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Epidemiological Aspects and Postoperative Follow-Up of Mitral Valve Repair Procedures at the Cardiovascular Surgery Department of Cheikh Zaid Hospital, Rabat (Morocco): A Case Series of 10 Patients

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Abstract **Case Series**

Mitral valve repair is the preferred approach in the management of mitral regurgitation, as it significantly improves patient prognosis. Through this study, we present the experience of our department in performing mitral valve repair.

Keywords: Mitral valve repair, mitral regurgitation, postoperative follow-up.

INTRODUCTION

Mitral valve repair (MVr) is the preferred treatment for mitral regurgitation (MR) when feasible, offering several advantages over valve replacement. In addition to avoiding lifelong anticoagulation and its associated risks, MVr preserves the native mitral apparatus, which helps maintain the structural integrity and anchoring of the left ventricular (LV) fibrous skeleton. This preservation supports optimal LV geometry and contributes to improved postoperative outcomes. Thus, all current guidelines recommend mitral valve repair as the first-line intervention for correcting mitral regurgitation, with indications that extend beyond degenerative MR to include ischemic and infective (endocarditis-related) etiologies. Several mitral valve repair (MVr) techniques are employed depending on the underlying mechanism of mitral regurgitation, highlighting the importance of thorough preoperative assessment by transthoracic echocardiography. In addition, intraoperative transesophageal echocardiography (TEE) is essential to assess the immediate success of the repair and guide surgical decision-making in real time.

In the following study, we report the experience of the Cardiovascular Surgery Department at Cheikh Zaid Hospital in Rabat with mitral valve repair (MVr).

PATIENTS AND METHODS

Study objective and Population

This study is a retrospective, single-center analysis conducted at the Cardiovascular Surgery Department of Cheikh Zaid Hospital in Rabat over a three-year period (2020–2023). It aims to evaluate the department's experience with mitral valve repair (MVr) by examining epidemiological data and postoperative outcomes. A total of 10 patients who underwent MVr during this timeframe were included.

Patients scheduled to undergo concomitant tricuspid valve repair were not excluded from the study, unlike those requiring surgical intervention on the aortic valve and/or coronary artery bypass grafting (CABG), who were excluded. Informed consent was obtained from all patients prior to inclusion in the study. Clinical evaluation was performed, with particular attention to symptomatology, based on the New York Heart Association (NYHA) functional classification. Echocardiographic assessment was also performed to evaluate the severity of mitral regurgitation and to determine its underlying mechanism. For this purpose, Carpentier's classification was used. Additional echocardiographic parameters were also evaluated, including left ventricular dimensions through measurements of end-diastolic and end-systolic diameters (LVEDD and LVESD), as well as the left ventricular ejection fraction (LVEF). Postoperative follow-up data were then collected, focusing initially on the success of the mitral valve repair and the occurrence

of intraoperative mortality. Clinical outcomes were subsequently assessed by evaluating improvement in functional status and 30-day postoperative mortality. All of these elements contributed to the establishment of the study population database.

Surgical Procedure

All 10 patients in this cohort were operated on by the same surgeon. Surgical procedures were performed under cardiopulmonary bypass (CPB) established via aortic and bicaval cannulation. Cardiac arrest was achieved using blood cardioplegia. Access to the mitral valve was obtained either through the Sondergaard's groove approach or via a biatrial transseptal approach in cases where concomitant tricuspid valve intervention was required. Different mitral valve repair techniques were employed depending on the underlying mechanism of mitral regurgitation. Intraoperative transesophageal echocardiography (TEE) was systematically used to assess the success of the mitral valve repair.

Statistical Analysis

Patient data were collected through medical record review. The variables analyzed included: age, sex, New York Heart Association (NYHA) functional class, left ventricular ejection fraction (LVEF), left ventricular end-diastolic diameter (LVEDD), end-systolic diameter (LVESD), mechanism of mitral regurgitation, type of mitral valve repair, aortic cross-clamp time, intraoperative mortality, and 30-day postoperative mortality. For statistical analysis, Microsoft Excel 2019 was used to create the patient database, and IBM SPSS Statistics version 25 was employed for data processing. A descriptive analysis was performed, reporting either frequencies or means for the studied variables. The chi-square test and Cramer's V were used to assess the relationship between sex and clinical status.

