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CASE REPORT

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Partial ring annuloplasty in the management of mitral annular calcification

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Abstract

Mitral annular calcification (MAC) complicates the management of mitral valve (MV) disease, regardless of its etiology. Strategies to address MV surgery in MAC include two main options with their own pros and cons; respect and resect strategy. Here, we present a case of minimally-invasive MV repair with partial annuloplasty in the management of noncircumferential MAC with respect to strategy. This technique may be an alternative option for rescuing high-risk patients without extensive decalcification.

KEYWORDS
mitral annular calcification, mitral valve repair, partial annuloplasty

1 | INTRODUCTION

Mitral annular calcification (MAC) is a degenerative process of the mitral valve (MV) and primarily affects the posterior annulus, whereas it usually spares leaflets and anterior annulus.[1] It is associated with increased age, female sex, renal failure, previous mediastinal radiotherapy history.[1,2]

MAC complicates the management of MV disease in MV repair or replacement and is associated with increased mortality and morbidity.[3] Strategies to address MV surgery in MAC include two main options with their own pros and cons; annular decalcification followed by annular reconstruction (resect strategy) or MV surgery (MVS) with avoidance of annular decalcification (respect strategy). Here, we present a case of minimally-invasive MV repair with partial annuloplasty in the management of noncircumferential MAC.

1.1 | Case report

A 71-year-old female, without any known comorbidities except systemic hypertension, presented with progressive dyspnea (New York Heart Association functional class II). Transthoracic echocardiography (TTE) revealed severe mitral regurgitation (MR) with MV prolapse and flail leaflet at P2 and severe MAC at the posterior annulus.

Detailed cardiac imaging modalities such as transesophageal echocardiography (TEE) and multidetector computed tomography (MDCT) were used to assess the anatomy of MV and MAC extension. MDCT revealed a noncircumferential moderate MAC (CT-based MAC score = 4)[4] extending from anterior-lateral commissure to midpoint of P2 on the annular plane and no extension towards subvalvular apparatus and left ventricular myocardium (Figure 1A,B).

After a multidisciplinary heart team discussion, the patient was scheduled for a minimally-invasive MVS. Taking into consideration the

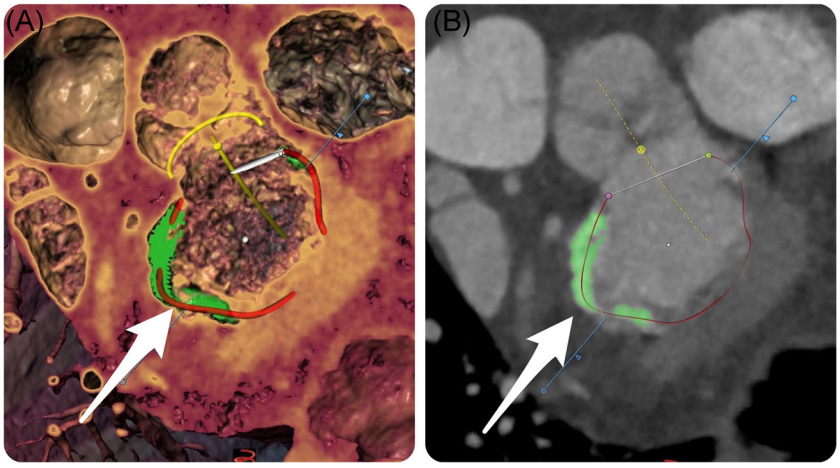

FIGURE 1 (A and B) Multidetector computed tomography images show mitral annular calcification (MAC) extension (arrow; in green color) at the lateral part of the posterior annulus and no MAC at the rest of mitral annulus and aorto-mitral continuity (red and yellow line).

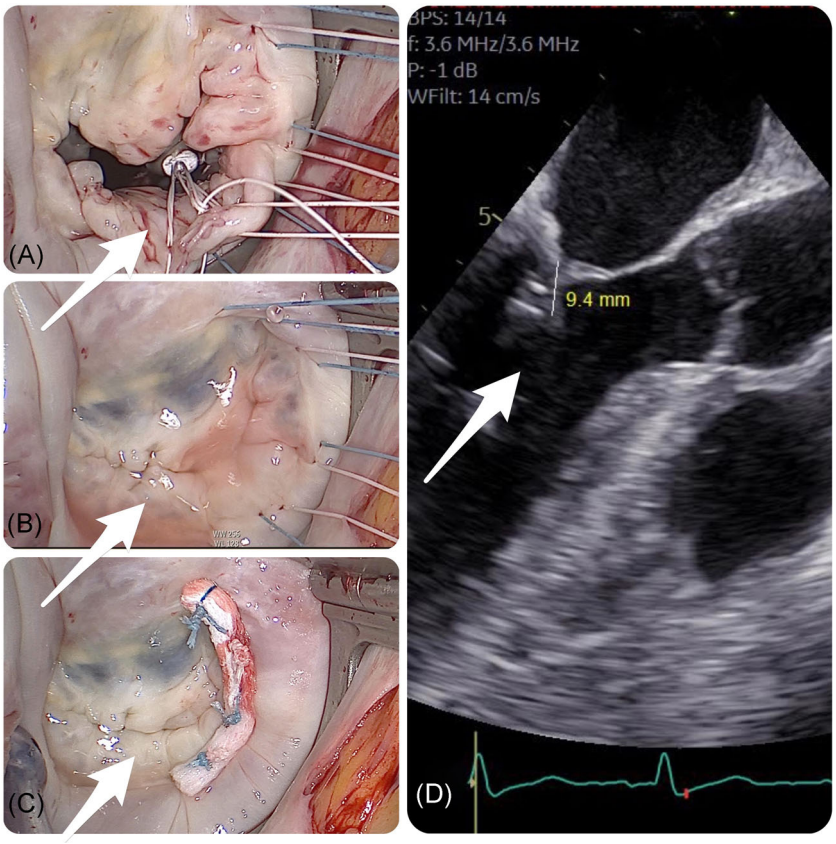

FIGURE 2 (A) Neochordae implantation onto the flail P2 segment. Saline test before (B) and after (C) partial ring annuloplasty. (D) Perioperative transesophageal echocardiography shows sufficient coaptation length and no relevant MR after mitral valve repair.

high risk of potential decalcification complications such as atrioventricular groove rupture, coronary artery injury, and stroke, the respect strategy including MV repair with partial annuloplasty was decided to be performed. Written informed consent was obtained from the patient.

