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Original Article

Outcome Prediction after Surgical Management of Prosthetic Mitral Valve Dysfunction; a single center experience

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Abstract

Background: Prosthetic Mitral valve dysfunction is a serious complication associated with a high mortality rate particularly in obstructive cases. The number of cases undergoing redo mitral valve surgery is increasing. This study aims to identify the risk factors of mortality and morbidity in patients who underwent redo mitral valve surgery for prosthetic mitral valve dysfunction.

Methods: This study was conducted on 80 patients who underwent re-operation for management of prosthetic mitral valve dysfunction from December 2014 to February 2018. Patients' age ranged between 21 and 58 years with a mean of 36.8±9.60 years, and 53 patients (66.3%) were males. The causes of mitral valve malfunction were thrombus in 67 patients (83.7%) and pannus in 13 patients (16.3%).

Results: 53 patients (66.25%) had urgent surgical intervention. Thrombectomy or pannus resection was done in 75 patients (93.75%) and valve replacement in 5 patients (6.25%). Re-exploration was required in 11 patients (13.75%) and was significantly associated with diabetes (p= 0.004), preoperative liver dysfunction (p= 0.04), elevated INR (p= 0.006), trial of thrombolysis (p<0.001) and prolonged ischemic time (p= 0.01). Postoperative renal failure occurred in 11 patients (13.75%) and was associated with diabetes (p< 0.001), preoperative renal dysfunction (p< 0.001), prolonged cardiopulmonary bypass and ischemic times (p< 0.001). 17 patients (21%) required prolonged mechanical ventilation and it was significantly associated with chronic obstructive lung disease (p< 0.001), pulmonary edema (p <0.001), low systolic blood pressure (p <0.001), low ejection fraction (p<0.001) and thrombectomy (p<0.001). Operative mortality occurred in 13 patients (16%) and was significantly associated with preoperative stroke, renal dysfunction, low blood pressure and acute pulmonary edema (p <0.001).

Conclusion: Reoperation for prosthetic mitral valve dysfunction is associated with high morbidity and mortality. Outcomes can be predicted based on preoperative clinical status and operative times. Thrombectomy and pannus resection with the repair of the paravalvular leak is a simple and easy technique for management of those patients with a reduction of cardiopulmonary bypass and cross-clamp times.

KEYWORDS

Mitral valve thrombosis; Reoperation; Risk prediction; Thrombectomy; Pannus resection

Article History

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Introduction

Despite the advancement achieved in valve surgery, prosthetic mitral valve dysfunction is a serious complication associated with high mortality, particularly in obstructive cases. Several studies were carried out to identify the risk factors for prosthetic valve dysfunction [1], and an algorithm for management of obstructive thrombosed prosthetic heart valve was developed recently [2]. With the advances in cardiac surgery, the longevity of patients has improved, and consequently more patients are referred for redo surgery for several reasons. Reoperations carry high risk due to advanced patients age and comorbidities, in addition to the technical challenges [3].

Prosthetic valves dysfunction may be caused by suture line dehiscence leading to paravalvular regurgitation or breakage and separation of the valve components or valve obstruction. Several factors; such as thrombosis, pannus formation, bacterial endocarditis, chordal debris, and papillary muscle entrapment can cause mechanical malfunctions of prosthetic heart valves. Thrombosis or pannus formation is considered as the most common causes of prosthetic mitral valve obstruction [4].

Compared to the bioprosthetic valves, mechanical valves are more durable but carry the risk of thrombosis and obstruction [5] which occur in 1- 2.7% per patient-year in the aortic position and 1- 4.4% per patient-year in the mitral position [6, 7]. Surgery is the primary treatment modality for the management of thrombosed mechanical valves; however, thrombolytic therapy became an alternative and is increasingly used as the first line therapy for mechanical valve obstruction [8].

We aimed in this study to investigate the risk factors of mortality and morbidity in patients who underwent redo mitral valve surgery for prosthetic mitral valve dysfunction.

