DOI: 10.7860/JCDR/2016/20209.8913

Original Article

Surgery Section

Redo Mitral Valve Replacement for Prosthetic Valve Thrombosis: Single Center Experience

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ABSTRACT

Introduction: Prosthetic Valve Thrombosis (PVT) remains a significant cause of morbidity and mortality after valve replacement. Although surgical treatment is usually preferred as life-saving in cases of obstructive PVT, optimal treatment is yet to be decided.

Aim: To evaluate risk factors and outcome of the patients undergoing redo mitral valve surgery for acute PVT.

Materials and Methods: Between January 2012 and February 2015, 65 patients underwent redo surgery for obstructive PVT of mitral valve in Department of Cardiothoracic Surgery, UN Mehta Institute of Cardiology & Research Centre. Patients having acute PVT of aortic valve or combined aortic and mitral valve were excluded. Pre-operative, intra-operative and post-operative factors affecting the outcome as well as follow-up data were measured.

Results: There were total 65 patients, 17 males and 48 females. Most common presenting symptom was dyspnea (100%), followed by palpitation (57.88%) and fatigue (29.45%). Total mortality was 29.2% (19/65). Mortality rate was significantly higher (16/35, 46%) in patients with direct surgery (Group-2) as compared to those with failed thrombolysis (3/30, 10%) (Group-1).

Mortality was also significantly higher in patients presented with New York Heart Association (NYHA) III/IV class as compared to those presented with NYHA I/II class (p=0.02). All survived patients are NYHA Class I-II in follow-up with mean follow-up period was 24 ± 9 months.

Conclusion: PVT still remains a challenging problem in a post-operative patient with a high mortality independent of treatment modality. Though life-saving, the surgical management of this condition still carries a high risk in haemodynamically unstable and in NYHA class III/IV patients.

Keywords: Heart valve, Prosthetic, Redo

INTRODUCTION

Rheumatic Fever (RF) and Rheumatic Heart Disease (RHD) remains the most common aetiology for valvular surgeries in developing countries like India [1]. Valve replacement still remains a valuable option in the management of patients with complex severe valvular heart disease. However valve replacement does not provide a definitive cure to the patient and outcome of the patients is affected by multiple factors like prosthetic valve type thrombosis, bleeding etc. [2]

Prosthetic Valve Thrombosis (PVT) is a rare but serious complication of valve replacement, with incidence of 0.3–1.3% patient years [3]. PVT depends upon various factors like valve types, position of the implanted valve, presence or absence of atrial fibrillation, ventricular dysfunction and most importantly anticoagulation status of the patient [4]. Although surgical treatment is usually preferred as life-saving in cases of obstructive PVT, optimal treatment is yet to be decided.

Aim of our single center study was to evaluate risk factors and outcome of the patients undergoing redo mitral valve surgery for acute PVT. We preferred this subset because overall morbidity and mortality of PVT in mitral position is higher and management is difficult.

MATERIALS AND METHODS

Between January 2012 and February 2015, 65 patients who underwent redo surgery for obstructive PVT of mitral valve in Department of Cardiothoracic Surgery, UN Mehta Institute of Cardiology & Research Centre, were included in this retrospective study. Patients having acute PVT of aortic valve or combined aortic and mitral valve were excluded. Patients having acute PVT obstruction of mitral valve were first managed with diuretics, heart rate controlling agents, inotropes and non-invasive positive pressure ventilation if needed. They were investigated initially with fluoroscopy followed by Trans-thoracic Echocardiography (TTE) for gradient across the mitral valve and panus/thrombosis of valve. We routinely do not perform TEE unless diagnostic dilemma is present. Once diagnosed, they were managed according to ACC guidelines for PVT [5]. Patients having New York Heart Association (NYHA) class I-II symptoms, having obstruction of < 14 days and/or small thrombus (0.8cm^2) were managed initially with thrombolytic therapy. All these patients were included in Group-1. They were observed for 48 hours after starting thrombolysis. Patients with no change in gradient and/or no decrease in size of thrombus or clinical deterioration were considered for a redo surgery in same sitting.

Those with NYHA class III-IV, late presentation, failed thrombolysis, contradiction for thrombolysis therapy, and/or clot size of more than 15mm were considered for emergency redo for surgery (Group-2). Those patients with confirm diagnosis of large panus and restricted moments of leaflets were considered for redo surgery (Group-2).

