Mitral Valve repair using the Peeling, Endarterectomy & Decortication (PED) technique for debulking thick leaflets

Jaishankar Raman, MBBS PhD FRACS, Pankaj Saxena, MBBS PhD FRACS, Varun Sharma, MBBS MPH, Andrew Newcomb, MBBS FRACS, A. Sampath Kumar, MBBS MS MCh

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Mitral Valve repair using the Peeling, Endarterectomy & Decortication (PED) technique for debulking thick leaflets

Running Title: PED for mitral valve Repair

Jaishankar Raman MBBS PhD FRACS1,2,4, Pankaj Saxena MBBS PhD FRACS3, Varun Sharma MBBS MPH1,2, Andrew Newcomb, MBBS FRACS4, A Sampath Kumar MBBS MS MCh5

1) Department of Cardiac Surgery, Austin Health, Heidelberg, Melbourne, Australia
2) Department of Surgery, Melbourne Medical School, University of Melbourne, Melbourne, Australia
3) Department of Cardiothoracic Surgery, Townsville University Hospital, Townsville, Queensland, Australia
4) Department of Cardiac Surgery, St Vincent’s Hospital, Melbourne, Australia
5) Dept of Cardiac Surgery, All India Institute of Medical Sciences, New Delhi, India

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Corresponding Author

Prof. Jaishankar Raman
Department of Cardiac Surgery, St Vincent’s Health, University of Melbourne, Australia
jairaman2462@gmail.com
jraman@unimelb.edu.au
Central Message: Thickened mitral valve leaflets can be made more pliable by the PED (Peeling, Endarterectomy, Decortication) technique, enhancing the prospect of repair in these patients.

Perspective Statement: Thickened mitral valve leaflets are seen in a variety of conditions. Conventional repair techniques mention leaflet resection, implantation of neo-chords and annuloplasty. We have adapted elements of rheumatic mitral valve repair to come up with the PED repair (peeling, endarterectomy, decortication). This has so far not been described in the management of non-rheumatic mitral valve disease.

Legend for Central Picture: Elevation & Mobilization of Fibrous Rind over Mitral Leaflet
Abstract:

Repair remains the intervention of choice for mitral valve disease, but options for repair become limited in the presence of severe valvular thickening and sub-valvular fibrosis.

Repair techniques have been described in the rheumatic patients to deal with thickened mitral valve leaflets, by either leaflet peeling or cusp thinning. This has not been described in non-rheumatic mitral valve diseases. We have used a technique in patients with myxomatous and other non-rheumatic mitral valve diseases to reduce the thickness of the leaflets using a combination of peeling, endarterectomy and decortication (PED). We illustrate this with a typical case.
**Introduction**

The burden of mitral valve disease has doubled over the last 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 or prosthetic degeneration (2) (3). Options for repair become limited in the presence of severe valvular thickening and sub-valvular fibrosis, due to technical challenges. Repair techniques have been described in the rheumatic patients to deal with thickened mitral valve leaflets (4-6), by either leaflet peeling or cusp thinning. This has not been described in detail, in non-rheumatic mitral valve diseases. We have used the current technique in patients with myxomatous mitral valve disease, infective endocarditis, functional MR 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 1a). This technique can be applied to one 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 #15 blade or using two 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 & 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 1b). This is analogous to an 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 1c) 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 intra-operative images of a typical PED repair, which 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.

**IRB/Hospital Ethics Committee:** 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 multi-site use at the University of Melbourne Hospitals. The patient was 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 non-rheumatic patients. The current technique extends the option of repair to a spectrum of patients who would otherwise necessitate 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 non-rheumatic
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. Intra-operative 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 impact on recurrence of fibrosis.

Mitral valve repair has evolved from leaflet resection of varying grades to leaflet
preservation, chordal transfer to neo-chords, rigid to semi-rigid and flexible rings, edge-to-
edge repairs to MitraClip implants, etc. based on intra-operative evaluations. The PED repair
is another string to the bow 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. While the current publication focuses on the
technique, we have deployed this in over 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.

To conclude, we have described a new method for surgical repair using a combination of peeling, endarterectomy and decortication, 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.

Figure Legends

Figure 1 – Schematic diagram of mitral valve PED 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

Figure 2 – Operative Views of Leaflet repair using the 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.


Figures

Figure 1 (a): Pre-repair image of mitral valve with thickened opaque leaflets

Figure 1 (b): Rind over anterior leaflet being mobilized using a Watson-Cheyne dissector

Figure 1 (c): Anterior and posterior leaflets freed up with translucent appearance
Figure 2 (a): Pre-repair View of the Mitral Valve

Figure 2(b): Post PED Repair with translucent leaflets