

Case Report

The Role of Mitral Valve Repair in Heart Failure

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We report a 71-year-old man with severe mitral valve regurgitation in end stage heart failure intractable to medical treatment. He underwent mitral valve repair, coronary artery bypass grafting and tricuspid annuloplasty, and his postoperative course was uneventful with significant improvement of his symptoms. Mitral valve repair should be considered as a treatment modality in patients with cardiac failure and significant mitral valve regurgitation.

The management of patients with heart failure is a worldwide health problem, and a leading cause of hospitalisation and mortality. Despite improvements in medical therapy, approximately 50% of patients with severe congestive heart failure die within 3 years of presentation. In the United States alone, nearly 4.9 million people suffer from heart failure. However, less than 2,500 of the 500,000 patients diagnosed annually are transplanted, because of limitations of organs, comorbid medical conditions, and often the advanced age of this population.¹ Functional mitral regurgitation is a significant complication of heart failure that affects life expectancy. In an effort to address this problem, mitral valve reconstruction has evolved as a surgical alternative in order to treat this group of patients.

Case presentation

This is the case of a 71-year-old man in heart failure, New York Heart Association (NYHA) class IV, with severe mitral valve regurgitation (MR). His recent medical history included hospitalisation (twice) for pulmonary oedema in the previous two months. Two years ago, he underwent surgical closure of an *ostium secundum*, and at

that time he had moderate MR, 60% occlusion of the right coronary artery, and an ejection fraction of 50%. Six months ago, he underwent angioplasty and stenting of the right coronary artery. His past medical history included paroxysmal atrial fibrillation, mild renal failure (creatinine: 1.7-2.2 mg/dl) and prostate hypertrophy. His preoperative cardiac echo showed severe MR (4+/4+) with mild aortic insufficiency and moderate tricuspid regurgitation (Figure 1). The diameter of the left atrium was 79 mm and the left ventricular end-diastolic diameter was 73 mm with diffuse wall hypokinesis. The ejection fraction was 22%. The coronary angiogram showed 20% occlusion in the left main stem and 70% occlusion of the circumflex artery. There was no recurrent stenosis in the right coronary artery after the stenting.

The patient underwent a redo sternotomy. A mitral valve annuloplasty was performed with insertion of a 30 mm band (Colvin-Gallway, Medtronic, Inc., USA.), ligation of the left atrial appendage, De Vega tricuspid annuloplasty and bypass with a venous graft to the first marginal branch. No regurgitation of the valves after the repair was observed during the operation. After weaning from the cardiopulmonary bypass the pressure of the left atrium was

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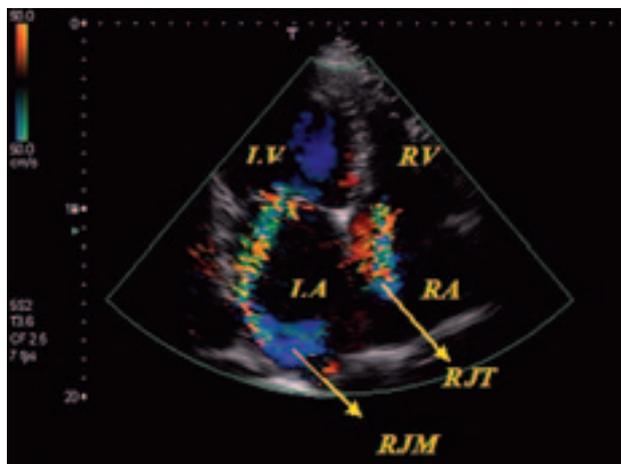


Figure 1. Preoperative echo, four-chamber view, depicting severe (4+) mitral regurgitation with the regurgitant jet reaching the pulmonary veins. Also shown is the regurgitant jet from the tricuspid valve. LA – left atrium; LV – left ventricle; RA – right atrium; RV – right ventricle; RJM – regurgitant jet from mitral valve; RJT – regurgitant jet from the tricuspid valve.

14 mmHg. The patient was extubated after two days and transferred to the ward, where his postoperative course was uneventful. His postoperative echo revealed trivial MR and no tricuspid regurgitation.

Three months after the operation, his ejection fraction was 32%, with trivial MR and no tricuspid regurgitation (Figure 2). His left ventricular end-diastolic diameter was 69 mm. At 6 months the EF is 36%. The patient is currently in functional class I and his creatinine level has decreased to 1.4 mg/dl.

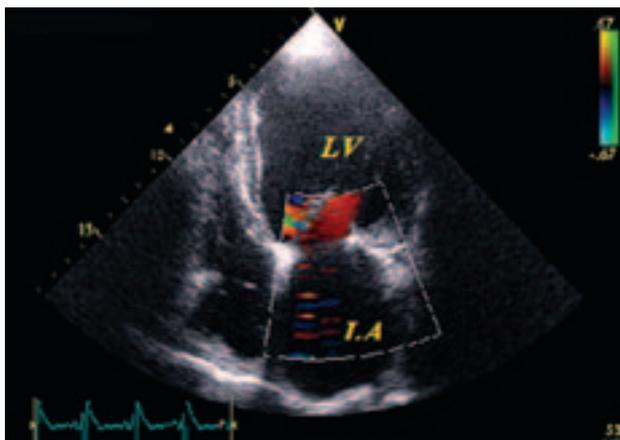


Figure 2. Three-month postoperative echo shows trivial (1/2+ / 4+) mitral valve regurgitation with decreased dimension of the left heart chambers. LA – left atrium; LV – left ventricle.

