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Research article

Comparative Study Between Bi Leaflet Excision Versus Posterior Leaflet Preservation in Patients Undergoing Mitral Valve Replacement in Suez Canal University Hospital

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Abstract

Background

Preserving the subvalvular mitral apparatus has been recognized as necessary for improvement of-left ventricular systolic function after mitral valve replacement.

Aim

compare convential excision technique with posterior leaflet preservation technique.

Methods

In a comparative prospective randomized study, simple randomization table, 44 patients with mitral valve disease undergoing mitral valve replacement (MVR) were divided in two groups as group one of 22 patients who were undergoing MVR with posterior leaflet preservation and group two 22 patients who were undergoing MVR with total excision of the native valve. All patients were subjected to echo study preoperatively and within 6 months post operatively. Echocardiographic examination included left atrial diameter (LAD), ventricular end diastolic dimension (LVED), left ventricular end systolic dimension(LVESD), left ventricular end diastolic volume (LVEDV),ventricular end systolic volume (LVESV), ejection fraction (EF), and fractional shortening (FS).

Results

Left ventricular end-diastolic volume (LVEDD) in group I was decreased significantly from 54.44 10.72mm preoperatively to 46.2 9.89mm postoperatively (p=0.043). In group II, EDD was 49.23 6.26mm and changed non significantly to 48.22 10.6mm (p = 0.72). There was a statistically significant reduction of EF% in group II from preoperative mean value of 65.55 7.15 to 51.40 9.04 postoperatively (p = 0.000).

Conclusion

Whenever mitral valve repair is not possible. MVR with posterior leaflet preservation is recommended as the second choice for superior LV chamber size reduction and better LV performance.

Keywords: Mitral Valve Replacement; Posterior Leaflet Preservation; Left Ventricular Function.

Introduction

Recently, the outcome for patients with mitral valve disease has significantly improved. This may be due to concomitant advances in many fields. In particular, the development of surgical techniques has contributed to this improvement. After the evaluation of results in mitral valve surgery and exploration of the relationship between the mitral valve and the mitral subvalvular apparatus, it is currently accepted that mitral valve repair is superior to replacement and that replacement with preservation of the mitral subvalvular apparatus is preferable to replacement alone [1].

Preserving the subvalvular mitral apparatus has been recognized as necessary for improvement of left ventricular systolic function, exercise capacity, and better survival after mitral valve replacement. It has been shown to preserve regional left ventricular mechanics and three dimensional contraction synergy, and may prevent myocardial rupture [2].

Although some investigators have retrospectively examined the issue of complete versus partial chordal preservation, this question has not been addressed rigorously in -the clinical setting with extended follow-up. As a result, many surgeons continue to retain only the posterior leaflet chordal tendencies because of concerns over greater technical complexity, longer operating time, potential interference with mechanical valve leaflet motion,need to undersize the mitral prosthesis, and the possibility of creating left ventricular (LV) outflow tract obstruction [3].

A variety of techniques have been reported to overcome these limitations with different advantages and disadvantages. These techniques, differ primarily in the location where the anterior leaflet and chordate are inserted in the mitral annulus [4].

In patients with diseased mitral-valve where-repair is not recom-

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mended. LV function can still be preserved by retaining subculture apparatus with implantation of a rotatable prosthetic valve [5].

The aim of this work is to compare between mitral valve breakfast excisions versus posterior leaflet preservation in rheumatic patients undergoing mitral valve replacements.

