Mitral Valve Replacement with Papillary Muscle Resuspension in Rheumatic Mitral Valve Disease

Romatizmal Mitral Kapak Hastalığında Papiller Kas Resüspansiyonu ile Mitral Kapak Replasmanı

Kemal UZUN,[a]
Hayrettin TEKÜMİT,[b]
Cenk TATAROĞLU,[c]
Ali Rıza CENAL,[d]
Esat AKINCI[d]

[a]Department of Cardiovascular Surgery, Ordu University Faculty of Medicine, Ordu
[b]Department of Cardiovascular Surgery, Bezmialem Foundation University Faculty of Medicine,
[c]Clinic of Cardiovascular Surgery, Private Avrupa Şafak Hospital,
[d]Clinic of Cardiovascular Surgery, Private Avrasya Hospital,
İstanbul

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Yazışma Adresi/*Correspondence:*
Kemal UZUN
Ordu University Faculty of Medicine, Department of Cardiovascular Surgery, Ordu,
TÜRKİYE/TURKEY
drkemaluzun@hotmail.com

ABSTRACT Objective: In this study, we compared two different mitral valve replacement techniques (with and without papillary muscle resuspension via artificial chordae) in patients with rheumatic mitral valve disease; in regard to effects on left ventricular functions and sizes. **Material and Methods:** The study included 164 patients that underwent mitral valve replacement with the complete resection of the mitral valve and subvalvular apparatus due to rheumatic mitral valve disease between January 2010 and September 2015. First, the patients were classified into two different sections according to severety of mitral insufficiency. Then, those who underwent papillary muscle resuspension were compared with those who didn't in each section. **Results:** Overall hospital mortality rate was 0.6% with 1 death. Among the patients who have significant mitral insufficiency, there was a significant difference between those with and without resuspension in respect to rates of inotrophic support taking and hospitalization duration times (59.2% versus 26.6%, p=0.033 and 10.59±5.8 versus 7.64±5.5 days , p= 0.036, respectively) in early postoperative period and ejection fractions (increased significantly in patients with resuspension from 56.23±9.1 to 59±6.5, while decreased in patients without resuspension from 58.37±9.9 to 57.07±9.1) during the mid-term postoperative period. **Conclusion:** In the case of valve replacement in rheumatic mitral valve disease, if there is significant mitral regurgitation preoperatively, performing papillary muscle resuspension affects left ventricular systolic functions positively. So, resuspension of the papillary muscles can be considered as a favorable alternative to other valve sparing technique due to potential advantages of maintaining mitral annulopapillary muscle continuity.

Key Words: Rheumatic heart disease; heart valve prosthesis implantation; chordae tendineae

ÖZET Amaç: Biz bu çalışmada romatizmal mitral kapaklı hastalarda iki farklı mitral kapak replasman tekniğini (yapay korda ile papiller kas resüspansiyonu yapılan ve yapılmayan) sol ventrikül fonksiyon ve boyutlarına etkileri bakımından karşılaştırdık. **Gereç ve Yöntemler:** Çalışmaya Ocak 2010- Eylül 2015 arasında romatizmal mitral kapak hastalığı nedeni ile mitral kapak ve subvalvuler yapılar tamamen rezeke edilerek kapak replasmanı yapılan 164 olgu dahil edildi. İlk olarak hastalar preoperatif önemli mitral yetersizlik olup olmamasına göre 2 gruba ayrıldı. Sonra her grup içinde papiller kas resüspansiyonu yapılanlar yapılmayanlar ile karşılaştırıldı. **Bulgular:** Total mortalite 1 ölüm ile %0,6 idi. Önemli mitral yetersizliği olan hastalardan resüspansiyon yapılan ve yapılmayanlar arasında inotropik destek ihtiyacı ve hastanede kalış süreleri bakımından anlamlı farklılık vardı (%59,2'ye karşı %26,6, p=0,033 ve 10,59±5,8'e karşı 7.64±5.5 gün, p= 0,036, sırasıyla) ve orta dönemde ejeksiyon fraksiyonları resüspansiyonlu hastalarda istatistiksel anlamlı artış gösterirken (56,23±9,1'den 59±6,5'e), resüspansiyonsuz grupta azaldı (58,37±9,9'dan 57,07±9,1'e). **Sonuç:** Romatizmal mitral kapak hastalığında kapak replasmanı gerektiğinde eğer anlamlı mitral yetersizliği varsa papiller kas resüspansiyonu yapmak sol ventrikül sistolik fonksiyonlarını ve boyutlarını olumlu etkilemektedir. Bu sebeple papiller kas resüspansiyonun mitral annulo-papiller kas devamlılığını sürdürmesinin potansiyel avantajları nedeniyle diğer kapak koruyucu tekniklere iyi bir alternatif olarak değerlendirilebilir.

