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**Corresponding Author**
M. Yokesh,
Department of General Medicine, Sree Mookambika Institute of Medical Sciences, Kanyakumari, India

**Author Designation**
[1]Professor
[2]Professor and HOD

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# Repairing the Mitral Valve Using Flexible Bands for Non-Ischemic Mitral Regurgitation

[1]M. Yokesh and [2]M.K. Suresh
*[1,2]Department of General Medicine, Sree Mookambika Institute of Medical Sciences, Kanyakumari, India*

**Abstract**
Mitral valve annuloplasty is a fundamental component in mitral valve repair to restore the size and shape of the native annulus and to prevent future annular dilatation. To assess the early results of MV repair using flexible bands in patients with non ischemic mitral regurgitation. We prospectively reviewed 53 patients who underwent mitral valve repair with a flexible. We evaluate all patients 1 year postoperatively to assess the progress of the repair procedure. Mean age at the time of operation was 38.8±11 years and more than half of them were females (56.6%). Preoperative mean ejection fraction was 61.7±8.9% and the majority (84.9%) of patients had severe mitral regurge on preoperative echocardiography. Regarding the 30-day mortality was 1.9%. At last follow up, 47.2% of patients had no or mild regurgitation and the mean ejection fraction was 57.9±8.2%. The early outcomes of mitral valve repair with flexible band show good results in our prospective observational study. Mitral valve annuloplasty with flexible band gives satisfactory results as regards NYHA classification, left ventricular function and dimensions.

## INTRODUCTION

Mitral valve repair is the treatment of choice for MR. It gives better results than mitral valve replacement in form of survival, ventricular function and thromboembolic complications. In Egypt, rheumatic heart disease is still the commonest cause of MR[1]. The most important and critical points in mitral repair are understanding anatomy, pathophysiology of mitral valve apparatus, severity and mechanism of mitral regurgitation, all these can be achieved by transesophageal echocardiography[2]. The basic component of mitral valve repair is annuloplasty. According to Carpentier's concepts, an annuloplastic device is important for (I) restoring the size and shape of annulus., (II) preventing more annular dilatation and (III) providing annular support[3]. Different types of annuloplasty devices are marketed to-day: rigid and flexible, opened or closed, with fixed or variable diameter. The choice of a device is difficult and in many cases complex and controversial. Any device can be used according to the choice of surgeon[4]. After the discovery of the continuous and cyclical three-dimensional movements of the mitral orifice, more studies turn the attention to the flexible ring. Such studies demonstrate the flexible ring is better adapted to the various phases in the cardiac cycle, in particular to diastole. Moreover it determines greater preservation of ventricular function than the rigid ring. Recently it has also been verified the advantage of the flexible ring in the preservation of the native valve apparatus and in the shape change of the mitral orifice during systole[5]. Many studies were carried out on the different surgical techniques used for management of non ischemic MR. In this study we are trying to show early results of MV repair using flexible bands in patients with non Ischemic mitral regurgitation.