RESULTS

Baseline Characteristics of the Study Population

Ten patients underwent mitral valve repair performed by the same surgeon, and all echocardiographic evaluations were conducted by the same cardiologist, ensuring consistency in measurements and interpretation. The cohort had a mean age of 59 years, ranging from 32 to 76 years, with a standard deviation indicating a relatively homogeneous population with a male predominance.

Table 1: Distribution of Patients by Age

	N	Minimum	Maximum	Mean	Std. Deviation
Age of Patients	10	32	76	59,50	14,669
Valid N (listwise)	10				

Table 2: Distribution of Patients by Sex

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	M	7	70,0	70,0	70,0
	F	3	30,0	30,0	100,0
	Total	10	100,0	100,0	

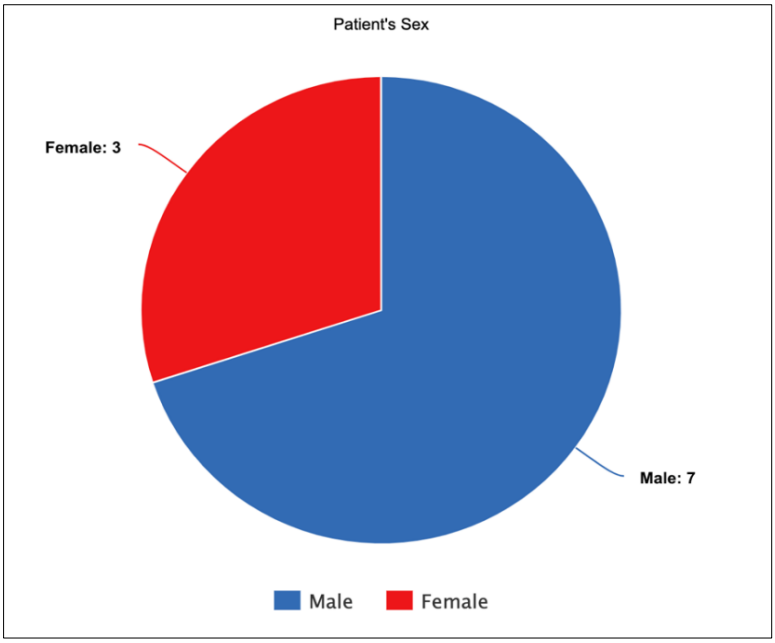


Figure 1: Sex Distribution of the Patients

Clinical and Echocardiographic Characteristics of the Study Population

All patients were symptomatic, presenting with a clinical status of at least New York Heart Association (NYHA) class III. The cohort included five patients in class III and five in class IV. The relationship between sex and clinical stage showed a male predominance; however, the association was not statistically significant, with a p-value > 0.05 and a weak correlation (Cramér's V < 0.70).

Table 3: Patient clinical Status

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	III	5	50,0	50,0	50,0
	IV	5	50,0	50,0	100,0
	Total	10	100,0	100,0	

Table 4: Relationship between Sex and Patient Clinical Status (NYHA Classification)

		Patient Clinical Status		Total
		III	IV	
Patient's Sex	M	4	3	7
	F	1	2	3
Total		5	5	10

