

Mitral Valve Replacement with Bileaflet Preservation for Complex Annular Calcification

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ABSTRACT

Extensive calcification of mitral apparatus may preclude optimal valve repair, thus requiring debridement. We performed mitral valve replacement in a 55-year-old woman with a modified bileaflet preservation technique to avoid complications related to extensive debridement. Posterior transposition of the anterior leaflet as a buttress over the posterior ventricular wall provided extra support for the weakened tissues and covered the decalcified areas, which protected against debris embolism. This technique is safe and reproducible, especially for elderly patients who have complex calcification that requires extensive debridement, enables better preservation of ventricular function, and avoids disruption of the mechanical left ventricular wall.

INTRODUCTION

Although valve repair is the desired technique to treat mitral valve pathologies of all etiologies, extensive calcification with the involvement of leaflets and subvalvular tissue may preclude an optimal repair. The extension of the calcification process to the posterior annulus, with the involvement of the leaflets and subvalvular tissue, may necessitate valve replacement with posterior leaflet resection, particularly in elderly patients and those with connective tissue disorders. The latter situation may also lead to technical difficulties in seating the prosthesis during valve replacement and is associated with an increased frequency of periprosthetic leakage. Extensive decalcification of the annulus may lead to either atrioventricular separation, coronary artery disruption, or cardiac rupture—contrary to the protective effects of leaflet preservation on left ventricular function [Lee 1996; Casselman 1999; Fukada 2005]. In this report, we present a case of mitral valve replacement technique with posterior left ventricular wall augmentation in a 55-year-old lady with a heavily calcified mitral annulus that extended to the left ventricular and atrial walls.

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CASE REPORT

A 55-year-old female patient with severe mitral regurgitation was referred to our clinic for surgery. Her plain chest radiogram revealed an increased cardiothoracic index with visible calcification of the mitral annulus (Figure 1A). Her contrast-enhanced computed tomography revealed severe calcification of the annulus with subvalvular extension (Figure 1B). Her intraoperative transesophageal echocardiogram showed severe mitral regurgitation with mitral annular calcification extending to the atrial and left ventricular walls and to the interatrial septum (Figure 2A). Following the standard median sternotomy and cardiopulmonary bypass, a left atriotomy revealed severe left atrial and mitral annular calcification that extended to subvalvular structures, which prevented a successful repair procedure. Mitral valve replacement, with a St. Jude® no. 29 (St. Jude Medical Inc., St. Paul, MN, USA) mechanical prosthetic valve, was performed with a novel posterior left ventricular wall that provided support during the procedure and modified the aforementioned chordal preservation technique [Kuralay 2002; Fuster 2007]. Separation of fused commissures and fused, thickened chordae was followed by decalcification of annulus and subvalvular tissues, including the posterior left ventricular wall. The anterior leaflet was incised at the base from its attachment to the anterior annulus and mobilized onto the debrided posterior leaflet (Figure 3A). Pletgetted 2-0 Ti-Cron

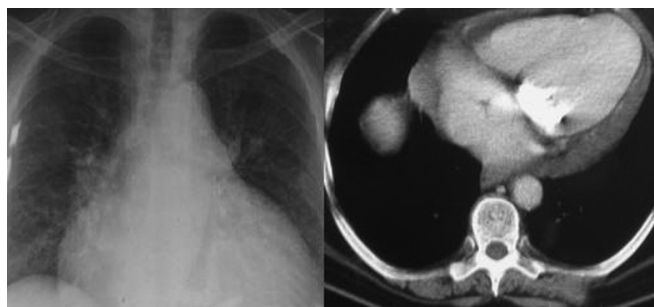


Figure 1. A, Plain chest radiogram demonstrating a ring-like calcification of the mitral annulus. B, Annular calcification extending to subvalvular chordae visible on transverse sections of computed tomography.

