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Original Article

Surgical outcomes of obstructive mechanical valve thrombosis, risk factors, and comorbidity analysis

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Abstract

Background
Obstructive mechanical valves thrombosis is a life-threatening complication associated with high morbidity and mortality. Although thrombolytic therapy has gained a lot of popularity in recent years, yet the treatment of choice is still controversial.

Objective
The aim of this study was to evaluate the outcomes of patients who underwent redo valve surgery for obstructive mechanical valve thrombosis.

Patients and methods
Outcomes of 380 patients who underwent emergency redo surgery for obstructive mechanical valve thrombosis at our institute during a 5-year period (January 2012 to December 2017) were reviewed retrospectively. Clinical symptoms and transthoracic echocardiography were the mainstay in diagnosis. Fluoroscopy was used in the presence of dilemma regarding diagnosis. All patients were treated on an emergency basis. Postoperative outcomes were analyzed to determine risk factors and comorbidities affecting mortality rates in this high-risk group of patients.

Results
Number of patients was 380, with prevalence of female sex being 268 (70.52%). Mean age was 32.65 ± 10.70 years. Associated comorbidities were hypertension in 96 (25.26%), diabetes mellitus in 32 (8.42%), elevated liver enzymes in 32 (8.42%), elevated creatinine in 44 (11.57%), and preoperative cardiac arrest in eight (2.10%). Overall mortality was seen in 52 (13.68%) patients. Risk factors influencing mortality rates were preoperative hemodynamic instability, increased NYHA class, renal dysfunction, low left ventricular ejection fraction, and right ventricle dysfunction. Moreover, mortality was significantly affected by repetition of redo surgery, long bypass and cross-clamp time, high postoperative cardiac support, duration of mechanical ventilation, and ICU stay.

Conclusion
Prosthetic valve thrombosis is a life-threatening situation associated with substantial risk regardless of treatment modality. Late presentation with hemodynamic instability, increased NYHA class, low left ventricular ejection fraction, and severe right ventricle dysfunction carry worst prognosis in surgically treated patients.

Keywords: Comorbidities, obstructive, outcome, prosthetic valve thrombosis, risk factors

Introduction

Advanced rheumatic heart diseases represent a serious problem in developing countries which are treated by surgical valve replacement. However, a prosthetic mechanical valve poses a bunch of complications, including failure, endocarditis, complications of anticoagulation and valve thrombosis, or prosthetic valve obstruction [1].

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Obstructive mechanical valve thrombosis is a life-threatening complication whose management is still controversial [2]. Different mechanisms may be involved in the obstruction of a prosthetic valve with different

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pathologies including thrombus, pannus, and vegetation formation [3].

Various factors can predispose to prosthetic valve thrombosis such as valve position, pregnancy, atrial fibrillation, ventricular dysfunction, and inadequate anticoagulation therapy, which is considered the most common cause for this complication. The incidence of prosthetic valve thrombosis in the mitral position is five times higher as compared with that of the aortic position [4,5].

Treatment options for obstructive prosthetic valve thrombosis include surgical intervention, thrombolytic therapy, and heparin; however, the optimal treatment is still controversial [6].

Although thrombolytic treatment of left-sided prosthetic valve thrombosis has gained a lot of popularity in recent years especially for critically ill patients in whom surgery carries high risk or in patients with contraindication to surgery [7], yet surgical management remains the first option for patients with NYHA functional class III or IV and not at high surgical risk. In addition, endocarditis as a cause of obstruction with abscess formation and usually very large thrombi or mobile masses is a clear indication for surgical intervention. Hence, individual basis should be considered to determine best treatment option for each patient and to balance benefits and risks against center experience [8].

Against this background, we analyzed the mortality rates in these high-risk surgically treated patients and identified the risk factors and co-morbidities associated with worst postoperative outcomes in our national referral cardiac center, which has high volume of surgical activity.

Patients and methods

Ethics committee approval was taken. Between the period from January 2012 to December 2017, 380 consecutive patients presented to our emergency unit at National Heart Institute, Cairo, Egypt, complaining of shortness of breath and/or other thromboembolic or acute obstructive symptoms. Patients of both sexes and any age who were previously subjected to mechanical valve replacement for treatment of left-sided rheumatic heart diseases were included in our study. Patients with infective endocarditis or associated cardiac surgical procedure or who underwent thrombolytic therapy were excluded from the study.