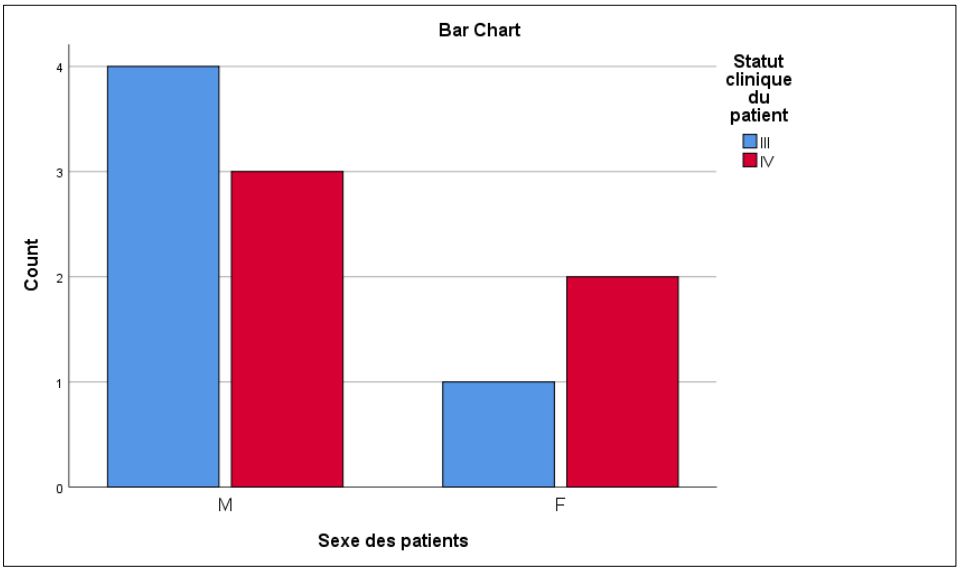


Figure 2: Relationship between Sex and Clinical Status

Chi-Square Tests					
	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	,476[a]	1	,490		
Continuity Correction[b]	,000	1	1,000		
Likelihood Ratio	,483	1	,487		
Fisher's Exact Test				1,000	,500
N of Valid Cases	10				
a. 4 cells (100,0%) have expected count less than 5. The minimum expected count is 1,50.					
b. Computed only for a 2x2 table					

p=0,01, indicating that the relationship is not statistically significant.

Table 5: Chi-Square Test and Cramér's V

Symmetric Measures			
		Value	Approximate Significance
Nominal by Nominal	Phi	,218	,490
	Cramer's V	,218	,490
N of Valid Cases		10	

V de Cramer à 49%, la normale etant ≥70% du coup la relation n'est pas forte.

From an echocardiographic standpoint, all patients presented with severe mitral regurgitation (MR), predominantly classified as Carpentier types I and II, with type II lesions being more frequent. While the functional classification of MR was mainly type I and II, the underlying anatomical mechanism was most often related to a prolapse of the P2 scallop of the posterior mitral leaflet, observed in 50% of cases. In addition, annular dilatation was identified in 30% of patients—20% of whom had associated atrial fibrillation and 10% with underlying dilated cardiomyopathy (DCM). One case of mitral regurgitation (MR) was related to a partial atrioventricular canal (AVC) defect. Overall, left ventricular (LV) systolic function was preserved, although likely overestimated due to the volume overload associated with MR. However, one patient had a reduced left ventricular ejection fraction (LVEF) of 25%. Left ventricular dilatation was defined as a diastolic diameter (LVEDD) ≥ 55 mm and a systolic diameter (LVESD) ≥ 35 mm.

Table 6: Distribution of Mitral Regurgitation Types among Patients

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	I	4	40,0	40,0	40,0
	II	6	60,0	60,0	100,0
	Total	10	100,0	100,0	

Table 7: Underlying Mechanism of Mitral Regurgitation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Partial Atrioventricular Canal Defect	1	10,0	10,0	10,0
	Dilated Cardiomyopathy (DCM)	1	10,0	10,0	20,0
	Mitral Annular Dilatation	2	20,0	20,0	40,0
	P2 Prolapse	5	50,0	50,0	90,0
	P2 and A2 Prolapse	1	10,0	10,0	100,0
	Total	10	100,0	100,0	

