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**Original Research Article**

# Rheumatic mitral valve surgery: about 1025 cases

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## ABSTRACT

**Background:** Rheumatic mitral valvulopathy is often associated with other valvulopathies. It remains endemic in developing countries where it is the leading cause of heart failure and cardiovascular death.
**Methods:** This study provides a retrospective analysis of 1025 cases involving patients who underwent mitral valve surgery at Ibn Sina Hospital in Rabat, Morocco between the dates of January 2, 2001 and April 5, 2012. Preoperatively a clinical and paraclinical assessment has been established.
**Results:** The predominant valvular defects are mitral stenosis, functional tricuspid insufficiency. The gesture was a first intervention in 93% of the cases, with mitral valve replacement in 90% of cases and plasty in 10% of the cases.
**Conclusions:** These patients deserve more accurate evaluation in the choice of the surgical strategy which strongly impacts the post-operative outcomes. This report discusses the factors supporting mitral repair surgery in rheumatic disease, according to the patients' characteristics and the effectiveness of the current repair techniques compared to prosthetic valve replacement in developing countries.

**Keywords:** Rheumatic valvulopathy, Mitral valve, Valvular surgery

## INTRODUCTION

Rheumatic mitral valvulopathy remains a disease frequent in our country and poses a public health problem.[1] It is often associated with other valvulopathies. In this study we will attempt to evaluate the clinical and therapeutic characteristics of rheumatic mitral valve disease.[2]

## METHODS

This study provides a retrospective analysis of 1025 cases involving patients who underwent mitral valve surgery at Ibn Sina Hospital in Rabat, Morocco between the dates of January 2, 2001 and April 5, 2012. These data were obtained by medical staff within the Department of Cardiovascular Surgery ("B") at Ibn Sina Hospital. Excluded from the study are the following groups:

- Patients diagnosed with mitral valve disease but in a pre-operative state.
- Patients diagnosed with congenital mitral valve disease.
- Patients operated on for only plasty in a closed mitral valve surgical procedure.

Statistical analysis was performed using the SPSS (v17.0) software program. Quantitative variables are analyzed in terms of means and standard deviations. Qualitative variables are analyzed in terms of percentages and frequencies.

## RESULTS

The average age of subjects in our study was 43.94 (±12.74). The average age of females was 43.65 (8, 82%). The average age of males was 44.45 (8, 79%).

The sample consisted of 602 (58.7%) women and 423 (41.3%) men. 5.8% (n=60) of patients in the sample had a history of open-heart mitral valve surgery (CEC). Of these, 26 received mitral valve replacement, while the remaining 34 received mitral plasty. 7% of patients had an antecedent of endocarditis and only 5% had a history of cerebrovascular accident. Cardiovascular risk factor were presents in 17% cases. All patients in our sample demonstrated evidence of Dyspnea. According to the NYHA classification, the frequencies are as follows: III for 66%, IV for 22% and II for 12%.

270 patients (26.4%) had signs of heart failure

- Congestive heart failure for 102 patients
- Right heart failure for 77 patients
- Left heart failure for 51 patients.

Others clinical signs were fouded: 85 patients (8.3%) reported paroxysmal nocturnal dyspnea, faintness occurred in 12 patients (1.2%), while syncope occurred in 12 other patients (1.2%). 709 patients (69.2%) were in complete arrhythmia by atrial fibrillation, while 316 patients (30.8%) were in sinus rhythm.

*All subjects in our study had a cardiomegaly*

- 693 patients (67.6%) had a V3 or a V4 cardiomegaly
- Parenchymal abnormalities were noted in 1007 subjects.

All patients received a trans-thoracic ultrasound. This procedure led to a morphological study of valvular structures in order to detect valvular defects and the impact of these on the heart chambers and on the pulmonary arterial bed.

- Pure mitral insufficiency was found in 215 patients (21%)
- Pure mitral stenosis was found in 402 patients (39.2%)
- Thus, pure mitral disease was found in 408 patients (39.8%).

*Patients that were diagnosed with insufficient mitral (IM) were classified as follows by degree of leakage*

- IM grade II at 252 patients (40%)
- IM grade III at 262 patients (42%)
- IM grade IV at 109 patients (18%)

We have found mitral vegetations at 47 patients (4.6%), mitral calcifications at 551 patients (53.8%) mitral rope rupture at 59 patients (5.8%) and thrombus of the left atrium in 134 cases (13.1%).

