Posterior Leaflet Detachment, Augmentation, and Reconstruction for Treatment of Functional Mitral Valve Regurgitation

Rakesh M. Suri, MD, D.Phil,[*] *and Hartzell V. Schaff, MD*[†]

Functional mitral regurgitation caused posterior leaflet tethering and central malcoaptation treated utilizing undersized annuloplasty alone is associated with high rates of early failure. We report the technical stepsnecessary for near complete near complete detachment, augmentation and reconstruction of a thin and diminutive posterior mitral leaflet to reproducibly re-establish normal mitral leaflet coaptation and eliminate functional MR.

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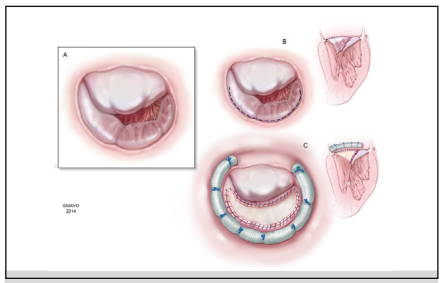

(A) Posterior leaflet tethering, (B) detachment, and (C) patch augmentation and insertion of 58-mm posterior flexible annuloplasty band anchored between fibrous trigones.

Central Message

Posterior mitral valve leaflet augmentation plus flexible posterior annuloplasty used to treat functional mitral valve regurgitation is capable of restoring mitral valve leaflet coaptation and eliminating regurgitation.

See Editorial Commentary on page 95–96.

INTRODUCTION

Functional mitral regurgitation, characterized by posterior leaflet tethering and central malcoaptation, has typically been treated using undersized annuloplasty alone. The recurrence of mitral regurgitation (MR) following this procedure has led to mitral valve replacement becoming a favored option.[1-3] When a nonelderly individual presents with this condition, however, it becomes appealing to consider the possibility of mitral valve repair to free patients from long-term oral anticoagulation or bioprosthetic mitral degeneration. We report the technical steps necessary for near-complete detachment, augmentation, and reconstruction of a thin and diminutive posterior mitral leaflet to reproducibly reestablish normal mitral leaflet coaptation and eliminate functional MR.

CLINICAL SUMMARY

A 68-year-old man presented with progressive New York Heart Association (NYHA) III heart failure symptoms. Medical history included chronic atrial fibrillation with history of catheter-based ablation, and hypothyroidism. On physical examination, the patient had a 3/6 systolic murmur at the left ventricular apex. Transthoracic echocardiogram revealed a left ventricular ejection fraction of 62%, tethering of the posterior mitral leaflet, anterior leaflet override, severe MR, a regurgitant volume of 62 cc, and a right ventricular systolic pressure of 42 mm Hg. Left ventricular end diastolic dimension was 6.6 cm and end systolic diameter was 4.3 cm, with a left atrial volume index of 70 cc/m^2. Cardiac catheterization revealed normal coronary arteries. The patient was offered mitral valve repair.

Following ministernotomy, heparinization, and aorto—-right atrial cannulation along with antegrade cold blood cardiopolegic arrest, the left atrium was opened via an incision posterior to the interatrial groove to expose the mitral valve. The left atrial appendage was excluded. Findings were as described on preoperative echocardiogram, including extensive posterior mitral leaflet tethering and diminished mobility of most of the length of the posterior mitral leaflet itself along with annular dilation (Figs. 1 and 2A and B). The nearly translucent and thin posterior mitral leaflet was detached from the muscular annulus itself (Fig. 1C), leaving several millimeters connected at both commissures. Secondary chordae tendinae were not divided. Despite the shortened leaflet height and delicate tissue quality, there was uniformly preserved chordal support to the leading edge of posterior mitral

[*]Department of Thoracic and Cardiovascular Surgery, Cleveland Clinic Foundation, Cleveland, Ohio
[†]Division of Cardiac Surgery, Mayo Clinic College of Medicine, Rochester, Minnesota

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Address reprint requests to Rakesh M. Suri, MD, DPhil, Department of Thoracic and Cardiovascular Surgery, Cleveland Clinic Foundation, 9500 Euclid Ave, J4-1, Cleveland, OH 44195. E-mail: surir@ccf.org

