

## Our Results of Rheumatic Mitral Valve Replacement With Preservation of Subvalvular Apparatus

*Subvalvular Aperey Korunması ile Birlikte Olan Romatizmal Mitral Kapak Replasman Sonuçları*

Nazmiye Selçuk KAPISIZ, Hasan Fahri KAPISIZ, Orhan Veli DOĞAN, Hasan ERDEM, Melahat TOKER, Ertan YÜCEL

*Department of Cardiovascular Surgery, Ankara Yıldırım Beyazıt Training and Research Hospital, Ankara*

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**Objectives:** We evaluated the results of rheumatic mitral valve replacement with preservation of subvalvular apparatus.

**Patients and Methods:** Mitral valve replacement, isolated or in combination with other procedures, was performed in 36 patients (31 females, 5 males; mean age  $37.7 \pm 14$  years; range 14 to 66 years) between January 1996 and 2000. Mitral insufficiency alone or in combination with mitral stenosis was present in 44.4% and 50%, respectively. Concomitant procedures were performed in 44% for associated cardiac lesions. Subvalvular apparatus was preserved in all patients by different techniques. Posterior leaflet was retained in 27 patients, anterior leaflet was retained in one patient, both anterior and posterior leaflets were retained in eight patients. The follow-up period ranged between 13 to 16 months.

**Results:** NYHA classification score was  $2.61 \pm 0.54$  preoperatively and  $1.63 \pm 0.76$  postoperatively ( $p < 0.05$ ). Left ventricular end diastolic diameter and left atrial diameter decreased at the end of the postoperative first year. Mortality, valvular thrombosis, or left ventricular outflow obstruction were not observed during the follow-up period.

**Conclusion:** Some reconstructive techniques can be performed in patients with severe rheumatic mitral stenosis and regurgitation. However, a second operation, usually mitral valve replacement, is required after some period in most of these patients. This condition brings an additional economical burden and an operational risk to the patient, as well. Therefore, whenever repair techniques are not sufficient due to advanced disease, we recommend mitral valve replacement with preservation of subvalvular apparatus.

**Key Words:** Mitral repair; subvalvular apparatus preservation; valve replacement.

**Amaç:** Bu çalışmada subvalvuler apparatus korunarak yapılan romatizmal mitral kapak replasman sonuçları incelendi.

**Hastalar ve Yöntemler:** Ocak 1996 ile Ocak 2000 arasında, 36 hastaya (31 kadın, 5 erkek; ort. yaşı  $37.7 \pm 14$ ; dağılım 14-66) izole veya diğer işlemlerle birlikte mitral kapak replasmanı uygulandı. Hastaların %44.4'ünde mitral yetmezlik tek başına, %50'sinde mitral stenoz ile birlikte bulunuyordu. Eşlik eden kardiyak lezyon nedeniyle hastaların %44'üne aynı zamanda ek cerrahi işlemler yapıldı. Subvalvular yapı farklı tekniklerle tüm hastalarda korundu. Yirmi yedi hastada posterior, bir hastada anterior, sekiz hastada da anterior ve posterior yaprakçıklar korundu. Takip süresi 13-16 ay arasında değişmekteydi.

**Bulgular:** Hastaların NYHA sınıflaması skoru ameliyat önce % $2.61 \pm 0.54$ , ameliyat sonrasında % $1.63 \pm 0.76$  bulundu ( $p < 0.05$ ). Sol ventrikül diyastol sonu çapı ve sol atriyal çap ameliyat sonrası birinci yılda azaldı. Takip süresince mortalite, kapak trombozu veya sol ventriküler çıkış yolu obstrüksiyonu görülmmedi.

**Sonuç:** Ciddi romatizmal mitral stenoz ve yetmezliği olan hastalarda bazı tamir işlemleri uygulanabilmektedir. Ancak, belli bir süre sonra bu hastaların çoğu ikinci bir ameliyat olarak mitral kapak replasmanı zorunlu olmaktadır. Bu durum, sebebi olduğu ekonomik yükün yanında, hastayı tekrar ameliyat riskiyle karşı karşıya bırakmaktadır. Bu nedenle, ilerlemiş hastalıkta tamir teknikleri yetersiz kaldığı takdirde, subvalvüler yapının korunduğu mitral kapak replasmanını öneriyoruz.