All patients were managed as an emergency case for possible diagnosis of acute mechanical valve thrombosis. Full history was taken from all patients and their relatives focusing on time of previous operation, history of anticoagulation and warfarin compliance, onset and severity of symptoms, and presence or absence of pregnancy in female patients. Full laboratory investigations, ECG, and chest radiography were done for all patients, including coagulation profile, complete blood picture, kidney function tests, and liver function tests. Data from these patients were reviewed retrospectively.

Clinical symptoms and transthoracic echocardiography (TTE) were the mainstay in diagnosis, and all patients were examined for dyspnea (identifying NYHA functional class), thromboembolic manifestations, and presence or absence of hemodynamic instability. In case of presence of hemodynamic instability, immediate measurements were taken, including the following:

(1) Intravenous access including central venous pressure insertion.
(2) Insertion of a urinary catheter to observe urine output.
(3) Positive inotropic cardiac support and vasopressors to maintain adequate blood pressure.
(4) Putting the patient on mechanical ventilator.

Examination by TTE was done for all patients identifying leaflet movement and pressure gradient across the valve. Limitations regarding TTE due to acoustic shadowing and reverberations which need to be distinguished from vegetation or a thrombus were overcome by transesophageal echocardiography or fluoroscopy, which provides exact visualization of mechanical prosthetic heart valve leaflet motion.

After a diagnosis of prosthetic valve thrombosis was well established, all patients were subjected to heart team consultation to determine the most suitable treatment modality based on individual basis. The decision for surgical treatment was taken either from the beginning or owing to presence of contraindication to thrombolytic therapy. Patients were prepared, and surgery was done on an emergency basis. Lateral radiography was done for all hemodynamically stable patients to determine the presence of adequate space between sternum and anterior surface of the heart.

Postoperative data were then collected and analyzed to determine risk factors and comorbidities influencing mortality rates in this high-risk surgically treated group of patients.

Surgical details

After induction of anesthesia, patients were painted with povidone–iodine 7.5% from neck to knee, with the groin region being exposed in case of need for femoral cannulation. The decision of femoral cannulation was taken by the main surgeon according to hemodynamic stability of the patient and presence or absence of adequate space between sternum and anterior surface of the heart on lateral radiography.

Redo median sternotomy incision was used in all patients. After sternotomy, both pleurae were opened to facilitate opening of chest retractor. Fine dissection of adhesion was performed using diathermy and/or dissection scissors.

Initiation of cardiopulmonary bypass was done using aortobicaval cannulation. Snares were used in case of associated tricuspid pathology or when right atrium needed to be opened. Warm blood cardioplegia was used in all pregnant women to maintain normothermia during the procedure in an attempt to preserve pregnancy, otherwise cold crystalloid cardioplegia was used in the rest of patients.

Standard left atriotomy was used to approach mitral valve, and standard aortotomy was used to approach aortic valve.

Removal of the thrombosed valve was done using a sharp knife, starting with some old sutures to create a plane of dissection. Then dissection scissor was used to completely remove the valve putting in mind to leave part of the old cuff if needed to ensure adequate holding capacity of tissues.

A double-stranded pledgetted sutures were used to insert the new valve in position, starting through the annulus and then passed through the cuff of the new valve. After ligation of all sutures and testing the valve, closure of left atriotomy by 3/0 prolene and aortotomy by 4/0 prolene sutures followed by deairing and removal of cross clamp was done.

Statistical analysis

Data were collected, revised, coded, and entered into the Statistical Package for the Social Sciences (IBM SPSS) version 20 (IBM Corporation, Chicago, Illinois, USA). Qualitative data were presented as number and percentages, whereas quantitative data with parametric distribution were presented as mean, SD, and ranges. The comparison between two groups with qualitative data was done by using the χ^2-test or Fisher exact test when the expected count in any cell was found to be less than 5. Comparison between two independent groups regarding quantitative data with parametric distribution was done by using the independent *t*-test.

Results

The total number of patients included in our study was 380. There were 268 (70.52%) female. The mean age was 32.65 ± 10.70 years. Among the total female patients (268), 143 (53.35%) patients were pregnant.