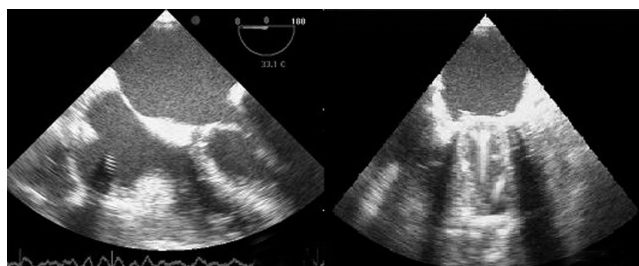


Figure 2. A, Preoperative transesophageal echocardiography demonstrating severe calcification of the mitral annulus, interatrial septum, and the lateral atrial wall. B, Perioperative echocardiography demonstrating normal prosthetic function after valve implantation.

(Davis & Geck, Wayne, NJ, USA) sutures were passed from the posterior atrial tissue to free edges of the posterior leaflet, and the bottom portion of the anterior leaflet before passing through the prosthesis. The free margin of the anterior leaflet was then oriented toward the left ventricular cavity, over the posterior wall, and was buttressed over the decalcified, subannular ventricular wall with Teflon felt. A second pericardial patch was attached to the Teflon felt along the medial third of the posterior wall and used for the same purpose (Figures 3A-D and 4). The latter maneuver avoided a space-occupying effect of thicker Teflon along the medial border below the mechanical valve. Transposition of the anterior leaflet and the chordae to the posterior annulus allowed for bileaflet preservation and augmentation of both the posterior annulus and thinned left ventricular posterior wall. The patient was weaned off bypass with low-dose dopamine following a standard valve implantation and left atrial closure. Twelve of the 16 pledgetted 2-0 Ti-Cron sutures that were used were passed along the posterior 2/3 of the mitral annulus. The patient was discharged to the

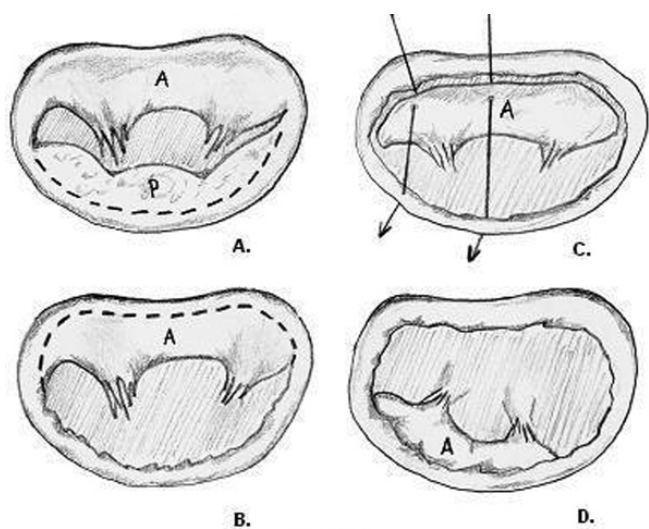


Figure 3. Illustration depicting the posterior transposition of the anterior leaflet and the subannular buttress with Teflon (A-D).

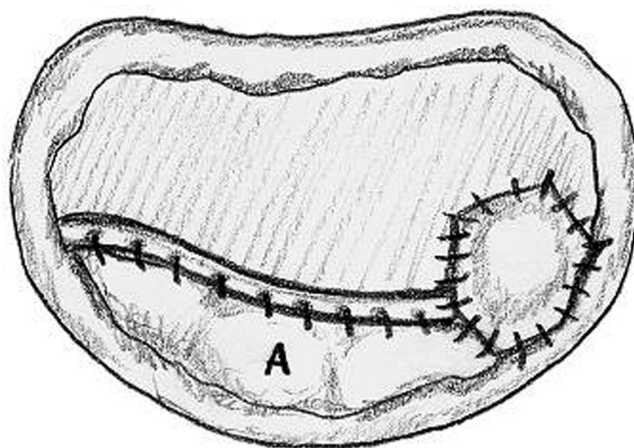


Figure 4. Illustration of the posterior transposition of the anterior leaflet and buttressing of the leaflet to posterior left ventricular wall with a Teflon felt. Note the pericardial support at posteromedial border of the ventricular wall and the annulus over the heavily debrided area.

hospital ward on day 1 and left the hospital on day 7 without any complications.