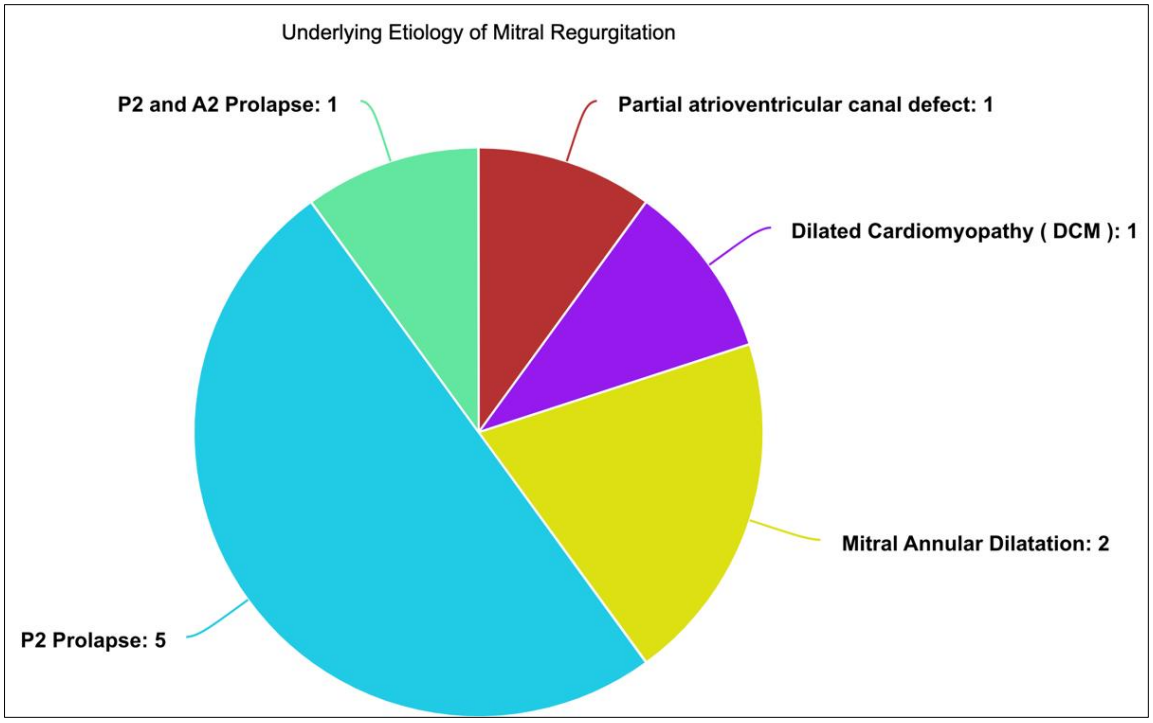


Figure 3: Distribution of Patients by Underlying Cause of Mitral Regurgitation

Table 8: LVEF Value in the Study Cohort

	N	Minimum	Maximum	Mean	Std. Deviation
LVEF	10	25	74	58,10	13,153
Valid N (listwise)	10				

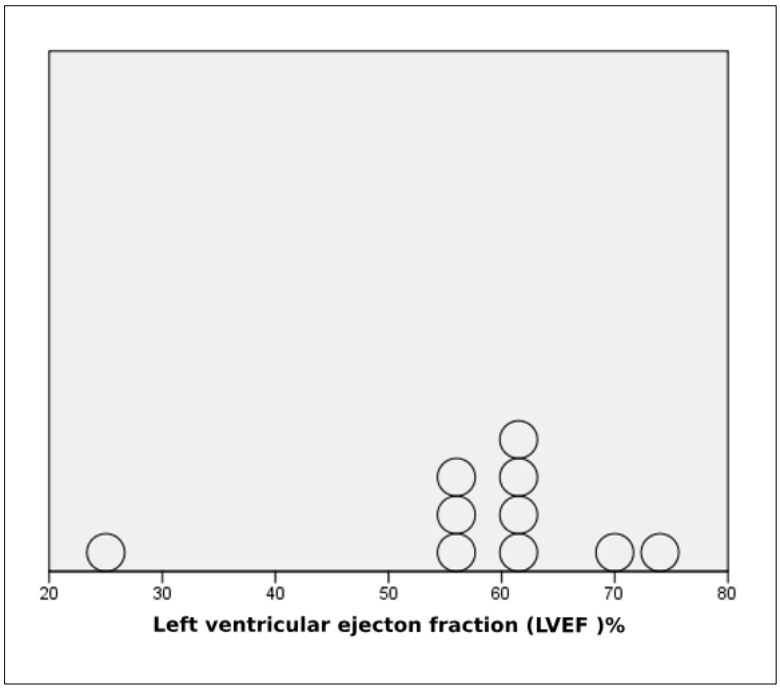


Figure 4: Patient Distribution by LVEF.