Regarding congestive heart failure symptoms at presentation, 76 (20.00%) patients presented with NYHA class II, 200 (52.63%) patients presented with NYHA class III, and 104 (27.37%) patients presented with NYHA class IV. Moreover, 28 (7.36%) patients were hemodynamically unstable, and 36 (9.47%) patients needed preoperative inotropic support, with eight (2.10%) patients having preoperative cardiac arrest.

Regarding associated comorbidities, 32 (8.42%) patients were diabetic, 96 (25.26%) patients were hypertensive, 44 (11.57%) patients presented with high creatinine levels and renal dysfunction, and 32 (8.42%) had significant elevated liver enzymes. A total of 143 female patients were pregnant, with 95 (66.43%) in the first trimester, 46 (32.17%) in the second trimester, and two (1.4%) in the third trimester.

Regarding warfarin compliance, only 40 (10.52%) patients gave history of adequate anticoagulation therapy. Patients with international normalized ratio (INR) less than 1.5 were 316 (83.16%), from 1.5 to 2 were 28 (7.37%), and more than 2 were 36 (9.47%). Other patient demographics are listed in Table 1.

Regarding the number of repetitions of redo surgery, 360 (94.73%) were first redo, 12 (3.16%) were second redo, and eight (2.11%) were third redo. Most patients presented with stuck mitral valve [328 (87.23%)], whereas 48 (12.77%) patients presented with stuck aortic valve.

The mean bypass time was 158.86 ± 35.74 and the mean cross clamp time was 99.67 ± 30.35. Most patients received warm

Table 1: Patient demographics

	n=380
Age (years)	32.65±10.70
Female	268 (70.52)
Pregnant women	143/268 (53.35)
Gestational age	
First trimester	95 (66.43)
Second trimester	46 (32.17)
Third trimester	2 (1.4)
BMI (kg/m^2)	24.27±3.91
Hypertensive	96 (25.26)
Diabetes mellitus	32 (8.42)
NYHA	
II	76 (20.00)
III	200 (52.63)
IV	104 (27.37)
INR	
<1.5	316 (83.16)
1.5-2	28 (7.37)
>2	36 (9.47)
Warfarin compliance	40 (10.52)
Significant elevated liver enzymes	32 (8.42)
Elevated creatinine	44 (11.57)
Atrial fibrillation	264 (69.74)
Hemodynamically instability	28 (7.36%)
Cardiac arrest	8 (2.10)
Preoperative echocardiography	
LVESD	4.20±0.83
LVEDD	5.69±0.69
EF	53.87±9.95
LA	5.03±0.74
RV diameter	2.59±0.78
TAPSE	1.62±0.23
Maximum PG over MV	28.05±2.56
Mean PG over MV	18.71±2.32
Maximum PG over AV	91.53±5.18
Mean PG over AV	59.61±2.98
Preoperative cardiac support	
Adrenaline	20 (5.26)
Noradrenaline	16 (4.21)
Nature of last cardiac operation	
MVR	292 (76.84)
AVR	44 (11.58)
DVR	44 (11.58)
Concomitant tricuspid repair	180 (47.36)
Interval between cardiac operations (years)	4.60±1.89

Values are presented as numbers (%) or mean±SD. AV, aortic valve; AVR, aortic valve replacement; DVR, double valve replacement; EF, ejection fraction; INR, international normalized ratio; LA, left atrium; LVEDD, left ventricular end diastolic diameter; LVESD, left ventricular end systolic diameter; MV, mitral valve; MVR, mitral valve replacement; NYHA, New York Heart Association; PG, pressure gradient; RV, right ventricle; TAPSE, tricuspid annular plane systolic excursion.

cardioplegia [236 (62.77%)], including pregnant females in an attempt to preserve pregnancy, whereas the rest [140 (36.23%)] received cold cardioplegia.

Intraoperatively, the cause of mitral and/or aortic valve obstruction was pannus + thrombus in 64 (17.02%) and thrombus in 312 (92.98%) patients. Regarding postoperative cardiac support, 272 (72.34%) needed dobutamine and 56 (14.89%) needed adrenaline.

Postoperatively, the mean duration of mechanical ventilation was 34.44 ± 39.31 h, the mean duration of ICU stay was 87.45 ± 32.14 h, and the mean duration of hospital stay was 11.08 ± 4.30 days. Regarding re-opening, 28 (7.36%) patients were re-explored for excessive bleeding, with a total number of 20 (6.08%) patients experiencing wound infection.