Anahtar Kelimeler: Romatolojik kalp hastalıkları; kalp kapağı protezi implantasyonu; korde tendine

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The importance of preserving the native valve and chordal attachments during mitral valve replacement (MVR) was mentioned for the first time by Lillehei et al. in the 1960s.[1] However, their suggestion did not gain wide acceptance due to reports asserting the contrary by Björk and Malers, and Rastelli and Kirklin.[2,3] The extensive use of mitral valve repair techniques have led to a remarkable decrease in the early and long-term mortality and morbidity of patients that underwent treatment for mitral insufficiency. This improvement was attributed to the preservation of mitral annulopapillary muscle continuity during mitral valve repair.[4] In parallel to this, the importance of maintaining the integrity of the mitral valve structure in respect to the preservation of left ventricular (LV) functions during MVR has once again been brought into consideration. David et al. and Hetzer et al. have examined mitral valve replacement with chordal preservation.[5,6] Following these studies, both clinical and experimental studies showed the favorable effects of preserving subvalvular structures during mitral valve replacement on LV systolic functions in the early and late postoperative periods in patients with chronic mitral insufficiency.[7-13]

Myocardial fibers originate from the fibrous skeleton of the heart and ends there. The mitral chordae tendineae provide the connection between the fibrous skeleton and a portion of left ventricular myocardium. Early contraction of the papillary muscles causes a shortening of the long axis of the left ventricle with an increase in the short axis, leading to an increased preejection stretch on the ventricular myocytes to enhance ejection.[11] The contractile dysfunction due to the severing of this connection is more pronounced when there is mitral insufficiency because LV cavity is already dilated, myofibrils are elongated systolic functions maintained with compensation mechanisms. Current clinical data suggest that patients with heavily calcified mitral valve annuli have stiff posterior ventricular walls.[11] These are the reasons why we compared and valued the patients that had mitral insufficiency with those who didn't.

The continuity of annulopapillary muscles can be maintained by using artificial chordae in patients with rheumatic valve disease, in whom the preservation of chordal attachments is not possible in the majority of cases.[14-18] However, there are controversial data regarding to the outcomes of valve-preserving methods on LV functions in patients with rheumatic valvular disease, particularly in those with valvular stenosis.[19-24]

In this study, we compared conventional mitral valve replacement with mitral valve replacement plus papillary muscle resuspension in patients with rheumatic mitral valve disease, in regard to effects on left ventricular functions and sizes.

MATERIAL AND METHODS

In this multicenter retrospective study, we reviewed all the patients undergoing MVR with a complete resection of both leaflets and subvalvular structures due to rheumatic mitral valve disease at our institutions from January 2010 to September 2015 (n= 205). Multiple valve replacement, concomitant coronary artery bypass grafting, and previous cardiac surgery (except for mitral valve surgery) were excluded (n= 41). Tricuspid valve repair, left atrial ablation were not discarded. The final cohort comprised 164 patients. We performed the study in accordance with the Principles of the Helsinki Declaration and informed consents were received from all individuals.