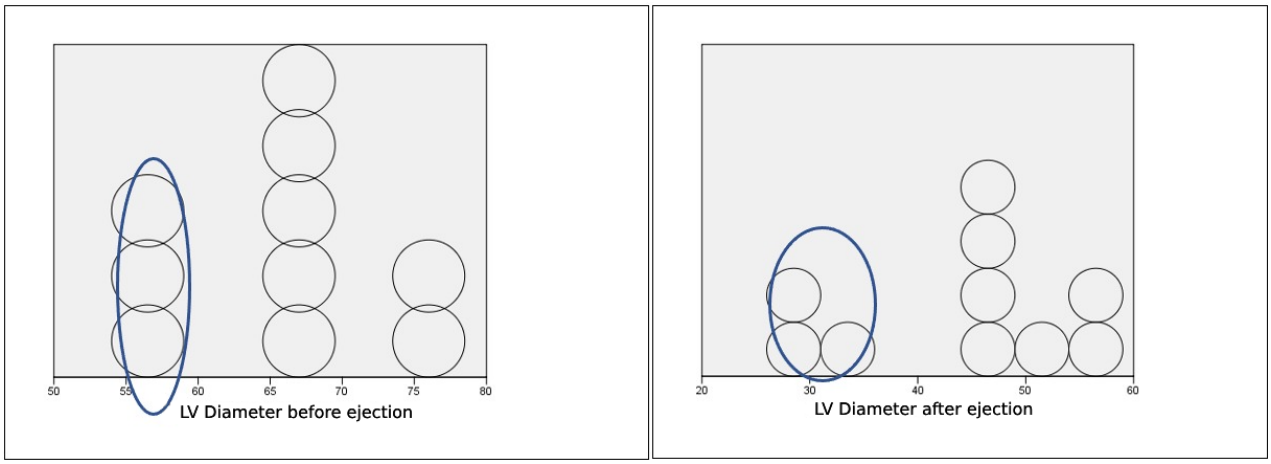


Figure 5: Distribution of Patients According to Left Ventricular End-Diastolic and End-Systolic Diameters (LVEDD and LVESD)

It was observed that the majority of patients had a dilated left ventricle, except for three individuals in whom the ventricular dimensions were at the upper limit of normal.

Operative Characteristics of the Study Population

The surgical indication was clear, based on the severity of mitral regurgitation and the patients' clinical symptoms, in accordance with the 2021 ESC guidelines [1]. All mitral valve repairs were assessed by intraoperative transesophageal echocardiography (TEE), which confirmed the success of the repairs before weaning from cardiopulmonary bypass. The mean aortic cross-clamp time was 79 minutes. There were no intraoperative or 30-day postoperative deaths, and no conversions to mitral valve replacement (MVR).

In cases of P2 prolapse, mitral valve repair consisted of resection of the redundant leaflet tissue followed by edge-to-edge suturing. In one case involving a combined A2 and P2 prolapse, neochordae were implanted on A2 in addition to P2 resection. For the patient with mitral regurgitation secondary to a partial atrioventricular canal (AVC) defect, the procedure involved closure of the ostium primum atrial septal defect (ASD) using a pericardial patch, along with closure of the mitral cleft using separate Prolene sutures. Mitral regurgitation due to annular dilatation was managed with the implantation of a prosthetic annuloplasty ring, including in the case related to dilated cardiomyopathy (DCM). Notably, all other mitral valve repairs were also reinforced with a mitral ring.