*450 (43.9%) patients experienced aortic valve disease:*

- 159 patients had severe aortic insufficiency
- 44 patients had a pur aortic stenosis
- 247 patients had an aortic disease

*633 (61.8%) patients were classified with tricuspid valve disease*

- Isolated tricuspid insufficiency was observed in 601 cases
- Tricuspid disease was observed in 32 cases.

*The PAPs parameter was available for 681 (66.4%) patients*

- Mild or moderate pulmonary arteriel hypertention (PAH) was observed in 316 (30.8%) of patients: PAH < 60 mm/hg.
- Major PAH was observed in 365 (35.6%) of these patients: PAH = 60 mm/Hg.

The left ventricular ejection fraction (LVEF) was available for 486 (47.4%) of patients. The proportions were as follows:

Normal LV function, was found in 372 of patients

Moderate LV dysfunction was found in 81 of patients

Severe LV dysfunction was found in 33 of patients.

- Normal LV function was defined as FE = 50% or better
- Moderate levels of dysfunction were defined as FE lying between 35% and 50%
- Severe dysfunction is defined as FE less than 35%.

Preoperative angiography was indicated for patients whose age is greater than 50, The procedure was performed on 198 (19.3%) patients in our sample. The results of preoperative coronary angiography were normal in 176 cases and pathological in 22 cases.

All patients in our sample received surgical intervention under Extracorporeal circulation (CEC). The gesture was a first intervention in 93% of the cases

Mitral valve replacement by mechanical prosthesis was performed in 917 (89.5%) of patients in the sample. Conservative surgery was performed for 102 (9.9%) patients:2.4% of without prosthetic ring, while 7.5% with prosthetic ring.) Reintegration of the prosthesis occurred in six patients (0.6%).

Aortic valvular surgery was performed for 414 (40.39%) of patients. 405 patients benefitted from aortic valve replacement (97.8%). While seven patients (1.7%) received aortic plasty.

Tricuspid valve surgery was performed on 633 patients (61.8%). Surgery was exclusively conservative: 537 with prosthetic ring, while 96 without prosthetic ring.

134 patients received a thrombectomy of the left auricle. Atrial septal defect closure was performed in 20 patients. Coronary bypass surgery was performed on 17 patients, while Mounting type Bentall was performed on two patients. Vasopressor drugs were used at the time of the CEC evaluation.

Atelectasis was observed in 15 (1.5%) patients. Pleurisy was observed in 12 (1.2%) patients. A pneumothorax was found in 9 (0.9%) patients.

Rhythm disorders were observed in 89 (8.7%) patients. Conduction disorders were observed in 24 (2.3%) patients. Right heart failure was found in 4 (0.4%) patients and cardiogenic shock was found in 4 (0.4%) patients.

A behavioral disorder was diagnosed in one patient, and one patient suffered a stroke.

Sepsis was documented for 27 (2.6%) patients. Of these, five suffered parietal sepsis, six suffered urinary sepsis, and seven patients suffered pulmonary sepsis.

Renal failure was observed in 15 (1.5%) cases. Anemia was found in seven (0.7%) patients and hyperglycemia was observed in seven (0.7%) patients.

Postoperative transthoracic echocardiographie data were available for 341 patients. Function of the Left Ventricle was normal in19,3% and PAPs was normal in 5,2%. 106 of these cases exhibited residual valvular defects.

## DISCUSSION

Study sample was characterized by the comparatively young age of our patients: The mean age was 43.94±12.74. 69.4% of patients are below the age of 50. This age range is common among countries of similar socio-economic levels such as China, India, Iran, Turkey and Tunisia (Table 1).