First, the patients were classified into two sections, based on their preoperatively significant mitral insufficiency (MI). Then, those who experienced papillary muscle resuspension (PR) were compared with those who didn't in each section. Therefore, four groups were formed: The first group consisted of the patients that did not have significant mitral insufficiency and underwent MVR without papillary muscle resuspension (Group MI-/PR-, n=51). The second group was the patients that did not have significant mitral insufficiency and underwent MVR with papillary muscle resuspension (Group MI-/PR+, n=41). The third included the patients that have significant mitral insufficiency and underwent MVR without papillary muscle resuspension (Group MI+/PR-, n=27). The fourth group was the patients that have significant mitral insufficiency and underwent MVR

with papillary muscle resuspension (Group MI+/PR+, n=45). Grade III-IV mitral insufficiency was accepted as significant mitral insufficiency. There was no statistically important difference between the groups in respect of the preoperative and demographic characteristics of the patients (Table 1).

SURGICAL TECHNIQUE

Median sternotomy, ascending aorta and bi-caval venous cannulation were performed in all patients. Roller pump and membrane oxygenator were used. Moderate (28°C) systemic hypothermia was applied. For myocardial protection, isothermic potassium-enriched blood was administered via alternating antegrade and retrograde routes.

The mitral valve was explored using classical left atriotomy. In patients who papillary muscle resuspension was performed, artificial chordae were created using expanded polytetraflouroethilene (ePTFE) sutures and continuity of the mitral annulopapillary muscle was maintained. We employed the oblique placement technique, as described by Soga et al.[16] One CV-3 ePTFE mattress suture is placed at the tips of the anterior and the posterior papillary muscles. The suture for the anterior papillary muscle is placed at the 9–10 o'clock position on the mitral annulus, and the suture for the posterior papillary muscle at 5–6 o'clock. The sutures are tied just less than taut before insertion of the prosthesis. In all patients, MVR was performed using 2/0 pledged polyester sutures. Thirty nine left atrial radiofrequency ablation, 45 tricuspid annuloplasty, and 11 left atrial thrombectomy were performed as additional procedures. There was no statistically important difference between the groups for this respect.

STATISTICAL ANALYSIS

SPSS statistical analysis program (SPSS for Windows, version 16.0, SPSS Inc., Chicago) was used for the statistical analysis. The results were expressed as mean ± standard deviation. The variables had normal distribution. The Student's t-test was used to compare quantitative data between the groups and chi-square test was used to compare qualitative data. A paired t-test was used to compare preoperative and postoperative echocardiographic data. A p value <0.05 was considered statistically significant.

RESULTS

Overall hospital mortality rate was 0.6% with 1 death. This patient was from Group Insufficiency+/Resuspension-. A 29-mm size valve was used in approximately two thirds of the patients (Table 2). There was no statistically important difference between the groups in terms of prosthetic valve sizes.

TABLE 1: Preoperative characteristics of the patients.

	Mitral insufficiency (-)*			Mitral insufficiency (+)*		
Characteristics	Resuspension (-) mean±SD	Resuspension (+) mean±SD	p value	Resuspension (-) mean±SD	Resuspension (+) mean±SD	p value
Age (year)	48.65±10.60	49.24±11.96	0.80	46.7±11.3	48.91±12.7	0.46
EF (%)	57.39±9.28	58.18±9.33	0.71	58.8±10.4	57.3±9.3	0.57
	n (%)	n (%)		n (%)	n (%)	
Male/Female	4/47 (7.8/92.2)	11/30 (26.8/73.2)	0.015	4/23 (14.8/85.2)	13/32 (28.9/71.1)	0.25
Hypertension	11 (21.6)	15 (36.6)	0.20	6 (22.2)	18 (40)	0.12
DM	4 (7.8)	4 (9.8)	0.24	1 (3.7)	5 (11.1)	0.51
AF	25 (49)	23 (56.1)	0.49	11 (40.7)	18 (40)	0.57
NYHA						
Class II	2 (3.9)	4 (9.8)	2 (7.4)	11 (24.4)		
Class III	35 (68.6)	25 (61)	0.49	15 (55.6)	25 (55.6)	0.10
Class IV	14 (27.5)	12 (29.3)	10 (37)	9 (20)		

* Significant (grade III-IV) mitral insufficiency, EF: Ejection Fraction, DM: Diabetes Mellitus, AF: Atrial Fibrillation, NYHA: New York Heart Association.

