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Operative Results of Surgical Intervention for Prosthetic Valve Thrombosis: Emergent vs Urgent Surgery

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ABSTRACT

Background: Prosthetic valve thrombosis is one of the dread complication of cardiac valve surgery.
Aim: To address the operative outcome of redo-valve surgery for prosthetic valve thrombosis (PVT) who underwent either as an emergency surgery or urgent surgery.
Methods: A retrospective analysis of redo-valve surgery was executed for patients who underwent surgical intervention for PVT from January 2014 to February 2020 at Rawalpindi Institute of Cardiology, Rawalpindi. Patients were categorized into two groups i.e. emergency surgery group (surgery offered for PVT without any delay as permitted by expeditious hospital logistics to avoid disabling morbidity or mortality) and Urgent surgery (surgery offered within 2 days of clinical presentation for PVT with relatively stable hemodynamic profile).
Results: A total of 48 patients underwent for surgical intervention for PVT. Emergent and urgent groups comprised of n=16 and n=32 respectively. Operative mortality in emergent group is calculated to be 37.5% (n=6/16) while it is 6.25% (n=2/32) in urgent surgery group with p-value of 0.006. The overall mortality in entire population is 16.67% (n=8/48). one of the striking finding in emergent group is that 37.5% (n=6/16) patients were preoperatively ventilated for imminent cardiorespiratory failure and those ultimately faced 100% mortality.
Conclusion: Our results conclude that overall operative mortality of PVT is high specially when performed under emergent indication with background of imminent cardiorespiratory failure mandating preoperative ventilation. Surgical intervention under urgent indication however yield very impressive results with low procedural operative mortality.
Keywords: Prosthetic valve thrombosis (PVT), Redo-Valve Surgery, Operative mortality

INTRODUCTION

Prosthetic valve obstruction (PVO) is a mortal complication of valvular heart surgery that often mandate urgent treatment.[1] Intra-cardiac thrombosis, pannus formation, vegetations of infective endocarditis, and structural failure of valvular prothesis etc. are frequent etiologies of PVO.[2] Prosthetic valve thrombosis (PVT) is a prominent of all cause of PVO. it is characterized by any obstruction of valve prosthesis by non-infective thrombotic material impairing the function of valve. Overall incidence of PVT ranges from 0.1- 6% per patient per year for prosthetic heart valves.[3] Mitral PVT is reported to be 5 times higher than aortic location and is reported up to 20% for prosthetic valve at tricuspid location.[4] Major predisposing factor linked with incidence of PVT includes type of valve prosthesis implanted, inadequate anticoagulation, valve position, atrial fibrillation, poor left ventricular function, prothrombotic disease etc.[5] The most dread complication of PVT are embolic cerebrovascular accident, hemodynamic collapse and death. The most recent AHA/ACC recommendation for PVT treatment include either initial slow infusion of thrombolytics therapy or surgical intervention.[6] Guidelines support surgical intervention when PVT is associated with recurrent PVT thrombosis, absolute contraindication to thrombolytics, low risk surgical group, NYHA IV, clot size of 0.8cm2 or more, clot in left atrium (LA), other cardiac disease needing surgical intervention and availability of surgical expertise. While fibrinolysis as treatment option is supported when there is non-availability of surgical expertise, first episode of valve thrombosis, no contraindication to fibrinolysis, High surgical risk, NYHA class I-III, clot size less than 0.8cm2, thrombus visualized, non LA-clot, normal other cardiac valves/ absence of coronary artery disease and patient choice.

Surgical intervention is indicated among notable number of PVT patients. Although surgical intervention is much challenging and carry reasonable risk of mortality but it has technical edge of complete extraction of thrombotic material along with pannus as well. Precedence of newer prosthetic valve implantation for future PVT is another trump card. The objective of this publication is to present our operative results for PVT surgery and extract lesson for future operative policy.

