



Transaortic edge-to-edge mitral valve repair for moderate secondary/functional mitral regurgitation in patients undergoing aortic root/valve intervention

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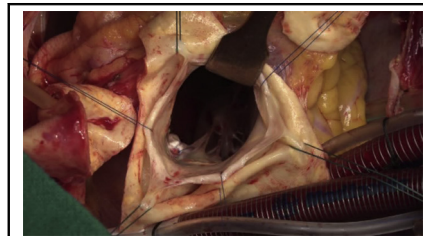
ABSTRACT

Objective: The present study evaluates the feasibility, safety, and efficacy of edge-to-edge repair for moderate secondary/functional mitral regurgitation in patients undergoing aortic valve/root interventions.

Methods: Sixteen patients underwent transaortic edge-to-edge mitral valve repair. Mitral regurgitation was 2+ in 8 patients and 3+ in 6 patients. Two patients in whom cardiac arrest developed preoperatively had severe (4+) mitral regurgitation. Patients underwent operation for severe aortic regurgitation ± aortic root lesions. The mean left ventricular systolic and diastolic diameters were 51.5 ± 12.8 mm and 70.7 ± 10.7 mm, respectively. Left ventricular ejection fraction ranged from 20% to 60%. Primary surgical procedure included Bentall's ± hemiarch replacement in 10 patients, aortic valve replacement in 5 patients, and noncoronary sinus replacement with aortic valve repair in 1 patient.

Results: Severity of mitral regurgitation decreased to trivial or zero in 13 patients, 1+ in 2 patients, and 2+ in 1 patient. There were no gradients across the mitral valve in 9 patients, less than 5 mm Hg in 6 patients, and 9 mm Hg in 1 patient. There was no operative mortality. Follow-up ranged from 2 weeks to 54 months. Echocardiography showed trivial or no mitral regurgitation in 12 patients, 1+ in 2 patients, and 2+ in 2 patients. None of the patients had significant mitral stenosis. The mean left ventricular systolic and diastolic diameters decreased to 40.5 ± 10.3 mm and 58.7 ± 11.6 mm, respectively. Ejection fraction also improved slightly (22%-65%).

Conclusions: Transaortic edge-to-edge mitral valve repair is a safe and effective technique to abolish secondary/functional mitral regurgitation. However, its impact on overall survival needs to be studied. (*J Thorac Cardiovasc Surg* 2017;154:1624-9)



Transaortic edge-to-edge mitral repair.

Central Message

Transaortic edge-to-edge mitral valve repair is a safe and effective technique to abolish secondary/functional MR in patients undergoing aortic root/valve intervention.

Perspective

Management of moderate functional MR in patients undergoing aortic root/valve intervention remains elusive. Because of lack of conclusive evidence of survival benefit, increased morbidity, and technical difficulties, transatrial mitral repair has not become popular. In this setting, transaortic edge-to-edge mitral repair is a technically feasible, effective, and safe option.

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Secondary or functional mitral regurgitation (MR) is a frequent accompaniment in patients undergoing aortic valve interventions.^{1,2} Although there are clear-cut guidelines for management of severe secondary/functional regurgitation, recommendations are vague for moderate

secondary/functional regurgitation,³⁻⁵ perhaps because the MR decreases with correction of the aortic pathology alone in a significant number of patients.^{6,7} Second, adding a conventional transatrial mitral intervention to aortic valve surgery is often associated with increased ischemia time, perioperative mortality, and morbidity.^{4,8} Moreover, exposure of the mitral valve through the left atrium is frequently difficult in patients with aortic pathology because of the leftward displacement of the

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Abbreviations and Acronyms

AR = aortic regurgitation
 MR = mitral regurgitation
 TEE = transesophageal echocardiography

mitral annulus. However, reduction in concomitant MR after correction of aortic valve pathology does not occur in all patients, and it is difficult to predict which patients will show improvement. Early persistence of MR has been found to affect survival adversely.^{1,2,4,9} Thus, a policy of not intervening on the mitral valve leaves some of the patients with increased risk associated with persistent MR. Therefore, at present, the surgeon has to consider a tradeoff between the increased operative risks and technical difficulties of a formal mitral valve repair and the potential risk associated with possible persistent MR postoperatively.

It is in this setting that transaortic edge-to-edge repair (Alfieri repair) of mitral valve emerges as a quick and technically simple procedure compared with conventional transatrial mitral valve repair. It does not add to the crossclamp times or the technical complexity. Transatrial edge-to-edge repair of the mitral valve has a proven history of safety and efficacy.^{10,11} Although described by Kavarana and colleagues¹² in the year 2000, there are few reports¹³⁻¹⁵ of transaortic edge-to-edge repair in the literature.