TABLE 2: Implanted valve size no.

	Mitral regurgitasyon (-)		Mitral regurgitasyon (+)		
Size no.	**Resuspension (-)**	**Resuspension (+)**	**Resuspension (-)**	**Resuspension (+)**	**Total**
27 mm, n (%)	13 (25.5)	3 (7.3)	8 (29.6)	5 (11.1)	29 (17.7)
29 mm, n (%)	34 (66.7)	28 (68.3)	16 (59.3)	30 (66.7)	108 (65.9)
31 mm, n (%)	3 (5.9)	10 (24.4)	2 (7.4)	9 (20)	24 (14.6)
33 mm, n (%)	1 (2)	0	1 (3.7)	1 (2.2)	3 (1.8)
Total, n (%)	51 (100)	41 (100)	27 (100)	45 (100)	164 (100)

P=0.062

TABLE 3: Intraoperative and postoperative data of the patients without mitral insufficiency.

	Resuspension (-)	Resuspension (+)	
Characteristics	**Mean±SD**	**Mean±SD**	**p value**
ACC (min.)	55.49±18.10	57.22±10.79	0.59
CPB (min.)	72.33±17.69	77.68±15.14	0.14
ICU stay (day)	2.34±1.6	2.24±1.6	0.81
Hospital stay (day)	10.14±6.7	9.17±6.4	0.58
	n (%)	**n (%)**	
Ventilation>24 hours	1 (2)	1 (2.4)	0.87
Inotropic support periods			
12 hours	11 (21.6)	11 (26.8)	
12-48 hours	2 (3.9)	3 (7.3)	0.79
>48 hours	1 (2)	1 (2.4)	
NYHA Classification*			
Class 0	36 (70.6)	28 (68.3)	
Class I	11 (21.6)	10 (24.4)	0.95
Class II	4 (7.8)	3 (7.3)	
Class III	0	0	

ACC: Aortic cross-clamping time, CPB: Cardiopulmonary bypass time, ICU: Intensive care unit, *in the last postoperative examination.

TABLE 4: Intraoperative and postoperative data of the patients with mitral insufficiency.

	Resuspension (-)	Resuspension (+)	
Characteristics	**Mean±SD**	**Mean±SD**	**p value**
ACC (min.)	55.25±30.34	59.15±20.19	0.69
CPB (min.)	90.44±17.49	78.64±12.42	0.001
ICU stay (day)	3.07±1.34	2.56±1.41	0.12
Hospital stay (day)	10.59±5.8	7.64±5.5	0.036
	n (%)	**n (%)**	
Ventilation>24 hours	3 (11.1)	2(4.4)	0.28
Inotropic support periods			
12 hours	9 (33.3)	9 (20)	
12-48 hours	4 (14.8)	2 (4.4)	0.033
>48 hours	3 (11.1)	1 (2.2)	
NYHA Classification*			
Class 0	11 (42.3)	25 (55.6)	
Class I	10 (38.5)	16 (35.6)	0.40
Class II	4 (15.4)	4 (8.9)	
Class III	1 (3.8)	0	

ACC: Aortic cross-clamping time, CPB: Cardiopulmonary bypass time, ICU: Intensive care unit, *in the last postoperative examination.

There was no significant difference in terms of intra-operative and early postoperative periods findings between the patients that did not have significant mitral insufficiency. On the other hand, aortic cross-clamping times were similar but cardiopulmonary bypass times were significantly longer in the patients without resuspension from those with resuspension in patients that have significant mitral insufficiency. Inotropic support times and hospital stay times were significantly higher in the group of no papillary muscle resuspension (Tables 3, 4).