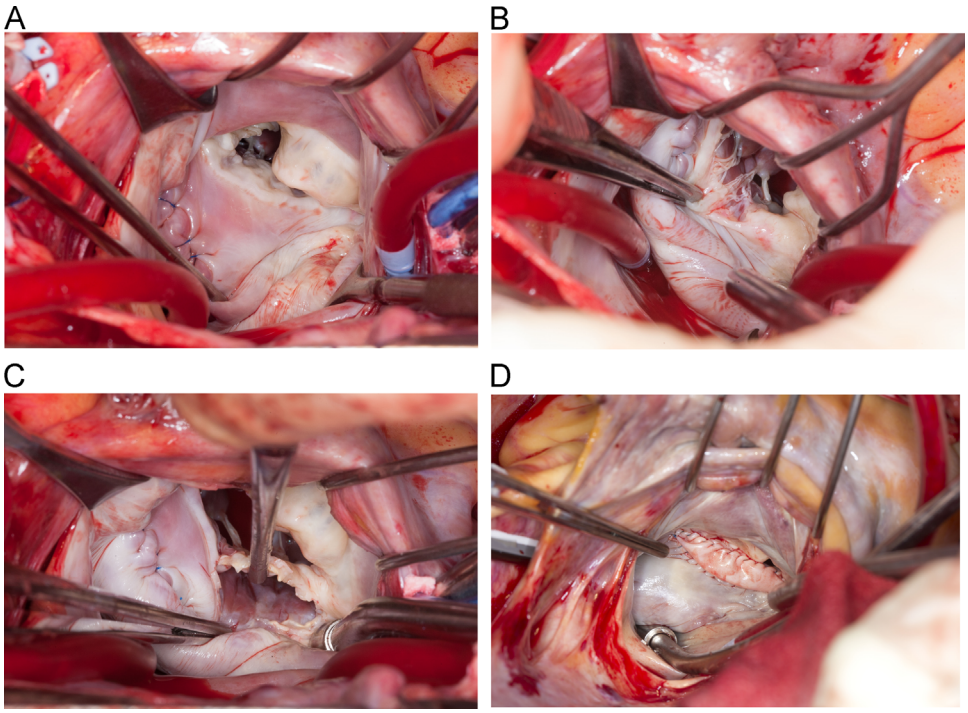

Figure 1. Technical steps for posterior leaflet augmentation. (A) Intraoperative photograph of extensive posterior leaflet restriction involving the entire posterior mitral valve leaflet, particularly, the lateral aspect. (B) Demonstration of native chordae tendineae tethering. (C) Detachment of the entire posterior margin of the posterior mitral valve leaflet with preservation of native chordae tendineae. (D) Completed augmentation repair using supple oval bovine pericardial patch to augment the posterior margin of almost the entire posterior mitral valve leaflet-annular junction. (Color version of figure is available online at http://www.semthorcardiovascsurg.com.)

leaflet. An oversized oval-shaped bovine pericardial patch was then fashioned and sewn into place circumferentially using 5-0 PROLENE suture (Fig. 1D). An slightly undersized 58-mm posterior flexible annuloplasty band was anchored between left and right fibrous trigones interrupted 3-0 Ethibond sutures (Figs. 1 D and E, and 2C). Following deairing, closure of the left atrium, release of cross clamp, and separation from cardiopulmonary bypass, transesophageal echocardiogram documented preserved ejection fraction and trivial residual MR with a transmitral gradient of 2 mm Hg. The patient was dismissed from hospital 4 days later with trivial residual MR confirmed via transthoracic echocardiogram.

DISCUSSION

A variety of techniques exist to correct the vexing problem of MR due to leaflet tethering.[2,4-6] The fundamental anatomical abnormality is relative paucity of posterior mitral leaflet tissue, which fails to coapt with the anterior leaflet, leading to regurgitation gap and ventriculoatrial regurgitation during ventricular systole. Although in myxomatous mitral valve disease there is an excess of proliferative leaflet tissue caused by the expansion of leaflet surface area leading to prolapse into the left atrium, the opposite is true with leaflet tethering—a deficit of tissue exists leading to a restricted "hyperventricularized" leaflet tip.

de Varennes et al describe the following steps in ischemic MR: "the posterior leaflet was then detached at its base from the middle of P2 all the way up to the posterior commissure. Annuloplasty sutures were then applied around the circumference of the mitral annulus."[7] Our strategy extends this principle, in that we detach almost the entire posterior margin of the tethered leaflet and suture a patch along the posterior margin from commissure to commissure. Dion et al detailed the following in rheumatic disease: "after dividing most of the secondary chords, the posterior leaflet is detached from the posterior annulus from commissure to commissure, the height and the length of the pericardial patch are measured and a slightly oversized annuloplasty ring is selected."[8]

Our technique differs from those outlined in prior reports in several unique ways. First we do not divide secondary cords but instead existing chordal support to develop a robust margin of