The present study has been performed to assess the feasibility and early outcomes after transaortic edge-to-edge repair of the mitral valve in patients undergoing aortic valve/root intervention having concomitant moderate (2+ or 3+) secondary/functional MR.

PATIENTS AND METHODS

After obtaining approval from the Institutional Review Board, we retrospectively reviewed the records of patients who underwent transaortic edge-to-edge mitral valve repair at the time of aortic root/valve intervention. Between January 2012 and November 2016, 16 patients (age 24-76 years, 47.7 ± 16.9 years) underwent transaortic edge-to-edge mitral valve repair. MR was 2+ in 8 patients and 3+ in 6 patients. Two patients in whom cardiac arrest developed preoperatively had severe (4+) functional MR and were operated as salvage procedures. Edge-to-edge repair was not performed if MR was organic or eccentric. However, patients with rheumatic cause who had ventricular enlargement and annular dilatation without any evidence of cuspal or subvalvular pathology were included. Fifteen patients were primarily operated for severe aortic regurgitation (AR) \pm aortic root lesions. One patient had combined stenosis and regurgitation. The underlying aortic pathology was annuloaortic ectasia in 6 patients, annuloaortic ectasia with type A dissection in 1 patient, localized aneurysm of noncoronary sinus of Valsalva in 1 patient, bicuspid aortic valve with dilated sinuses in 3 patients, bicuspid valve with severe AR in 1 patient, rheumatic aortic valve disease in 3 patients, and degenerative aortic valve disease in 1 patient. A profile of the patients is shown in Table 1.

Assessment of severity of MR and evaluation of other echocardiographic parameters were performed by intraoperative transesophageal echocardiography (TEE). The mean left ventricular internal diameter in

end-systole and end-diastole were 51.5 ± 12.8 mm (range, 35-69) and 70.7 ± 10.7 mm (range, 54-85 mm), respectively. Left ventricular ejection fraction ranged from 20% to 60%. Six patients had severe dysfunction (left ventricular ejection fraction $\leq 30\%$). The echocardiographic parameters of individual patients are shown in Table 2.

Surgical Technique

Intraoperative TEE was performed in all patients after anesthetic induction. After excision of the aortic valve in cases of aortic valve replacement (but before repair is started in cases of aortic valve repair), the mitral valve was visualized through the aortic annulus. The mid portion of the A2 segment of the anterior mitral leaflet was approximated with the mid portion of the P2 segment of the posterior mitral leaflet in an area free of chordal attachments. This was achieved with a pledgeted horizontal mattress stitch with 4-0 polypropylene suture taken 3 to 4 mm from the edge of the leaflet (Figure 1). The stitch was reinforced with 2 to 3 throws of the same suture. The technique of repair is shown in the accompanying Video 1.

Results of repair were assessed immediately by intraoperative TEE. The same echocardiographer performed all preoperative and postrepair TEE examinations. A pre-discharge transthoracic echocardiographic assessment was performed in all patients. Subsequently, patients were followed in the outpatient department by the single surgical team. Follow-up transthoracic echocardiographic assessment was performed by multiple echocardiographers at 3 months and annually thereafter.

RESULTS

Primary surgical procedure included Bentall's \pm hemi-arch replacement in 10 patients, aortic valve replacement in 5 patients, and noncoronary sinus replacement with aortic valve repair in 1 patient.

There was no operative mortality. The mean cardiopulmonary bypass time was 104 ± 30.5 minutes, and the mean aortic crossclamp time was 80.3 ± 21.5 minutes. Intraoperative TEE showed diminished severity of MR in all patients (Figure 2). There was trivial or no MR in 13 patients, mild (1+) MR in 2 patients, and moderate (2+) MR in 1 patient. There were no gradients across the mitral valve in 9 patients, less than 5 mm Hg in 6 patients, and 9 mm Hg in 1 patient (Table 2).

The median intensive care unit stay was 2 days, and the median duration of hospital stay was 7 days. Follow-up ranged from 2 weeks to 54 months (median, 20 months) and was 100% complete. There was no late death. One patient was in New York Heart Association class II at 1 year. All other patients were asymptomatic. Follow-up echocardiography showed trivial or no MR in 12 patients, mild MR in 2 patients, and moderate MR in 2 patients. One patient who had no MR intraoperatively developed mild MR after 3 months. In 1 patient, MR progressed from mild to moderate at 1 year. In 1 patient with moderate MR intraoperatively, it remained stable at 16 months (Table 2). None of the patients had significant mitral stenosis (mean gradient >5 mm Hg). Left ventricular internal diameter in end-systole and end-diastole decreased to 40.5 ± 10.3 (range, 28-64 mm) and 58.7 ± 11.6 (range, 42-74 mm), respectively. Ejection fraction also improved mildly (22%-65%).

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