Surgical Techniques

All patients were operated with invasive arterial pressure monitoring and pulmonary artery pressure monitoring. In operation theatre, in all patients femoral vessels were exposed in groin as a part of routine protocol followed by sternotomy using oscillating saw. We routinely close pericardium in all surgeries which decrease the chances of injury to heart or great vessels. After adhesiolysis, surgery was performed using cardiopulmonary bypass with bi-caval and aortic cannulation and moderate hypothermia (32^{o}C). After aortic cross clamp antegrade root cardioplegia was delivered which was repeated every 20min. Left atrium was approached either via watersons groove or via trans-septal (if tricuspid intervention required). Previous valve was checked and decision was made for either thrombectomy and clot evacuation or replacement. For replacement, we had used interrupted pledgeted sutures with pledget on left atrial side. After that LA was closed, hot shot cardioplegia was delivered and aortic cross clamp was removed once heart started beating. Once all parameters were satisfactory Cardio Pulmonary Bypass (CPB) was weaned off and sternum was closed.

Post-operatively, patients were routinely ventilated till inotropic requirement was high. Patients were then weaned off from ventilator once ionotropic requirement became reasonable and respiratory parameters were satisfactory. Post-operatively, patients were kept on rate controlling agents and diuretics.

Patients were started on heparin (10IU/kg) 6 hours after operation if not contraindicated. Oral anticoagulation was started once patient got extubated. Heparin was discontinued after INR came into therapeutic range of 3-3.5. All patients were also prescribed diuretics, antiarythmetics for atrial fibrillation and aspirin (Low dose 75mg) additionally. All patients underwent routine TTE before discharge. After discharge they were followed up at 7 days,14 days, 30 days, 3 month and then after every 3 monthly. On follow-up visits thorough history, clinical examination and INR was performed. 2-D echo was performed every for first 3 months and thereafter according to clinical condition.

STATISTICAL ANALYSIS

The statistical analysis was performed using SPSS software v 20.0 (Chicago, IL, USA). Continuous data were expressed as mean ± SD. Univariate analysis of the continuous data was performed using student's t-test, whereas chi-square test was used for the categorical data. The cut off value of $p<0.05$ was considered for the statistical significance.

RESULTS

There were total 65 patients, 17 males (26.15%) and 48 females (73.84%). Most common presenting symptom was dyspnea (100%), followed by palpitation (57.88%) and fatigue (29.45%). Thirty five patients were in class III-IV with elevated Jugular Venous Pressure (JVP) and features of pulmonary edema and required emergency redo surgery as per criteria Group-2. Thirty patients were included in Group-1 as per mention criteria.

Mean duration of Cardio Pulmonary Bypass (CPB) time and aortic cross clamp time was 111.85 ± 46.9 and 74.0 ± 24.7 mins. Mean ICU stay and hospital stay was 13.5± 5.5 days and 17.2± 9.7 days. Mean duration of inotropes were 93.78 ± 40.20 hrs. Total mortality was 29.2% (19/65). Mortality rate was significantly higher (16/35, 46%) in patients with direct surgery (Group-2) as compared to those with failed thrombolysis (3/30, 10%) (Group-1). Most common cause of death was low cardiac output syndrome (14, 74%) followed by sepsis (3, 16%) and Multiple Organ Dysfunction Syndrome (MODS) (2, 10%). Mortality was also significantly higher in patients presented with NYHA III/IV class as compared to those presented with NYHA I/II class (p=0.002) [Table/Fig-1].

Most of the patients had stuck valve with pannus formation. Details of procedure are described in detail in [Table/Fig-2]. Mean duration from first operation to redo surgery was 7.45 ± 5.56years. In redo surgery, only one patient required femoral cannulation due to in advent injury to right atrium during adhesiolysis. In 61(94%) patients re-replacement was performed. Follow-up was 100% complete. All patients were NYHA Class I-II in follow-up [Table/Fig-3].

Variables	Mortality (n,%)	p-value
Group-1 (n=35) Group-2 (n=30)	16 (45%) 3 (10%)	0.002
New York Heart Association Class III/IV (n=35) New York Heart Association Class I/II (n=30)	16 (45%) 3 (10%)	0.002
Low Cardiac Output (n=19)	14 (74%)	
Sepsis (n=19)	3 (16%)	
MODS (n=19)	2 (10%)	

[Table/Fig-1]: Predictors and causes of mortality in study population.

