

Mitral Valve Repair for Mitral Regurgitation

Rocío García-Orta,^a Eduardo Moreno-Escobar,^b María F. Ruiz-López,^a Matilde Vidal-Alarcón,^a Juan Lara-Torrano,^c and José Azpitarte^a

^aServicio de Cardiología, Hospital Universitario Virgen de las Nieves, Granada, Spain.

^bServicio de Cardiología, Hospital Clínico de San Cecilio, Granada, Spain.

^cServicio de Cirugía Cardiovascular, Hospital Universitario Virgen de las Nieves, Granada, Spain.

We analyzed the results of mitral valve repair in 81 consecutive patients with severe mitral regurgitation. Of these patients, 66.6% had myxomatous degeneration, 11% ischemic disease, 8% chordal rupture, 5% congenital disease, and 3.7% endocarditis. Repair could not be achieved in five patients, and valve replacement was necessary. Six died during surgery (mortality 7%). During follow-up (mean 30 [8] months), there was 1 death due to refractory ischemic heart failure and mitral regurgitation ($\geq 2/4$) was observed in 11 patients. A good result (i.e., survival without a prosthesis, major complications, or mitral regurgitation $>1/4$) was obtained in 78% of patients with myxomatous degeneration versus 48% of those with other etiologies ($P=.023$). A good result was obtained more frequently in cases of isolated posterior cusp degeneration than in those involving degeneration of both cusps (85% vs 70%; $P=.03$).

Key words: Mitral regurgitation. Mitral valve surgery. Echocardiography.

Cirugía de reparación valvular en la regurgitación mitral

Analizamos los resultados de la reparación valvular mitral en 81 pacientes consecutivos con insuficiencia severa de la válvula. El 66,6% de los pacientes tenía degeneración mixoide; el 11%, etiología isquémica; el 8%, rotura de cuerdas; el 5%, congénita y el 3,7%, endocarditis. En 5 casos fue preciso sustituir la válvula al no conseguirse una reparación adecuada. La mortalidad operatoria fue de 6 pacientes (7%). En el seguimiento (media, 30 \pm 8 meses) hubo un fallecimiento por insuficiencia cardíaca isquémica refractaria y 11 pacientes quedaron con insuficiencia mitral $\geq 2/4$. Se obtuvo buen resultado (supervivencia sin prótesis, regurgitación mitral $> 1/4$ o complicación mayor) en el 78% de los pacientes con afección mixoide frente al 48% de aquellos cuya enfermedad no era mixoide ($p = 0,023$). La tasa de buen resultado fue superior en la degeneración aislada del velo posterior que en la afección de ambos velos (85% frente a 70%; $p = 0,003$).

Palabras clave: Insuficiencia mitral. Cirugía válvula mitral. Ecocardiografía.

INTRODUCTION

Patients with severe mitral regurgitation (MR) should undergo surgery when they present symptoms or, if asymptomatic, when there is objective evidence of left ventricular dysfunction.¹ However, some authors advocate early surgery in patients with no symptoms or ventricular dysfunction, provided the MR can be corrected with repair surgery.²

Before this standard can be implemented, several requirements must be met: *a*) low operative risk in

patients with few symptoms and normal ventricular function; *b*) precise identification of the valves that can be successfully repaired; and *c*) availability of surgeons able to perform the procedure. The purpose of this study was to analyze our more recent experience with repair surgery for regurgitant mitral valve from the above perspective.

METHODS

Consecutive patients referred to the Cardiovascular Surgery Department of the Hospital Virgen de las Nieves, Granada, Spain, between 2002 and 2004 with severe mitral regurgitation and an indication for surgery were prospectively included ($n=148$). Patients over 80 years of age ($n=1$), and those who required emergency surgery ($n=4$), had undergone surgery during the active phase of infective endocarditis ($n=2$), or had severe comorbidity ($n=1$) were excluded. Decisions regarding the operating procedure (repair

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Correspondence: Dra. R. García Orta.
Sabina, 7. Los Llanos. 18193 Monachil. Granada. España.
E-mail: eduroc@telefonica.net

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TABLE 1. Patient Characteristics (n=81)