The patients that did not have significant mitral insufficiency were followed-up for 4 to 34 months (mean 22.61±8.43) and the patients that had significant mitral insufficiency were followed-up for 5 to 38 months (mean 23.17±9.55). No mortality, thrombotic or hemorrhagic complications occurred during this period. One patient developed mild-to-moderate paravalvular leakage in Group Insufficiency-/Resuspension+ and 1 in Group Insufficiency+/Resuspension+ patients, both of which did not require reoperation.

When the preoperative and the last postoperative transthoracic echocardiography measures compared, left atrial diameter (LAD), left ventricular end-diastolic diameter (LVEDD), left ventricular end-systolic diameter (LVESD), systolic pulmonary artery pressure (PAPs) values improved very significantly and left ventricular ejection frac-

tion (EF) improved significantly in all patients that did not have significant preoperative mitral insufficiency (papillar resuspension + or -) (Table 5).

In the patients that had significant mitral insufficiency, all echocardiography measures improved very significantly in the group with resuspension. While LAD and PAPs values improved significantly, improvements in LVEDD and LVESD values were not statistically significant, and EF values were significantly decreased in the group without resuspension (Table 6).

DISCUSSION

In his article, "Papillary muscle-annular continuity: Is it important?", he made an important contribution to the establishment of the chordal preservation approach in mitral valve surgery, David pointed out the presence of strong evidence and suggested that the preservation of annulopapillary muscle continuity in mitral valve surgery has favorable effects on left ventricular functions and clinical outcomes. Also stated that the mitral valve repair should be preferred over replacement in patients that undergo mitral valve surgery.[25] He recommended the preservation of chorda tendinea if replacement is necessary, or the resuspension of the papillary muscle with ePTFE sutures if preservation is not feasible due to calcification, fibrosis or other reasons.

Many studies have shown the advantages of preserving mitral annulopapillary muscle continuity in dilated hearts due to chronic mitral insufficiency, and a general consensus has been reached in this regard.[5-13] These advantages are not limited to patients with mitral valve insufficiency; Borger et al. evaluated 513 reoperative MVRs in a mixed group of patients with various etiologies ,the mortality rate was 3.6% in patients for whom the subvalvular structures were preserved and 13.3% in patients for whom the subvalvular structures were not preserved ($p<0.001$).[26] Wu et al. showed the superiority of the replacement with preservation of subvalvular structures in rheumatic mitral insufficiency compared with conventional replacement, in terms of mortality, the need for postoperative intensive care unit admission, left ventricular function, and cardiac sizes.[27]

Stenosis is widely present in rheumatic mitral valve disorders, and virtually, the advantage of preserving subvalvular structures is not clear and there have been controversial results in this regard. Chowdhury et al. evaluated 451 patients with rheumatic mitral valve disorder and reported significant improvements in left ventricular functions during the early and late postoperative period in patients whose chordal preservation (total or only posterior) was performed, when compared with patients in whom subvalvular structures were completely excised.[19]

In a similar study by Garcia-Fuster et al. that evaluated 566 patients with rheumatic mitral valve disorder they showed favorable outcomes of chordal preservation on clinical and echocardiographic parameters during both the early and late postoperative period.[23] When postoperative first year outcomes were compared with the preoperative data, EF significantly decreased if chordal preservation were not performed, but showed a significant increase with chordal preservation. Left ventricular size also increased in the non-preservation group and significantly decreased in the preservation group. The improvements were more remarkable in patients with mitral insufficiency and mixed lesions when compared with those having pure mitral stenosis.

