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**ORIGINAL ARTICLE**

**Mechanical valve obstruction: Re-replace or not.**

Ehab Mohamed Kasem <sup>1,2</sup>

<sup>1</sup> Cardiothoracic Surgery Department, Zagazig university hospital, Zagazig, Egypt.

<sup>2</sup> King Abdullah Medical City Makkah, Saudi Arabia.

**Corresponding author:**

<sup>1</sup> Cardiothoracic surgery department, Zagazig University Hospital, Zagazig, Egypt.

<sup>2</sup> King Abdullah medical city Makkah, Saudi Arabia

E-mail: [ehab\\_kasem@hotmail.com](mailto:ehab_kasem@hotmail.com)

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**ABSTRACT**

**Background:** Failure of mechanical prosthesis after mechanical valve replacement is a dreadful complication. Pannus and thrombosis are common causes of dysfunction. Different strategic plans for management are available but current approach still needs more evidence.

**Methods:** Retrospective study analysis data of patients operated secondary to mechanical valve obstruction (MVO) from July 2014 to December 2019. Preoperative, operative and post operative are collected and analyzed.

**Results:** 27 patients were operated secondary to MVO. Mean age was  $31 \pm 12$  years. Majority of patients were female 15 (55.5 %) and most of patients in NYHA class III. TTE data showed persevered EF ( $50 \pm 11$ ). MVO differ according to obstructed valve, 15 patients with mitral valve thrombus, and 5 of them thrombus and pannus. In aortic valve obstruction, 12 patients were with pannus and 3 of them with thrombus. The commonest preoperative rhythm was sinus rhythm in 17 patients while AF in 10 patients. Mean bypass time was  $117 \pm 11$  per/min while aortic cross clamp was  $99 \pm 12$  per/min. Mitral valve replacement was done in 12 patients and, valve thrombectomy in 5 patients. In Aortic valve obstruction, 9 valve replacement were done and 3 excisions of the pannus. In the present study, the total bleeding was  $635 \pm 325$  ml, and no cases re-explored. One case needed permeant pacing. Total ICU stay was  $43 \pm 12$  hours while total hospital stay was  $9.07 \pm 1.5$  days. Mortality was 2 patients; one patient was early secondary to NYHA status and acute heart failure. The 2<sup>nd</sup> was late secondary to endocarditis. Early and mid-term follow up showed no pannus formation or reintervention with mean follow up period up to 36 months.

**Conclusions:** MVO is serious and life-threatening complications. Urgent intervention is the clue. Conservative or surgical approach should be directed for each patient. Thrombolysis has limited role and restricted indications and should directed to critically ill and high-risk patient, while open thrombectomy and pannus excision has good early and mid-term outcome but still lack long term outcome and more evidence still needed. Surgery is the definitive treatment with documented good long-term outcome.

**Keywords**

Mechanical valve obstruction, Pannus, Thrombus, Current approaches, Surgical outcome



**INTRODUCTION**

Mechanical valve obstruction (MVO) is a dreadful complication after valve replacement. Its incidence is 0.3 % to 0.8 %. Overgrowth of pannus and thrombus formation are the commonest causes of MVO. It

occurs in about 78 % of causes [1]. MVO may be asymptomatic or may be presented with life threatening heart failure. Once suspected, transthoracic or trans esophageal echocardiography is the standard method of diagnosis. [2]. Management of MVO are widely variable.

Thrombolysis, thrombectomy and valve replacement are current approaches. Multidisciplinary team (MDT) is required for each patient. Current guidelines in favor of thrombolysis but its strict indication and high incidence of complications (bleeding 10 %, thromboembolism 8 % and recurrence in 31 %) limit its use to small, recent thrombus and critical ill patients for surgery [3]. Thrombectomy is another alternative with comparable outcome, but recurrence is also high [4]. Still surgery is the definitive therapy for MVO despite its high risk and mortality [5]. In the cases with Pannus, either resecting the membrane with or without replacement of the valve [6,7]. The aim of this study is to present our experience with different strategic plans in management of MVO and assess its safety and feasibility.

### PATIENTS AND METHODS

From July 2014 to December 2019 patients operated secondary to mechanical valve obstruction are enrolled into our study. Patients with IE, and paravalvular leakage were excluded from the study. Preoperative, operative, and post-operative data of these patients are collected retrospectively. Postoperative variables included period of mechanical ventilation, amount of blood loss, need for blood transfusion, ICU stay, and hospital stay. In addition, complications were recorded including re-exploration for bleeding, sternal wound infection, cerebrovascular accident, chest infection and arrhythmias.

