

Clinical and Echocardiographic Study of Mitral Valve Repair in A Tertiary Center in Oman

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ABSTRACT

Introduction: In recent years, mitral valve (MV) repair has become the procedure of choice for treating isolated mitral regurgitation (MR). The aim of this study was to evaluate immediate and long-term clinical and echocardiographic results of MV repair performed at a tertiary hospital in Oman.

Materials and Methods: The study population consisted of patients with severe MR above 18 years of age who had isolated MV repair between 2006 and 2016 at Royal Hospital, Oman. Retrospective observational study. Primary Endpoints: 1-year freedom from reoperation, recurrence of severe MR and mortality. Secondary Endpoints: Five-year echocardiographic recurrence of severe MR, ejection fraction (EF), NYHA class and mortality.

Results: The case records of 351 patients with MR who had MV surgery in Royal Hospital were reviewed. A total of 89 patients had isolated MV repair surgery with follow up 1 year. The etiology of mitral disease was degenerative in 58.42%, rheumatic in 20.22%, post endocarditis in 12.35%, congenital 5.61% and ischemic MR in 3.37%. Operative mortality was 2.24% (2/89). Pre-operative NYHA class III/IV was noted in 62.92% of patients (56/89). All the patients had an EF of > 60%. Among the 87 patients followed up for one-year, 95.40 % (83/87) of patients were free from reoperation. Four patients (4.59%) had recurrence of severe MR needing MV replacement surgery. Of the 87 patients, 56 patients were followed in our institute for 5 years had demonstrated trivial to mild MR in 73.2% (41/56) moderate MR in 16.07% (9/56), and severe MR in 10.07% (6/56) of patients though 83.92% (47/56) patients were in NYHA class I. Majority of grade 3 (10.71%) and 4 MR (8.92%) occurred in patients with rheumatic etiology who underwent MV repair. Ejection fraction remained > 60% in 89.28% patients. There was no mortality at 5 years among the 56 patients followed-up.

Conclusions: MV repair in a tertiary center in Oman showed favorable early and one-year results as regards mortality, freedom from reoperation and recurrence of significant MR. Those followed-up at five years, majority of patients were asymptomatic though echocardiographic recurrence of moderate and severe MR was high predominantly in patients with rheumatic etiology.

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Introduction

In recent years, mitral valve (MV) repair has become the procedure of choice for

treating isolated mitral regurgitation (MR) and this trend continues to increase with time (1). MV repair has been reported to give excellent results in patients with MR (1,2).

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Advantages of MV repair over replacement include lower operative mortality, better preservation of ventricular function, lower risk of thromboembolism and anticoagulant-related complications, reduced risk of endocarditis, and better freedom from valve-related complications with an excellent long-term durability (1-6). From these studies it's found that, the operative mortality for MV repair was 1.2 to 1.4% compared to 3.8% with replacement. Freedom from recurrent mitral regurgitation (grade $\geq 3+$) at 1, 5, and 10 years was about $99\% \pm 1\%$, $87\% \pm 2\%$, and $69\% \pm 4\%$, respectively. The overall survival at 15 years about 79% (1-6). The selection of patients who are most likely to benefit from MV repair and the long-term durability of the reconstituted valve are important aspects of this treatment. In Oman, no descriptive studies were done about MV repair. Our study aimed to assess the immediate and long-term clinical and echocardiographic outcomes of MV repair in our institute.

Materials and Methods

The study population is consecutive series of patients with severe MR above 18 years of age who had isolated MV repair between 2006 and 2016 at Royal Hospital, Oman. MR assessment by echocardiography (Transthoracic and Transesophageal) was done according to published guidelines criteria (7,8). MR grade was defined as 0, none or trivial; 1, mild; 2, mild-to-moderate; 3, moderate; or 4, severe. Grade 4 MR was defined as central jet MR $>40\%$ of the left atrial area or holosystolic eccentric jet MR, vena contracta (VC) width >0.7 cm, regurgitant volume (RV) ≥ 60 mL, regurgitant fraction (RF) $\geq 50\%$, or an effective regurgitant orifice (EROA) ≥ 0.40 cm². Grade 3 MR was defined as VC width 0.5 to 0.69 cm, RV 45 to 59 mL, RF 40% to 49%, or an EROA 0.3 to 0.39 cm², whereas grade 2 MR was defined as VC width 0.3 to 0.49 cm, RV 30 to 44 ml, RF 30% to 39%, or an EROA 0.2 to 0.29 cm² in this study (7,8).

All symptomatic patients New York Heart Failure (NYHA) class II and above and those asymptomatic or minimally symptomatic patients (NYHA class I) were operated as per echocardiographic criteria as per published

guidelines (9,10). None of the patients had any significant involvement of other valves or significant pulmonary hypertension. Major symptoms included shortness of breath on exertion and treated symptomatic heart failure. All patients had EF $> 60\%$ preoperatively. Exclusion criteria included unstable patients with or without shock or with adjunct procedures, atrial fibrillation needing surgical ablation, EF $< 60\%$ and missing data either pre or post operatively.