## MATERIALS AND METHODS

Data was collected from patients attending the Department of General Medicine and cardiology opd of Sree Mookambika Institute of Medical sciences, kanyakumari, tamil nadu, from march 2023 to September 2024. inclusion criteria is normal weight individuals aged 21-50 years attending medicine opd. The study is a prospective observational study, on 53 patients with non ischemic mitral valve regurgitation undergoing mitral valve repair. Patients included in this study are those who have MV regurgitation with or without tricuspid regurgitation and meet the indications for MV operation according to (2020) American College of Cardiology/American Heart Association (ACC/AHA) guide-lines. While, patients excluded from the study are those with previous open cardiac surgery, concomitant aortic valve replacement, left ventricular (LV) impairment (ejection fraction <40%), ischemic MR, infective endocarditis and intraoperative residual MV regurgitation after MV repair needing MV replacement. After approval of the IRP committee and a written consent from all patients, patients were subjected to preoperative history taking, clinical examination, investigations as CXR, echocardiography, cardiac catheterization if needed, exclusion of septic foci and routine preoperative laboratory tests. Transesophageal echocardiography (TEE) was performed in all patients after the induction of anesthesia. All operations were done through a median sternotomy. Cardiopulmonary bypass was conducted with bicaval cannulation and mild systemic hypothermia (32°C). Myocardial protection was done by integrate blood cardioplegic solution. We used either pericardial or Teflon bands for posterior band annuloplasty. The size of annuloplasty band was selected according to the intertrigonal distance. Flexible band was implanted with 2-0 Ethi bond interrupted horizontal mattress sutures. Statistical analysis was done using the statistical package for social sciences (SPSS).Different statistical methods were used as appropriate. Mean±SD was determined for quantitative data and frequency for categorical variables. The independent t-test was performed on all continuous variables. The normal distribution data was checked before any t-test. The Chi-Square test was used to analyze group difference for categorical variables. In logistic regression models, age was adjusted for estimation of each or all the independent effects of hypertension, ischemic heart disease and diabetes mellitus . A p-value <0.05 was considered significant.

## RESULTS AND DISCUSSIONS

Demographic criteria of the patients showed that mean age of studied group was 38.8±11 years and >half of them were females (56.6%) **(Table 1)**. The most common cause of MR was degenerative accounting for (75.5%) of patients. The most common pathology of MR was prolapse of PMVL (30.2%).

**Table 1: Demographic criteria and Pathology of Mitral Valve Regurgitation**

| | Variable | N=53 | %=100 |
|---|---|---|---|
| age | | | Mean±SD: 38.8±11<br>Range: 19-60 |
| gender | Male | 23 | 43.4 |
| | Female | 30 | 56.6 |
| Aetiology of MR | degenerative | 40 | 75.5 |
| | Rheumatic | 12 | 22.6 |
| | congenital | 1 | 1.9 |
| pathology | Dilated annulus | 11 | 20.8 |
| | Prolapse of AMVL | 13 | 24.5 |
| | Prolapse of PMVL | 16 | 30.2 |
| | Restricted PMVL | 12 | 22.6 |
| | Cleft mitral valve leaflet | 1 | 1.9 |

Preoperative echocardiographic data, as presented in **(Table 2)** showed that mean of Ejection fraction of studied group was 61.7±8.9%, mean of LVEDD of them was 59.6±9.5mm and mean of PA pressure of them was 50±18.1mm Hg. The majority (84.9%) of patients had severe mitral regurge and 26.4% of them had mild tricuspid regurge.

**Table 2: Preoperative Echo Data Among the Studied Group**

| Variable | Mean ± SD | Range |
|---|---|---|
| Ejection fraction, (%): | 61.7±8.9 | 46-79 |
| LVEDD, (mm): | 59.6±9.5 | 45-80 |
| PA pressure (mm Hg): | 50 ±18.1 | 30-94 |
| | N=53 | % |
| Degree of mitral regurge: | | |
| Moderate to severe | 8 | 15.1 |
| Severe | 45 | 84.9 |
| Tricuspid regurge: | | |
| No | 14 | 26.4 |
| Mild | 14 | 26.4 |
| Moderate | 8 | 15.1 |
| Moderate to severe | 2 | 3.8 |
| Severe | 13 | 24.5 |
| Trivial | 2 | 3.8 |

Operative techniques used for repair are presented in **(Table 3)**. Pericardial bands were used in 40 (75.5%) patients. Tricuspid valve repair by DeVega annuloplasty, Modified segmental annuloplasty (El-Gabry technique) and Pericardial band was performed in 23 patients (43.4%).