The overall mortality was 52 (13.68%), with 24 (6.31%) intraoperative deaths. Postoperative complications were renal failure in 20 (5.26%), liver cell failure in four (1.05%), pneumonia in 20 (5.26%), stroke in 12 (3.15%), and heart block in eight (2.10%). Detailed operative and postoperative outcomes are shown in Table 2.

In an attempt to determine risk factors and comorbidities influencing rate of mortality in this particular group of patients, we studied factors affecting 30-day mortality between survival and mortality groups. We found that mortality is highly affected by the following factors: old age, hypertension, body mass index, increased NYHA class, low INR, liver or renal impairment, and hemodynamic instability.

Moreover, mortality rates were strongly positively correlated with the preoperative need of inotropic support or mechanical ventilation, preoperative low left ventricular (LV) ejection fraction and severe right ventricular dysfunction, increased pressure gradient across the valve, long bypass and cross-clamp time, repeated redo surgeries, and presence of postoperative complications such as renal or liver cell failure. Factors influencing 30-day mortality are listed in Table 3.

Discussion

Stuck valve represents 1–6% of postoperative prosthetic valve complications. It is most common owing to inadequate anticoagulation therapy. This phenomenon may be acute, leading to a fresh thrombus or chronic, associated with organized thrombus on top of pannus formation [9,10].

Once suspected, immediate echocardiographic diagnosis is mandatory and prompt treatment should be started at once. However, the treatment of choice remains controversial and may include reoperation, thrombectomy, and thrombolytic therapy [10,11].

It is well established that fresh thrombus has a higher incidence of being successfully treated by fibrinolysis in a period of less than 14 days approximately, regardless of the site of the thrombus in the body [12]. Hence, fibrinolysis may be an attractive treatment option in selected cases.

Table 2: Operative and postoperative outcomes

	n=380
Number of cardiac operations	
First redo	360 (94.73)
Second redo	12 (3.16)
Third redo	8 (2.11)
Type of cardiac operation[a]	
MVR	328 (87.23)
AVR	48 (12.77)
Bypass time (min)[a]	158.86±35.74
Cross clamp time (min)[a]	99.67±30.35
Type of cardioplegia[a]	
Warm	236 (62.77)
Cold	140 (36.23)
Causes of valve malfunction[a]	
Pannus+thrombus	64 (17.02)
Thrombus	312 (92.98)
Postoperative cardiac support[a]	
Dobutamine	272 (72.34)
Adrenaline	56 (14.89)
Duration of the ventilation (h)[a]	34.44±39.31
Duration of ICU stay (h)[a]	87.45±32.14
Mediastinal drainage (ml)[a]	593.10±323.58
Reopening[a]	28 (7.36)
Complications[a]	
Renal failure	20 (5.26)
Liver cell failure	4 (1.05)
Pneumonia	20 (5.26)
Stroke	12 (3.15)
Heart block	8 (2.10)
Mortality	
Intraoperatively	24 (6.31)
ICU	28 (7.36)
Total	52 (13.68)
Wound infection	
Superficial	16 (4.87)
Deep	4 (1.21)
Total	20 (6.08)
Ward stay (days)	11.08±4.30
Postoperative echocardiography	
LVESD	4.20±0.74
LVEDD	5.63±0.52
EF	51.37±9.08
LA	5.00±0.71
RV diameter	2.50±0.62
Maximum PG over MV	13.94±1.31
Mean PG over MV	4.39±0.64
Maximum PG over AV	24.84±1.34
Mean PG over AV	18.38±1.32
Fate of pregnancy	
Maternal death	16 (11.19)
Abortion	81 (56.64)
Premature delivery	34 (23.77)

Contd...

Table 2: Contd...

	n=380
Mature delivery	12 (8.4)

Values are presented as numbers (%) or mean±SD. [a]Number of patients decreased to 376, as four patients died during opening of the redo owing to cardiac or aortic injury before cannulation. AV, aortic valve; AVR, aortic valve replacement; DVR, double valve replacement; EF, ejection fraction; LA, left atrium; LVEDD, left ventricular end diastolic diameter; LVESD, left ventricular end systolic diameter; MV, mitral valve; MVR, mitral valve replacement; PG, pressure gradient; RV, right ventricle.

