Posterior leaflet preservation during mitral valve replacement for rheumatic mitral stenosis

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INTRODUCTION

The principle of posterior mitral leaflet preservation in mitral valve replacement was introduced by Walton Lillehei¹ in the middle sixties. Although the basic aim of such replacement was prevention of rupture of the left ventricular free wall, it indicated a considerable reduction in operative mortality (from 37% to 14%). By the beginning of the eighties this, for a time "forgotten" method, started to be used again by some authors²⁻⁵. Numerous experimental studies⁴⁻⁹ pointed at the valvuloven-tricular mutual dependence, stating that it was significant, both for normal valvular function and better left ventricular performance. The clinical confirmation of annulo-papillary continuity preservation has been proven in a case of mitral valve replacement attributed to chronic mitral regurgitation. In comparison to the standard method, mitral valve replacement with posterior leaflet preservation showed better postoperative left ventricular performance and better late survival of patients⁶⁻¹⁰⁻¹⁶. Regarding mitral stenosis, opinions are not uniform¹¹⁻¹⁹⁻⁻²⁵. Late postoperative morphological and functional changes of the left ventricle develop due to hemodynamic conditions and the presence of subvalvar structures that are liable to changes. We have investigated the effect of posterior leaflet preservation on the hemodynamic valvular characteristics and left ventricular performance during late follow-up.

MATERIAL AND METHODS

The study included 20 patients who underwent surgery for rheumatic mitral stenosis from January 1988 to December 1989. The patients had either isolated mitral stenosis or dominant stenosis with mild mitral regurgitation (up to 2+). None of patients had either damaged aortic valve, significant coronary artery disease or previous heart surgery. The identical type of prosthetic valve (Carbomedics) was inserted in all patients. In 10 patients (group A) we applied the standard mitral valve replacement (cMVR)
with excision of both mitral leaflets, while in other 10 patients (group B) a modified mitral valve replacement (mMVR) with posterior leaflet preservation was done. The choice of the method depended on the surgeon’s decision. Anesthesia, cardiopulmonary bypass and myocardial protection used were identical in all patients. The valve was secured with interrupted mattress sutures supported with Teflon felt pledgets. Tricuspid annuloplasty (De Vega) was performed in two patients from group A and in three patients from group B. Preoperative features of patients are presented on Table 1.

It may be noted that there were no marked differences regarding the patients’ age, sex, staging according to NYHA classification, cardiac rhythm and left atrial size.

In January 1999, control examinations were done. Over the past 10 years none of patients developed either myocardial infarction, angina pectoris, thromboembolic complications or signs of valvular dysfunction. All of them were compliant on peroral anticoagulant therapy with INR findings ranging from 2.5 to 3.5. Beside assessment of clinical status, transthoracic echocardiography, hemodynamic characteristics of the inserted valve and left ventricular performance were also evaluated. Assessment was done using Ultramark 9, ATL, 1987. (Figure 1 and 2).

The following parameters were calculated: maximal (PG) and mean (MG) gradients, effective area of mitral valve opening, presence of spontaneous contrast, telediastolic (TDV) and telesystolic (TSV) left ventricular volume, stroke volume (SV), ejection fraction (EP) and left ventricular fractional shortening (FS), as well as segmental left ventricular motion.

**STATISTICS**

All parameters are expressed as mean SD. Differences between preoperative and postoperative values within a group were determined by a Student’s test. A value of p<0.05 was considered significant.

**RESULTS**

Postoperatively, 10 years after, all patients were in the I or II stage according to the NYHA classification. The 3 patients from group A and the 2 patients from group B had sinus rhythm, while the others had atrial fibrillation. The patients from both groups showed decreased size of the left atrium (5.21±0.96 versus 5.13±1.79), but the difference was not statistically significant.

The average size of the inserted valve was 26.6 mm in group A and 27.25 mm in group B (Table 2). Maximal and mean transvalvular gradients were higher in group B than in group A (10.12±2.87 versus 11.1±3.07 and 3.57±1.40 versus 3.87±1.62), while effective area of artificial valve opening was larger in group A (2.35±0.45 versus 2.30±0.3). The difference was not statistically significant. Spontaneous contrast was present in two patients from group A, as well as in two patients from group B.

Table 3 presents the values of left ventricular performance.