**Table 3: Operative Data Among the Studied Group**

| Variable | Mean±SD | Range |
|---|---|---|
| **Technique of repair:** | | |
| **Annuloplasty and excision of fibrous peel** | 12 | 22.6 |
| **Annuloplasty** | 12 | 22.6 |
| **Annuloplasty and artificial chordae with gortex suture** | 3 | 24.5 |
| **Annuloplasty and quadrangular resection of p2** | 9 | 17 |
| **Posterior Leaflet triangular exclusion** | 7 | 13.2 |
| **Types of the bands:** | | |
| **Pericardial band 30** | 14 | 26.4 |
| **Pericardial band 32** | 26 | 49.1 |
| **Teflon band 32** | 13 | 24.5 |
| **Tricuspid valve repair:** | | |
| **No** | 30 | 56.6 |
| **Elgabry annuloplasty technique** | 10 | 18.9 |
| **Devage annuloplasty** | 3 | 5.7 |
| **Pericardial band** | 10 | 18.9 |

Post-operative echocardiographic data as presented in **(Table 4)** showed that mean of Ejection fraction of studied group was 57.9±8.2%, mean of LVEDD of them was 51.7±8.7mm and mean of PA pressure of them was 35.2±15.2mm Hg. 47.4% of them had no or mild mitral regurge and 43.4% of them had mild tricuspid regurge.

**Table 4: Postoperative NYHA of Patients**

| Variable | N=53 | %=100 |
|---|---|---|
| Postoperative NYHA: | | |
| Class I | 33 | 62.3 |
| Class II | 16 | 30.2 |
| Class III | 4 | 7.5 |
| Class IV | 0 | 0 |

Post-operative echo cardiography follow up. **(Table 5)**.

**Table 5: Postoperative Echocardiography Follow up**

| Variable | Mean±SD | Range |
|---|---|---|
| Ejection fraction, (%): | 57.9 ±8.2 | 43-73 |
| LVEDD, (mm): | 51.7±8.7 | 38-69 |
| PA pressure (mm Hg): | 35.2±15.2 | 20-70 |
| | N=53 | % |
| Degree of mitral regurge: | | |
| No | 8 | 15.1 |
| Mild | 17 | 32.1 |
| Mild to moderate | 1 | 1.9 |
| Trivial | 27 | 50.9 |
| Tricuspid regurge: | | |
| No | 15 | 28.3 |
| Mild | 23 | 43.4 |
| Trivial | 15 | 28.3 |

Also our patients showed improvement of postoperative NYHA class. Regarding early morbidity occurred in our patients showed in **(Table 6)**.

**Table 6: Complications Rate Among the Studied Patients**

| Variable | N=53 | % |
|---|---|---|
| **Neurological complication:** | | |
| No | 52 | 1 |
| Lt sided hemiparesis | 98.1 | 1.9 |
| **Bleeding and re exploration:** | | |
| No | 49 | 4 |
| Yes | 92.5 | 7.5 |
| **Hospital Mortality:** | | |
| No | 52 | 1 |
| Yes | 98.1 | 1.9 |
| **Arrhythmia:** | | |
| No | 42 | 79.2 |
| AF | 11 | 20.8 |
| **Chest complications:** | | |
| No | 46 | 86.8 |
| Chest infection | 4 | 7.5 |
| Late bleeding | 3 | 5.7 |
| **Wound infections:** | | |
| No | 49 | 92.5 |
| Yes | 4 | 7.5 |

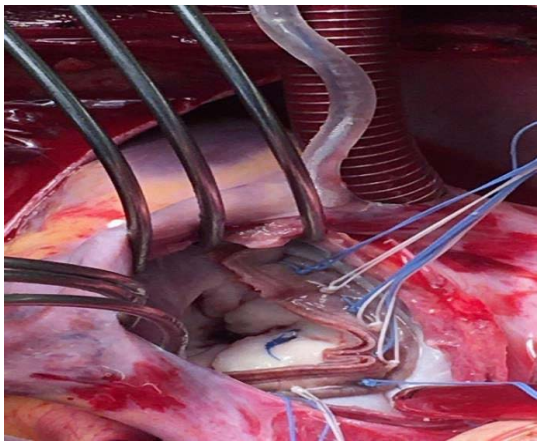

Fig. 1: Posterior Annuloplasty by Pericardial Band and Posterior Leaflet Triangular Exclusion