Patients and Methods:

This prospective cohort study was conducted on 80 patients who underwent re-operation for management of prosthetic mitral valve thrombosis or malfunction from December 2014 to February 2018. Prosthetic valve dysfunction was defined as any change in the valve function causing significant stenosis or regurgitation [4].

In this study, we included all patients presented with mechanical or bioprosthetic mitral valve dysfunction and had isolated mitral valve surgery with or without tricuspid repair. We excluded patients with infective prosthetic endocarditis and those who had concomitant cardiac surgical procedure or had a previous coronary artery bypass grafting.

The Ethical Committee approved the study, and patients' consent was obtained before enrollment.

Preoperative preparation:

All patients were evaluated by detailed preoperative history taking and physical examination. Details of the prior surgery were reported including the access, valve type, and size and the last dose of the anticoagulant. Chest X-rays (posteroanterior and lateral views) were performed to assess the chest condition, the number of stainless-steel wires of previous sternotomy and the relation between the heart and the sternum. Echocardiography (transthoracic TTE with or without transesophageal TEE) was done to assess leaflet mobility, presence of thrombi, vegetation, paravalvular leak, valve dehiscence, pulmonary artery pressure, chamber dimensions, and ejection fraction. Fluoroscopy was done if the echocardiography was not conclusive for valve mobility. Blood culture was performed in suspected cases of endocarditis.

Once the diagnosis of prosthetic dysfunction was confirmed, all patients were admitted to the intensive care unit. Surgical interventions were performed without correction of INR especially in patients with poor clinical status or pulmonary edema.

Operative Technique:

All operations were carried out under general anesthesia and through median sternotomy using the oscillating saw. After the sternum was re-opened, major bleeding points from the edges were controlled. An appropriate sternal retractor was then placed and opened slowly. Access to the aorta and right atrium was done first. Purse strings were placed so that cannulation can be performed quickly if bleeding occurs. Femoral vessels were exposed in selected cases (e.g., suspicion of severe mediastinal adhesions or high central venous

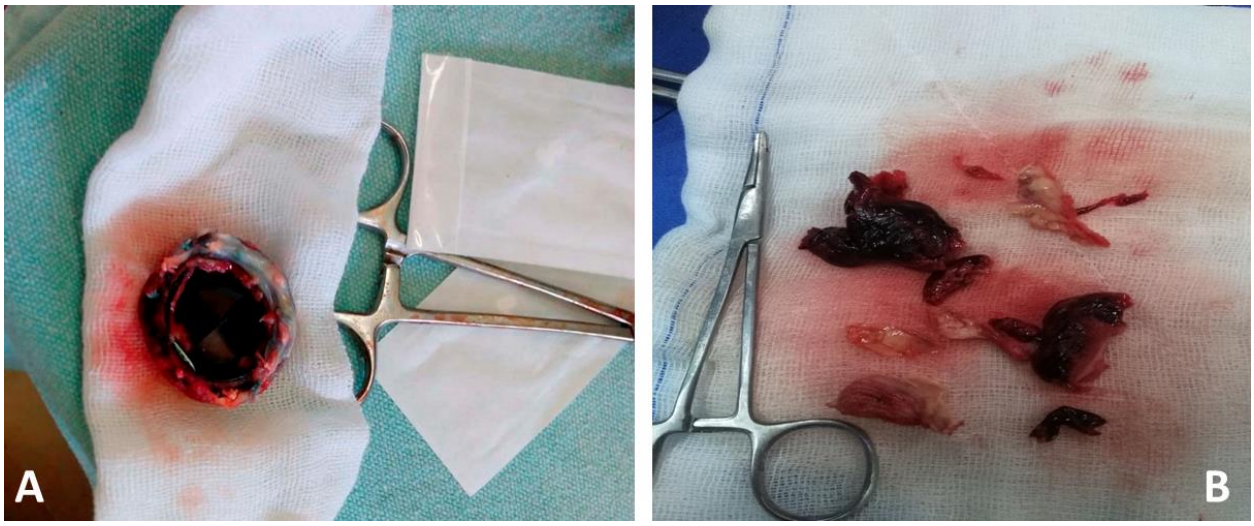

Figure 1: (A) Prosthetic valve with thrombus and pannus after removal from the patients. (B) Organized and fresh thrombus after thrombectomy

pressure after induction of anesthesia). The femoral artery was exposed and prepared without cannulation in 14 cases before opening the sternum, and it was cannulated in 3 cases.