![Table 1: PREOPERATIVE CLINICAL DATA](image)

<table>
<thead>
<tr>
<th></th>
<th>A(n=10)</th>
<th>B(n=10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age (years)</td>
<td>47.8</td>
<td>50.2</td>
</tr>
<tr>
<td>Sex (m/F)</td>
<td>2/8</td>
<td>3/7</td>
</tr>
<tr>
<td>NYHA FC (III or IV)</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Rhythm (Sinus/AF)</td>
<td>2/8</td>
<td>0/10</td>
</tr>
<tr>
<td>LAD+/- SD (mm)</td>
<td>54.28±1.11</td>
<td>57.60±1.56</td>
</tr>
</tbody>
</table>

M/F - male/female; NYHA FC- New York Heart Association Functional Class; AF- Atrial fibrillation; LAD- Left Atrial Diameter

![Figure 1](image) ECHOCARDIOGRAM (M AND 2D MODE) OF THE PATIENT WITH MITRAL VALVE REPLACEMENT AND POSTERIOR CUSP PRESERVATION (arrow pointed to the preserved posterio cusp)

![Figure 2](image) ECHOCARDIOGRAM (M AND 2D MODE) OF THE PATIENT WITH MITRAL VALVE REPLACEMENT WITHOUT CUSP PRESERVATION
It may be noted that TDV, TSV and SV values were increased in group A. Although the differences for TDV and SV were considerable, they were not of statistical significance. EF and FS values were increased in group B, but did not reach statistical significance. It is important to mention that the values obtained for group A and group B were within normal limits. Diaphragmal segmental hypokinesis was evident in one patient from group A and in two patients from group B.

**DISCUSSION**

The advantage of preservation of one or both mitral leaflets in mitral valve replacement has been confirmed by many experimental and clinical studies on chronic mitral regurgitation. The advantage lies in better postoperative left ventricular performance 2-13,20-22. David 23 and Lee 24 demonstrated increased long-term survival after posterior leaflet preservation. Some authors claimed that favorable effects might be achieved in mitral stenosis 2,19,25. However, most disputed this 17,18,26,27. Possible long-term advantages of the method applied in mitral stenosis have not been studied. Considering that long-term results are influenced by numerous factors (patient’s age, pathological substrate, clinical condition, left ventricular performance, associated diseases, size and type of inserted valve etc.), our aim was to form as coherent a group as possible, so that possible differences could be attributed to mitral leaflet preservation.

Considerable improvement of clinical features was evidenced in all patients. Maximal and mean transvalvular gradient and effective area of artificial valve opening values were in concordance with findings of other authors 28-31. Fontaine 32 demonstrated that in vitro presence of subvalvular structures effected hemodynamic characteristics of the inserted valves. The fact that the obtained values of PG and MG were decreased in group A, despite the smaller average size of the valve, could not be considered as clinical confirmation of the above, because the differences were only slight. Besides, the patients from group A had endocardial thickening and partial papillary muscular fibrosis. The presence of spontaneous contrast as an indicator of increased thromboembolic risk 33,34, were disclosed only in a small number of patients and were the result of preoperatively changed subvalvular structures.

The obtained TDV, TSV and SV values in group A and B were within normal limits and without statistical significance. The increased TDV values in group A may be considered expression of better adaptability of the left ventricle to the increased preload caused by the interrupted annulo-papillary continuity. The obtained differences in values of EF and SF were not statistically significant and good left ventricular performance was present in both groups. Diaphragmal segmental hypokinesis was rare and

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**TABELA 2**

**HAEMODYNAMIC DATA OF IMPLANTED VALVE**

<table>
<thead>
<tr>
<th></th>
<th>A(n=10)</th>
<th>B(n=10)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valve size(mm)</td>
<td>26.6</td>
<td>27.25</td>
<td>NS</td>
</tr>
<tr>
<td>PG+/–SD(mmHg)</td>
<td>10.12±2.28</td>
<td>11.1±3.07</td>
<td>NS</td>
</tr>
<tr>
<td>MG+/–SD(mmHg)</td>
<td>3.57±1.4</td>
<td>3.87±1.62</td>
<td>NS</td>
</tr>
<tr>
<td>Valve area+/–SD(cm²)</td>
<td>2.35±0.45</td>
<td>2.30±0.3</td>
<td>NS</td>
</tr>
<tr>
<td>Spontaneous ECHO contrast*</td>
<td>2</td>
<td>2</td>
<td>-</td>
</tr>
</tbody>
</table>

*Indicates the possible prethrombotic state. PG-maximal transvalvular pressure gradient; MG-mean transvalvular pressure gradient