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MATERIAL AND METHODS

Study is conducted at Rawalpindi Institute of Cardiology (RIC), Rawalpindi, Pakistan for tenure of January 2014 to February 2020. Ethical approval from institutional review board and ethical committee was taken. Electronic database of cardiac surgery (Casecade, Lahore) was searched and it retrieved 48 case who were operated for PVT. Patients were categorized into two group i.e. Emergent group

(offered surgical intervention at the earliest possible time as permitted by hospital logistics) and Urgent group (offered surgery within 2 days of hospital admission with medical optimization of hemodynamic profile and operative list feasibility). Treatment decision as surgical intervention was supported by multidisciplinary cardiac team comprised of cardiologist, cardiac surgeon and cardiac intensivist for entire patient population. Age, gender, NYHA class (I-IV), preoperative ventilation status, emergent vs urgent status, Type and location of previous valve implant, location and size of clot, preoperative creatinine (mg/dl), Liver dysfunction (yes or no by measuring derangement in serum bilirubin levels, serum ALT level) were noted. Operative information like cross clamp time (min), total cardiopulmonary time (min), presence of pannus, type of valve implanted are recorded. Postoperative information like ventilation hours, length of ICU stay (Hours), operative mortality, disabling stroke etc were noted.

Statistical analysis of scrutinized data is performed by Microsoft Excel 2016 and SPSS version 20. Mean and standard deviation for numeric data & frequency for categorical data was calculated for above mentioned clinical parameters. Two Groups were compared to find statistically significance with p-value. P-value of 0.05 or less is considered as significant by using student T-Test or Chi-square test for numeric and categorical data respectively. All those patient who needed combined cardiac surgery procedure like coronary artery bypass surgery (CABG) or right sided valve thrombosis were excluded from study.

RESULTS

A total of 48 patients (n=48) underwent redo-valve surgery for PVT. Clinical information of data analysis mentioned in material and method part are summarized in table no.1. It revealed that patients in emergent PVT surgery group were younger and had worse NYHA class (i.e. IV) when compared with urgent PVT surgery group with p-valve below < 0.05. However, there was no statistical significant difference (p-value more than 0.05) between the two group regarding location of PVT cardiac valve location, type of previous prosthesis implanted, presence of LA clot or size of clot. Serum creatinine levels were higher in urgent group as compared to emergent group with p-value of 0.0325 but there was no difference in preoperative liver dysfunction in either group with p-valve of 0.217. One of the most important clinical difference between the groups was higher incidence of pre-operative ventilation in emergent group vs urgent group with p-value of 0.00083. Regarding operative parameters, aortic cross clamp time (min) & total duration of CPB (min) between the two group was not different statistically (p-valve more than 0.05). In all the patient, removal of thrombotic clot, pannus and effected valves was accomplished and replaced with newer bileaflet mechanical prosthetic valve. Significant proportion of patients in both group harbor pannus formation underlying thrombotic material.

Postoperatively, the duration of Ventilation (Hrs), length of ICU stay (Hrs) and incidence of disabling stroke was not statistically different (p-value more than 0.05) between groups. However, the incidence of multiple organ dysfunction syndrome (MODS) was much more in emergent surgery group vs urgent surgery group for PVT with p-value of 0.006. Similarly, operative mortality was higher in emergent group (n=6/16) vs urgent group (n=2/32) with p-value of 0.006. It is important that all the operative mortality was associated MODS on both groups.

Table 1: Demographic, operative and outcome variable of n=48 who underwent surgical intervention for PVT as emergent vs urgent surgery

Variables	**Emergent group**	**Urgent group**	**p-value**
Age	28 + 9.5	38.81+ 10.02	0.0057
Gender Male Female	 43.75% (n=7/16) 56.25 (n=9/16)	 50% (n=16/32) 50% (n=16/32)	0.682
NYHA III IV	 0% (n=0) 100% (n=16)	 37.5% (n=12) 62.5% (n=20)	0.0047
Previous valve Aortic Mitral Aortic+ Mitral	 37.5% (n=6/16) 43.75% (n=7/16) 18.75% (n=3/16)	 21.87% (n=7/32) 43.75%(n=16/32) 34.37% (n=11/32)	 0.25 0.68 0.26
Type of valve Mechanical Biprosthesis	 100% (n=16/16) 0% (n=0/16)	 90.62% (n=29/32) 9.38% (n=3/32)	0.205
LA clot	62.5% (n=10/16)	87.5% (n=28/32)	0.044
Clot size (1cm2 or more)	62.5% (n=10/16)	81.25% (n=26/32)	0.1573
preoperative serum Creatinine level (Mg/dl)	0.903 + 0.17	1.081 + 0.414	0.0325
Preoperative Liver dysfunction (Yes)	56.25% (n=9/16)	37.5% (n=12/32)	0.217