The left pleural space was opened to drop the left ventricular apex to improve mitral valve exposure. The aorta is cannulated distal to the former site of cannulation to avoid unyielding fibrous tissue. If the adhesions on the aorta make dissection difficult, the pericardial reflection was opened, and the aorta was cannulated close to the brachiocephalic trunk. When the aorta was cross-clamped, antegrade cold blood cardioplegia was given and systemic hypothermia to 28-32°C was used. Repeated doses of cardioplegia were given every 30 minutes.

After complete cardiac arrest, the left atrium was opened. Simple thrombectomy was appropriate in most patients with or without pannus resection or repair of the paravalvular leak. Replacement of the valve was preferred if the thrombus is inaccessible on the ventricular surface of the valve or thrombotic material undistinguished from the vegetation of endocarditis (Figure 1).

Post-operative Care:

All Patients were transferred to the ICU on inotropic support if needed. They were monitored continuously for arterial pressure through an invasive arterial cannula, central venous pressure through a venous line inserted in the internal jugular vein and the urine output. Weaning from inotropic support and mechanical ventilation was started when the patient was hemodynamically stable. Patients were left in the ICU for 12-24 hours after weaning from mechanical ventilation and inotropic support; then they were transferred to the ward after removal of central venous line and drainage tubes. Patients were discharged from the hospital with a clean wound, stable sternum, normal laboratory findings with INR within the therapeutic level and absence of fever.

Definitions:

Hepatic dysfunction was defined as serum bilirubin >2.0 mg/dL. Urgent operations were defined as a surgical intervention within 24 hours of the hospital admission. Postoperative renal failure is the requirement for new dialysis postoperatively. Prolonged mechanical ventilation is the need for ventilatory support for more than 24 hours and prolonged ICU stay as the stay in ICU for more than 72 hours. Sternal wound infections were defined as infections that required operative intervention. Re-exploration for bleeding was defined as the drainage of more than 500ml in the 1st hour, 800ml in the first 2 hours, 900ml in the first 3 hours, 1000ml in the first 4 hours, 1200ml in the first 5 hours or sudden massive bleeding with hemodynamic instability or cardiac tamponade. Paravalvular leak refers to the regurgitation of blood due to causes other than infective endocarditis. Prosthetic valve failure refers to all other causes of prosthetic valve dysfunction

Table 1: Baseline characteristics of the patients. Continuous variables are presented as mean± SD and categorical variables as number and percentage.

Parameters	n=80
Age(mean±SD) (Years)	36.8±9.60
Male(n)	53(66.3%)
Body mass index (above 25 kg/m2)(n)	9 (11.3%)
Diabetes mellitus (n)	7(8.86%)
History of cerebrovascualr accident (n)	5(6.3%)
Preoperative renal dysfunction (n)	3 (7.3%)
Preoperative liver dysfunction(n)	4(5%)
Symptoms and signs	
New York Heart Association (NYHA) class III(n)	34(42.5%)
NYHA class IV(n)	46(57.5%)
Acute pulmonary edema(n)	9(11.3%)
Lower limb edema (n)	5(6.3%)
Chronic obstructive pulmonary disease	8(10%)
Atrial fibrillation (n)	43(53.8%)
Mean arterial blood pressure <70 mmHg (n)	25(31.3%)
Heart rate > 100 (n)	46(57.5%)
Creatinine (mg/dL) (mean ±SD)	1.016±0.41
INR (International normalization ratio)<2(n)	56(70%)
INR mean±SD	1.72±0.68
Time from last operation (months) mean±SD	61.40±44.10
Time to operation	
Emergency (within few hours) (n)	9(11.25%)
Urgent ≤ 24 hours (n)	53(66.25%)
Elective > 24 hours (n)	18(22.5%)
Transthoracic echocardiographic data	
Ejection fraction (EF) (%) mean±SD	53.64±7.47
EF<50%(n)	20(25 %)
EF>50%(n)	60(75%)
Systolic pulmonary artery pressure (SPAP) (mmHg) mean±SD	58.86±10.09
SPAP <60 mmHg (n)	44(55%)
SPAP >60 mmHg (n)	36(45%)
Transesophageal echocardiography (n)	10(12.5%)
Echocardiography of the mitral valve prosthesis	
Elevated pressure gradient(n)	68(85%)
Immobile leaflet(n)	72(90%)
Detected thrombus(n)	8(10%)
Paravalvular leak(n)	7(8.8%)

