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REVIEW

Surgical Techniques for the Management of the 'Hostile Mitral Annulus'

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The mitral annulus can be rendered hostile by several uncommon clinical situations such as infective endocarditis, calcification, or previous valve surgery. These can all lead to difficulties seating a prosthesis or annuloplasty ring. The posterior mitral annulus or anteriorly the intervalvar fibrous body can be affected. These situations continue to pose a formidable technical challenge to the cardiac surgeon in the operating room. We review the evidence around solutions for these problems with the intent of giving surgeons an overview of techniques to address these issues.

Keywords Mitral valve surgery • Endocarditis • Cardiac surgery • Redo cardiac surgery • Heart valve prosthesis • Mitral annular repair

Introduction

Degenerative mitral valve disease is common in Western society, and mitral valve surgery accounts for approximately 7% of operations in the STS database [1]. There are several clinical situations such as infective endocarditis, calcification, or previous valve operations that can cause difficulties managing the mitral annulus or of the intervalvar fibrous body and all continue to pose a formidable technical challenge to the cardiac surgeon. Surgical debridement of calcified or infected mitral annulus or explantation of a previous prosthesis can all render the mitral annulus friable, weak, and sometimes deficient, making it unsuitable for secure placement of a new mitral prosthesis. The patient is at risk from potentially fatal complications including intractable haemorrhage from atrioventricular disruption or ventricular rupture, and acute myocardial infarction secondary to circumflex artery injury. These situations may also affect seating of the prosthetic valve increasing the risk of paravalvular leak and its resulting complications. It is therefore not surprising that various surgical techniques have been used to approach these problems. The authors sought to review the surgical options and technical challenges in situations such as these, collectively referred to as 'the hostile mitral annulus'. These have been divided into techniques for mitral annular calcification (MAC) and the management of annular destructive lesions relating to endocarditis or redo valve replacement which can affect all parts of the mitral annulus including the intervalvar fibrous body.

Posterior Mitral Annular Calcification (MAC)

Mitral annular calcification (MAC) has been thoroughly classified by Carpentier et al. [2]. Although in severe cases it can affect the whole of the mitral annulus it is most commonly found to affect the posterior mitral annulus. It is a contributing factor in cardiac rupture at the atrioventricular junction, in rupture of the left ventricular free wall, and in injury to the circumflex artery. It is not surprising that it is sometimes referred to as 'the bar of death' and its presence leads some surgeons to avoid intervention on the mitral valve altogether. There are several described surgical strategies to deal with this challenge.

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One approach is to avoid excision of the calcium bar and to proceed with valve replacement without excising the calcium bar. Cammack et al. reported securing mitral prostheses to the calcium bar in a series of 11 patients with mitral annular calcification [3]. This technique is prone to paravalvular leak and/or dehiscence. This has been confirmed by Cammack and others [4,5]. In addition to paravalvular leak sutures placed deep to the calcium bar in an attempt to secure the valve may compromise the circumflex artery. Coselli and Crawford proposed securing the prosthesis to the leaflet tissue by plicating it with pledgetted mattress sutures [6] (Fig. 1). This technique necessitates downsizing the valve and sewing to fragile leaflet tissue which can generate issues with iatragenic mitral stenosis and paravalvular leak, respectively.