Preoperative ventilation (%)	31.25% (n=5/16)	0% (n=0/32)	0.00083
Cross clamp time (min)	90.06 + 26.80	75.66 + 27.001	0.0712
CPB time (min)	140.5 + 39.25	113.87 + 39.30	0.232
mechanical valve implanted	100%	100%	0
Pannus	62.5% (n=10/16)	56.25% (n=18/32)	0.67
Postoperative ventilation (Hrs)	24.71 + 27.72	13.48 + 10.48	0.247
Length of ICU stay (hrs)	37.68 + 24.85	69.40 + 39.94	0.125
Disabling stroke (%)	12.5% (n=2/16)	3.125% (n=1/32)	0.205
MODS(%)	37.5% (n=6/16)	6.25% (n=2/32)	0.006
In-hospital mortality (%)	37.5% (n=6/16)	6.25% (n=2/32)	0.006

DISCUSSION

PVT results from new intra-cardiac clot formation with background of atrial fibrillation and fluctuating coagulation profile or may evolve over inflammatory pannus.[7] The resultant thrombus may cause obstructive PVT or non-obstructive PVT depending upon it severity to blood flow obstruction across the prosthetic valve. Severity of clinical symptomatology and risk of dread complication are prominent feature of disease. Prompt clinical investigation with TTE/TEE or fluoroscopic evaluation is needed to locate site of thrombosis, clot size and volume, prosthetic valve malfunction like disc mobility etc.[8,9,10] PVT predispose to imminent life threatening conditions like major thromboembolism or cardiovascular collapse or death thus make PVT as true cardiovascular emergency particularly when left sided heart valves are involved.

Ultimate treatment option available for PVT are either fibrinolytic or surgical intervention.[6] There has been lot of controversies about superiority of one treatment strategy over the other because lack of randomized control trials. There is a strong emerging opinion in favor of thrombolytics superiority for PVT over surgical intervention on the basis of recent published data.[11,12] Sufficient evidence support fewer complications rate related to thrombolytics than reported in past years.[6,13] However thrombolytic therapy is not the best treatment option for all PVT particularly in presence of large LA clot where risk of disabling cerebrovascular stroke is significant.[6] Additionally the structural malfunction of prosthetic valve and pannus are less like to resolve with thrombolytics. Thus surgical intervention is more logical choice to be offer.

One of the most concern able outcome of surgical intervention is operative mortality. In initial published reports from 80s showed the operative mortality for surgical intervention in PVT is reported as high as 62%.[14] Over the years, the operative mortality for PVT surgery has much improved. Recent data showed that the operative mortality is strongly liked to procedural emergency and it is doubles the mortality from 10-15% (non-emergency surgery) to 20-40%.[15,16] The reason for this high mortality rate is supposed as poor general condition, failure to achieve preoperative optimization, worsen cardiac function. In our operative series, the overall mortality for surgery is comparable to published data (16.67%). The most striking feature is that it is grossly high when surgery performed for emergency (37.5%) and 100% for preoperatively ventilated patient with imminent cardiorespiratory failure. Another surprised fact is remarkably low mortality in urgent surgery group with overall mortality of 6.25% that is as low as of reported for thrombolytics therpay in PVT. We find that if surgery is performed timely with better hemodynamic profile, the operative results are appealing.

In all of our patient population, we replaced the implanted valve with a newer bileaflet mechanical prosthetic valve no matter there was any pannus present or absent. There are few published reports who favor that debridement of clot is sufficient at many times.[17] Our cardiac surgery group is in absolute favor of valve replacement to exclude theoretic risk of recurrent thrombosis and manipulation related risk of prosthetic valve malfunction.

CONCLUSION

Our results conclude that overall operative mortality of PVT is high specially when performed under emergent indication with background of imminent cardiorespiratory failure mandating preoperative ventilation. Surgical intervention under urgent indication however yields very impressive results with low operative mortality.

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