including valve thrombosis, tissue ingrowth, and mechanical dysfunction.

Statistical analysis

Data were summarized as proportions, percentages for categorical variables and continuous data were presented as mean ± SD. Categorical variables were compared using the Pearson's Chi-squared test or Fisher's exact test, and independent continuous variables were compared by the unpaired Student t-test or Kruskal-Wallis test as appropriate. The analysis was performed by the Statistical Package for the Social Sciences (SPSS Version 23, IBM Corporation, Chicago, IL, USA). P-value <0.05 was considered statistically significant.

Results

The age of our patients ranged between 21- 58 years with a mean of 36.8±9.60 years and 53 of them (66.3%) were males. Baseline characteristics of the studied patients are shown in Table 1. The diagnosis was done by clinical data and transthoracic echocardiography (TTE), and in ten patients, transesophageal echocardiography (TEE) was needed to confirm the diagnosis.

The cause of mitral valve malfunction was thrombus in 67 patients (83.7%), pannus in 13 patients (16.3%), and paravalvular leak in 7 patients (8.75%). Thrombectomy and pannus resection were done in 75 patients (93.75%) and valve re-replacement in 5 patients (6.25%). Direct left atriotomy was used in 36 patients (45%), and the transseptal approach in 44 patients (55%). Seven patients needed femoral cannulation (8.8%). Cardiopulmonary bypass (CPB) time exceeded 120 minutes in 24 patients (30%).

Eleven patients (13.8%) needed re-exploration for postoperative bleeding, and 17 patients (21.2%) had prolonged ventilation. Postoperative renal dysfunction occurred in 11 patients (13.8%), and chest infection in 14 (17.5%) patients. The mean of ICU stay was 99.16± 68.90 hours, and 48(60%) patients had ICU stay for more than 72 hours. The mean hospital stay was 10.78± 2.36 days. Operative mortality occurred in 13 patients (16.2%) (Table 2).

Re-exploration for bleeding was significantly associated with preoperative liver dysfunction,

Table 2: Postoperative complications. Continuous variables are presented as mean± SD and categorical variables as number and percentage.

Postoperative complications	n=80
Duration of mechanical ventilation	
≤24 hours	63(78.8%)
>24 hours	17(21.2%)
Re-exploration	11(13.7%)
Renal failure	11(13.8%)
Stroke	5(6.25%)
Thromboembolic complications	1(1.25%)
Chest infection	14(17.5%)
Wound infection	8(10%)
ICU stay (hours) Mean± SD	99.16±68.90
ICU stay ≤72 hours	48(60%)
ICU stay >72 hours	32(40%)
Hospital stay (days) Mean± SD	10.78±2.36
Operative mortality	13(16.3%)

preoperative INR >2 and trial of thrombolysis. (Table 3) Postoperative renal failure was significantly correlated with preoperative renal dysfunction, diabetes mellitus, prolonged CPB and cross-clamp times. (Table 4) Prolonged postoperative mechanical ventilation and ICU stay were significantly associated with chronic obstructive pulmonary disease (COPD), New York Heart Association (NYHA) class IV, acute pulmonary edema, mean arterial blood pressure < 70, ejection fraction (EF) <50 %, chest infection, CPB time>120 minutes, aortic-cross clamp time>90 minutes, renal dysfunction and re-exploration (Table 5 and Table 6).