Demographic and clinical	
Mean age, range	61 (18-79)
Men	50 (70%)
NYHA Class	
I	10 (14%)
II	29 (41%)
III	28 (39%)
IV	4 (6%)
Permanent AF	27 (38%)
Coronary disease	13 (18%)
Prior surgery	1
EuroSCORE	4.1±1.8
Parsonnet	10.4±5.7
Anatomical etiology of MR	
Myxoid degeneration	55 (66%)
Rheumatic	0
Ischemic	9 (11%)
Isolated chordal rupture	7 (8%)
Postinfective endocarditis	3 (4%)
Congenital	4 (5%)
Not classified	3 (4%)
Functional echocardiography	
MR area, cm ²	12.2±5
RO, mm ²	59.5±27
RV, mL	89.7±37
RF, %	57.5±12
LAD, mm	51.3±8
LVEDD, mm	54.3±6
LVEDS, mm	33.6±6
dP/dt, mm/s	1607±974
LVEF, %	63±9
SPAP, mm Hg	46±17

*EF indicates ejection fraction; LAD, left atrial dimension; LV, left ventricle; LVEDD, left ventricular end-diastolic diameter; LVEF, left ventricular ejection fraction; LVEDS, left ventricular end-systolic diameter; MR, mitral regurgitation; NYHA, New York Heart Association; RF, regurgitant fraction; RO, regurgitant orifice; RV, regurgitant volume; SPAP, systolic pulmonary arterial pressure. Figures between parentheses are percentages of the total.

versus replacement) were made sequentially: *a*) echocardiographic assessment of the possibilities of repair; *b*) when positive, information to the patient regarding the advantages and disadvantages of both procedures; *c*) incorporation of the patient's opinion in the process; and *d*) final decision of the surgeon, once all the above had been taken into account and the valve had been examined in the surgical field.

Preoperative transthoracic and transesophageal echocardiography were performed to assess the etiology and precise anatomy of the mitral valve lesion (examination of leaflets, mitral annulus, and anatomy of subvalvular apparatus) and to recommend repair according to the valve characteristics.

An intraoperative study was performed at completion of surgery to assess the result and make the pertinent recommendations. All significant postoperative events were recorded and close clinical and echocardiographic follow-up was planned after

TABLE 2. Leaflet and Segment Involvement

Altered Leaflet and Segments	Percentage of Patients With Involvement of This Leaflet/Segment
Anterior leaflet	41
A1	14
A2	37
A3	23
Posterior leaflet	83
P1	26
P2	77
P3	33
Both leaflets	32

discharge. A good outcome was defined as survival of the patient, prosthesis implantation not required, a continent valve (or regurgitation <1/4) and no major complications such as endocarditis or stroke. The statistical calculations were done with SPSS 11.0®.

RESULTS

Valve repair was performed in 81 of the 148 patients who underwent surgery for severe mitral regurgitation (Table 1). The main characteristics of these patients included a high percentage of men, relatively high incidence of atrial fibrillation, 10 asymptomatic patients, predominance of myxoid disease as the cause of mitral regurgitation, and mean ejection fraction above 60%. The posterior leaflet was most commonly affected (54% of patients had posterior leaflet prolapse; 14% anterior, and 32% both leaflets). The total percentage of leaflet and segment involvement is described in Table 2.

The technique most commonly used was quadrangular resection (65%), generally associated with a half-ring implantation and a sliding plasty. Ring implantation alone and the Alfieri technique were performed, respectively, in 18.8% and 14.5% of the cases. Other procedures, such as chordal transposition, annular decalcification, commissuroplasty, etc, were used on occasions. De Vega tricuspid annuloplasty was performed in 7 patients, and myocardial revascularization was added in another 7. A good intraoperative outcome was obtained in 89% of the cases. One patient was left with significant mitral regurgitation, 2 with moderate stenosis, and a prosthesis was finally implanted in 5. Systolic anterior motion of the mitral valve was detected in 7 patients; the problem was solved by controlling hemodynamics in 4 and modification of the plasty in the other 3.