**TABLE 3**

**ECHO PARAMETERS OF LEFT VENTRICULA (LV) FUNCTION**

<table>
<thead>
<tr>
<th></th>
<th>A(n=10)</th>
<th>B(n=10)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>LV-TDV+/–SD(ml)</td>
<td>126.0±23.15</td>
<td>114.5±29.96</td>
<td>NS</td>
</tr>
<tr>
<td>LV-RSV+/–SD(ml)</td>
<td>42.4±16.3</td>
<td>36.62±21.20</td>
<td>NS</td>
</tr>
<tr>
<td>LV-SV+/–SD(ml)</td>
<td>83.7±21.2</td>
<td>77.75±16.74</td>
<td>NS</td>
</tr>
<tr>
<td>LV-FS+/–SD(%)</td>
<td>63.66±7.99</td>
<td>67.12±12.36</td>
<td>NS</td>
</tr>
<tr>
<td>LV-FS+/–SD(%)</td>
<td>32.66±4.78</td>
<td>38.25±8.80</td>
<td>NS</td>
</tr>
<tr>
<td>Hypokinetic DS</td>
<td>1</td>
<td>2</td>
<td>-</td>
</tr>
</tbody>
</table>

TDV-telediastolic volume; TSV-telesystolic volume; SV-stroke volume; EF-ejection fraction; FS-fractional shortening; DS-diaphragmal segment

It may be noted that TDV, TSV and SV values were increased in group A. Although the differences for TDV and SV were considerable, they were not of statistical significance. EF and FS values were increased in group B, but did not reach statistical significance. It is important to mention that the values obtained for group A and group B were within normal limits. Diaphragmal segmental hypokinesis was evident in one patient from group A and in two patients from group B.
could have been sooner attributed to preoperative sub-
valvular structure fibrosis than failure in posterior leaflet
preservation.

CONCLUSION

Data from the present study demonstrate that in patients
with rheumatic stenosis posterior leaflet preservation did
not have increased beneficial effect on left ventricular per-
formance during long-term follow-up. An adequate poste-
rior leaflet preservation does not change hemodynamic
valvular characteristics even after long-term follow-up.

REZIME

Zamena mitralne valvule sa prezervacijom zadnjeg
listića pokazala se korisnom za postoperativne performan-
se leve komore (LK) kod bolesnika sa mitralnom regurgi-
tacijom. Neki autorii su utvrdili da je korisna i dugoročno
za funkcijskom leve komore. Ispitivali smo dugoročni efekat
ove tehnike kod bolesnika s reumatskim mitralnom ste-
nozom.

U radu je ispitivano 20 bolesnika sa zamenom mitralne
valvule zbog reumatske mitralne stenoze u periodu od ja-
nuara 1988. do decembra 1989-godine. U grupi A (10 bo-
lesnika) urađena je ekscizija oba listića i hordi, dok je u
grupi B (10 bolesnika) zadnji listić sačuvan. Svim boles-
nicima je ugradjena Carbomedics valvula. Uporedjivali smo klinički i postoperativni status, hemodinamske i ka-
rakteristike LK kod obe grupe. Kontrolni ehokardiografs-
ski pregled je uključivao: maksimalni (PG) i srednji (MG)
gradijent; efektivnu površinu valvule (AREA); volumen
leve komore na kraju dijastole (EDV) i sistole (ESV); udarni
volumen (SV); ejekcionu frakciju (EF); frakciono
skraćenje (FS) i segementnu pokretljivost LK.

Srednja veličina ugradjene valvule je bila 26.6 u grupi A
i 27.2 u grupi B.

Hemodinamske karakteristike: PG (10.12 vs 11.1); MG
(3.57 vs 3.87); AREA (2.35 vs 2.30); TSV (126.0 vs
114.5); TSV (42.2 vs 36.62); SV (83.7 vs 77.75); EF
(3.57 vs 3.87); AREA (2.35 vs 2.30); TDV (126.0 vs
27.2 u grupi B.

Kod bolesnika sa reumatskim mitralnom stenozom ko-
konzervacija zadnjeg listića nije imala povoljne efekte na
performanse LK. Konzervacija zadnjeg listića nije menjala
hemodinamske karakteristike valvule u dugoročnom
praćenju.

Ključne reči: mitralna valvula, reumatska mitralna
stenozica, zamena valvule, konzervacija
zadnjeg listića, dugoročno praćenje

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