Discussion

Functional MR in patients with heart failure represents a key point in the natural history of the disease that shortens life expectancy. In functional MR, the valve has no degenerative lesions and it is a complication of severe left ventricular dysfunction.² Severe MR is associated with serious haemodynamic changes and a poor prognosis.³

In our case the MR was clearly functional. The patient's history made it difficult to determine the cause of heart failure with precision. It could have been due to ischaemic heart disease, or dilated cardiomyopathy, or his congenital heart defect, or even have been the result of impaired myocardial preservation during the first cardiac operation.

For patients with heart failure and MR, treatment with diuretics, angiotensin-converting enzyme inhibitors and beta-blockers is the mainstream of management. Cardiac dyssynchrony, as reflected by a prolonged QRS complex, often in the form of left bundle branch block, is encountered in about 30% of patients with moderate to advanced heart failure. Recent studies have documented that patients in NYHA class III or IV, with an ejection fraction $\leq 35\%$ and QRS duration ≥ 120 -150 ms, showed significant haemodynamic and clinical improvement after cardiac resynchronisation therapy via biventricular pacing.⁴

Heart transplantation is the final option for patients with severe left ventricular dysfunction, when medical therapy fails. However, heart transplantation has constraints due to age limitations, a shortage of donors and the comorbid medical conditions.

In an effort to resolve this problem, improvement of mitral valve function appears as a vital perspective. The question is mitral valve repair, or replacement, or rethink? It has been reported that mitral valve replacement in patients with cardiac failure was associated with a fivefold increase in intraoperative mortality compared with mitral annuloplasty.⁵ Calafiore et al recommended mitral valve replacement when the distance between the coaptation point of the leaflets and the plane of the mitral annulus exceeds 10 mm.⁶ The indication for surgical treatment has not yet been clarified. It is agreed that patients who have indications for coronary artery bypass grafting with moderate to severe ischaemic MR (3+ to 4+) should also undergo concomitant valve surgery.⁷ It is controversial whether patients with mild to moderate MR who undergo coronary artery bypass grafting should have concomitant mitral valve surgery. Data from the STS

database suggest that concomitant mitral valve surgery increases the perioperative risk of coronary artery bypass grafting by roughly twofold.⁸ Borger et al recommended that patients with mild to moderate ischaemic MR and multiple comorbidities, or a life expectancy of less than 5 years, should be treated conservatively and undergo coronary artery bypass grafting only.⁷ In low risk patients the mitral valve surgery can be performed with low mortality rates of 5%.⁷ In the case of dilated cardiomyopathy, Calafiore et al suggested that severe MR (3+ to 4+) is a clear indication for surgical treatment. However, the same authors recommend that moderate MR in any patient symptomatic of heart failure is sufficient to justify its correction.⁶

Mitral valve repair preserves the natural continuity of the subvalvular apparatus and reinforces the function and geometry of the left ventricle.⁹ In addition, the procedure is related with a low thromboembolic rate and a decreased likelihood of late endocarditis.¹⁰ Mitral valve annuloplasty is a safe method with low rates of morbidity and mortality and represents the technique of choice.^{11,12,14} Most patients who have undergone mitral valve repair demonstrate an increased ejection fraction, a significant decrease of left ventricular dimensions and significant symptomatic improvement (1-2 functional classes).¹²⁻¹⁴

The precise reason for these results has not yet been clarified. It has been proposed that annular stabilisation and elimination of the regurgitation reduces the volume overload of the left ventricle, by altering the ventricular geometry (remodelling) with a consequent improvement in function. This is more pronounced in patients with idiopathic dilated cardiomyopathy and MR.⁷ It has been documented that an excessive increase in the left ventricular end-diastolic diameter, the use of a larger ring, ischaemic heart disease, and advanced age (>65 years) are associated with higher mortality and inability to recover ventricular function after annuloplasty.^{11,12}

Tricuspid valve regurgitation in patients with severe functional MR can be due to the involvement of the tricuspid valve by the cardiomyopathic process (in patients with dilated cardiomyopathy) and/or the effects of chronic pulmonary hypertension. Combined mitral and tricuspid valve regurgitation increases the mortality from heart failure.¹⁵ For this reason, tricuspid valve repair was also performed in our case. The left atrium may be affected directly by the cardiomyopathy or indirectly by volume overload, and predisposes to atrial fibrillation. Surgical ligation of the left

atrial appendage reduces the risk of thromboembolism, and we typically apply this strategy to all mitral valve operations.

In ischaemic MR the initial results seemed encouraging, with low perioperative mortality rates.¹⁶ However, Tahta et al examined 585 patients undergoing undersized annuloplasty surgery over a 17-year period and concluded that in 28% of patients moderate or greater degree MR developed by 6 months postoperatively.¹⁷ MR recurrence tends to occur early after operation, with relatively low recurrence rates thereafter. This fact led a number of investigators to examine alternative surgical therapies, but nothing has changed in terms of outcomes at this moment.⁹ In MR due to dilated cardiomyopathy the operative mortality ranges from 0-11%.¹⁸ One-year survival in large series is in accordance with this result and ranges from 84-89%. However, 5-year survival rates range from 33-67%.^{11,12,18,19} Wu et al recently reported a cohort study of 682 patients with heart failure and MR of whom 126 underwent mitral annuloplasty. Although the results did not show a statistically significant difference in long-term survival, a haemodynamic and symptomatic improvement was demonstrated, with good intermediate-term outcomes and low surgical mortality.¹³ In addition, although it is the largest study reported thus far, it has methodological flaws, as it covered a time span of 8 years from one institution, with evolution of the surgical techniques and the management of these patients, and it included a heterogeneous group of patients.

The development of MR in patients with heart failure is associated with a dramatic deterioration in their clinical condition and complicates their management. Mitral valve repair in selected patients may be an important therapeutic option with immediate improvement in their clinical and haemodynamic status and quality of life. Further studies are needed in order to show the impact of this treatment modality on the long-term survival of patients with heart failure.

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