Mitral valve repair using the peeling, endarterectomy, and decortication technique for debulking thick leaflets

Jaishankar Raman, MBBS, PhD, FRACS,[a,b,c] Pankaj Saxena, MBBS, PhD, FRACS,[d] Varun Sharma, MBBS, MPH,[a,b] Andrew Newcomb, MBBS, FRACS,[c] and A. Sampath Kumar, MBBS MS, MCh,[e] Melbourne and Townsville, Australia, and New Delhi, India

From the [a]Department of Cardiac Surgery, Austin Health, Heidelberg, Melbourne, Australia; [b]Department of Surgery, Melbourne Medical School, University of Melbourne, Melbourne, Australia; [c]Department of Cardiac Surgery, St Vincent's Hospital, Melbourne, Melbourne, Australia; [d]Department of Cardiothoracic Surgery, Townsville University Hospital, Townsville, Queensland, Australia; and [e]Department of Cardiac Surgery, All India Institute of Medical Sciences, New Delhi, India.

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Address for reprints: Jaishankar Raman, MBBS, PhD, FRACS, Department of Cardiothoracic Surgery, St Vincent's Health, University of Melbourne, Level 4, 41, Victoria Parade, Fitzroy North, Melbourne 3065, Australia (E-mail: jraman@unimelb.edu.au).

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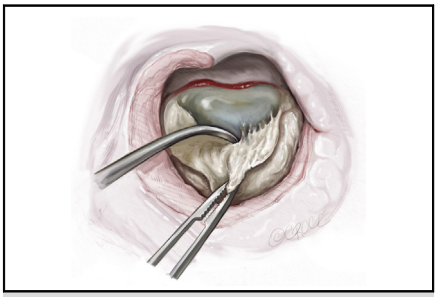

Elevation and mobilization of fibrous rind over mitral leaflet.

CENTRAL MESSAGE

Thickened mitral valve leaflets can made more pliable by the PED technique, enhancing the prospect of repair in these patients.

The burden of mitral valve disease has doubled over the past 30 years, linked to the aging of society, with an estimated 12.6 million deaths in 2017.[1] Mitral repair remains the intervention of choice where possible, avoiding the need for anticoagulation therapy or prosthetic degeneration.[2,3] Options for repair become limited in the presence of severe valvular thickening and subvalvular fibrosis due to technical challenges. Repair techniques have been described in patients with rheumatic heart disease to deal with thickened mitral valve leaflets,[4-6] by either leaflet peeling or cusp thinning. This has not been described in detail in nonrheumatic mitral valve diseases. We have used the current technique in patients with myxomatous mitral valve disease, infective endocarditis, functional mitral regurgitation, and connective tissue disorders to reduce the thickness of the leaflets using a combination of peeling, endarterectomy, and decortication (PED). We illustrate this with a typical application in a patient with myxomatous mitral valve disease who had significant thickening of both leaflets with posterior leaflet prolapse.

TECHNIQUE

The mitral valve is exposed using standard techniques and analyzed using the saline test. This is accompanied by standard valve assessment techniques. The elements of the PED technique can be applied to mitral leaflets that appear fibrotic or thickened (Figure 1, *A*). This technique can be applied to 1 or both leaflets.

If both leaflets appear thickened, the PED repair begins along the posterior leaflet. Typically, a square-ended forceps is used to gently develop the plane of fibrous layer near the annulus and at times from the posterior wall of the left atrium. This layer usually peels off from the entire leaflet surface up to the coaptation zone. The plane on the anterior leaflet is then developed using a No. 15 blade or using 2 sets of forceps, starting from the junction of the leaflet and the annulus. Gentle retraction is provided either through the free edge of the valve or the fibrous layer itself using a DeBakey forceps. Once the plane has been entered, elevation and freeing up of the fibrous rind may be aided by a Watson-Cheyne dissector, peeling from the annular border to the free edge of the leaflet (Figure 1, *B*). This is analogous to an

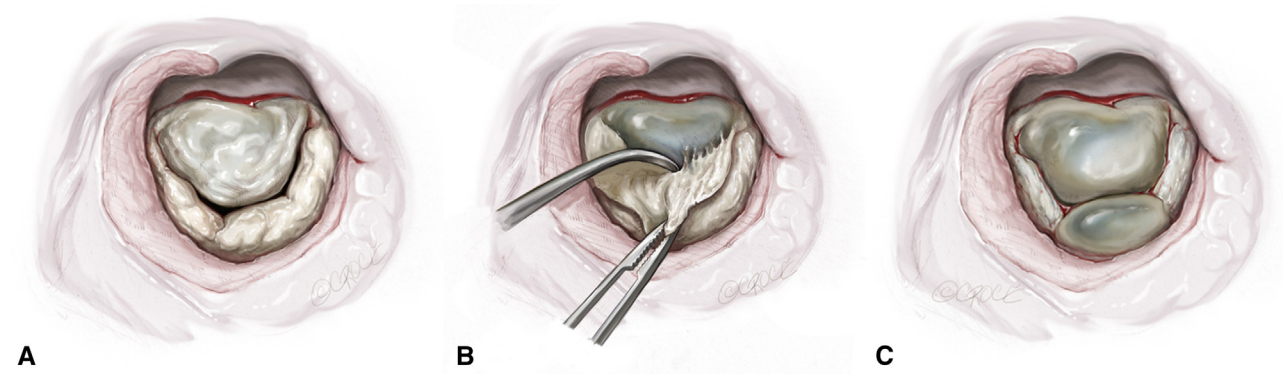

FIGURE 1. Schematic diagram of mitral valve peeling, endarterectomy, decortication procedure. A, Fibrotic appearance of both leaflets. B, Developing the plane between the fibrous rind and the underlying anterior leaflet. C, Fully freed up anterior leaflet and P2 scallop of the posterior leaflet.
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endarterectomy. Once fibrous tissue has been dissected off the valve and is only attached at the free edge of the valve, it may be excised using a Metzenbaum scissors.