Patients and Methods

Forty four consecutive patients, with mitral valve disease(mitral regurge or stenosis) undergoing MVR in a prospective randomized comparative study which did in Emergency department collaborated with the Cardiac Surgery Department, Suez Canal university hospital and accepted by the ethical committee and the hospital authority. Patients were divided into two groups using simple randomization table each is 22 patients; group one undergoing mitral valve replacement with posterior leaflet preservation and group 2 undergoing mitral valve replacements without posterior leaflet preservation. Patients were evaluated prospectively. All clinical and echocardiography data describing this population were collected prospectively. NYHA class, left atrial diameter (LAD), ventricular end diastolic dimension (LVED), left ventricular end systolic dimension(LVESD), left ventricular end diastolic volume (LVEDV),ventricular end systolic volume (LVESV), ejection fraction (EF), and fractional shortening (FS). results of the two groups were measured preoperatively and 6 months postoperatively; then compared. Median sternotomy was performed under general anesthesia and cardiopulmonary bypass was instituted with ascending aortic and brachial cannulation. Moderate hemodilution and mild systemic hypothermia (>28°C) were used. A LV vent was inserted through the right superior pulmonary vein in selected patients. Myocardial protection was initiated with a dose of high-potassium blood cardioplegia through the ascending aortic root to induce cardiac arrest. This was followed by continuous retrograde cardioplegia directly into each coronary ostium. The intertribal groove is incised, and the two atria are dissected and divided up to the fossa oval is. This dissection exposes the roof of the left atrium, which is opened close to the mitral valve. In patients with a small left atrium, the inferior extension of the left atrial incision between the right inferior pulmonary vein and the inferior vena cave optimizes the mitral valve exposure Horizontal bilateral transaction (in case of concomitant tricuspid valve disease) was done. If the condition of the valve leaflet and subvalvular tissue was deemed worthy of preservation, every attempt was made to ensure that the preserved chordo-papillary apparatus allowed implantation of an appropriate-sized prosthesis without causing prosthetic valve entrapment or left ventricular outflow obstruction. In patients with calcified leaflets with annular extension and sever subvalvular fusion, the mitral apparatus was completely excised (group 2).In the posterior chordal group (group1), the anterior mitral leaflet was completely excised and the posterior mitral leaflet with choreographic apparatus was preserved by everting valve sutures taken through the annuli and the edge of the posterior leaflet to include it between the annulus and the sewing ring of the prosthesis. The left atriotomy was closed by a running 3/0 polypropylene suture. In cases where transsexual approach was used, the septum and right atriotomy were closed by running 4/0 polypropylene sutures. Defeating maneuvers were employed before removal of the aortic cross clamp. In cases of associated tricuspid regurge, we have performed Devega repair while the heart is beating after removal of cross clamp. The examination included 2-dimensional, 2-dimensional derived M-mode, continuous wave and pulsed Doppler, and color Doppler studies. Standard left parasternal, apical, right parasternal, subcostal, and suprasternal views were obtained in a step-by-step successive pattern of interrogation. Echocardiographic examination included left atrial diameter (LAD), ventricular end diastolic dimension (LVED), left ventricular end systolic dimension(LVESD), left ventricular end diastolic volume (LVEDV),ventricular end systolic volume (LVESV), ejection fraction (EF), and fractional shortening (FS). The postoperative measurements were made without knowledge of the preoperative values.

Results

44 patients, with mitral valve disease (mitral regurge or stenosis) undergoing MVR Patients were divided into two groups each is 22 patients; group one undergoing mitral valve replacement with posterior leaflet preservation and group 2 undergoing mitral valve replacement without posterior leaflet preservation. Out of 44 patients, 18(40.9%) were males and 26(59.1%) were females. Mean age of patients was 36,53 ± 15,05 years for patients in group1 and 33,42 ± 11,64 years for patients in group 2.

By analysis of variance, we could not identify differences among the 2 groups as regard the valve size (p=0.53). There was no need to undersize the required valve size in group 1.Postoperative data were obtained from patients at an early post-operative period after 6 months from the operation.

Regarding NYHA functional, it was improved in both groups. In group, I it was significantly changed from 2.85 0.36 preoperatively to 1.55 0.75 postoperatively (p value, 0.024). On the other hand, no significant change was found in group II. The mean NYHA class was 2.80 0.52 preoperatively and 2.75 0.96 postoperatively (p value, 0.823).

The Left atrial diameter (LAD) was significantly decreased in all patients of the 2 groups (p = 0.002).In group I, It decreased from 50 10.02mm preoperatively, to 40.66 7.15mm postoperatively . In group II, It decreased from 49.23 6.262mm preoperatively, to 41.87 12.22mm postoperatively. By analysis of variance, no statistically significant difference was between the 2 groups as regard the rate of reduction of LAD diameter (p=0.52).

Left Ventricular End-Diastolic Volume (LVEDD)

in group I was decreased significantly from 54.44 10.72mm preoperatively to 46.2 9.89mm postoperatively (p=0.043). In group II EDD was 49.23 6.26mm and changed non significantly to 48.22 10.6mm (p = 0.72).

Left Ventricular End-Systolic Diameter (LVESD)

No statistically significant reduction was found in group I (p=0.180), or group II (p = 0.720). In group I, The mean preoperative ESD was 34.41 8.34mm preoperatively non significantly decreased to 29.03mm postoperatively. In group II, It was 31.62 87 ml preoperatively, and 34 9.03 postoperatively.