Although rheumatic heart disease is still the commonest cause of MR in Egypt, only few rheumatic cases can be repaired because of extensive valve affection. In our study, the most common cause of MR was degenerative and the most common pathology was prolapse of PMVL[2]. Mitral valve repair is the ideal procedure for mitral regurgitation and is preferred to prosthetic valve replacement, whenever technically possible. All previous studies stated that mitral valve replacement has higher mortality rate than mitral valve repair[6]. Annuloplasty rings are considered the "gold standard" for the surgical treatment of MR. Studies showed that the MV annulus continually changes size and shape during the cardiac cycle. This led to the development of a flexible ring that could conform to the physiologic changing annular shape[7]. In our study we used different types of flexible bands for posterior annuloplasty and Pericardial band size 32 was the most commonly used one. Mitral valve repair was done in all our patients by annuloplasty with or without specific technique according to pathology of mitral valve apparatus e.g. quadrangular resection of p2, artificial chordae with Gortex suture, excision of fibrous peel,

posterior leaflet triangular exclusion, posterior leaflet exclusion and closure of cleft mitral valve. Regarding early morbidity occurred in our patients, 4 cases were reexplored for bleeding. According to arrhythmia, there were atrial fibrillation in 11 cases of the studied group. There were chest complications in the form of in 4 cases of chest infection and 3 cases of late bleeding. 4 cases developed superficial wound infections and one patient developed Lt sided hemiparesis. In study done by **salvador**[8] reported early morbidity was rexploration for bleeding in 3.6%, postoperative renal failure was 2.1 % required dialysis, postoperative stroke in 1.7%. No Intraoperative mortality was found in our study. As regards early mortality (with 30 days of operation) in our study, in 1 case died (1.9%), at second day postoperatively due to bleeding. In study performed by **Salvador**[8] revealed early mortality was 1% all related to low cardiac output syndrome. In a study done by **Bogachev**[7] showed that at follow up echocardiographic examinations, only the flexible band group showed significant LV remodeling. This study also showed superiority of the flexible posterior band over the semirigid complete ring in terms of freedom from recurrences of significant and/or severe MR and risk of MV re operation. **Brown**[9] proved high effectiveness of flexible posterior annuloplasty bands in preserving mitral annulus flexibility and provide good mid-term and long-term durability. **El Sharawy**[10] in their study concluded that early postoperative left ventricular dimensions were reduced ,also left ventricular function was significantly improved in flexible band group more than rigid one. Our study gives similar results as the flexible band annuloplasty showed good results regarding left ventricular function and dimension. In a meta-analysis done by **Hu**[11] concluded that the outcome of the flexible annuloplasty was comparable with the rigid ring in terms of in-hospital mortality, reoperation need, recurrence of significant mitral regurgitation (MR), late survival benefit and LV remodeling. However, the flexible annuloplasty was associated with higher LV ejection fraction, larger residual mitral valve area. A retrospective analysis conducted by **Panicker**[12] proved that there was no difference between the flexible and rigid rings in result in terms of LV regression and mitral regurgitation recurrence at 5-year follow-up. And concluded that rigid ring or flexible ring didn't have marked effect on the outcome of mitral valve annuloplasty at midterm follow-up.

## CONCLUSION

The early outcomes of mitral valve repair with flexible band show good results in our prospective observational study. Mitral valve annuloplasty with flexible band gives satisfactory results as regards NYHA classification, left ventricular function and dimension. Long-term data might be required to determine efficacy of annuloplasty by flexible band.