Operative mortality was significantly correlated with DM, history of cerebrovascular accident, renal and liver dysfunction, NYHA class IV, acute pulmonary edema, lower limb edema, COPD, atrial fibrillation, mean arterial blood pressure < 70, EF <50%, systolic pulmonary artery pressure (SPAP) >60mmHg, CPB time>120 minutes and aortic-cross clamp time>90 (Table 7).

Discussion

Prosthetic valve dysfunction is a life-threatening complication with an incidence of 0.1–6.0% per patient-year [9]. The optimal

*Table 3: Risk factors for re-exploration. Continuous variables are presented as mean± SD and categorical variables as number and percentage. * indicate significant difference between groups (p<0.05).*

Parameters	Re-exploration		P-value
	No (n =69)	Yes (n=11)	
Age (Years)	37.23±9.39	34.53±10.70	0.41
Diabetes mellitus	7(10.1%)	0	0.004*
History of cerebrovascular accident	4(5.8%)	1(9.1%)	0.4
Preoperative renal dysfunction	6(8.6%)	1(9.1%)	0.93
Preoperative liver dysfunction	4(5.8%)	0	0.048*
International normalization ratio (INR)>2	45(65.2%)	11(100%)	0.006*
Trial of thrombolysis	2(2.5%)	2(18.2%)	<0.001*
Urgent operation (≤ 24 hours)	52(75.4%)	10(90.9%)	0.01*
Cardiopulmonary bypass time>120 min.	23(33.3%)	3(27.2%)	0.43
Aortic-cross clamp time>90 min.	17(24.6%)	5 (45.4%)	0.011*
Thrombectomy	65(94.2%)	10(90.9%)	0.67
Valve replacement	4(5.8 %)	1(9.1%)	

management is controversial. Reoperations are associated with higher mortality compared to the primary operation and are technically demanding because of the adhesions around the heart. Reoperations are generally performed in a functionally compromised group of patients; therefore, these patients tolerate complications poorly [10].

The outcomes in our study were affected by the preoperative clinical status and the cardiopulmonary bypass and ischemic times. Re-exploration was required in 13.7% of our patients, and because of the urgency of the operation, most of the patients underwent surgery with elevated INR. High preoperative INR and trials of thrombolysis increased the risk of postoperative bleeding. Total bypass time and hepatic dysfunction were risk factors for postoperative bleeding. Valve dysfunction may lead to hepatic congestion preoperatively which affects the coagulation factors. Moreover, the CPB has a negative effect on the coagulation mechanisms which was exaggerated by prolonged total bypass time. Pansini and associates had excessive postoperative bleeding (defined as bleeding of more than 1000 ml in the first 24 hours postoperatively) in 14.5% of the patients while re-exploration was required in 8% of them [11].

*Table 4: Risk factors for postoperative renal failure. Continuous variables are presented as mean± SD and categorical variables as number and percentage. * indicate significant difference between groups (p<0.05).*

Parameters	Renal failure		P-value
	No (n =69)	Yes (n=11)	
Age (Years)	36.62±9.85	37.90±8.11	0.68
Diabetes mellitus	2(3.3%)	5(45.4%)	<0.001*
Preoperative renal dysfunction	2(3.3%)	5(45.4%)	<0.001*
Preoperative liver dysfunction	3(5.0%)	1(9.1%)	0.28
Mean blood pressure<70 mmHg	21(35.0%)	3(27.2%)	0.37
Cardiopulmonary bypass time>120 min.	19(31.6%)	7(63.6%)	0.001*
Aortic-cross clamp time>90 min.	13(21.6%)	9(81.8%)	<0.001*

*Table 5: Risk factors for prolonged mechanical ventilation. Continuous variables are presented as mean± SD and categorical variables as number and percentage. * indicate significant difference between groups (p<0.05).*