**Anahtar Sözcükler:** Mitral tamir; subvalvular aperey korunması; kapak replasmani.

Although debate over the value of preserving the mitral valve chordae and papillary muscles during mitral valve replacement has continued for 30 years,<sup>[1,2]</sup> the literature has advocated the beneficial effects of chordal preservation on left ventricular function.<sup>[3,4]</sup>

Mitral valve replacement with various surgical techniques of preservation of mitral valve apparatus were reported. In clinical studies, although the technique was different, the preservation of mitral valve apparatus similarly resulted in better preservation of left ventricular function.<sup>[5,6]</sup>

In this study, the extubation time, intensive care unit and hospital stay duration were examined in patients who had undergone mitral valve replacement with different subvalvular apparatus preservation techniques. New York Heart Association (NYHA) classifications, arrhythmia and left ventricular functions in the preoperative period were compared with the postoperative first year.

## PATIENTS AND METHODS

Mitral valve replacement with preservation of subvalvular apparatus by different techniques (isolated or with other surgical procedures), was performed in 36 patients between January 1996 and January 2000. There were (31 females, 5 males; mean age  $37.7 \pm 14$  years; range 14 to 66 years). Patient demographics, intraoperative and perioperative data, were reviewed retrospectively from the patient files and the repair charts. A preoperative diagnosis was made with transthoracic echocardiography in all cases, with confirmatory transesophageal echocardiography being used additionally in suspected cases with mixed or insufficient valve lesions or left atrial thrombus. Cardiac catheterization and coronary angiography were also used to evaluate the associated lesions. Patients were called by telephone for examination approximately by the end of the first year (13-16 months). In the follow up period, patients' complaints were questioned, and physical examination was performed. Complete blood count, blood biochemistry, urine analysis, electrocardiography, anteroposterior chest X-Ray, and transthoracic

echocardiography of each patient were also performed in each patient. Patient characteristics are given in Table 1.

Extubation time, need of inotropic support, intensive care unit and hospital stay times were recorded in all patients and preoperative and postoperative (13-16 months) NYHA classifications, arrhythmia and echocardiographic measurements of the left atrium, ejection fractions (EF), left ventricular end diastolic (LVEDD) and endsystolic (LVESD) diameters were compared. In addition to prosthetic valve function examination, transaortic gradient was measured to understand if left ventricular outflow obstruction developed in the follow up period.

### Statistical analysis

Preoperative and postoperative parametric variables were compared statistically by paired t test. P values less than 0.05 were accepted as statistically significant.

## RESULTS

Dominant pathologies were isolated mitral regurgitation and mitral regurgitation together with mitral stenosis. No mortality was observed in the early period and at the end of the follow up period. In four patients (11.1%) inotropic support was needed. The extubation time was prolonged to 48 hours in only one patient because of arrhythmia (frequent ventricular extrasystoles leading to ventricular tachycardia). All other patients were extubated in less than 10 hours (mean extubation time:  $6.41 \pm 2$ ). Mean intensive care unit stay was  $2.13 \pm 0.35$  days, mean hospital stay was  $8.69 \pm 2.12$  days. In early postoperative period, arrhythmia (atrial fibrillation) occurred in three patients who were in sinus rhythm preoperatively. Arrhythmia did not persist in the postoperative first year period in these patients. Postoperative valvular thrombosis or left ventricular outflow obstruction as a consequence of the preservation of subvalvular apparatus was not observed. We did not note hemolysis in any of the patients. Comparison of preoperative and postoperative periods in terms of NYHA classifications, LA size, LVEDD, LVESD, EF are given in Table 2. New York Heart

**Table 1. Patient characteristics**

Parameter	Range	Ort±SD	n	%
Sex				
Female			31	
Male			5	
Mean ( $\pm$ SD) age (years)		37.7 $\pm$ 14.0		
Isolated mitral disease			24	66.6
Mitral diagnosis				
Mitral stenosis			2	5.5
Mitral stenosis+mitral insufficiency			18	50
Mitral insufficiency			16	44.4
Associated cardiac lesions				
Aortic disease (stenosis, insufficiency, both)			9	25
Tricuspid disease (stenosis, insufficiency, both)			6	16.6
Aortic disease+Tricuspid disease			1	2.7
Total associated lesions			16	44.4
Type of leaflet preservation				
Anterior leaflet			1	2.7
Posterior leaflet			27	75
Anterior and posterior			8	22.2
Total			36	100
Results				
Perioperative mortality			0	0
Follow up range (months)		13-16		
Valve thrombosis			0	0
Left ventricular outflow obstruction			0	0

Association classification, LA size, LVEDD changes were found statistically significant between preoperative and postoperative periods.

