Selective, segmental decalcification: a safe alternative to extensive debridement of a severely calcified annulus during repair of mitral regurgitation

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Keywords: Mitral valve repair, calcified annulus.

Word count: 1265

The authors declare that they have no competing interests.

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Resection of the calcium bar and creation of a more compressible annulus with pericardium is necessary in case of extensive calcification of the mitral valve annulus in patients with advanced myxomatous degenerative disease (1,2). Such annular bar calcification is technically challenging and represents a risk factor for death following mitral valve operations, because of AV rupture or encroachment of the coronary arteries (3,4). We describe a safe because limited segmental annular debridement, away from the coronary arteries that allows enough flexibility of the remaining calcified annulus to perform reduction annuloplasty in a young female patient with severe mitral regurgitation and a highly dilated and severely calcified mitral annulus.

CASE REPORT

A 44-year-old woman with severe mitral regurgitation was referred because of rapid increasing shortness of breath and impaired physical capacity (New York Heart Association class II-III).

The preoperative chest radiograph revealed a dilated and severely calcified mitral annulus. On preoperative echocardiogram, severe mitral regurgitation was confirmed with a Carpentier's Type I lack of leaflet coaptation due to a annular diameter larger than 60mm, without segmental prolapse and without stenosis (Fig. 1A). The left ventricular ejection fraction was 70% and the end-diastolic diameter of the left ventricle (LV) was 72mm. Coronary angiography showed normal coronaries, left dominant and highlighted the proximity of the circumflex artery along the bar calcification of the mitral annulus which extended from one trigon to the other (Fig. 1B).

Because of increasing symptoms and LV dilatation, indication for mitral valve repair or replacement was confirmed. Surgery was performed through median sternotomy and cardiopulmonary bypass was instituted using aortic and bicaval cannulation. The mitral valve was approached through a left atriotomy. The heaviest calcifications were located on the annulus bar between trigons but the leaflets and the subvalvular apparatus were free of calcifications.

In order to avoid replacement, edge-to-edge repair was first attempted but approximation of the anterior and posterior leaflets was impossible due to extreme antero-septal dimension of the dilated valve. Replacement was considered but placement of the sutures around the calcifications would have had a significant risk of circumflex coronary artery injury. In addition also the largest mechanical prosthesis (33 mm) wouldn't have matched with the size of the mitral annulus. The proximity of the circumflex artery and, in part also from the right coronary artery, made an extensive debridement of the annulus not appealing.

Finally, guided by the preoperative coronary angiography, an annular portion between P2 and P3 was defined where no coronary artery underlies the annulus (Fig. 1B). Detachment of the posterior leaflet from the annulus was performed and the calcified bar was completely resected up to the atrioventricular groove in a depth extension of about 2 cm. The defect was repaired with a xenopericardial patch and the posterior leaflet was sutured back to the annulus/atrial wall.

No sealant was used. This limited maneuver rendered the annulus more flexible and allowed a downsized ring annuloplasty with a 40mm saddle shaped mitral ring possible, by reducing significantly the initial annular diameter (Figure 3). Sutures for annuloplasty were partially stitched through the bar or atrial sided. Water test revealed no residual regurgitation and the surface of coaptation was larger than 1cm. After closure of the left atrium, cardiopulmonary bypass was discontinued without difficulty, and sinus rhythm returned spontaneously.

Intraoperative transesophageal echocardiography confirmed a surface of coaptation of 1.3cm with no residual regurgitation and a normal left ventricular function (Fig. 2A). The postoperative course was uneventful, oral anticoagulation was initiated for 3 months, and the patient was discharged in satisfactory condition. At six months follow up, clinical condition and echocardiographic examination remained stable.

DISCUSSION

Patients with extensive annular calcification who require mitral valve surgery may present significant challenges to the surgeon. Removal of the calcium bar with subsequent annular reconstruction has been recommended (1,2). However, this remains a major surgical challenge and is related to a higher operative mortality of up to 9.7% (3). In degenerative mitral valve disease with extensive calcification of the mitral annulus only, with absence of rheumatic disease and or significant calcification of leaflets or subvalvular structures, valve repair should be preferred over replacement, especially in young patients (2). Durable repair has been demonstrated after calcium debridement (4).

The patient presented in this short report had two distinct problems: 1./ the calcification of the annulus and 2./ the huge diameter of the mitral annulus (around 6 cm). In addition, coronary angiography demonstrated a dangerous proximity of the circumflex artery to the calcified mitral annulus. To limit the risk of the procedure, we used a technique that differs slightly from that described by others: we decided to limit the decalcification to an annular segment where no coronary artery could be damaged. The extension of the debridement was thereby limited to the purpose of disrupting annular rigidity and allowing enough flexibility to perform a down-sized annuloplasty and achieve better leaflet coaptation. Of course, the risk of atrio-ventricular disruption still exists at the site of decalcification but the patch reconstruction is greatly facilitated when the gap is limited. An edge-to-edge repair was considered but the antero-septal dimensions of the valve made this not suitable. In addition, suboptimal results of this technique without annuloplasty or in cases with calcified annulus have been reported (5).

Although clinical result with intact valve repair was still excellent after 6 months, we remain concerned about late ring dehiscence, despite the fact that the great surface of coaptation achieved probably reliefs the annulus from tension. Also, potential progression of the remaining calcification that may later extend to the leaflets or chordae remains an issue but, again, if tension of the annulus is reduced, progression of the disease may be delayed.

The technique of selective, limited, segmental debridement of the mitral annulus to provide enough flexibility for annuloplasty was relatively easy to perform and is easily reproducible in the presence of heavily calcified mitral annulus combined to huge annular dilatation. This technique most probably limits the risk of damage to the coronary arteries.

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LEGEND TO THE FIGURES:

Figure 1A:

Preoperative angiography and echocardiography show the dilated and calcified mitral annulus.

Figure 1B

Mitral annulus segment without proximity of the circumflex coronary artery or the right coronary artery (within white frame).

Figure 2A

Transesophageal echocardiography shows no residual regurgitation and significantly improved leaflet coaptation.

Figure 2B

Chest radiograph at discharge. Arrow points at created bar gap.

Figure 3

Cartoon of the surgical technique.