Table 9: Types of Mitral Valve repair Procedures Performed

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Mitral Annuloplasty	3	30,0	30,0	30,0
	Ostium Primum ASD Closure with Mitral Cleft Repair	1	10,0	10,0	40,0
	Quandrangular Resection with Edge-to-Edge suturing	5	50,0	50,0	90,0
	Quandrangular Resection with Edge-to-Edge suturing and A2 Neochordae Placement	1	10,0	10,0	100,0
	Total	10	100,0	100,0	

Table 10: Aortic Cross-Clamp Time

	N	Minimum	Maximum	Mean	Std. Deviation
Aortic Cross-Clamp Time During Surgery	10	60	125	79,40	23,172
Valid N (listwise)	10				

Postoperative Follow-Up

Postoperative follow-up was both clinical and echocardiographic, performed at day 30. All patients showed a marked improvement in their clinical status, with regression from NYHA class III or IV to class I or II. Only one patient, the one with dilated cardiomyopathy (DCM), remained in class III postoperatively. No deaths were reported during the follow-up period. Echocardiographic evaluation confirmed the success of the mitral valve repair in all cases.

Table 11: Clinical Status at Postoperative Day 30

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	I	6	60,0	60,0	60,0
	II	3	30,0	30,0	90,0
	III	1	10,0	10,0	100,0
	Total	10	100,0	100,0	

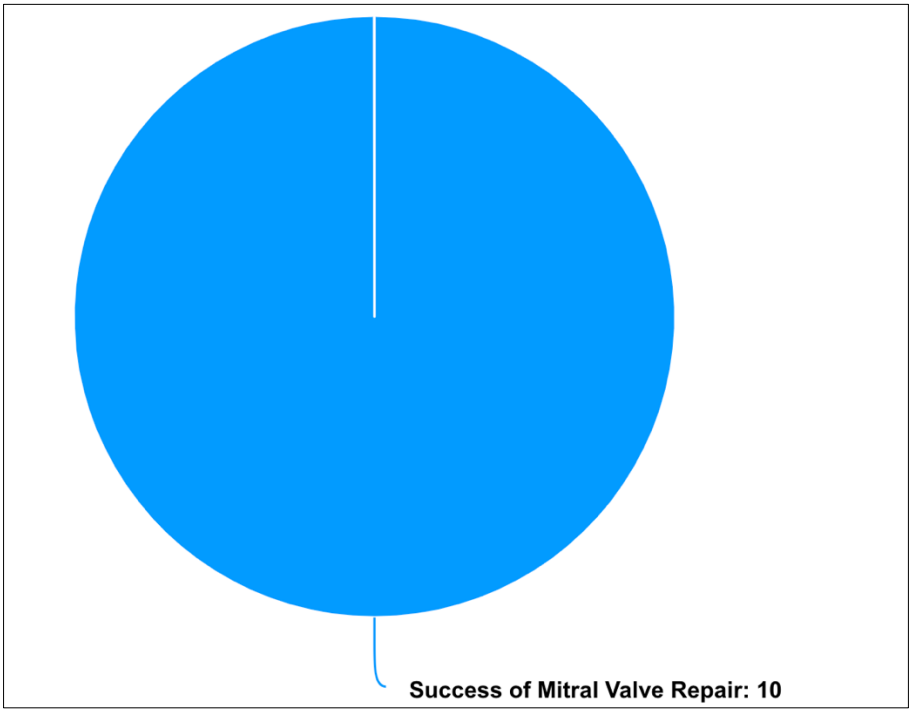
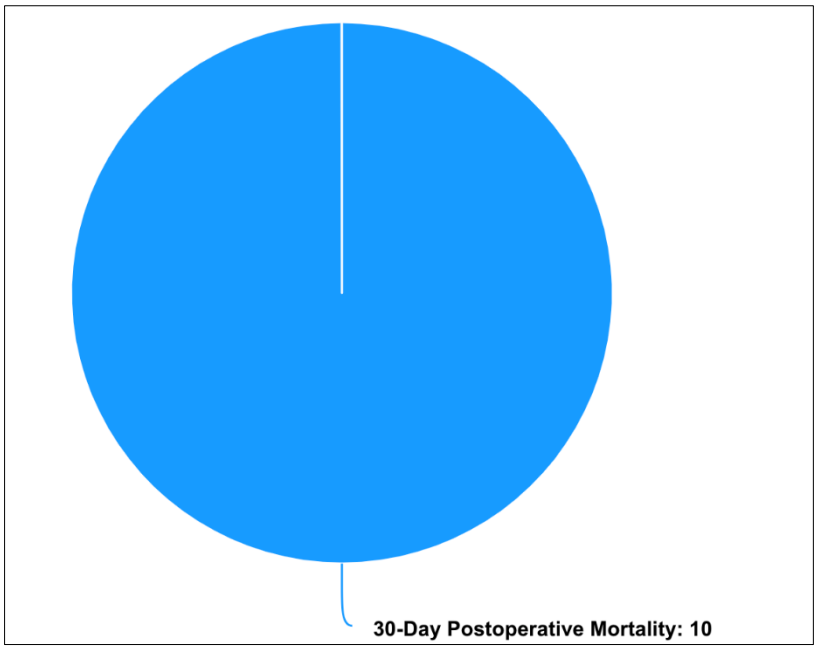


