Minimally Invasive Transaortic Mitral Valve Repair during Aortic Valve Replacement

Herein, we report the case of a 77-year-old man who presented with congestive heart failure. Echocardiography and cardiac catheterization revealed severe aortic stenosis with severe mitral regurgitation and a left ventricular ejection fraction of 0.20. Because of co-morbidities, the patient was considered to be at high risk for double-valve surgery. In order to reduce the operative risk, a minimally invasive aortic valve replacement was performed together with a transaortic edge-to-edge repair (Alfieri stitch) of the mitral valve. We discuss the surgical technique and note the positive outcome. To our knowledge, this is the 1st report of minimally invasive aortic valve replacement and transaortic mitral valve repair with use of the Alfieri stitch. (Tex Heart Inst J 2011;38(3):298-300)

Clinically significant mitral regurgitation is often found in conjunction with severe aortic valve stenosis. Performing double-valve surgery in patients with these conditions is associated with increased morbidity and mortality rates.1 In patients whose comorbidities make the risk of performing double-valve surgery prohibitive, an option is to perform the aortic valve replacement and a transaortic repair of the mitral valve with an edge-to-edge stitch.2 Herein, we report the case of an elderly man who underwent this surgery.

Case Report

In February 2010, a 77-year-old man with a history of stroke and peripheral vascular disease presented at our emergency department in florid pulmonary edema. He had a 6-month history of worsening dyspnea on exertion, paroxysmal nocturnal dyspnea, and leg edema. Upon physical examination, he had diffuse rales and a murmur of aortic stenosis. Upon physical examination, he had diffuse rales and a murmur of aortic stenosis. A 2-dimensional Doppler transthoracic echocardiogram revealed severe aortic valve stenosis with a peak gradient of 70 mmHg and a mean gradient of 45 mmHg, a calculated aortic valve area of 0.7 cm², severe mitral regurgitation, and a severely dilated left ventricle (LV) with an ejection fraction of 0.20. After the pulmonary edema had resolved, cardiac catheterization confirmed the echocardiographic findings and showed nonobstructive coronary artery disease. Given these findings and the patient’s comorbidities, we decided on a minimally invasive surgical approach.

The patient was placed in the supine position and underwent anesthetic induction and intubation with a single-lumen endotracheal tube and a bronchial blocker. Intraoperative transesophageal echocardiography (TEE) confirmed the previous findings, also showing that the mitral valve leaflets were free of significant disease and that the mitral regurgitation originated in the A2–P2 portion of the mitral valve (Fig. 1). The mitral regurgitation was thought to be functional, caused by mitral annular dilation and tethering of the papillary muscles by the severely dilated LV. We decided to perform edge-to-edge repair of the mitral valve from a transaortic approach.

A femoral platform was used to establish cardiopulmonary bypass. A 2- to 3-cm incision was made in the left inguinal crease. A 5-0 Prolene purse-string suture (Ethicon Inc., a Johnson & Johnson company; Somerville, NJ) was placed in the femoral artery and vein. The left femoral artery was cannulated with a 16F–18F arterial cannula. The left femoral vein was cannulated with a 25F Bio-Medicus® femoral venous cannula (Medtronic, Inc.; Minneapolis, Minn), which was placed in the superior
vena cava with the aid of TEE. We then made a 4- to 5-cm transverse parasternal incision over the 3rd intercostal space and transected the 4th costochondral cartilage to enable adequate exposure of the aorta. This interspace was chosen in the event that the left atrium needed to be entered. The pericardium was opened above the phrenic nerve and over the aorta to facilitate exposure. A retrograde coronary sinus catheter was inserted directly through the incision, and a purse-string suture was placed in the right atrium. An LV vent was inserted via a purse-string suture in the right superior pulmonary vein.

A transverse aortotomy was performed to expose the aortic valve, which was removed under direct vision. The A2 and P2 segments of the mitral valve were identified, and an edge-to-edge repair was carried out with a 5-0 Prolene mattress suture that was reinforced with pericardial pledgets on the ventricular side of the mitral valve (Fig. 2). Next, a 27-mm Hancock® II bioprosthetic aortic valve (Medtronic) was implanted by use of standard techniques. The aortotomy was closed in 2-layer fashion, and the patient was weaned from cardiopulmonary bypass. The transected rib was reattached to the sternum with a 1-cm metal plate (Synthes, Inc.; West Chester, Pa), and a fiber wire was placed in figure-8 fashion. A single chest tube was left in the pleural space. The thoracotomy was closed in routine fashion.

Postoperative TEE showed no mitral regurgitation (Fig. 3); “elbowing” of the anterior leaflet during mid-diastole due to tethering of the anterior leaflet to the posterior leaflet (Fig. 4); and the double-orifice mitral valve that resulted from the edge-to-edge repair (Fig. 5).

After surgery, the patient did well. His shortness of breath resolved, and he was discharged from the hospital on postoperative day 6. Upon follow-up evaluation in March 2011, he was asymptomatic, and echocardiography showed grade 1+ mitral regurgitation.

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**Fig. 1** Intraoperative transesophageal echocardiogram (mid-esophageal long-axis view) shows a central jet of mitral regurgitation originating from the A2–P2 portion of the mitral valve.

**Fig. 2** Intraoperative photograph shows edge-to-edge repair of the ventricular aspect of the mitral valve leaflets (arrow).

**Fig. 3** Postoperative transesophageal echocardiogram (mid-esophageal 4-chamber view) during systole shows no mitral regurgitation.

**Fig. 4** Postoperative transesophageal echocardiogram (mid-esophageal long-axis view) during mid-diastole shows “elbowing” of the anterior leaflet (black arrow), which is due to the tethering of that leaflet to the posterior leaflet by the edge-to-edge repair. The new bioprosthetic aortic valve is also shown (white arrow).

LA = left atrium; LV = left ventricle
Discussion

The edge-to-edge mitral valve repair is known as the Alfieri stitch. This technique involves placing a suture at the center (the A2–P2 portion) of the margins of both leaflets, which creates a double-orifice mitral valve. In high-risk patients with aortic and mitral valve conditions, the operative risk can be minimized by performing the edge-to-edge mitral repair through a transaortic approach when replacing the aortic valve.

Performing this procedure can be relatively easy, especially when the aortic annulus is large, but it can be somewhat more challenging in patients who have a small, nonelastic aortic annulus. The cross-clamp, bypass, and total operative times are shorter than those in double-valve surgery. Furthermore, unlike standard mitral valve repair, the transaortic edge-to-edge technique precludes the need for an atriotomy.

Experience with edge-to-edge repair of the mitral valve through the transaortic approach is limited to 2 case reports and 3 small case series. In the largest case series (13 patients), mitral regurgitation was significantly reduced from a median qualitative angiographic grade of 3 preoperatively to 1 postoperatively ($P<0.0001$). No mitral stenosis from the edge-to-edge repair was noted in any of the patients on postoperative TEE. On follow-up echocardiography, at a mean of 12.5 months after surgery, no worsening of the mitral regurgitation was noted when compared with the postoperative TEE. Although this case series was small, it showed that the procedure was safe, feasible, and provided good results that were maintained as of mid-term follow-up.

All previous reports of this technique have involved a surgical approach by median sternotomy. To our knowledge, this is the 1st report of minimally invasive aortic valve replacement and transaortic mitral valve repair with use of the Alfieri stitch. Clearly, more experience is needed before wide recommendation of this approach can be made. However, we believe that this option is feasible in patients who are at prohibitive risk for double-valve surgery and whose mitral regurgitation originates in the A2–P2 portion of the mitral valve.

References