Operative mortality was 6 patients (7.4%) in the overall group and 3.5% in myxoid subgroup. In the isolated posterior leaflet prolapse group, there was one death, a patient at very high risk (morbid obesity,

surgery in the context of heart failure). The factors associated with mortality in the bivariate analysis were used for a logistic regression analysis (Table 3), which is necessarily of limited interpretation because of the small number of events and the resulting broad confidence intervals. Independent factors were diabetes, Parsonnet score and euroSCORE, and borderline NYHA functional class. During follow-up (30 ± 8 months; median, 31 months [6 months-3.5 years]), 1 patient with severe ischemic ventricular dysfunction died due to refractory heart failure. Other complications during the postoperative and follow-up are described in Table 4. The echocardiographic examination detected $MR \geq 2/4$ in 11 patients; prosthetic replacement was decided for 2 of them. Most of these patients had an ischemic etiology (75%, regurgitation $\geq 2/4$) and prolapse of both leaflets. Only 1 patient with isolated posterior leaflet prolapse presented 2/4 grade regurgitation on follow-up. In 1 patient, even though the mitral regurgitation was mild, hemolytic anemia was detected and corrected with treatment.

The rate of good outcome was higher in myxoid disease (78%) than the remaining heterogeneous group (48%; $P=.023$). In the group of myxoid degeneration, success was greater when the prolapse was exclusively in the posterior leaflet (85% vs 70% when both leaflets were involved; $P=.03$).

DISCUSSION

The indications of repair surgery, which have emerged in the context of considerable scientific-technical development,³⁻⁵ can be applicable in our setting, but with some reservations. The probability of obtaining a good outcome is high when myxoid involvement is limited to the posterior leaflet; however, it decreases when the anterior leaflet is also affected. Consequently, we believe that this surgery could be recommended in our setting for patients with severe mitral regurgitation, even when they are asymptomatic and have good ventricular function, if the degeneration affects only the posterior leaflet. This early indication is more inconclusive when the echocardiographic examination reveals that the degeneration reaches the anterior leaflet. In this case, there is definite possibility that the patient will require a prosthesis sooner or later. In our experience, the results were still less effective in the heterogeneous subgroup of nonmyxoid disease. In this cohort, the ischemic etiology predominated, with problems that are very different from those of myxoid degeneration⁶; we have a long road ahead before achieving adequate treatment of this complex disease.

The recurrence of $MR \geq 2/4$ is the Achilles heel of repair surgery. When echocardiographic follow-up of the repaired degenerative valves is performed, a cumulative yearly incidence of 8.3% is reported.⁷ This

TABLE 3. Mortality Analysis*

	Logistic Regression Analysis		
	P	OR	95% CI
Age	.76	1.1	0.8-1.9
Diabetes	.02	5.6	1.4-65
NYHA grade	.055	5	0.91-7
CHF hospitalizations	.22	1.4	0.03-12
Parsonnet score	.01	10	1.1-20
EuroSCORE	.05	1.1	1.5-2.7
Combined surgery	.07	14	0.9-254

*CHF indicates chronic heart failure; CI, confidence interval; NYHA, New York Heart Association; OR, odds ratio.

TABLE 4. Postoperative Complications*

	n=81
Early†	
Death	6
Myocardial infarction	4
Acute CVA	1
Heart failure	3
Pericardial effusion	1
Transient AF	16
Transient RF	9
Late‡	
Acute CVA	1
$MR \geq 2/4$	11
Heart failure	6
Pericardial effusion	1
Infective endocarditis	0
Hemolytic anemia	1
Repeat surgery	2
Death	1

*AF indicates atrial fibrillation; CVA, cerebrovascular accident; MR, mitral regurgitation; RF, renal failure.

†Prior to hospital discharge.

‡From discharge to last follow-up.

figure is not surprising, in view of the permanent, genetically determined cell alteration that characterizes this disease.⁸ Our incidence in myxoid disease was 9%, a figure similar to the reported rate.³

Although there are no randomized studies providing definitive evidence, the superiority of valve repair over replacement in terms of operative mortality, preservation of left ventricular function, and late survival is accepted. Repair surgery has the added advantage that long-term oral anticoagulant therapy in patients with stable sinus rhythm may be obviated. However, all this requires an adequate selection of patients,⁹ because there are specific circumstances under which clinical or anatomic reasons recommend direct implantation of a prosthesis as the most appropriate measure.¹⁰

Analysis of this series brings a critical vision to the results obtained with repair surgery for MR at our hospital. The findings obtained, although initial, respond to the demands of a specific reality and cannot be supplanted by simply adopting the standards used at other institutions.

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