**Table 1: Average age of patients in literature samples.**

| Samples | Contries | Number of cases | average age (years) |
|---|---|---|---|
| Alsoufi [56] | Canada | 174 | 58±12 |
| Girard [52] | France | 110 | 63.5±15.2 |
| Zouaoui [55] | Tunisia | 236 | 37.8±13.1 |
| Han [57] | China | 871 | 42±11 |
| Akay [58] | Turkey | 157 | 41.8±11.6 |
| Davoodi [70] | Iran | 100 | 47.4±12.2 |
| Panda [62] | India | 382 | 35.7±11.8 |
| Belfquih [61] | Morocco (Fes) | 100 | 36.7±11.5 |
| Ekouhon [69] | Morocco (Casablanca) | 59 | 34.7±2.7 |
| Our sample | Morocco (Rabat) | 1025 | 43.94±12.74 |

This result can be explained by the predominance of rheumatic etiology. Unlike countries where the socioeconomic level is more developed, such as Canada and France, the frequency of rheumatic valve disease decreases in favor of an increase in degenerative valve disease, where the onset of disease occurs at a more advanced age.[1]

The distribution of patients by sex in our sample shows that females comprise 58.7% of the sample versus 41.3% for men. Predominance of females is found in most samples (Girard, Zouaoui, Han, Akay, Davoodi, Belfquih). In samples that question this dominance, we believe that result is due to the small number of patients included in the sample. Selection bias of patients in the noted sample therefore does not challenge the role that we postulate for sex in the etiology of rheumatic valve disease.

The etiology of valvular pathology is not always easy to determine. Physicians are accustomed to recognizing and identify rheumatic valvular lesions which combine commissural fusion, thickening, and retraction of the free edge of the leaflets. The mitral valve apparatus in this case demonstrates shortening, thickening and fusion ropes, or an extension with valve prolapse. Calcifications, which are most important in the case of stenosis, also contribute to changes in valvular apparatus.

In developed countries, the predominant etiology of heart disease is degenerative valvular.[1] In contrast, in developing countries, rheumatic heart disease occurs frequently and poses a public health problem. Nevertheless, these results are underestimated since diagnosis in these samples is based solely on clinical evidence and not on echocardiography.[2]

Intraoperative findings may be of great significance to determine or guide the surgical intervention. This is particularly true for patients where echocardiographic exploration was inconclusive or when valvular lesions are borderline. In our sample, we noted the presence of dyspnea in all patients.

The observed advanced stage of vascular disease in our patients may be explained by the existence of delay in treatment that is due mostly to socioeconomic factors. Several international studies have demonstrated the relationship of treatment delay to socioeconomic factors.

In our sample, heart failure was found in the 26.4% of patients. In the literature, this effect ranges between 14% and 76%.[3-6]

With regard to the electrocardiographic profile, 69.2% of patients in our sample showed ACFA preoperatively. This figure is similar to those reported in other international studies.[7] The installation of atrial fibrillation marks an evolutionary turning point in the disease: it

aggravates hemodynamic conditions and reduces tolerance.

**Table 2: Distribution of mitral valve defect in the samples.**

| Samples | Mitral disease | Mitral regurgitation | Mitral stenosis |
|---|---|---|---|
| Alsoufi [56] | 34% | 35% | 31% |
| Zouaoui [55] | 59% | 11% | 30% |
| Han [57] | 14% | 28% | 58% |
| Davoodi [70] | 7% | 74% | 19 |
| Shinn [50] | 56.9% | 12,5% | 30.6% |
| Belfquih [61] | 68% | 16% | 16% |
| Our sample | 39.8% | 21% | 39.2% |

It increases the risk of thromboembolic complications - in particular, the occurrence of ischemic stroke that affects the functional prognosis of valvular patients, often in an early age.[8-10]

Radiographically, the presence of cardiomegaly is noted in all patients in our sample. This pattern indicates that all patients were operated on at an advanced stage, with valvular defects having had time to ring significantly on the heart chambers. On echocardiography, there was an occurrence of mitral disease in 39.8% of cases and of mitral stenosis in 39.2%. Results have varied depending on the study: Zouaoui, Shinn, and Belfquih obtained similar results with rates of mitral disease (occurring at 59%, 56.9%, and 68%, respectively).[3,7,11] In contrast, Davoodi found a prevalence of deficiencies in mitral (74% of cases), while Han reported a majority of mitral narrowing (58% of cases).[6,12] Moreover, in the series of Alsoufi, patients were distributed evenly between sickness, failure, and mitral stenosis (Table 2).[13]

Regarding the aortic valve, we found a prevalence of aortic diseases (54.9%). This result is similar in the studies by Shinn (58.8%) and Alsoufi (42%).[3,13] Against this, in the series of Han and Davoodi.[6,12] there was a predominance of aortic failure: 54% and 84% of cases, respectively (Table 3).