However, according to Vitale *et al.* [13], in almost 50% of the cases, thrombus is associated with pannus formation, and this association requires surgical management.

In a study done by Roudaut *et al*. [14], comparing long-term results of surgical versus thrombolytic management in 263 cases presented by prosthetic valve thrombosis, they found significant better results regarding recurrence and mortality in surgically treated group.

Renzulli *et al.* [12] have concluded that immediate surgical intervention has safer and more efficient results than fibrinolysis, which is successful only in 53.8% of patients and with embolic complications.

Roudaut *et al.* [15] also confirmed the superiority of prompt surgical treatment over fibrinolysis in terms of better early success rate and decreased incidence of complications in patients with mechanical valve obstruction.

This is consistent with our findings that surgical management should be the first-line of treatment for prosthetic valve obstruction, and fibrinolytic therapy should be spared to those patients with contraindication to surgery or when surgery is at high risk.

In our study, the mean age was 32.65 ± 10.70 years, ranging from 16 to 65 years. This relatively young age is owing to rheumatic heart disease, which is common in Egypt, and is presented at younger age group. Moreover, the short time elapsed between the first operation and redo surgery (stuck valve) may contribute to this young age at presentation, with a mean time to reoperation of 4.60 ± 1.89 years.

This is similar to other studies from Egypt, such as Fouda *et al.* [16] who studied the outcome of surgical management of 60 patients with mechanical mitral valve dysfunction from July 2011 till June 2013 at Kasr El-Ainy hospitals, Cairo, and the mean age of the study patients was 39 ± 10.14 years.

Other areas of the world with different valve pathologies may have older age groups, like a study from USA done by Potter *et al.* [17] who studied 106 patients who underwent repeated mitral valve replacement between January 1993 and December 2000 at Mayo Clinic, Minnesota, USA, and the mean age of the study group was 66 ± 12 years, where degenerative valve disease was the main pathology.

In our study, the high prevalence of pregnant women among patients with obstructive valve (37.63%) is owing to lack of warfarin compliance (for fear of teratogenicity) especially during the first trimesters (66.43%). This goes in line with many studies that reported pregnancy as a risk factor for prosthetic valve thrombosis.

Many studies have reported low INR levels and inadequate anticoagulation therapy as the main cause of prosthetic valve thrombosis. In this study, the number of patients with INR below 1.5 was 316 (83.16%).

The mean time to reoperation in a study done by Raboi *et al.* [18] was 26 ± 19.2 months. This is close to our mean time to reoperation. Poverty and lack of adherence of patients to medical instructions especially anticoagulant therapy are the main cause of rapid prosthetic valve thrombosis.

In our study, most patients presented with valve thrombosis in the mitral position (76.84%). All presented patients were managed as emergency cases, with a short time lag between diagnosis and transfer to operative room. This is similar to Toker *et al.* [19] who had 65.1% of their patients operated on under emergency conditions.

Our mean cardiopulmonary bypass time and cross-clamp time were 158.86 ± 35.74 min and 99.67 ± 30.35 min, respectively. This is close to the mean time of Toker *et al.* [19] who reported that the mean aortic cross-clamp time was 85.5 ± 36.4 min and total perfusion time was 135.3 ± 68.73 min.

The rate of re-exploration for high drainage in our study was 7.36%, and this is similar to other studies like Akay *et al*. [20], who reported a re-exploration rate of 7.1% for his studied group of patients.

In our study, 20 (5.26%) patients were complicated with renal failure and needed dialysis. This was owing to either low cardiac output, acute tubular necrosis, or vulnerable patients with borderline renal functions preoperatively. This percentage was similar to the results of Toker and colleagues, with 3.2%, and differs from some studies that showed a higher present of renal failure, like Akay and colleagues, with 14.2%, Potter and colleagues, with 10.4%, and Vohra and colleagues, with 12% [17,19–21].

The total ICU stay for our patients was 87.45 ± 32.14 h. This is slightly longer than Akay and colleagues who reported a total ICU stay of 81.6 ± 38.4 h. The total hospital stay in our study was 11.08 ± 4.30 days. This was longer than the results of Akay and colleagues who reported a total hospital stay of 9.1 ± 2.7 days, and shorter than other studies like Ahn and colleagues, who reported a total hospital stay of 16.9 ± 6.7 days, and Vohra and colleagues, who reported 17 ± 11 days [20–22].