Regarding Left ventricular end-diastolic volume (LVEDV) there was no statistically significant reduction found in group I (p=0.128), or group II (p = 0.801). The mean preoperative EDV was 150.39 66.51 ml preoperatively and non-significantly decreased to 119.68 67.89 ml postoperatively. In group II It was 112.92 35.55 ml preoperatively and 116.01 65.89 ml postoperatively.

Left ventricular end-systolic volume (LVESV) was significantly reduced in group I (p=0.012) versus non-significant reduction in group II (p= 0.964). The mean preoperative EDV in group I was 55.03 36.08 ml preoperatively and significantly decreased to 47.46 31.3 ml postoperative. In group II it was 45.93 16.22 ml preoperatively, and 46.27 Of 34.57 ml postoperatively.

Left Ventricular Ejection Fraction (LVEF %)

There was a statistically significant reduction of EF% in group II from preoperative mean value of 65.55 7.15 to 51.40 9.04 postoperatively (p = 0.000). For group I, it decreased from 64.47 9.29 preoperatively to 59.63 12 postoperatively non significantly.

There was no statistically significant reduction of FS% in group II from preoperative mean value of 34 5.86 to 2.91 26.16 postoperatively (p=0.12). The degree of reduction of FS was not significant in group1, it decreased from 36.82 6.73preoperatively to 32.14 7.65 postoperativeely.

Regarding Pressure Gradient (PG)

There was no statistically significant difference between PG across the prosthetic valves implanted in the 2 groups (p =0.170). it was 7.83±2.93 mmHg, and in group II it was 11.85±6.13 mmHg. In this study, Paired sample "t" test was used to observe the extent of LV mass regression in these patients postoperatively. Continuous data in the text and tables are presented as mean standard deviation.

Table1: Differentsize of inserted mechanical valves and numbers of patients with mitral valve replacement(MVR) with posterior leaflet preservation (group1), and total leaflet excision(group2).

Valve Size (mm)	Group I	Group II
25	10	6
27	9	10
29	3	3
31	0	3

Group 1: patients with (MVR) with posterior leaflet preservation.

Group 2: patients with (MVR) with total leaflet excision.

There was no need to undersize the required valve size in group 1.In both groups 27 and 29 sizes are used more frequently than other measures. In group 1, 10 patients had 25 size versus 6 patients in group 2. In group 2 , 3 patients had 31 valve size versus none in group 1. By analysis of variance, we could not identify differences among the 2 groups as regard the valve size (p=0.53).

Table 2: Postoperative comparison between the mean left ventricular end diastolic dimension (LVEDD) between patients undergoing mitral valve replacement(MVR) with posterior leaflet preservation (group 1)and total leaflet excision (group2).

	Group I	Group II	P value
Mean EDD (mm)	46.2	48.22	0.031
±SD	9.89	10.68	

Group 1: Patient with MVR with posterior leaflet preservation.

Group 2: Patients with MVR with total leaflet excision.

Left ventricular end-diastolic volume (LVEDD):in group I was decreased significantly from 54.44 ± 10.72 mm preoperatively to 46.2 ± 9.89 mm postoperatively (p=0.043).In group II EDD was 49.23 ± 6.26 mm and changed non significantly to 48.22 ± 10.6 mm (p = 0.72).

Table 3: Postoperative comparison between meanleft ventricular end systolic volume(LVESV) between patients undergoing mitral valve replacement (MVR) with posterior leaflet preservation (group 1) , and total leaflet excision (group2).

	Group I	Group II
Mean ESV	47.46	46.27
(ml)		
±SD	31.3	34.57

Group 1: Patient with MVR with posterior leaflet preservation.

Group 2: Patients with MVR with total leaflet excision.

Left ventricular end-systolic volume (LVESV) was significantly reduced in group I (p=0.012) versus non-significant reduction in group II (p= 0.964). The mean preoperative EDV in group I was 55.03 ± 36.08 mlpreoperatively and significantly decreased to 47.46 ± 31.3 ml postoperative. In group II it was 45.93 ± 16.22 ml preoperatively, and 46.27 ± in 34.57 ml postoperatively.

Table 4: Postoperative comparison between the mean ejectionfraction (EF %) for patients undergoing mitral valve replacement (MVR) with posterior leaflet preservation (group 1), and total leaflet excision (group2).

	Group I	Group II
Mean EF%	**59.63**	**51.40**
± SD	**12**	**9.04**

Group 1: Patient with MVR with posterior leaflet preservation.

Group 2: Patients with MVR with total leaflet excision.