**Table 3: Distribution of aortic valve defect.**

| Samples | Aortic disease | Aortic regurgitation | Aortic stenosis |
|---|---|---|---|
| Alsoufi [56] | 42% | 35% | 23% |
| Han [57] | 15% | 54% | 31% |
| Davoodi [70] | 5% | 84% | 11% |
| Shinn [50] | 58.8% | 33.8% | 7.5% |
| Our sample | 54.9% | 35.3% | 9.8% |

Functional IT is the most common acquired valve defect. In the case of the tricuspid, it is the indirect consequence of the valve's malfunction in the left heart, especially the mitral [81]. In our study, 61.8% of operated patients had tricuspid valve disease, with a predominance of IT (95% of cases). This predominance was also found in other studies: Alsoufi, Han, Davoodi, and Shinn.[3,6,12,13]

Polyvalvular involvement is common, especially when an etiology of rheumatic valve disease is found. In our study, pure mitral valve was present in 19.8% of cases.

PAH was found in all patients in whom PAPs had been reported on the record of the ETT (66.4%): 53.6% had a major PAH with PAPS ≥60 mmHg. 46.4% had <60 mmHg. The function of the left ventricle can be described as follows: The ejection fraction (EF) has been identified in 47.4% of patients. 76.6% of patients had FE≥50%, while 23.4% of patients had EF <50%. Alsoufi, Han, Shinn, and Belfquih reported in their data sets an ejection fraction less than 60% in 72%, 66%, 63.8% and 60% cases, respectively.[3,7,12,13] Coronary angiography was found in just 19.3% of patients. It was normal in 17.2% of patients, whereas only 2.1% had an interference atheromatous coronary. This impact is so low that it encourages rethinking the indication of the coronary angiography in patients with valvular disease, specifically when valve disease is rheumatic.

In present study, the intervention was a primary type of intervention in 93.2% of cases, a reoperation response in 5.8% of cases, three surgeries in 0.8% of cases, and four in 0.2% of cases. Sometimes the surgical intervention achieves ideal timing, but for lack of means, many patients cannot access surgery. Thus we see worsening valvular defects and increased incidence of cavity expansion, impaired biventricular function, elevated pressure in the pulmonary arterial bed, or tissue hypo perfusion. Due to long years of delay, the surgical team is then forced to expand the indication for surgery and begin aggressive treatment. The necessity of an associated aortic valve replacement does not condition the choice of mitral surgery, and plastic surgery should be considered if it is feasible.[14] In our sample, all patients had required a procedure on the mitral valve. Valve replacement was the most widely used (89.5% of patients). Only 9.9% of patients received conservative surgery (2.4% without prosthetic ring and 7.5% with ring.) A reinsertion of the prosthesis occurred in 0.6% of patients.

**Table 4: Gestures performed on mitral valve.**

| Samples | Valve replacement (%) | Mitral plasty (%) |
|---|---|---|
| Girard [52] | 53, 8 | 46, 2 |
| Davoodi [70] | 57 | 43 |
| Shinn [50] | 98,1 | 1,9 |
| Belfquih [61] | 98 | 2 |

In present study, the rheumatic etiology was frequently multi-orifical, scalable, and, for a young population, the valvular substitute was purely mechanical. It is the same for women of childbearing age, and even less for younger patients (≤ 65 years). The high morbidity and mortality of

surgical occasions in poly valvular is persuasive as to the implantation of bio prosthesis in the latter (Table 4). In our study, 33 patients admitted for mitral stenosis underwent emergency surgery for severe mitral regurgitation that had been created by percutaneous mitral dilatation. The percentage of severe multiple percutaneous mitral dilatation after mitral regurgitation varies from 2% to 10% in the literature.[15-18] Aortic valve disease was found in 43.9% of our patients. Abstentions affected 3.51% of patients, while surgery was indicated for 40.39% of patients, and consisted of aortic valve replacement in 97.8% of cases, aortic plasty (1.7%), or prosthetic reinsertion (0.5%). Aortic valve replacement is the rule in most series.[12] Aortic plasty has been reported between 2% and 8%.[3,6,13] In our sample, we see a massive use of small size prostheses, which reflect the closeness of the native aortic rings.