#### Surgical management

Redo-median sternotomy is the standard incision. Groin prepared and exposing the femoral artery and vein. Cannulation and cardioplegia according to dysfunction valve. In case of redo-aortic valve, aortotomy done in oblique fashion for possibility of aortic root enlargement. According to analysis of the obstructed valve, if the decision is resection of the pannus, it depended on analysis of pannus membrane. Replacement was our decision, if it was diffuse, located on ventricular side, thick and tightly adherent to valve mainly hinge point of valve and IE/OA is moderately or severely affected. Resection was our decision, if pannus membrane was localized, thin and located at atrial side than ventricular side and IE/OA is more than 0.85. Resection of the pannus starts from midportion of swing ring and extend medial and lateral. ARE added in 4 patients with successful implantation of size 21. In redo-mitral valve, limited Transseptal approach is the preferred

approach, to avoid dissection, adhesion and address right side valve lesion. If the thrombus is not strictly adherent without pannus overgrowth, so the decision was thrombectomy. Valve replacement was done if thrombus is larger and strictly adherent with pannus. All extracted valves sent for culture and sensitivity and excised membranes were sent for histopathology.

#### Ethical approval.

The study was approved by the research ethical committee of Faculty of Medicine, Zagazig University. The study was done according to The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

#### Statistical analysis.

Categorical data were presented as frequencies and percentages, while continuous variables were expressed as mean  $\pm$  SD or median values.

### RESULTS

#### Preoperative and operative data

In current study, the mean age was (31  $\pm$  12) years. Majority of patients were female 15 (55.5%) and most of them were in NYHA class III. Transthoracic echocardiography showed persevered ejection fraction (50  $\pm$  11). The pathology of MVO was secondary to thrombus in 10 patients and thrombus and pannus in 5 patients in mitral position. 12 patients with aortic valve lesion, nine of them secondary to pannus and three with pannus and additional thrombus. The commonest preoperative rhythm was sinus rhythm (SR) in 17 patients and atrial fibrillation (AF) was diagnosed in 10 patients. Commonest symptoms were dyspnea in 15 patients, palpitation 8 patients and chest pain in 4 patients (Table 1). In the present study, mean bypass time was (117  $\pm$  11 min) while aortic cross clamp was (99  $\pm$  12 min). Mitral valve replacement with mechanical valve was done in 9 patients and tissue valve in 3 patients upon patients request. Valve thrombectomy was done in 5 patients. Tricuspid valve repair was additionally needed in 5 patients; repair done with 3D Medtronic ring size 28 and one patient needed mechanical aortic valve replacement. In aortic valve lesions, 9 replacements with mechanical valve were done in 9 patients, and excisions of the pannus were done in 3 patients. Aortic root enlargement was needed in 4 patients to accommodate big size mechanical valve. Histopathological analysis showed that this tissue consisting of chronic inflammatory cells (lymphocytes, plasma cells,

macrophages, and foreign body giant cells), spindle cells, capillary blood vessels and endothelial cells laying down the lumen which is consistent with pannus histopathology (Table 2) (Figure 1, 2, 3).

**Postoperative outcomes**

In the present study, the total bleeding was (635 ± 325 ml), no cases needed re-exploration. One case needed permeant pacing. Total ICU stay time was (43 ± 12 hours), while total hospital stay was (9.07 ± 1.5 days). Mortality was 2 patients, one early

secondary to NYHA status and acute heart failure. The 2<sup>nd</sup> was late secondary to endocarditis. Early and mid-term follow up showed no pannus formation or reintervention with mean follow up period up to 36 months (Table 3).