Findings	Procedure	N
Pannus + clot formation	Re- replacement	61
Posterior mitral leaflet (PML) entrapment	PML resection + surgical thrombectomy	2
Clot only	Surgical thrombectomy	2
Associated tricuspid regurgitation	Devega's repair Ring annuloplasty Tricuspid Valve replacement	8 4 2

[Table/Fig-2]: Intraoperative findings and procedure performed.

Follow-up Duration (years, Mean ± SD)	1.33 ± 1.03
INR (Mean ± SD)	3.29 ±0.48
Left ventricular ejection fraction (LVEF) (%,Mean ± SD)	53.74± 8.45
Right Ventricular Systolic Pressure (RVSP) (mmHg, Mean ± SD)	36.34 ±13.11
Peak Mitral Valve Gradient (mmHg,(Mean ± SD)	10.4 ±4.3
Mean Mitral Valve Gradient (mmHg, Mean±SD)	5.1±2.23

[Table/Fig-3]: Follow-up data of surviving patients.

DISCUSSION

Till date due to unavailability of ideal valve, some valve-related complications are bound to happen and such patients must be reported.

In recent years, there were significant improvements in the outcome of the patients undergoing revision valvular surgery. Despite this redo-MVR for acute PVT, obstruction remains a challenge. To the best of our knowledge this is the first study reporting experience of 65 patients of acute PVT obstruction of mitral valve within short time span of 3 years from a single center.

The complications of prosthetic heart valves are divided into: structural valvular deterioration, non-structural dysfunction, valve thrombosis, embolism, bleeding and endocarditis [6-8]. Most common cause for redo operation was pannus formation followed by perivalvular leakage, endocarditis and thrombosis or thromboembolism [6-8]. We found that the most common cause was pannus formation which was present in 61(94%) patients.

Mortality rate of redo surgeries have been documented upto 30% in literature with recent mortality rate of 5-6% [6-9]. Higher mortality rates have been attributed to female gender, NHYA class, and emergency operation (endocarditis, prosthesis obstruction etc.,). We found that mortality rates in patients with PVT with NHYA I and II class are still comparable to routine redo surgeries (3/30, 10%). But patients of PVT with haemodynamic instability and higher NYHA had significantly higher mortality (45%).

As mentioned earlier, 61 patients required re-replacement either mechanical or biological valve. In 2 patients preserved posterior mitral leaflet was obstructing the valve with clot formation. These patients were managed with Posterior Mitral Leaflet (PML) resection and surgical thrombolysis. In another 2 patients only surgical thrombolysis was performed as there was thrombus obstructing the leaflets with minimal pannus formation. These patients were drug defaulters.

Thrombosis and pannus formation was most common cause for PVT in our series which is contradictory to other investigators who reported paravalvular leak which is most common cause for redo surgeries for mechanical prosthesis [10]. Although thrombosis has been directly related to anti-coagulation, a direct relationship with the intensity of anti-coagulation has not been demonstrated [11]. Apart from the anti- coagulation recurrent embolism size and design of the prosthesis atrial rhythm, cardiac failure and individual propensity are concomitant risk factors [12].

There may be several factors for these findings: 1) Most of the patient were less compliant to oral anticoagulation due to multiple factors like lack of awareness, unavailability of medicines in remote areas, loss of follow-up etc.,; 2) Another possible reason is: Preservation of excessive chordal apparatus in first surgery causing interference

with leaflet mobility. We have started an awareness programme to educate them about the same using video and also started to follow them up over telephone especially for the ones from remote areas. Hope this will lead to decreased incidences of PVT.

CONCLUSION

PVT still remains a challenging problem in a post-operative patient with a high mortality independent of treatment modality. Echocardiography and fluoroscopy plays vital role in diagnosis. Though life-saving, the surgical management of this condition still carries a high risk in haemodynamically unstable and in NYHA class III/IV patients. So, best management of this condition is to prevent development of PVT.

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FINANCIAL OR OTHER COMPETING INTERESTS: None.

Date of Submission: **Mar 17, 2016**
Date of Peer Review: **Jul 08, 2016**
Date of Acceptance: **Aug 24, 2016**
Date of Publishing: **Nov 01, 2016**