In 75% of cases, the treatment of the tricuspid regurgitation is that of right valve failure, pulmonary hypertension, or left valve pathologies. Although it has long been considered that this treatment suffices to reduce regurgitation values without clinical significance, it proves that the persistence of significant mitral IT after surgery, during PAH or a right regurgitation considerably enhances failure, even if the patient is asymptomatic.[19,20] Moreover, IT tends to worsen over time.[20.21] In our sample, 61.8% of our patients had a conservative surgery on the tricuspid valve, including 84.84% with prosthetic ring, and 15.16% without ring.

Cardiopulmonary bypass output is potentially a period that is difficult for the heart. Conductive and barriers to ejection are the most common causes that can make an exit CEC difficult. A rigorous strategy that includes the performance of hemodynamic monitoring facilitates the diagnosis of the appropriate therapeutic road.[22] In patients with impaired left ventricular function preoperatively, use of inotropes is generally provided and prepared.[23] Inotropes are started from the aortic unclamping, and prosecuted during a period sufficient assistance. The choice of the inotropic agent is made on the basis of the alteration of contractility level and the associated vascular effect sought.[24] In our context, 85.2% of our patients required assistance by pharmacological dobutamine when stopping, with the addition of CEC adrenaline in some cases (9.7%) to stabilize hemodynamics.

***Evolutionary profile***

Despite technical progress and accumulated knowledge, valvular surgery is risky, burdened with many complications.

*Cardiac*

Of 370 patients, 8.7% had a rhythm disorder, 2.3% had a Conduction disorder, 0.4% right heart failure, and 0.4% suffered from Cardiogenic shock.

*Lung*

In the literature, the pleural effusion is visible in 40-50% of patients, mostly to the left; in most cases, it disappears spontaneously when the primary cause is resolved (e.g. atelectasis, cardiogenic pneumonia, cardiogenic shock, pulmonary edema, pleurotomy for sampling breast). Less than 1% of cases, the effusion is massive and must be drained.[25] In our sample, atelectasis was observed in 1.5% of patients, home pleurisy home in 1.2%, pneumothorax in 0.9%, and the PAO in 0.1% of patients.

*Neurological*

In present study, stroke was noted in 0.1% and behavior disorder in 0.1% of patients.

*Renal*

In present series, renal failure was observed in 1.5% of patients. To circumvent these difficulties, hemofiltration designed within cardiac surgery services is highly desirable.

*Infectious*

After cardiac surgery, infections occur in 5% -20% of patients, and if this occurs, it quintuples postoperative mortality.[26] The three sites that are most commonly affected are the respiratory (50%), the surgical wound (27%), and catheters or implants (22%).[26] 2.6% of our patients suffered infectious complications such as sepsis.

*Postoperative control echocardiography*

In present study, data on residual valvular defects were available only in 341 cases, or 33.3%. Of these 106 (31%) had residual defects.

Post-CEC dysfunction has a very particular evolution: it improves spontaneously during the first hour after the charging, then worsens between the 4th and the 6th hour.[27] In our context, left ventricular function has only been reported in 238 cases of ETT, with dysfunction noted in 16.8%. Biventricular function is not a univocal assessment, especially among poly valvular immediately after surgery.

The value of the systolic pulmonary artery pressure before and after the operation was specified for only 89 patients. In our study, the PAPs normalized after surgery in 40 patients. The persistently high PAPs in some of our patients (n = 49) suggests an irreversible component of pulmonary vascular resistance which remains high, a suboptimal mitral obstacle. Several studies reported a significant decrease in resistance and pulmonary vascular blood pressure of the left atrial lung in the first days following surgery, justifying the interest in, and the impact of, the replacement.[28,29] In the longer term, the

replacement leads, on average, to a drop in pulmonary artery pressure.[30.31]

## CONCLUSION

Rheumatic mitral valvulopathy remains a disease frequent in our country and poses a public health problem. It is often associated with other valvulopathies.

At the end of our study we find that the population of the mitral valves arrives at the stage surgery at an average age of 44 years; with a female predominance in complex socio-cultural realities and environment, this topic deserves more critical analysis and evaluation from medical specialists to avoid indiscriminate and erroneous application of any "standard" surgery

Involvement of the mitral valve results in mitral regurgitation and/or stenosis and when surgery is indicated, mitral valve replacement is usually necessary.

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