## DISCUSSION

The physiologic importance of the mitral subvalvular apparatus has been known since the

early days of mitral valve replacement.<sup>[1]</sup> For many years, however, the standard technique for mitral valve replacement included excision of both leaflets and their attached chordae tendineae. Over the past several years, increased emphasis has been placed on retention of the mitral subvalvular apparatus during valve replacement. This has been motivated by

**Table 2. Comparison of preoperative and postoperative periods**

	Preoperative	Postoperative	p
NYHA classification	2.61 $\pm$ 0.54	1.63 $\pm$ 0.76	<0.05
LA size	5.0 $\pm$ 0.1 cm	4.6 $\pm$ 0.1 cm	<0.05
LVEDD	5.9 $\pm$ 0.1	5.19 $\pm$ 0.05 cm	<0.05
LVESD	3.8 $\pm$ 0.1	3.7 $\pm$ 0.05	>0.05
EF	60.1 $\pm$ 1.1%	61.1 $\pm$ 0.3%	>0.05

NYHA: New York Heart Association; LA: Left atrium; LVEDD: Left ventricular end diastolic diameters; LVESD: Left ventricular end systolic diameters; EF: Ejection fractions.

the proof of the dependence of left ventricular performance on the presence of the mitral valve and subvalvular apparatus, and of the improvement in left ventricular function associated with mitral valvuloplasty as opposed to that associated with standard mitral valve replacement.<sup>[7-9]</sup> Following the positive results obtained from the experimental studies, the first clinical study was described by Miki et al.<sup>[10]</sup> in 1988. According to these authors, subvalvular apparatus should be preserved totally when mitral repair was technically impossible, and thus left ventricular functions could be improved as much as mitral valve repair operations. They also noted negative effects of the standard technique on left ventricular functions in postoperative period.<sup>[10]</sup>

When replacement was compared with repair, the latter was superior in many respects. Long-term survival, valve related mortality and morbidity were all worse after replacement with a mechanical or bioprosthetic valve.<sup>[11-13]</sup> Mavioglu et al.<sup>[14]</sup> reviewed the medium- and long-term results in an attempt to define the suitability of mitral valve repair for rheumatic patients, and in so doing identified five-and eight-year survival rates of 94% and 85%, respectively. Therefore our method of choice for all rheumatic mitral disease patients is valvular repair whenever the valve pathology is appropriate, irrespective of other concomitant valvular pathologies. But the major problem associated with valve repair, especially for rheumatic patients, is that of reoperation.

Our institution is the main referral center serving a community with a very low socioeconomic status, and the majority of mitral valve diseases in our patients are rheumatic in origin. Since these patients are generally referred late, with mitral valve disease too complex to be treated, mitral valve repair could not be possible. That is why we preferred mitral valve replacement with subvalvular apparatus retention in these patients with complex mitral valve disease.

Although in principle, mitral valve replacement for regurgitation or stenosis with conservation of the mitral leaflets and subvalvular

apparatus preserves geometry of the left ventricle,<sup>[3,7]</sup> caution is warranted because, if use of this technique includes preservation of both leaflets, it may lead to severe left ventricular outflow tract obstruction (LVOTO) and even mitral inflow obstruction requiring reintervention. Waggoner et al.<sup>[15]</sup> reported that five of seven patients in whom mitral valve replacement was carried out with preservation of both leaflets, developed LVOTO. In our study we retained both leaflets in eight patients, anterior leaflet in one patient and posterior leaflet in 27 patients. We did not observe LVOTO on transthoracic echocardiography in any patient. In our opinion, since partial preservation is better in terms of development of LVOT compared to total preservation and the number of patients with preservation of both leaflets is small in our series, we did not see any patient with LVOT obstruction. The mitral prosthetic valve dysfunction and valve thrombosis are other complications of leaflet and subvalvular apparatus retainment.

In our study we did not observe any mortality in the first year of the follow up period. Left ventricular outflow tract obstruction, prosthetic valve dysfunction or prosthetic valve thrombosis were not observed in any of our patients. New York Heart Association classification, left atrial size, LVEDD decreased after one year period in these patients. Although the change is statistically insignificant, LVESD decreased and EF increased during the follow up. We obtained good left ventricular functions. This is in accordance with the results published in the literature.<sup>[16]</sup>

To conclude, we primarily recommend repair techniques whenever possible. But in case of patients like those in the present study, with advanced disease, although some reconstructive techniques could be performed, after a period of time mitral valve replacement would be required in most patients. This would lead to increased economic burden besides the risks of reoperation on the patient. In previous reports, the hemodynamic results of mitral valve replacement (MVR) with preservation of sub-

valvular apparatus were found to be superior to the standard technique. So, in cases with severe rheumatic involvement, like those in this study, where repair techniques are not possible, we recommend MVR with preservation of subvalvular apparatus over standard mitral valve replacement.

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