Parameters	Prolonged mechanical ventilation		P-value
	No (n =63)	Yes (n =17)	
Age (Years)	36.42±9.63	38.17±9.64	0.50
Chronic obstructive pulmonary disease	1(1.58%)	7(41.4%)	<0.001*
Diabetes mellitus	5(7.9%)	2(11.7%)	0.41
History of cerebrovascular accident	3(4.71%)	2(11.7%)	0.012*
Preoperative renal dysfunction	4(6.3%)	3(17.6%)	0.02*
Preoperative liver dysfunction	4(6.3%)	0 (0.0%)	0.28
Symptoms and signs			
New York Heart Association (NYHA) class III	24(38.1%)	10(58.8%)	0.04*
NYHA class IV	30(47.6%)	15(88.2%)	<0.001*
Acute pulmonary edema	4(5 %)	6(35.2%)	0.001*
Lower limb edema	3(3.75%)	3(17.6%)	0.003*
Atrial fibrillation	33(41.25%)	10(58.8%)	0.081
Mean arterial blood pressure < 70 mmHg	15(18.25%)	9(52.9%)	<0.001*
Heart rate > 100 beat/minute	38(47.5%)	9(52.9%)	0.08
International normalization ratio (INR)<2	49(77.8%)	7(41.4%)	<0.001*
Echocardiographic data			
Ejection fraction (EF)<50 %	8(12.7%)	12(70.5%)	<0.001*
Systolic pulmonary artery pressure (SPAP) >60mmhg	25(39.7%)	11(64.7%)	0.013*
Urgent operation (≤ 24 hours)	47(74.6%)	15(58.8%)	0.23
Thrombectomy	63(100.0%)	12(70.5%)	0.001*
Valve replacement	0(0.0%)	5(29.5%)	
Need for re-exploration	8(10%)	3(17.6%)	0.17
Postoperative complications:			
Renal failure	5(6.25%)	6(35.3%)	0.004*
Stroke	3(3.75%)	2(11.8%)	0.048*
Chest infection	6(7.5%)	8(47.1%)	0.001*
Wound infection	6(7.5 %)	2(11.8%)	0.41
Cardiopulmonary bypass time>120 min.	16(20 %)	10(58.8%)	0.001*
Aortic-cross clamp time>90 min.	11(13.75%)	11(64.7%)	0.001*

Preoperative renal dysfunction, diabetes mellitus, and prolonged CPB and cross-clamp times were risk factors for renal failure necessitating dialysis which occurred in 13.7% of the patients. Akay and colleagues reported postoperative renal dysfunction in 14% of their patients [12]. Chang and colleagues found that diabetes mellitus was associated with acute kidney injury [13]. DM has an effect of the renal micro-circulation and prolonged CPB time induces systemic inflammatory changes which may have an independent toxic impact on the kidneys.

NYHA class, renal impairment, and prolonged CPB and cross-clamp times were risk factors for prolonged ICU stay and mechanical ventilation. Pulmonary complications occurred in 9 patients

*Table 6: Risk factors for prolonged ICU stay. Continuous variables are presented as mean± SD and categorical variables as number and percentage. * indicate significant difference between groups (p<0.05).*