Design: Our study adopted a retrospective observational design involving a comprehensive analysis of case files, incorporating both clinical and echocardiographic evaluations of survivors. The primary endpoints focused on assessing the 1-year freedom from reoperation, recurrence of severe mitral regurgitation (MR), and mortality. Additionally, secondary endpoints encompassed the evaluation of five-year outcomes, including echocardiographic recurrence of severe MR, ejection fraction (EF), New York Heart Association (NYHA) class, and mortality. All clinically relevant baseline variables were recorded. The clinical in-hospital and follow-up data related to clinical status, echocardiographic parameters were collected from previous records and from outpatient clinic/echocardiographic evaluations. Data were collected from electronic records and entered in the case report form (CRF) and then transferred to EpiData software and analyzed for univariate descriptive statistics. Ministry of Health Ethical approval was obtained (No: MESRC #36).

Results

The case records of 351 patients with MR who had MV surgery in Royal Hospital were reviewed. 262 patients were excluded as they had concomitant procedures or primary replacement surgery. A total of 89 patients had isolated MV repair surgery with follow up 1-5 years. The median age of the patients who had repairs was 50 (20-81) years. Table 1 shows the demographic profile of the patients. Out of 89 cases, 53 (59.55%) were male and 36 (40.44%) were female, thus, male to female ratio of 1.5:1. Table 2 shows

the etiology of mitral valve disease. The etiology of mitral disease was degenerative in 58.42%, rheumatic in 20.22%, post endocarditis in 12.35%, congenital 5.61% and ischemic MR in 3.37%. Other than ischemic etiology those above 40 years had no significant coronary artery disease or normal coronaries. Those with ischemic etiology had undergone percutaneous revascularization previously. Surgically, all patients underwent ring annuloplasty with or without triangular or quadrangular resection, chordal repair/creating neo-chordae, chordal shortening or cuspal thinning, decalcification, removal of infected tissue and reconstruction of valve. All the patients had an EF of > 60%. Pre-operative NYHA class I/II seen in 37.07% (33/89) and class III/IV was noted in 62.92% of patients (56/89) (Figure 1). Operative mortality was 2.24% (2/89). Among the 87 patients followed up for one-year, 95.40 % (83/87) of patients were free from reoperation. Four patients (4.59%) had recurrence of severe MR needing MV replacement surgery. There was no one-year mortality.

Of the 87 patients, 56 patients were followed in our institute and had echocardiographic examination at 5 years (Table 3), demonstrated trivial to mild MR in 73.2% (41/56) moderate MR in 16.07% (9/56), and severe MR in 10.07% (6/56) of patients though 83.92% (47/56) patients were in NYHA class I (Figure 2). 31 patients were lost to follow up or missing data. Majority of grade 3 (10.71%) and 4 MR (8.92%) occurred in patients with rheumatic heart disease as etiology who underwent MV repair. There was no significant mean gradient across mitral valve (> 5 mmHg) over the years. Ejection fraction remained > 60% in majority of patients (89.28%) (Table 3). Those with severe MR developed significant left ventricular dysfunction over 5 years and were advised reoperation. Mortality could not be assessed at 5 years due to 31 patients lost to follow up. There was no mortality at 5 years among the 56 patients followed-up.

Video 1 and 2 demonstrating pre-operative and 5-year post-operative transthoracic echocardiographic findings in a patient with degenerative mitral regurgitation who underwent ring annuloplasty.

Table 1. Demographic and clinical profile of 89 mitral valve repair patients.

Variable	Number (%)
Sex	
Male	53(59.55)
Female	36(40.44)
Age Group in years	
20-29	9 (10.11)
30-39	13(14.60)
40-49	13 (14.60)
50-59	24(26.96)
60-69	24 (26.96)
70-81	6 (6.74)
Age, mean (\pm SD)	51 \pm 13.9
Ejection Fraction > 60%	89 (100)
Operative Mortality	2 (2.24)
One-year outcome (87 patients)	
Survival	83 (95.40)
Reoperation	4 (4.59)

Abbreviations: SD:Standard Deviation

Table 2. Etiology of mitral valve disease in 89 patients with mitral valve repair.