**Table 1:** Preoperative data of the patients.

<b>31±12 years.</b>	Mean Age
<b>12/15</b>	<b>Gender M/F</b>
<b>3</b>	<b>NYHA</b>
<b>19</b>	II
<b>5</b>	III
	IV
<b>15</b>	<b>Symptoms</b>
<b>8</b>	Dyspnea
<b>4</b>	Palpitation
	Chest pain
<b>5</b>	<b>INR</b>
<b>12</b>	1
<b>10</b>	1-1,5
	1.5-2
<b>17</b>	<b>RHYTHM</b>
<b>10</b>	Sinus
	AF
<b>50 ± 11</b>	<b>Echo Data</b>
<b>10</b>	EF
<b>5</b>	<b>Mitral valve obstruction</b>
	Thrombus
	Thrombus pannus
<b>9</b>	<b>Aortic valve obstruction</b>
<b>3</b>	Pannus
	Pannus+ thrombus

NYHA (New York heart Association), AF, atrial fibrillation, EF, ejection fraction, INR international normalization ratio

**Table 2:** Operative data of the Patients.

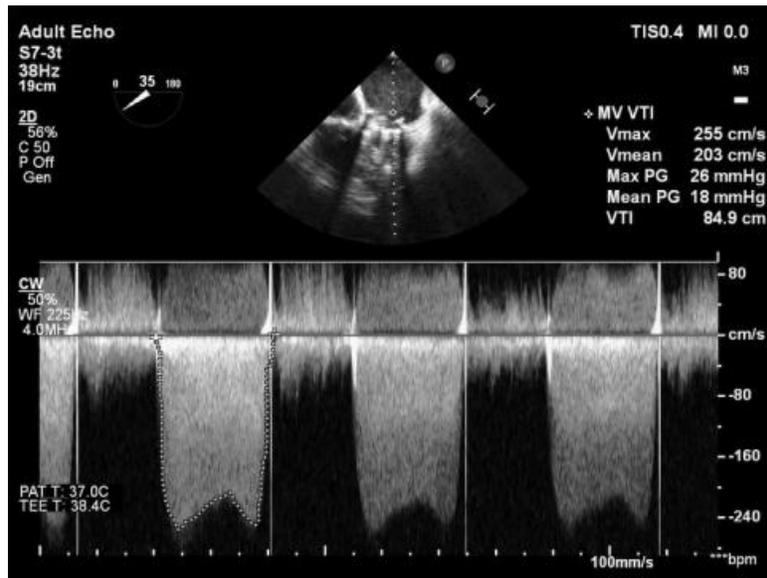
<b>117 ± 11 min</b>	Cardiopulmonary bypass time
<b>99 ± 12 min.</b>	<b>Aortic cross clamp</b>
<b>9</b>	<b>Mitral valve</b>
<b>3</b>	Replacement with mechanical
<b>5</b>	Replacement with tissue
	Thrombectomy
	Additional procedure
<b>1</b>	AVR
<b>5</b>	TVR
	<b>Aortic valve</b>

3	Excision of pannus AVR Additional procedure ARE
9	
4	

AVR, aortic valve replacement TVR, tricuspid valve repair, ARE aortic root enlargement.

**Table 3:** Post-operative data.

<b>635 ± 325 ml</b>	<b>bleeding</b>
<b>0</b>	Re exploration
<b>1</b>	Need of permeant pacing
<b>43 ± 12 hours.</b>	ICU stay
<b>9.07 ± 1.5 days</b>	Hospital stays
<b>(3±6) mm</b>	Postoperative Transvalvular gradient
<b>(6±13) mm</b>	Mitral valve
	Aortic valve
<b>2</b>	Mortality