Left Ventricular Ejection Fraction (Lvef %)

There was a statistically significant reduction of EF% in group

II from preoperative mean value of 65.55 7.15to 51.40 ± 9.04 postoperatively (p = 0.000).For group I, it decreased from 64.47 ± 9.29 preoperatively to 59.63± 12 postoperatively non significantly.

Discussion

Preoperative strategies to decrease the prevalence of postoperative low cardiac output have included the revision of the indications of MVR, improvement of myocardial protection and mitral prosthesis, and the use of mitral reconstructive procedure to correct MR when possible. For the group of patients who undergo MVR, the importance of preservation of the native valve and the attached chordate has gained popularity [6].

Over the years, neglect of the importance of the mitral supportive apparatus was further established by Ross's after load "mismatch theory". According to Ross's thesis, it is the operative transformation of an incompetent to competent valve that deprives the mechanically overload failing left ventricle of its safety outlet of the volume pressure stress. Analyzing the factors involved in the preoperative and postoperative behavior of this failing hearts, Ross does not mention at all so critical a subject as the operative destruction of the chordal supportive system of the left ventricular parietal wall. Being aware of the theory, many surgeons accepted the tremendous mortality in MVR of ischemic mitral regurgitation [7].

Miller et al described the surgical technique used to preserve the chordate to the posterior leaflet and David extended this approach by advocating preservation of the anterior leaflet by removal of the central quadrilateral portion (without chordal).Spence and colleagues elegantly demonstrated that division of the chordate during MVR resulted in a severe deterioration in LV function [8].

Wiener and associates demonstrated in a prospective study that subvalvular preservation is associated with improved LV function and exercise capacity post-MVR [9].

In addition to the beneficial effects of subvalvular preservation on LV performance post-MVR, this technique likely decreases the risk of myocardial rupture, an uncommon but disastrous complication of MVR [10].

In the present study, 44 patients with mitral valve disease underwent MVR. They were divided into 2 groups (22 patients) each who had MVR with posterior leaflet preservation (group1) and (group 2) who had MVR with total chordal excision.

Regarding valvular lesions, we include in the study patients with predominantly MS, predominant MR, and mixed lesions. This is in accordance with the studies performed by Shah and colleagues, Harpole and associates, and Straub and associates. Other investigators restricted their researches on chordal preservation to patients with chronic mitral regurge, to patients with pure mitral stenos is or to patients with mixed lesions excluding pure mitral resurge.

One of objectives of our study' was to assess the feasibility of chordal preservation in rheumatic mitral valve disease with different lesions. Pure MS accounts for 35% of lesions in group 1, 60% in group II.

LAD (Left atrial diameter) was significantly decreased in all patients of the 2 groups. By analysis of variance, no statistically significant difference was found between the 2 groups as regard the rate of reduction of LAD diameter. Replacement of a diseased mitral valve by a competent prosthetic valve helped this reduction in LAD.

This result correlates well with the result of other investigators who compared total excision MVR and posterior chordal sparing MVR groups. However, they demonstrated greater reduction in posterior chordal sparing group when compared to total excision group.

Our data showed significant reduction of LVEDD in group 1 post operatively. By analysis of variance in the degree of reduction was significant in comparison of both groups.

Sagitta and coworkers studied 40 patients with MVR for MS, 18 with conventional total excision (CMVR) and 22 with preservation of annul papillary continuity (MVR) either by native chordate (n=6) or by expanded poly tetra fluoro ethylene sutures (n=16) At 3.1-6.5 years after surgery, periodic echocardiography showed significant differences ($p < 0.05$) in LVESD (35.8 versus 31.6 mm, respectively, in the CMVR and MVR groups. At 6.6-9.7 years postoperatively, but LVESD was significantly greater in the CMVR group than in the MVR group (37.3 versus 31.5mm) [11].

Wimbledon and associates demonstrated that when preoperative ESD is more than 50mm, a poor postoperative outcome is predicted despite chordal preservation in relatively young patients with rheumatic mitral regurgitation [13].

In our study, postoperatively, no significant reduction in LVEDV was noticed in both groups. In other studies, LVEDV was significantly decreased in the posterior leaflet preservation group early postoperatively.

In our study regarding the mean postoperative LVESV, there was no significant difference between group I&II, but it decreased significantly only in group I.

Rose and coworkers showed an increase in end-systolic stress, which in turn increased end-systolic volume in chordal transaction group. Conversely, chordal preservation MVR resulted in smaller LV size, allowing a reduced end-systolic stress and preservation of ejection performance despite closure of the low impedance left atrial ejection pathway [13].

