arterial Hypertension Changes in Patients with Mitral Valve Replacement (n=75)

PASP	Pre-op	Post-op	p-value
	53.24±12.6	42.84±11.04	0.001



Trend towards postoperative arrhythmia was significantly less 1%. Mortality was found in 5.3% patients.

Mean PASP significantly declined by 10.4% from baseline 53.24 ± 12.6 to 42.84 ± 11.04 mm Hg 24 hours following MVR (p= 0.001).

DISCUSSION

Our results support the notion that MVR is a safe and effective method for patients with pulmonary arterial hypertension.

Our results showed that female group of patient underwent MVR with PAH were higher than male indicating that female are at increased risk as (61% vs. 39%). Song X et al established that MVR with PAH is more prevalent in female patients compared to male patients (71.9% vs. 28.1%). Another study by Darr U et al found that MVR with PAH procedure was more in female than male (66.6% vs. 33.4%).^{18,19} Present study demonstrated similar results.

The present study provides evidence that the mean age of the patient who underwent MVR with PAH was 32.48 ± 13.64 years. Elwany SE et al demonstrated that the mean age of the patient was 31 ± 16.5 years. Kumar N et al found the mean age of the patient was 30.80 ± 14.6 years.^{20,21} Present study showed similar result, indicating that the disease occur more earlier in Pakistani population. Darr U et al reported that mean age of the patient underwent MVR with PAH was 42.6 ± 12.85 years.¹⁹ Song X et al found that age of the patient underwent MVR with PAH was $53. \pm 9.7$ years.¹⁸ In contrast with these studied present study showed dissimilar result may be due to small sample size.

Elwany SE et al also demonstrated that patients undergoing MVR had lower mean CPB and X clamp time as 55 ± 18.3 min and 28 ± 22.3 min.²⁰ Present study recognized that that patients undergoing MVR had lower mean CPB X clamp time in patients underwent MVR with PASP as 66.39 ± 20.816 and 48.65 ± 14.3 . Song X et al reported that longer mean CPB time was 119.9 ± 37.4 min and aortic cross-clamp time was 82.5 ± 31.8 min.¹⁸ In contrast with these studied present study showed dissimilar result may be due to small sample size.

Song X et al found significantly less mortality in patients underwent MVR as 3.1 %.¹⁸ Kumar N et al analyzed that patients underwent MVR had lower in hospital mortality as 5.88%, further study by Mubeen M et al indicated less in hospital mortality in patients underwent MVR with PAH as 5.5%, present study showed similar results.^{21,22} Darr U et al determined no in-hospital mortality in patients underwent MVR while, Elwany SE et al examined significant high in hospital mortality rate as 10%.^{19,20}

Present study reported that patients who underwent MVR with PAH were associated with adverse morbidities. Song X et al observed that PAH showed strong correlation with postoperative arrhythmia and right ventricular dysfunction 84% and 40.6%.¹⁸ Darr U et al found significantly less morbidity rate in PAH patients underwent MVR as AF (1%), stroke (2%) and right ventricular dysfunction (2%).¹⁹

Present study et al scrutinized that significant decline in the mean PASP by 10.4% from mean preoperative level of 53.24 ± 12.6 to 42.84 ± 11.04 mm Hg within 24th hours following MVR ($p = 0.001$). Kumar N et al scrutinized that the mean PASP decreased by 28% from a mean preoperative level of

58 ± 8 to 30 ± 4 mm Hg within 24th hours following MVR ($p = 0.001$).²¹ Elwany SE et al reported that mean PASP decreased significantly by 33% soon after 24th hour MVR in patients with PAH from baseline as 55 ± 2.6 to 22 ± 1.6 .²⁰ Song X et al observed that mean PASP reduced by 53% from baseline 101.2 ± 20.3 to after 24th hour post-operative MVR as 48.1 ± 14.3 mm, in present study PASP improvement after MVR is less spectacular due to supra-systemic PA pressures.¹⁹

Song X et al reported that there was no significant change in LVEF ($57.9 \pm 7.6\%$) showed significant decrease in LVIDD (49.2 ± 5.9 mm).¹⁸ Elwany SE et al demonstrated that no significant change in LVEF $50 \pm 6.4\%$ to $51.5 \pm 7.2\%$ and LVIDD 57 ± 3.7 to 59 ± 4.6 mm, LVISD 26 ± 4.7 to 26 ± 5.6 mm in 24 hours after MVR.²⁰ Present study showed that significant improvement in echocardiographic parameters i.e. LVISD, LVPWD, LVIDD and EF in 24 hours after MVR.

CONCLUSION

MVR is safe and effective in majority of patients with severe pulmonary artery hypertension and after surgical procedure PASP returns to near normal range and this decrease is significant.

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