The overall mortality rate in our study was 13.68%, which represent 52 patients. This is similar to other studies such as Vohra and colleagues, with 12%, AbouelKasem and colleagues, with 14%, and Fouda and colleagues, with 15%. Other studies showed a lower mortality rate, such as Ahn and colleagues, with 5%, and Akay and colleagues, with

Table 3: Factors affecting 30-day mortality

	Survival group (n=328)	Mortality group (n=52)	P
Age (years)	30.65±7.91	45.15±16.56	<0.001*
Female	232 (70.73)	36 (69.23)	0.824
BMI (kg/m²)	23.49±3.71	26.30±4.64	<0.001*
Hypertensive	77 (23.47)	19 (36.53)	0.003*
Diabetes mellitus	24 (7.31)	8 (15.38)	0.516
NYHA			
II	76 (23.18)	0 (00.00)	<0.001*
III	192 (58.53)	8 (15.38)	
IV	60 (18.29)	44 (84.62)	
INR			
<1.5	288 (87.80)	28 (53.84)	<0.001*
1.5-2	20 (6.10)	8 (15.38)	
>2	20 (6.10)	16 (30.76)	
Warfarin compliance ()	36 (10.9%)	4 (7.69)	<0.473
Significant elevated liver enzymes	20 (6.09)	12 (23.07)	<0.001*
Elevated creatinine	20 (6.09)	24 (46.15)	<0.001*
Atrial fibrillation	228 (69.51)	36 (69.23)	0.964
Hemodynamically instability	4 (1.21)	24 (46.15)	<0.001*
Cardiac arrest	2 (0.60)	6 (11.53)	<0.001*
Preoperative cardiac echo			
LVESD	4.03±0.69	5.22±0.92	<0.001*
LVEDD	5.57±0.48	6.42±0.79	<0.001*
EF	55.96±7.91	41.00±11.80	<0.001*
LA	4.96±0.66	5.50±1.01	<0.001*
RV diameter	2.38±0.43	3.86±1.16	<0.001*
TAPSE	1.67±0.18	1.30±0.30	<0.001*
Maximum PG over MV	27.67±2.30	30.16±3.01	<0.001*
Mean PG over MV	18.50±2.30	19.91±2.15	<0.001*
Maximum PG over AV	90.74±5.11	93.13±4.98	<0.001*
Mean PG over AV	58.99±2.67	59.84±2.52	<0.032*
Preoperative cardiac support			
Adrenaline	4 (1.21)	16 (30.67)	<0.001*
Noradrenaline	3 (0.91)	13 (25.00)	
Nature of last cardiac operation			
MVR	252 (76.82)	40 (76.92)	<0.463
AVR	36 (10.97)	8 (15.38)	
DVR	40 (12.19)	4 (7.69)	
Concomitant Tricuspid repair	148 (45.12)	32 (61.53)	<0.027*
Interval between cardiac operations (years)	4.32±1.83	4.61±2.32	<0.308
Repetition of redo surgery			
First redo	324 (98.78)	36 (69.23)	<0.001*
Second redo	4 (1.22)	8 (15.38)	
Third redo	0 (0.00)	8 (15.38)	
Types of cardiac operation			
MVR	283 (86.28)	45 (93.75)	<0.147
AVR	45 (13.72)	3 (6.25)	
Bypass time (minutes)	154.62±26.93	187.41±66.27	<0.001*
Cross clamp time (min)	95.86±24.01	125.41±51.80	<0.001*
Types of cardioplegia			
Warm	220 (67.07)	16 (33.33)	<0.001*
Cold	108 (32.93)	32 (66.67)	
Causes of valve malfunction			
Pannus+thrombus	58 (17.68)	8 (16.67)	<0.862
Thrombus	270 (22.32)	40 (83.34)	

Contd...

Table 3: Contd...

