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Restrictive mitral annuloplasty in refractory cardiogenic shock with acute postinfarction mitral insufficiency and intact papillary muscle

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Acute severe mitral insufficiency following myocardial infarction usually results from rupture of a papillary muscle, which should be treated on an emergency basis by either mitral valve repair or replacement. In the case of acute postinfarction mitral regurgitation with intact papillary muscle, no consensus exists, even with regard to the indication for surgery.

Restrictive mitral annuloplasty (RMA) has been applied in chronic ischemic mitral insufficiency, with encouraging mid-term results. In this report, we describe 2 patients in whom RMA was applied as a lifesaving procedure in the presence of refractory cardiogenic shock in postinfarction mitral insufficiency with intact papillary muscle.

Clinical Summaries

Patient 1. A 55-year-old woman had an acute inferior wall infarction with cardiogenic shock. She received an intra-aortic balloon pump (IABP) and inotropes and was intubated. Coronary angiography revealed occlusion of the right coronary and circumflex arteries. Transesophageal echocardiography (TEE) showed grade 4+ mitral insufficiency resulting from systolic restrictive motion of both leaflets (Carpentier type IIIb; Figures 1 and 2). The regurgitation jet was slightly eccentric because of the more restrictive posterior leaflet. Because of further hemodynamic deterioration, we decided to attempt correction of the mitral regurgitation as a lifesaving procedure.

During the operation, a fresh infarction of the posterolateral wall involving the posterior papillary muscle was observed. The subvalvular apparatus was intact, and there was no structural anomaly of the mitral valve leaflets. RMA was performed with a size 28 Carpentier Edwards Physio ring (Edwards Lifesciences, Irvine, CA), thereby downsizing the prosthetic ring by two sizes. Tentative revascularization of the circumflex and right coronary artery territory was performed with a sequential saphenous vein graft.

The patient was weaned from extracorporeal circulation with inotropic support (epinephrine at 0.22 mg/kg/min, dobutamine at 15 mg/kg/min, dopamine at 8 mg/kg/min, and enoximon at 4 mg/kg/min). Intraoperative TEE showed trivial mitral regurgitation with a mean transvalvular mitral gradient of 3 mmHg (mitral valve surface area > 2 cm²) and a leaflet coaptation length of 9 mm.

Troponin T rose to 22 mg/L on day 1. The IABP was removed after 8 days. The patient was discharged after 23 days. Nine months after surgery she is in New York Heart Association functional class I, with no mitral insufficiency on echocardiographic follow up.

Patient 2. A 69-year-old woman was referred because of hemodynamic deterioration 3 days after an inferior wall infarction. Coronary angiography revealed occlusion of the right coronary artery. During balloon angioplasty, the patient went into cardiogenic shock, was resuscitated, and received an IABP. Troponin T rose to 19 mg/L. TEE showed grade 4+ mitral regurgitation as a result of restrictive leaflet motion in systole (Carpentier IIIb).
Figure 1. Transesophageal echocardiogram showing restrictive systolic motion of anterior and posterior leaflets with reduced coaptation. LA, Left atrium; LV, left ventricle; ECG, electrocardiogram.

Figure 2. Color Doppler echocardiographic imaging demonstrating grade 4+ mitral regurgitation resulting from systolic restriction with reduced coaptation. ECG, Electrocardiogram.
Initially, hemodynamic stabilization was obtained with inotropes in addition to the IABP. Three weeks later, the patient could not be weaned from mechanical ventilation. She acquired gram-negative sepsis, and during exchange of the IABP catheter she suffered hemodynamic collapse and was again resuscitated. Apart from nonoliguric renal insufficiency, she had neither major organ dysfunction nor neurological complications, but she required continuous administration of epinephrine at 0.20 mg/kg/min, dobutamine at 10 mg/kg/min and enoximon at 2 mg/kg/min. In an attempt to overcome this deadlock situation, we decided to try to correct the mitral insufficiency 27 days after the initial infarction. We performed RMA with size 26 (instead of 30) Physio ring. The patient could then be weaned from ECC with the same inotropic support. Postoperative TEE showed no mitral insufficiency, with a mean transvalvular gradient of 2 mmHg and leaflet coaptation length of 9 mm.

The postoperative course was uneventful. The IABP was removed on day 7. The patient was extubated after 20 days and was discharged after 32 days. Two months after surgery, she is in New York Heart Association functional class II, with grade 1 mitral insufficiency on echocardiography.

Discussion

Cardiogenic shock in postinfarction mitral insufficiency portends a poor prognosis, with approximately 55% in-hospital mortality in the SHOCK trial. Coronary revascularization with or without mitral valve surgery in that study showed a somewhat reduced but still high mortality of 40%, versus 71% in nonsurgically treated patients. Most patients who did not undergo surgery could not be stabilized and died. Thus the timing of surgery may be important in determining outcome, and early surgery before or immediately at the onset of cardiogenic shock might save lives. Our first patient underwent surgery on an emergency basis. In the second case, initial stabilization allowed us to postpone surgery.

The question as to whether mitral valve repair is preferable to replacement in acute ischemic mitral insufficiency is still unanswered. Grossi and colleagues and Gillinov and associates reported similar survivals after replacement versus repair in patients with complex and acute mitral regurgitation. However, preference of the operating surgeon certainly introduced selection bias in these retrospective studies.

It has been established that preservation of the subvalvular apparatus positively influences post-operative left ventricular function. Therefore in cases where mitral valve surgery is proposed as a lifesaving procedure, we believe, as illustrated by the cases reported here, that a successful mitral valve repair is preferable, especially in the absence of papillary muscle rupture. In our hands RMA has proven its value in curing chronic ischemic mitral insufficiency by restoring an adequate length of leaflet coaptation. Similarly, we believe that the stress in the subvalvular apparatus can also be reduced by this technique in acute cases, thereby decreasing the risk of postrepair rupture of the infarcted myocardium.