Etiology	Number (%)
Degenerative	52(58.42)
Rheumatic	18 (20.22)
Post-Endocarditis	11(12.35)
Congenital	5 (5.61)
Ischemic	3 (3.37)

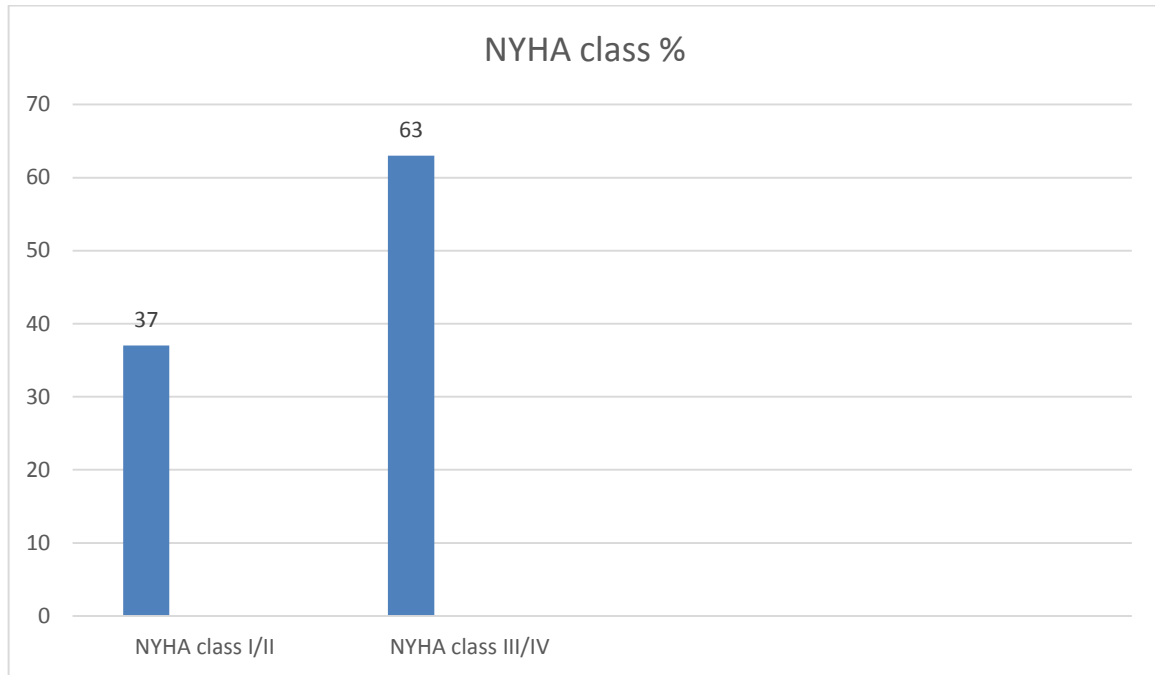


Figure 1. Distribution of New York Heart Association (NYHA) functional class before mitral valve repair in 89 patients.

Abbreviations: NYHA:New York Heart Association

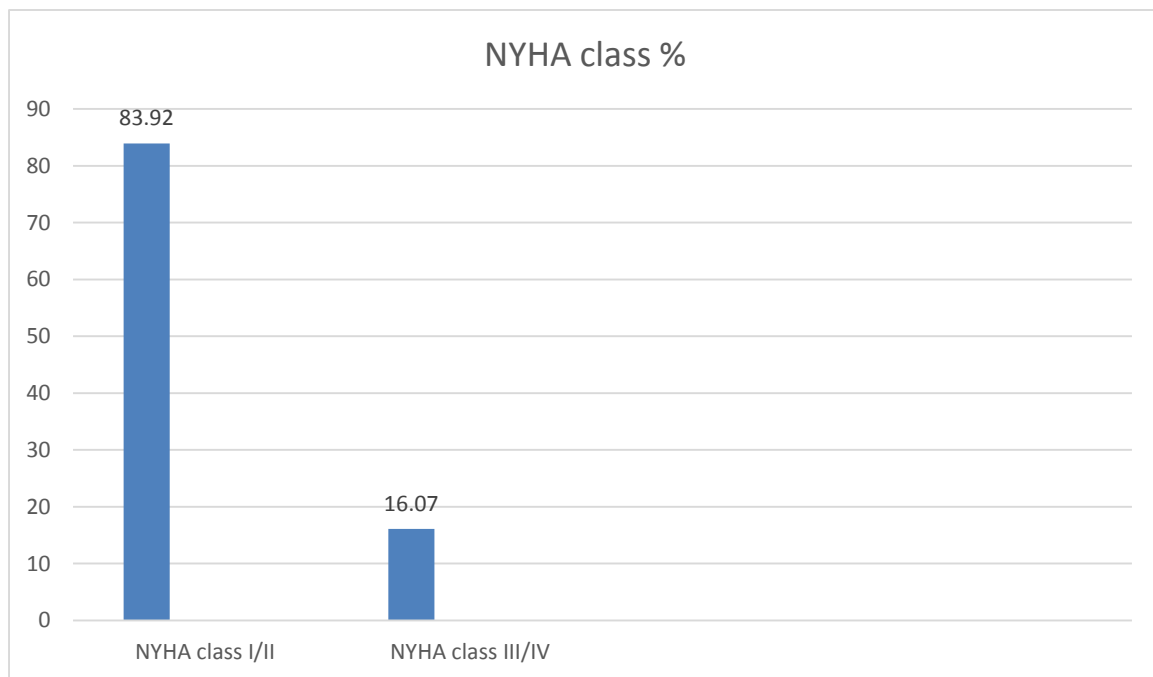


Figure 2. Distribution of New York Heart Association (NYHA) functional class at 5-years after mitral valve repair in 56 patients.