	Survival group (n=328)	Mortality group (n=52)	P
Postoperative cardiac support			
Dobutamine	236 (71.95)	36 (75.00)	<0.001*
Adrenaline	44 (13.41)	12 (25.00)	
Duration of the ventilation (h)	24.55±20.34	148.85±17.43	<0.001*
Duration of ICU stay (h)	82.14±27.24	148.85±17.43	<0.001*
Mediastinal drainage (ml)	601.00±334.53	522.85±129.96	<0.097
Reopening	22 (6.71)	6 (11.53)	<0.215
Renal failure	8 (2.43)	12 (25.00)	<0.001*
Liver cell failure	1 (0.30)	3 (5.76)	<0.001*
Pneumonia	15 (4.57)	5 (9.61)	<0.130
Stroke	9 (2.74)	3 (5.76)	<0.246
Heart block	5 (1.52)	3 (5.76)	<0.006*
Wound infection			
Superficial	14 (4.26)	4 (8.33)	<0.413
Deep	4 (1.21)	0 (0.00)	
Postoperative echocardiography			
LVESD	4.11±0.64	5.16±1.04	<0.001*
LVEDD	5.57±0.45	6.23±0.79	<0.001*
EF	52.55±7.91	39.62±12.02	<0.001*
LA	4.98±0.65	5.16±1.22	<0.119
RV diameter	2.38±0.43	3.52±1.26	<0.001*

Values are presented as numbers (%) or mean±SD. *Significant difference between the groups (P<0.05). AV, aortic valve; AVR, aortic valve replacement; DVR, double valve replacement; EF, ejection fraction; INR, international normalized ratio; LA, left atrium; LVEDD, left ventricular end diastolic diameter; LVESD, left ventricular end systolic diameter; MV, mitral valve; MVR, mitral valve replacement; NYHA, New York Heart Association; PG, pressure gradient; RV, right ventricle; TAPSE, tricuspid annular plane systolic excursion.

6.4%. On the contrary, higher mortality rates were reported by Lafci and colleagues, with 16.7%, Raboi and colleagues, with 17.8%, and Toker and colleagues, with 20.6%. The discrepancy in mortality rates between our study and studies done by Ahn and colleagues and Akay and colleagues may be referred to the fewer number of included patients in their studies, early detection of patients, less chronic valvular conditions (mainly degenerative), and preserved cardiac function at presentation [16,18–20,22–24].

It is well known that redo surgery for thrombosed mechanical valve is more difficult and carries a higher risk than surgery to native heart valves. Predictors of hospital mortality were reported in different studies. AbouelKasem and colleagues in their study reported pulmonary hypertension (>60 mmHg), increased NYHA functional class, high creatinine level > 1.8 mg% and long bypass time as the main risk factors affecting hospital mortality. Moreover, Akay and colleagues reported that low LV ejection fraction less than 35%, NYHA functional class IV, pulmonary edema, female sex, and urgent operations were found to increase risk of mortality [20,23].

Brandao *et al*. (2002) shared the same predictors as AbouelKasem reporting that prolonged bypass time, increased creatinine level, increased NYHA functional class were associated with higher mortality rates. While, Toker *et al*. (2006) reported that left ventricular low ejection fraction was the only predictor found to affect hospital mortality.[25,19].

Our study suggests similar predictors for increased in-hospital mortality in this particular group of patients. Factors affecting 30-day mortality are listed in Table 3.[25]

Conclusion

Prosthetic valve thrombosis is a life-threatening situation associated with substantial risk regardless of treatment modality. The risk of reoperation to replace a thrombosed mechanical valve is well established. Postoperative complications and associated comorbidities at the time of presentation will add to the risk and will increase mortality rates among patients.

During our study, we observed a number of precipitating factors that frequently associate with prosthetic valve thrombosis, and the most important of which is the lack of patient adherence to warfarin therapy owing to either pregnancy or ignorance and low socioeconomic class of patients. So, to prevent such complication, there must be a shared responsibility upon the patient and the medical staff.

The patients have the right to be informed in details about warfarin therapy, targeted INR, doses, methods, and frequency of follow-up. Moreover, they should be advised about their dental health, importance of daily intake of warfarin therapy, importance of frequent and regular visits to perform INR test, and importance of not to stop warfarin therapy under any circumstances except after consultation of specialized cardiac doctor, such as in case of pregnancy or patient needed to perform surgical intervention.

Different risk factors and predictors can influence mortality rates in patients with obstructive valve thrombosis, such as late presentation, hemodynamic instability, increased NYHA class, and prolonged bypass time together with impaired renal functions, which carry the worst prognosis in surgically treated patients.

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Conflicts of interest

There are no conflicts of interest.

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