Once PED is complete, the valve leaflets appear translucent (Figure 1, *C*) and the valve is tested in standard fashion. Repair of the posterior leaflet is performed as required, using a triangular resection and leaflet reconstruction. Annular repair is then undertaken using a flexible annuloplasty band or ring. Figure 2 shows intraoperative images of a typical PED repair that was as an adjunct to a posterior leaflet prolapse with a very thickened posterior leaflet. Adjunctive procedures such as leaflet resection and repair in this case, are easily combined with the PED repair.

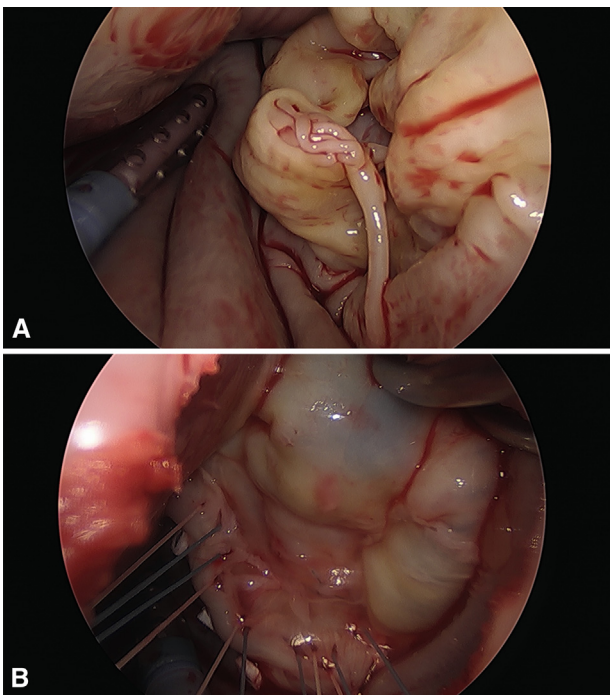

FIGURE 2. Operative views of leaflet repair using the peeling, endarterectomy, decortication (PED) procedure. A, Exposure of the mitral valve and assessment of the valve for PED procedure. B, Once complete, the leaflets are almost translucent, most prominently seen in the anterior leaflet in this figure.

For purposes of reporting this case, tissue removal and assessment along with outcomes evaluation are approved through the Ethics Committee, protocol No: HREC/73660/Austin-2021, and also approved for multisite use at the University of Melbourne Hospitals. The patients provided informed written consent for the procedure and the publication of their study data.

COMMENT

The PED technique provides a useful primary technique in a spectrum of mitral valve pathology where there is thickening of the mitral valve, including in patients with nonrheumatic heart disease. The current technique extends the option of repair to a spectrum of patients who would otherwise require valve replacement due to fibrous restriction of the leaflets. This technique is useful as an adjunctive procedure to other repair techniques, improving the quality of repair by facilitating increased mobility of the mitral valve leaflets. The underlying leaflets seem more pliable and have greater surface area for coaptation. This technique allows the removal of fibrous endocardium, analogous to endarterectomy of plaque filled arteries. The need for leaflet augmentation is virtually eliminated with the PED technique.

Methods addressing thickened mitral valves are crucial for both rheumatic and nonrheumatic pathologies. In this setting, the PED technique likely represents an addition to the armamentarium of techniques available for valvular repair, avoiding the need for conversion to valve replacement, which could subject patients to complications of anticoagulation or bioprosthetic degeneration. A key component of this repair is to be able to get into the right plane or develop the plane between the fibrous rind and the underlying leaflet. Repair of leaflets can be undertaken

if small perforations occur during the peeling process. However, we find it uncommon in our experience. This technique is not advised if there is calcification of the leaflets or calcified changes to the fibrous rind. However, as experience grows, mildly or partially calcified rinds can be removed safely. Our contention is that a fibrous rind is removed as in decortication of the lung. Intraoperative visual assessment of the adequacy of decortication are similar in both the lung and the mitral valve leaflets. However, long-term follow-up will inform us as to whether there is an influence on recurrence of fibrosis.

Mitral valve repair has evolved from leaflet resection of varying grades to leaflet preservation, chordal transfer to neochords, rigid to semi-rigid and flexible rings, and edge-to-edge repairs to MitraClip (Abbott) implants, based on intraoperative evaluations. The PED repair is another arrow in the quiver of a mitral valve repair surgeon. This technique utilizes favorable outcomes seen in rheumatic valve repair where the leaflet tissues are able to withstand the long-term hemodynamic stresses after repair. Although our article focuses on the technique, we have deployed this in more than 135 patients since 2009 in multiple institutions in North America and Australia. A detailed publication focusing on clinical and echocardiographic follow-up is being compiled.

CONCLUSIONS

We have described a new method for surgical repair using a PED combination technique, by illustrating its use in a patient with myxomatous mitral valve disease. This repair technique has not been well described in the literature to the best of our knowledge.

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