Abbreviations: NYHA: New York Heart Association.

Discussion

National Heart Center, Royal Hospital is one of three public tertiary care hospitals in Oman with 25 years pediatric and adult cardiac surgical setup. However the prevalence of valvar heart disease is low in the country with resultant less number of surgical valvar intervention. We performed this study to know the results of MV repair in a low volume center. This study confirms excellent immediate and one-year results of MV repair when compared to other studies. Daneshmand et al. reported operative mortality of 2.3% and Zhou et al. reported 2.5% which is similar to current study of 2.2% (11,12). Zhou et al. reported 94% survival and freedom from reoperation which is similar to 95.40 in this study (12). However, long-term results of recurrence of moderate and severe MR echocardiographically is not satisfactory though clinically patients were in good functional class.

With regard to etiology, we found that, the most common cause of MR is degenerative as in other studies and which could be attributed to a better short and long-term outcome (4,13). Other factors independently predicting overall long-term outcome reported in the literature are younger age, better functional class at presentation, and the absence of significant coronary artery disease (3). In this study, the median age of the patients who had repairs was 50 years

and more than a third (37%) of patients were in NYHA class I/II. Moreover, asymptomatic or minimally symptomatic patients were operated early (37%) which support the recommendation of early intervention in patient with asymptomatic severe MR if high likelihood of durable repair as proposed by the guidelines for the management of heart valve diseases (13).

In this study, even though there was low risk of reoperation at one year (4.59%), the 5-year echocardiographic recurrence of moderate (16.07%) and severe MR (10.07%) was significant. Those with severe MR were advised reoperation due to LV dysfunction, however they deferred. Kaneyuki et al. reported 56 patients with MV repair; during 5 year follow-up, 10 (17.8%) patients developed moderate or severe mitral regurgitation which is lower than current study where 27% of patients had moderate or severe MR (14). Early failure of MV repair within 2-3 years after repair are related to improper indication, inadequate repair, and technical factors which was not seen our patients (13,15,16,17). Late recurrence of significant MR were found to be due to recurrent rheumatic activity, which leads to a progressive structural deterioration of the mitral apparatus which could be the cause in the current study as most of our patients are not on penicillin prophylaxis post operatively (14).

Table 3. Ejection fraction and mitral regurgitation severity with etiology in 56 patients with mitral valve repair at 5 years follow-up.

Variable	Number (%)
Ejection fraction	
- > 60%	50(89.28)
- 45 – 60%	3(5.35)
- < 45%	3(5.35)
Mitral regurgitation	
- Trivial and mild	41(73.2)
- Moderate	9(16.07)
- Degenerative etiology	2 (3.57)
- Rheumatic etiology	6 (10.71)
- Infective endocarditis	1 (1.78)
- Severe	6 (10.7)
- Degenerative etiology	1 (1.78)
- Rheumatic etiology	5 (8.92)

This calls for strict follow-up of post MV repair patients and emphasize need for chronic rheumatic penicillin prophylaxis to prevent further activity and deterioration in regurgitation. In the study by Yau et al. in patients with rheumatic MV repair, at a mean follow-up of 68 months, 16% of repair patients required reoperation due to severe MR which is higher than occurrence of severe MR in this study (8.9%) in rheumatic patients (18). Our and other data suggest a survival benefit of mitral repair for rheumatic disease, albeit with a higher recurrence rate. As noted in other studies and similar to our study, this could be attributed to overall younger patients undergoing MV repair and elective admission status (18,19). In this series 21% of patients were rheumatic etiology who underwent repair which could attribute to more echocardiographic 5-year recurrence of significant MR.

Limitation

The design of our study is retrospective cross-sectional which carry its own limitations. Another limitation is exclusion of patients with low EF which would have indicated more poor outcomes. The main challenge was missing data and these patients were excluded from the study. We were unable to contact some patients from other nationality as they travelled back home. Also the prevalence of valvar heart disease is low and the results cannot be generalized. These limitations could have overestimated good prognosis in this cohort of patients.

Conclusion

MV repair in a tertiary center in Oman showed favorable early and one-year results in most of the cases as regards mortality, freedom from reoperation and NYHA class at one year. Those followed-up at five years at our institute, majority of patients were asymptomatic though echocardiographic recurrence of moderate and severe MR was high predominantly in patients with rheumatic etiology.

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