A minimally-invasive approach through a right anterolateral mini-thoracotomy was performed and MV was visualized using a three-dimensional endoscope (Aesculap Einstein Vision). Cardiopulmonary bypass was established with percutaneous cannulation of the femoral artery (16 F Fem-Flex II; Edwards Lifescience) and vein (25 F Quickdraw femoral venous cannula; Edwards Lifesciences).

Preoperative findings regarding the anatomy of MV and extension of MAC were confirmed intraoperatively. The MV annulus and leaflet tissue were evaluated for the feasibility of leaflet repair. Since the likelihood of successful mitral repair was considered high, the treatment of choice was MV repair as planned preoperatively. Neochordae were placed onto the flail P2 segment (Figure 2A). Central regurgitation jet was shown in a saline test before annuloplasty (Figure 2B). MAC was kept in place to avoid manipulation and the MAC-free part of the posterior annulus (from the midpoint of P2 to posteromedial commissure) was supported with a

Cosgrove band which was cut at its midpoint. The saline test showed no residual MR (Figure 2C). Preoperative TEE, TTE in predischarge period and at 3 months follow-up revealed sufficient coaptation length (9.4 mm) (Figure 2D), low transmitral pressure gradient, and no relevant MR after MV repair. The patient was discharged from the intensive care unit the day after the operation and had an uneventful postoperative course.

2 | DISCUSSION

This case shows a minimally-invasive MV repair with an unconventional annuloplasty technique in a patient with noncircumferential MAC. The lessons learned from the present study can be summarized as follows: (1) Preoperative detailed cardiac imaging modalities provided further information regarding the anatomy of MV and MAC extension on an annular or vertical plane, which facilitate procedural planning preoperatively. (2) Partial annuloplasty of the MAC-free part of the MV annulus can be an alternative option in the case of noncircumferential MAC to minimize mortality and morbidity, and also potential risks of resect strategy.

MAC can cause MR or coexist with it. Regardless of the etiology of MR, MAC confronts the surgeons with challenges in the setting of MVS or transcatheter mitral valve replacement (TMVR). Although several strategies have been reported to overcome this challenging pathology, no surgical or transcatheter strategy has been described to be the gold standard. The strategies can be summarized in three subtitles; (1) resect strategy; extensive annular decalcification and reconstruction followed by MV repair or replacement. This technique provides theoretically better durability, less risk of paravalvular leakage, but it is also associated with risk of atrioventricular groove disruption and injury to surrounding structure.[5] (2) respect strategy-avoiding annular decalcification; intra-atrial or supra-annular MV replacement, oversized ring annuloplasty with sutures through or around the calcification and MV repair without ring annuloplasty. In these techniques, potential risks of extensive decalcification procedures may be minimized, but the risk of injury to surrounding structures on the annulus still exists in the case of suturing through or around the calcification. In addition, such techniques are also associated with the risk of lower repair durability, paravalvular leakage, or embolism of friable calcium.[6,7] It should be taken into account that MAC must be addressed to achieve successful repair in cases in which the MAC causes MR. (3) TMVR is becoming an alternative option for high-risk patients with several pros and cons. The main concern with TMVR is left ventricular outflow tract obstruction after valve replacement.[8]

Because MV repair has been already reported to provide better outcomes than replacement, the feasibility of repair should be considered, even if MAC is present.[9] In this concern, partial annuloplasty may provide an alternative option for patients with non-circumferential MAC. In the present case, partial annuloplasty with neochordae implantation was considered to be performed as the best choice of therapy with several arguments; (1) the calcified part of the annulus (anterolateral commissure to P2) is where the shortest distance between the annulus and the left circumflex artery (LCX) occurs and carries the highest risk for LCX injury in decalcification procedure or suturing through MAC. Keeping MAC in situ lowers the risk of injury to surrounding structures. (2) The extensively calcified part of the annulus is already supported by a so-called natural annuloplasty ring and will prevent annular dilatation on this segment. The rest of the posterior annulus is where ongoing annular dilatation occurs and it is one of the causes of insufficient leaflet coaptation length. The anterior annulus is already supported by fibrous tissue and theoretically does not dilate. In these terms, partial ring implantation followed by additional repair techniques such as neochordae implantation, cleft closure may be feasible in the management of non-circumferential MAC. (3) This technique may provide to lower potential risks of atrioventricular groove disruption and shorter cardiopulmonary bypass and aortic clamping time. But it should be emphasized that this technique should be considered as an alternative option when less than one-third of the annulus is affected by MAC.

In conclusion, MAC complicates the management of MV disease. Detailed imaging modalities can facilitate procedural planning preoperatively. Minimally-invasive MV repair with partial annuloplasty can be safely performed in patients with noncircumferential MAC. This technique may be an alternative option for rescuing high-risk patients without performing extensive decalcification procedures.

This report has not been published elsewhere nor is it currently under consideration for publication elsewhere.

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CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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