**Conflict of Interest:** No.

## REFERENCES


1. Baumgartner H., V. Falk, J.J. Bax, M. De Bonis, C. Hamm, P.J. Holm and B. Iung., 2017. 2017 ESC/EACTS Guidelines for the management of valvular heart disease., Eur Heart J., Vol. 38: 10.1093/eurheartj/ehx391.
2. Benfari G., P. Sorajja, G. Pedrazzini, M. Taramasso and M. Gavazzoni *et al.*, 2022. Association of transcatheter edge-to-edge repair with improved survival in older patients with severe, symptomatic degenerative mitral regurgitation. Eur. Heart J., Vol. 43: 10.1093/eurheartj/ehab910.
3. Simonato M., B. Whisenant, H.B. Ribeiro, J.G. Webb and R. Kornowski *et al.,* 2021. Transcatheter Mitral Valve Replacement After Surgical Repair or Replacement: comprehensive midterm evaluation of valve-in-valve and valve-in-ring implantation from the VIVID registry. Circulation, Vol. 143: 10.1161/Circulationaha.120.049088.
4. Mizuno T., A. Chen, K. Mamada, A. Takahashi, S. Uchida and M. Uechi., 2021. Analysis of mitral valve morphology in dogs undergoing mitral valve repair with three-dimensional transesophageal echocardiography. J. Vet. Cardiol., Vol. 34: 10.1016/j.jvc.2021.01.004.
5. Mor M., G. Petrogalli, T. Mikolajczyk and R. Faglia., 2015. Study of a Test Bench for Artificial Heart Valves: Description and Preliminary Results. Applied Mech. Mater., Vol. 783: 10.4028/www.scientific.net/AMM.783.17.
6. Faerber G., S. Tkebuchava, M. Diab, C. Schulze, M. Bauer and T. Doenst., 2021. Minimally-invasive mitral valve repair of symmetric and asymmetric Barlow´s disease. Clin. Res. Cardiol., Vol. 110: 10.1007/s00392-021-01844-9.
7. Bogachev-Prokophiev A.V., A.V. Afanasyev, S.I. Zheleznev, V.M. Nazarov, R.M. Sharifulin and A.M. Karaskov., 2017. Mid-term results of mitral valve repair using flexible bands versus complete rings in patients with degenerative mitral valve disease: a prospective, randomized study. J Cardiothorac Surg., Vol. 12.
8. Salvador L., S. Mirone and R. Bianchini, *et al*., 2008. A 20-year experience with mitral valve repair with artificial chordae in 608 patients. J Thorac Cardiovasc Surg., Vol. 135: 10.1016/j.jtcvs.2007.12.026.
9. Brown M.L., H.V. Schaff, Z. Li, R.M. Suri, R.C. Daly and T.A. Orszulak., 2009. Results of mitral valve annuloplasty with a standard-sized posterior band: Is measuring important. The J. Thoracic Cardiovasc. Surg., Vol. 138: 10.1016/j.jtcvs.2009.01.022.
10. ElSharawy, M., M.A. ElNewihy, M.F. ElGabry, M.M.A. Rabo and S.E. Saeed, 2019. Mitral Valve Repair with Flexible Band Versus Rigid Band in Non Rheumatic Mitral Regurgitation A Comparative Clinical Trial. Indian J. Public Health Res. and Dev., Vol. 10. 10.37506/v10/i12/2019/ijphrd/192413.

11. Hu X. and Q. Zhao., 2011. Systematic evaluation of the flexible and rigid annuloplasty ring after mitral valve repair for mitral regurgitation. Eur. J. Cardio-Thoracic Surg., Vol. 40: 10.1016/j.ejcts. 2010.11.080.
12. Panicker V.T., R. Sreekantan and S.S. Kotera., 2020. Flexible or rigid ring in mitral annuloplasty-do the results differ. Indian J. Thoracic Cardiovasc. Surg., Vol. 36: 10.1007/ s12055-020-01019-7.