Parameters	Prolonged ICU stay		P-value
	No (n=48)	Yes (n=32)	
Age (Years)	37.12±9.72	36.31±9.54	0.71
Chronic obstructive pulmonary disease	1(1.25%)	7 (21.8%)	<0.001*
Diabetes mellitus	2(4.2%)	5(15.6)	0.01*
History of cerebrovascular accident	3(6.3%)	2(6.3%)	1.00
Preoperative renal dysfunction	1(2.08%)	6(18.7%)	<0.001*
Preoperative liver dysfunction	3(6.3%)	1(3.1%)	0.31
Symptoms and signs			
New York Heart Association (NYHA) class III	20(41.7%)	14(43.8%)	0.85
NYHA class IV	26(54.2%)	19(59.4%)	0.64
Acute pulmonary edema	2(4.2%)	8(25%)	<0.001*
Lower limb edema	2(4.2%)	3(9.4%)	0.34
Preoperative mechanical ventilation	3(6.2%)	1(3.12%)	0.51
Echocardiographic data			
Ejection fraction (EF)<50%	8(16.6%)	12(37.5%)	0.003*
Systolic pulmonary artery pressure (SPAP) >60mmHg	18(37.5%)	18(56.3%)	0.048*
Thrombectomy	46(95.8%)	29(90.6%)	0.34
Valve replacement	2(4.2%)	3(9.4%)	
Urgent operation (≤ 24 hours)	34(70.8%)	28(87.5%)	0.08
Postoperative parameters			
Mechanical ventilation>24 hours	8(16.7%)	9(28.1%)	0.07
Re-exploration	4(8.3%)	7(23.3%)	<0.001*
Postoperative complications			
Renal failure	3(6.3%)	8(25%)	0.017*
Stroke	2(4.2%)	3(9.4%)	0.34
Chest infection	4(8.4%)	9(28.1%)	0.019*
Wound infection	6(9%)	2(6.2%)	0.47
Cardiopulmonary bypass time>120 min.	13(27.1%)	13(40.6%)	0.11
Aortic cross-clamp time>90	7(14.6%)	15(46.9%)	<0.001*

(11.25%). Risk factors for prolonged ventilation and ICU stay differ between studies because of the variations in comorbidities and different baseline patients' characteristics [14, 15]

Operative mortality was significantly associated with the history of stroke, renal failure, acute pulmonary edema, NYHA class IV, prolonged CPB and cross-clamp times, mean arterial blood pressure <70 mmHg, and ejection fraction<50%. Mortality occurred in 13 patients (16.3%), and the reported operative mortality ranged from 10% to 40% in emergency operations [11, 12]. In our study, the sex and age did not affect hospital mortality; however, advanced age is associated with a decreased physiologic reserve and increased morbidity. In accordance with these findings, several series showed that age and gender did not affect the hospital mortality [15, 16], and in other series, female gender was a risk factor for mortality [12, 17].

*Table 7: Risk factors for operative mortality. Continuous variables are presented as mean± SD and categorical variables as number and percentage. * indicate significant difference between groups (p<0.05).*

Parameters	Operative mortality		P-value
	No (n=67)	Yes (n=13)	
Age	37.23±9.39	34.53±10.70	0.57
Female	45(67.16%)	8(61.5%)	0.69
Body mass index (BMI) >25 kg/m2	8(11.9%)	1(7.6%)	0.66
Diabetes mellitus	7(10.4%)	0 (0.0%)	0.004*
History of cerebrovascular accident	2(2.9%)	3(27.2%)	<0.001*
Preoperative renal dysfunction	3(4.4%)	4(30.7%)	<0.001*
Preoperative liver dysfunction	4(5.9%)	0 (0.0%)	0.043*
Symptoms and signs			
New York Heart Association (NYHA) class III	26(38.8%)	8(80.0%)	<0.001*
NYHA class IV	40(59.7%)	6(46.2%)	0.21
Acute pulmonary edema	4(5.9%)	6(46.2%)	<0.001*
Lower limb edema	3(4.4%)	2(15.4%)	0.011*
Chronic obstructive pulmonary disease	5(7.4%)	3(23.07%)	0.003*
Atrial fibrillation	33(49.2%)	10(76.9%)	0.015*
Mean arterial blood pressure < 70 mmHg	16(23.8%)	8(61.5%)	<0.001*
Heart rate > 100 beat/minute	40(59.7%)	7(53.8%)	0.57
International normalization ratio (INR)<2	49(73.1%)	7(53.8%)	0.07
Echocardiographic data			
Ejection fraction (EF)<50%	15(22.3%)	5(38.4%)	0.038*
Systolic pulmonary artery pressure (SPAP) >60 mmHg	28(41.8%)	8(61.5%)	0.047*
Elevated pressure gradient	59(88.1%)	9(69.2%)	0.12
Immobile leaflet	61(91%)	11(84.6%)	0.47
Detected thrombus	7(10.4%)	1(7.7%)	0.76
Paravalvular leak	5(7.5%)	2(15.4%)	0.35
Time from last operation (months) mean± SD	63.73±44.72	49.38±34.30	0.47
Urgent operation (≤ 24 hours)	50(74.6%)	12(15 %)	0.16
Thrombectomy± repair of paravalvular leak.	63(94.0%)	11(92.3%)	0.81
Valve replacement	3(4.4%)	2(15.4%)	
Postoperative parameters			
Mechanical ventilation>24 hours	7(10.44%)	10(76.9%)	<0.001*
Re-exploration	8(11.9%)	3(23.3%)	0.03*
Postoperative complications			
Renal failure	4(5.9%)	7(53.8%)	<0.001*
Stroke	2(2.98%)	3(23.1%)	<0.001*
Chest infection	8(11.9%)	6(46.2%)	<0.001*
Wound infection	6(9%)	2(15.4%)	0.22
Cardiopulmonary bypass time> 120 min	16(23.9%)	10(76.9%)	<0.001*
Aortic cross-clamp time> 90 minutes	14(20.9%)	11(84.6%)	<0.001*