Using a similar technique, Alhan et al. compared 15 patients that underwent MVR with total chordal preservation due to pure mitral stenosis with 15 patients that underwent conventional MVR, and they reported that the EF remained unchanged in the chordal preservation group at the postoperative for six months and showed a significant decrease in non-preservation group.[20] The difference in EF persisted when the outcomes were evaluated at eight years.[21]

In Coutinho et al's study, they did not find a long term difference between the patients that performed replacement with posterior leaflet protection and those that performed conventional replacement. It may be considered as shortcomings of this study that the absence of a group protected both leaflets and the patients with mitral insuffi-

ciency did not discuss separately in terms of protection of subvalvular. We agree with them that the protection of subvalvular apparatus has no effect on left ventricular function in patients without mitral insufficiency. However, in patients with mitral insufficiency we and many other researchers have identified the differences between MVR with chordal preservation and conventional MVR. Coutinho et al. have already identified pure mitral regurgitation as one of the independent risk factors for late mortality.[28]

Okita et al. compared three patient groups that underwent either MVR with chordal preservation, conventional MVR or OMC due to pure mitral stenosis.[24] There were no differences between the groups in terms of mitral valve area, cardiac index, LV end-diastolic and end-systolic volume index and contractility index in the early postoperative period; However, LV EF showed a significant increase in the chordal preservation and OMC groups and a slight decrease in the conventional MVR group. In the intermediate postoperative period, echocardiographic data showed increased EF, and radionuclide angiography showed increased global EF compared with preoperative data, and the difference between the groups disappeared, and only regional shortening in anterolateral portion of the LV was higher in the chordal preservation and OMC groups. Also EF values, measured by radionuclide angiography during exercise, did not differ between the groups. In a previous study, although Okita et al. clearly showed the effects of chordal preservation in patients with mitral insufficiency, however, in their recent study, they could not show the advantages of chordal preservation on global left ventricular performance in patients with mitral stenosis.[12]

In patients without severe mitral insufficiency, the present study found that changes in EF and LV and left atrial size are equal in both conventional and papillary resuspension groups and the papillary resuspension was not superior in terms of postoperative findings, such as the use of inotropic agents in the early postoperative period, the development of low cardiac output, the length of stay in the intensive care unit and time to discharge. We had a prejudice before present study that the conventional MVR adversely affects left ventricular functions in all patients but we noticed that the negative impression of conventional MVR is overrated in patients without significant mitral insufficiency.

But if mitral insufficiency is prominent, conventional MVR decreases EF and reduction in LV size is less. The papillary resuspension was superior also in terms of postoperative findings. The patient with papillary resuspension had shorter cardiopulmonary bypass time. These patients had lower ratio of receiving inotropic agents and were discharged from the hospital earlier (Table 4).

Resuspension of the papillary muscle using ePTFE sutures appears to be an option where native chordal preservation is not feasible during mitral valve replacement. Although the use of artificial chordae in mitral valve repair dates back to a previous period, David was the first to report the creation of artificial chordae during replacement in a publication from 1990.[14,29] Various techniques have been described to create artificial chordae during MVR. In one of these initial reports, Bernhard et al. placed ePTFE suture between the edge of the papillary muscle and suture hook of the mechanical valve.[15] Soga et al. described an oblique artificial chorda technique using 2 ePTFE mattress sutures.[16] We also used this technique to create artificial chordae. Soga et al. used this technique in nineteen patients with mitral stenosis. The mean EF was 64±2% in the preoperative period, 61±2% in the early postoperative period, and then increased to 68±2% in the late postoperative period (at 14 months) ($p<0.01$), whereas LVEDD remained unchanged. In the postoperative period (mean 12.61± 6.43 months), there was a significant increase in the EF, a very significant decrease in LVEDD and significant decrease in LVESD.

As mentioned above, in the study by Borger et al. that evaluated 513 reoperative MVRs, it was shown that operative mortality significantly reduced in patients with subvalvular apparatus preservation (103 posterior preservation, 31 poste-

TABLE 5: Comparisons of the echocardiographic measurements between the preoperative with postoperative mid-term period in patients without mitral insufficiency.