Mills and Okita in separate publications described the reinforcement of mitral prostheses with collars of pericardium or Dacron in order to assist in securing the mitral valve prosthesis, in patients with MAC and also in patients with endocarditis [7,8]. The prosthesis was secured by double-layered sutures, with the first row of buttressed sutures passing through the leaflet, collar and the sewing cuff of the prosthetic valve. The second row of running sutures secured the collar to the supra-annular left atrial wall (Fig. 2). Both groups encountered periprosthetic leakage in one of their patients. Gandjbakhch et al. described another approach that may avoid extensive annular dissection by placing the mitral prosthesis in an intra-atrial position. They used a specifically manufactured Dacron collar-reinforced prosthesis and stitched it to the left atrial wall using two rows of sutures. This group reported their experience with 36 patients in whom the mitral annulus had been destroyed by calcification (21 patients) or endocarditis (15 patients) [9,10]. There was high mortality (36%) and four patients needed reoperation for a dehisced prosthesis. Although the results in this series were suboptimal, these patients were felt to have no other option at the time of the publication. The concept of anchoring the prosthesis in two rows of sutures, thereby dispersing the haemodynamic stress, was widely accepted [11,12]. Caution is necessary, however, in patients with thin atrial tissues because of the possibility of tearing and lethal bleeding, as reported by the authors [10]. Another potential pitfall is the transfer of high left ventricular pressure into the left atrium, which may lead to severe haemorrhage, valve dehiscence, or late aneurysm.

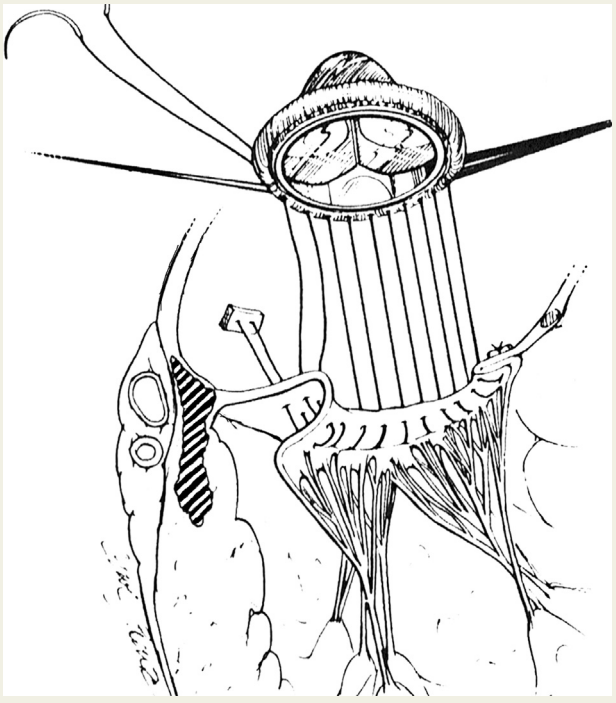

Figure 1 Technique of securing the prosthesis to the leaflet tissue.
Adapted and reprinted with permission [6].

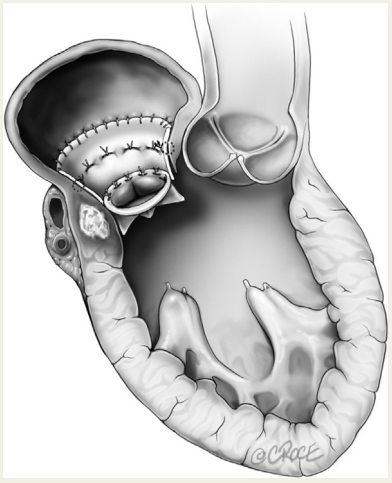

Figure 2 Intra-atrial insertion of Dacron collar reinforced mitral valve prosthesis. Illustration Beth Croce, CMI.

Ergin recommended partial ventricular translocation of the prosthesis along the posterior annulus, so that the weakened area of the annulus was left on the atrial side of the repair facing low pressure [13]. Although these techniques do not consistently achieve a stable valve replacement, they may still find application in an occasional case of an elderly individual with few options.

Mitral Annular Reconstruction

All surgeons will undertake thorough decalcification of the aortic annulus to achieve a stable aortic valve replacement while replacing the aortic valve for calcific aortic stenosis. Similarly, decalcification is necessary to create a supple mitral annulus for a stable mitral valve replacement. Decalcification, either partial or complete, has been proposed by several groups. Grossi et al. described partial decalcification of the annulus in a series of 64 patients [14]. They proposed debridement of calcium limited to the area of repair and reconstruction of the annulus using non-pledgetted vertical figure-of-eight sutures. The authors demonstrated that the