In our study, LVEDD was significantly reduced in group 1 and between the two groups but in LVEDV failed to decline postoperatively, however, LVESV was decreased significantly in group 1 only. A likely explanation for this finding is that the increased after load (after load mismatch) led to the use of preload reserve, which prevented end-diastolic volume from falling after surgery. contrary, preserving posterior chordal structures resulted in more favorable LV geometry and, consequently, LV after load.

This, in turn, leads to greater ventricular remodeling with

consequent reduction of LV dimensions and volume. Our findings are supported by a greater reduction in LV mass index in patients with posterior chordal preservation group.

In our study, Postoperatively, there was a significant reduction in EF in group II. It decreased from 65.55 7.15 preoperatively to 51.40 9.04 postoperatively (p=0.002), but there was no significant change in group1.

Several reports indicate that EF markedly declines early after total excision of the mitral subculture apparatus and did not recover in the late postoperative follow up.

As regards preservation group, our study showed that LVEF decreased non significantly in the early postoperative period. It decreased from 61.29 6.74 preoperatively to 51.40 postoperatively (p=0.851) in excision group II. For group 1, it decreased from 64.47±9.29 preoperatively to 59.63 12 postoperatively (p=0.237).

In our study, we did not find a statistically significant difference between mean prosthetic valve sizes implanted for patients in the 2 groups (p=0.53). We were able to implant 27 to 31mm prosthesis in 55% of patients in group 1(12 patients) and 60% of patients in group 2 (14 patients). However, we felt that without preserving the mitral apparatus one could insert a valve of one size larger but there was no statistically significant difference between PG across the prosthetic valves implanted in the 2 groups (p= 0.070).

In our study, we relied on EF and FS to assess LV performance. Although EF is a clinically reliable and accurate parameter, it is load dependent.

Conclusion

Role of mitral subvalvular apparatus in LV performance had been proven. Severing the chordate tendinous and papillary muscles adversely LV function and has been associated with poor outcome after MVR. To sum up, we can say that whenever mitral valve repair is not possible. MVR with posterior leaflet preservation is recommended as the second choice. It has the advantages of being technically feasible in rheumatic patients, with superior LV chamber size reduction and better LV performance.

References

1. Tennessee H , Komeda M (2005) Update on mitral valve surgery. Organs MJ 8(4): 222-227.
2. Homeboy UK (2005) Mitral valve replacement with and without chordal preservation in a rheumatic population: serial echocardiographic assessment of Left ventricular size and function. Ann ThoracSurg 79: 1926-33.
3. Un KL (2012) Randomized trial comparing partial versus complete chordal- sparing mitral valve replacement ventricular volume and function. J Thorac Cardiovasc Surg 123: 707-714.
4. Foster, Ho WC (2007) The effect of preservation of chordate tendinous in mitral valve replacement for post infarction mitral regurgitation. Circulation 74(Suppl. I): I116-20.
5. Khan GK, Marriot HJ (2005) Valvular heart diseases. In Heart disease diagnosis and treatment: a practical approach. 2nd edition Humana press mc: 399-40.
6. Heinlein CA (1937) Early changes in left ventricular size and function after correction of left ventricular volume overload. Am J Cardiol 47: 991-1004.
7. Ross N, Uden DE (1985) Strauss HD: The importance of the mitral apparatus in left ventricular function after correction of mitral regurgitation. Circulation 68(supply II): II-76-II-82.
8. Spence S, Gaasch WH, Carroll JD, Levine HJ (1986) Chronic mitral regurgitation: Predictive value of preoperative echocardiographic indexes of left ventricular function and wall stress. J Am Coll Cardiol 3: 235-242.
9. Walter, Gault JH, Bouchard RL, Karliner JS, Ross J Jr, et al. (2001) Mechanics of left ventricular contraction in chronic severe mitral regurgitation. Circulation 47: 1252-1259.
10. Various (1991) Serial noninvasive assessment of left ventricular hypertrophy and function after surgical correction of mitral regurgitation. Am J Cardiol 44: 585-594.
11. Sagitta, Spotnitz HM (2004) Systolic and diastolic properties of the human left ventricle during valve replacement for chronic mitral regurgitation. Am J Cardiol 47: 40-50.
12. Wimbledon (1981) Left ventricular stresses in the intact human heart 40: 180-150.
13. Rose JK (1992) Determinants of survival and left ventricular performance after mitral valve replacement. Circulation 81: 1173-1181.