Diabetes was not a risk factor for hospital mortality which could be attributed to the small number of diabetic patients in our study.

Preoperative renal impairment negatively affected operative mortality [18, 19]. Patients presented with valve obstruction and low blood pressure are prone to kidney injury which further leads to fluid retention and exaggerates the heart failure. In agreement with other studies, the previous stroke was associated with higher mortality [20]. Stroke can occur due to concomitant carotid disease or embolization from left atrial thrombus. Recent hemorrhagic or ischemic stroke is a contraindication to elective cardiac surgery as it is associated with high mortality.

The pathology of the mitral valve dysfunction had no impact on mortality. Other studies found that the indication for surgery had no effect on hospital mortality [14, 16]; meanwhile, other series found that operative mortality was significantly higher in reoperation for prosthetic endocarditis [21, 22]. In our study, we excluded patients with infective endocarditis, and the outcomes were not affected by the pathology of valve dysfunction. This could be attributed to the variable severity of the same valve pathology; therefore, a variable effect on the clinical status of the patients. Emergency surgery was associated with operative mortality which reflected the bad clinical condition of the patients that required immediate intervention without routine preparation [17, 18]. The reported mortality risk of elective reoperation was 5.4%- 11%, while, for emergency procedures, it could be as high as 38% to 61.5% [19].

The cardinal cause of prosthetic valve thrombosis in our series was inadequate coagulation. Thrombectomy and pannus resection with the repair of a paravalvular leak were our preferred surgical techniques. The technique is simple and has a low CPB and ischemic times compared to valve replacement. Mortality in the current study was significantly associated with long CPB and cross-clamp times which is consistent with the published series [16, 19, 23]. The cause of the prolonged CPB time was the lengthy weaning from the circulatory support because of the associated poor left ventricular function [20] which is a risk factor for morality [24, 25].

Study limitations:

The main limitation of the study is the relatively small sample size. Univariable risk factors for morbidity and mortality after reoperation for mitral valve dysfunction were identified; however, there could be interaction and confounding factors that were not be adjusted because of the small number of events. The other limitation is the single center experience, and the results cannot be generalized to other patients. However, the study presents the outcomes of a relatively uncommon condition and evaluates the effect of thrombectomy as an approach for those patients which is not thoroughly evaluated in the literature.

Conclusion

Reoperation for prosthetic mitral valve dysfunction is associated with high morbidity and mortality. Outcomes can be predicted based on preoperative clinical status and operative times. Thrombectomy and pannus resection with the repair of the paravalvular leak is a simple and easy technique for management of those patients with a reduction of cardiopulmonary bypass and cross-clamp times.

Conflict of interest: Authors declare no conflict of interest.

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