DISCUSSION

Extensive calcification of the mitral apparatus may hinder valve repair, consequently requiring replacement. Moreover, bulky calcification may interfere with suture placement and prosthetic implantation, causing a higher incidence of periprosthetic leakage. Extensive decalcification, as suggested by Carpentier et al [1996], may lead to an atrioventricular rupture, circumflex artery damage, or fragmentation of calcium debris with cerebrovascular events [Carpentier 1996]. Following mitral valve replacement, many surgeons are concerned about loss of annuloventricular continuity and preservation of left ventricular function [Casselmann 1999, Fukada 2005, Fuster 2007]. In this aspect, we modified the previously presented leaflet preservation techniques with posterior transposition of the anterior leaflet and the subvalvular apparatus. One major difference is that we also used the free margin of the anterior leaflet, which has a larger area, to buttress the debrided ventricular wall and the annulus. A Teflon felt collar was used to attach the leaflet margin to the posterior wall. Along the posteromedial border, a pericardial patch was attached to the medial margin of the anterior leaflet and the corresponding end of the Teflon felt to cover the posteromedial left ventricular wall. This augmentation technique was considered in an attempt to avoid direct pressure on the decalcified left ventricular wall and the annulus. Another benefit may be the avoidance of embolization from calcium fragments in the debrided areas completely covered by the anterior leaflet and the felts.

A posterior affixation of the anterior leaflet has been criticized for causing possible weakness on the anterior regional wall, because the posterior annulus is excessively strengthened with preserved chordae [Kuralay 2002]. Leaving the anterior leaflet in situ to overcome such a weakness,

however, may lead to a risk of left ventricular outflow tract obstruction. This is the case because of the systolic anterior movement of the native leaflet and the redundant chordae, and to a reduction in left ventricular size. An extensive decalcification from the annulus and the posterior wall was necessary, despite leaving weak annular and ventricular tissue. A modified augmentation technique was used to support these structures and left ventricular function, with a secondary benefit of avoiding embolic phenomena. It is desirable to avoid using synthetic materials such as Teflon; nevertheless, it is possible that pericardial felt might not have provided adequate support to the severely debrided posterior wall. Along the posteromedial wall, however, a pericardial extension was used to eliminate interference with mechanical prosthetic function.

This technique is safe and reproducible, particularly in elderly patients with complex calcification that requires extensive debridement, such as in our case. This method may also enable better preservation of ventricular function and prevent disruption of the mechanical left ventricular wall.

REFERENCES

- Carpentier AF, Pellerin M, Fuzellier JF, Relland JY. 1996. Extensive calcification of the mitral annulus: pathology and surgical management. *J Thorac Cardiovasc Surg* 111:718-30.
- Casselmann FP, Gillinov AM, McDonald ML, Cosgrove III DM. 1999. Use of anterior mitral leaflet to reinforce the posterior mitral annulus after debridement of calcium. *Ann Thorac Surg* 68:261-2.
- Fukada Y, Matsui Y, Sasaki Y, Yasuda K. 2005. A case of mitral valve replacement with a collar-reinforced prosthetic valve for heavily calcified mitral annulus. *Ann Thorac Cardiovasc Surg* 11:260-3.
- Fuster RG, Rodriguez I, Estevez V, Vazquez A. 2007. Posterior transposition of anterior leaflet for complete chordal preservation. *Eur J Cardiothorac Surg* 31:550-551.
- Kuralay E, Demirkilic U, Gunay C, Tatar H. 2002. Mitral valve replacement with bileaflet preservation: a modified technique. *Eur J Cardiothorac Surg* 22:630-2.
- Lee EM, Shapiro LM, Wells FC. 1996. Importance of subvalvular preservation and early operation in mitral valve surgery. *Circulation* 94:2117-23.