	Resuspension (+)	Resuspension (-)
Preop LA (cm)	5.15±0.88	5.23 ± 1.03
Postop LA (cm)	4.58±0.79	4.69 ±0.98
p value#	<0.001	<0.001
Preop LVEDD (cm)	5.34±0.68	5.10 ±0.64
Postop LVEDD (cm)	4.89±0.66	4.75±0.61
p value#	<0.001	<0.001
Pre LVESD (cm)	3.69±0.64	3.48 ±0.63
Postop LVESD (cm)	3.22±0.61	3.04±0.65
p value#	<0.001	<0.001
Preop EF (%)	58.18±9.33	57.39± 9.28
Postop EF (%)	60.66±7.20	60.15 ± 8.69
p value #	0.028	0.019
Preop PAP (mmHg.)	53.33±16.93	51.79 ±14.14
Postop PAP (mmHg)	30.48±10.20	36.17± 11.70
p value#	<0.001	<0.001

#paired t-test.

LA: Left atrium; LVEDD: Left ventricular end-diastolic diameter; LVESD: Left ventricular end-systolic diameter, EF: Ejection fraction; PAP: Pulmonary artery pressure.

TABLE 6: Comparisons of the echocardiographic measurements between the preoperative with postoperative mid-term period in patient with mitral insufficiency.

	Resuspension (+)	Resuspension (-)
Preop LA (cm)	5.39±0.8	5.34±0.8
Postop LA (cm)	4.9±0.7	5.03±0.8
p value#	<0.001	0.001
Preop LVEDD (cm)	5.60±0.8	5.36±0.6
Postop LVEDD (cm)	5±0.6	5.23±0.7
p value#	<0.001	0.09
Pre LVESD (cm)	4.34±0.5	4.24±0.7
Postop LVESD (cm)	4.12±0.5	4.14±0.7
p value#	<0.001	0.06
Preop EF (%)	56.23±9.1	58.37±9.9
Postop EF (%)	59±6.5	57.07±9.1
p value #	0.004	0.014
Preop PAP (mmHg.)	51±18	48±10.8
Postop PAP (mmHg)	32.3±9.3	34.22±9.2
p value#	<0.001	<0.001

#paired t-test.

LA: Left atrium; LVEDD: Left ventricular end-diastolic diameter; LVESD: Left ventricular end-systolic diameter, EF: Ejection fraction; PAP: Pulmonary artery pressure.

rior + anterior preservation, and 135 Gore-Tex neochordal construction).[26] In this study, all patients that underwent chordal preservation were evaluated together without performing a separate evaluation for patients with artificial chorda construction. However, artificial chorda technique is the most commonly used technique.

Many studies revealed that MVR with the use of artificial chordae preserved the existing condition of the left ventricle or provided improvements, as the MVR with native chordal preservation. We also noted similar improvements in our patients where artificial chordae had been used.

Spencer et al. and Deniz et al. reported that midventricular rupture was less common when the chordae of posterior leaflets were preserved during MVR.[30,31] Okita et al. suggested that the preservation of autologous chordae or reconstruction with ePTFE chordae might provide a supportive structure against tension on the posterior ventricular wall, thereby preventing rupture.[24] Carpentier and Cabrol, in response to the study by Okita et al., reported that chordal preservation not only preserved left ventricular functions but also appeared to be the ideal way of preventing a rupture of the left ventricular wall. We did not encounter left ventricular rupture in any patient.

The main concerns while performing MVR with the preservation of subvalvular structures include interference of prosthetic valve movements by the remaining subvalvular structures, obstruction in the left ventricular outlet, the need for implanting a valve of a smaller size, and continuing inflammatory process and subvalvular overgrowth in rheumatic disease which my cause valve dysfunction in the long term period. We have not seen interaction between the artifical chordae and mechanical valve in all cases and data was not available about such a complication in resources we searched. Resuspension of the papillary muscle using artificial chordae seems to overcome these concerns and maintains annulopapillary muscle continuity.

CONCLUSION

In case there is significant rheumatic mitral insufficiency, MVR with papiller muscle resupension

results with a better improvement of left ventricular functions and sizes when compared with conventional MVR. Therefore, the resuspension of the papillary muscle can be considered as an appropriate alternative to the other valve sparing techniques. However both techniques are equally useful in patients not having significant mitral insufficiency.

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