**Figure 1**

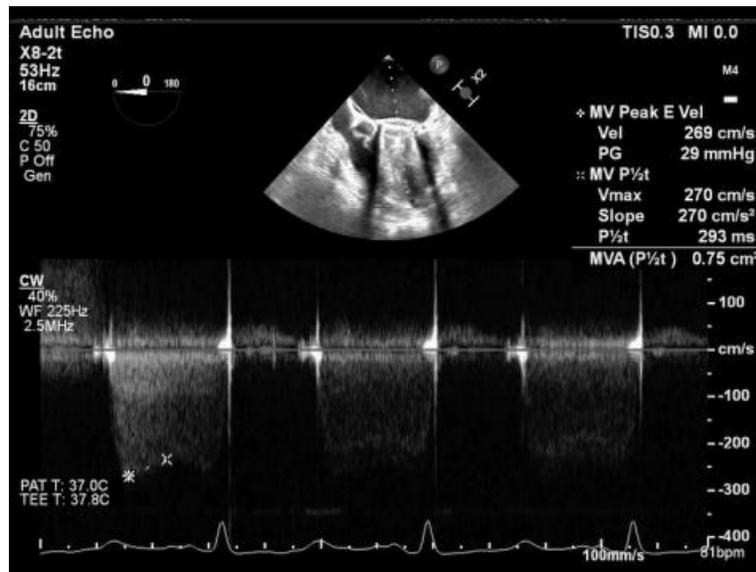


Figure 2



Figure 3

### DISCUSSION

MVO are most dreadful complications after mechanical valve replacement. Its incidence is very low about 0.3 to 0.9 %, but its mortality is very high up to 27 %. Echocardiography is golden diagnostic tool, however in some case differentiation between the thrombus and the pannus is not accurate [1, 2]. In our study, TTE was the diagnostic tool in 97 % of cases and Cin fluoroscopy needed in some cases. The mean age in our study was  $29 \pm 11$  years which is challenging to surgeon in decision. Young aged is commonly affected in endemic area with rheumatic heart disease like our country. This finding consistence with Fouda et al. [8], the mean age in

their study was  $39 \pm 10$  years. In contrast, Potter et al. included cases with mean age  $66 \pm 12$  years due to different pathology and the degenerative valve was the main pathology in this study [9].

In our study, AF and Low anticoagulating were the main causes of valve thrombus, which highlight need of rate control, and adequacy of anticoagulation and regular follow up after initial valve replacement.

Current guidelines are in favor for thrombolysis in valve thrombus but with strict precautions [10,11]. Also, long-term outcome and efficacy of thrombolysis are still in debate. Renzulli et al. reported 53.8 % successful fibrinolysis in patient with mitral valve thrombosis and embolic

complications [12]. Vitale et al. reported 50 % of cases with thrombus associated with pannus required surgical excision [13].

In our study, surgery was the definitive therapy in all patients. Either with valve thrombectomy and pannus excision or valve replacement. No role for anticoagulation or fibrinolysis therapy. All patients operated on emergency base regarding NYHA. The decision thrombectomy or valve replacement were depending on surgeon decision, time of first valve implantation and associated other valve pathology. We did 12 valves replacement (9 mechanical and 3 tissue valves), and 5 valve thrombectomy with pannus excision. The decision and outcome of thrombectomy was debatable among surgeons. Ogutu et al. documented safety and feasibility of thrombectomy in mechanical valve obstruction with advantages of short surgical duration, lower risk, and less mortality than valve replacement [14]. Similarly, Montero et al. reported safety and low risk of thrombectomy in Bjork valve thrombosis [15]. In contrast, Kontos et al. in their reports recommend better to avoid valve thrombectomy as thrombus may be firmly adherent and may cause slight damage to the valve disc which precipitate to new thrombus formation [16]. Deviri et al. concluded that valve replacement or thrombus debridement should be surgeon decision depending on anatomic and technical factors at time of surgery [1].

Pannus formation was found in 62 % of cases (5 in mitral position and 12 in aortic position). In our study, 47 % of this pannus was with concomitant thrombus and it was more in aortic position. This may be a part of immunological reaction of body to the implanted forging body and it is a sign of exuberant healing process in response to forging body. In our study, pannus was more in women with small annuli and residual PPM after first surgery.

We performed redo AVR in 9 patients with 4 of them need ARE and 3 patients required pannus excision. This was feasible and easy with low surgical duration. Another advantage of saving the original prosthetic valve was decrease possibility of para valvular leakage. Park et al. reported 34 patients (30 women) with RHD underwent pannus removal on ventricular side of mitral valve through aortic valve during reoperation and concluded that pannus removal was safe and effective procedure for patients with malfunction mitral valve [17].

No cases needed re-exploration and one case needed permeant pacing. Mortality was 2 patients, one early

secondary to NYHA status and acute heart failure. The 2<sup>nd</sup> was late secondary to endocarditis. Early and mid-term follow up documented efficacy of thrombectomy and excision of pannus in comparison to valve replacement but need more evidence and cases.

## CONCLUSIONS

MVO is a dreadful complication. Intervention should be timely and sooner. Thrombolysis is indicated by guidelines in target group of patients. Valve thrombectomy and pannus excision are safe and feasible with adequate outcome but still more evidence is needed. Surgery although with high risk but still definitive therapy in such cases. Surgery should be on emergence base to avoid drawbacks and better outcome.

### Limitation of the study

Study is limited by low number of cases, retrospective and single center. More patients needed and more long term follow up is recommended.

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### CONFLICT OF INTEREST

None.

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