Table 12: Success of Mitral Valve Repair

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	10	100,0	100,0	100,0

Table 13: 30-Day Postoperative Mortality

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	10	100,0	100,0	100,0



DISCUSSION

In this study, we included 10 patients over a three-year period. The small sample size may be explained by the fact that, in our country, the most common form of valvular disease is rheumatic in origin, most often leading to mitral stenosis or mixed mitral valve disease, which is generally managed by valve replacement rather than repair. Cases of isolated rheumatic mitral regurgitation rarely qualify for valve repair, as the procedure is technically more complex and the underlying disease is progressive. Our study population was relatively young, with a mean age of 59 years, which is consistent with values reported in the literature, where the average age is approximately 60 years. Casey *et al.,*[2] and Paige *et al.,*[3] reported mean patient ages of 64 and 61 years, respectively. In our series, there was a male predominance (70%), which is consistent with findings from other studies: Casey *et al.,* reported 71% male patients, while Takashi *et al.,*[4] reported 69%. All of our patients were classified as NYHA functional class III or IV, whereas other studies also included patients in class I or II [2, 4]. This difference may be attributed to delayed diagnosis or surgical referral in our context, resulting in patients being evaluated at a more advanced stage of the disease. Additionally, we performed a statistical test to assess whether sex influenced clinical presentation; the result was negative, indicating no significant association.

From an echocardiographic standpoint, the left ventricular ejection fraction (LVEF) was preserved in most patients, which is typically observed in cases of mitral regurgitation, although it is well known that LVEF tends to be overestimated in this context [5]. We observed only one case of severe left ventricular dysfunction, with an LVEF of 25%, which is not unexpected as it involved a case of dilated cardiomyopathy (DCM). In our study, the predominant mechanism of mitral regurgitation was Carpentier type II, followed by type I. These are the forms most amenable to mitral valve repair, whereas type III MR cases in our setting are typically managed with mitral valve replacement (MVR). From a lesion-based perspective, P2 prolapse was the most frequent finding, accounting for 50% of cases. This is comparable to the results reported by Casey *et al.,* who found P2 prolapse in 55% of their cohort. P2 prolapse is widely recognized as the most common anatomical lesion in degenerative mitral regurgitation [5].

From a surgical standpoint, the duration of the procedures was acceptable, with a mean aortic cross-clamp time of 79 minutes. By comparison, Casey *et al.,* reported an average time of 62 minutes. The type of mitral valve repair performed was tailored to the specific valvular lesion. There were no cases requiring conversion to mitral valve replacement, and all repairs were successful. No mortality was recorded, either in the immediate postoperative period or at 30-day follow-up. Additionally, a marked improvement in NYHA functional class was observed during follow-up. However, these favorable outcomes should be interpreted with caution given the small sample size.

CONCLUSION

Our department's experience with mitral valve repair has yielded encouraging results. Nevertheless, increasing patient volume remains essential to reach standards comparable to those of medium- and high-volume centers. This remains a challenge in a context where rheumatic heart disease continues to represent a significant portion of valvular pathology.

Author's contribution

Dr. R. Sayah was the surgeon responsible for managing the patients included in this study. Dr. A. El

Idrissi conducted the study, and all other authors reviewed, revised, and approved the final version of the manuscript.

Conflict of Interest: The authors declare they have no conflict of interest.

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