Case report - Valves

Enucleation of calcium core and in-situ valve replacement for massive posterior mitral annular calcification

Anan Nomura, Ikuo Fukuda*, Kazuyuki Daitoku, Kozo Fukui

Department of Thoracic and Cardiovascular Surgery, Hirosaki University Graduate School of Medicine, S-Zaifucho, Hirosaki, 036-8562 Aomori, Japan

Received 17 November 2010; received in revised form 29 December 2010; accepted 4 January 2011

Abstract

A 67-year-old female was admitted to our hospital for surgical treatment of the aortic and mitral valvular disease. She had chronic renal failure and dialysis was started 13 years previously. A diagnosis of severe aortic stenosis and regurgitation with severe mitral stenosis was made, and she underwent aortic valve and mitral valve replacement. Because mitral annular calcification had deeply invaded into the subvalvular region, enucleation of calcified core was performed using the ultrasonic aspiration system. The posterior mitral annulus was reconstructed using equine pericardium and aortic and mitral valve replacement was performed. The postoperative course was uneventful.

Keywords: Mitral annular calcification; Mitral valve replacement; Hemodialysis

1. Introduction

Calcified valvular heart disease is one of the serious complications of heart valve disease and mitral annular calcification (MAC) is a surgical challenge. Various approaches are proposed for this condition. Herein we report a case of aortic and mitral stenosis in a patient with hemodialysis. MAC was successfully treated by calcium core debridement using a Cavitron Ultrasonic Surgical Aspirator (CUSA®; Tyco Healthcare, Mansfield, MA, USA).

2. Case presentation

A 67-year-old female was admitted to our hospital for surgical treatment of combined aortic and mitral valvular disease. The patient had chronic renal failure due to chronic glomerular nephritis and a dialysis was started 13 years previously. Although an aortic valve and a mitral valve calcific stenosis were pointed out at that time, shortness of breath had developed recently. In addition, the patient showed hypotension during dialysis since the autumn of 2008, so that the administration of dopamine hydrochloride was required during dialysis.

Blood pressure and heart rate were 89/60 mmHg and 109 beats/min at admission, respectively. Echocardiography revealed a severely calcified tricuspid aortic valve and a severe mitral stenosis with heavily calcified posterior mitral annulus. Cardiac catheterization revealed the aortic valve peak pressure gradient was 97 mmHg, the aortic valve area was 1.0 cm², mitral valve area was 1.18 cm², systolic pulmonary artery pressure was 43 mmHg and pul-

*Corresponding author. Tel.: +81-172-395074; fax: +81-172-378340. E-mail address: ikuofuku@cc.hirosaki-u.ac.jp (I. Fukuda).
© 2011 Published by European Association for Cardio-Thoracic Surgery
Fig. 2. Intraoperative pictures of MAC. (a) and (b) Show pictures before enucleation of MAC. Calcified bar obliterated the mitral annulus and invaded to the subvalvular apparatus. (c) Indicates a picture during enucleation of calcification using CUSA. (d) Shows intraoperative view after reconstruction of the posterior mitral annulus. Satisfactory subvalvular space was obtained (from the left upper quadrant to the clockwise direction). MAC, mitral annular calcification; CUSA, Cavitron Ultrasonic Surgical Aspirator.

A diagnosis of severe aortic stenosis and regurgitation plus severe mitral stenosis was made. The patient underwent aortic valve and mitral valve replacement in November 2009. Logistic EuroSCORE was 27.1%. Cardiopulmonary bypass was established by aortic perfusion from the midportion of the ascending aorta and bicaval drainage. Aortic cross-clamp was applied under short-term circulatory arrest to avoid injury of the calcified aorta. Under intermittent selective coronary perfusion using crystalloid cardioplegic solution, severely calcified aortic valve was replaced with ATS 20 mm mechanical prosthesis (ATS Medical Inc, Minneapolis, MN, USA). The mitral annulus was obliterated by thick calcification of the posterior mitral ring and the posterior mitral leaflet. A calcified nodule extended to subvalvular apparatus including chordae tendinea and papillary muscles. Because the calcified hump bulged into the mitral orifice the mitral annular diameter was <20 mm. Since MAC had invaded deeply into the subvalvular region, we enucleated the calcified core of the MAC. An endocardium of the posterior mitral annulus was incised by a surgical knife, and then the calcium core was carefully destroyed and aspirated using CUSA at the energy level of 60% to obtain a diameter of 25 mm (Fig. 2c and Video 1). By this procedure, the calcium mass was reduced in size and a softened posterior mitral ring was attained. Then the opened endocardium was closed with interrupted 4-0 monofilament suture with equine pericardial strip to reinforce atrioventricular junction (Fig. 2d). The thickened anterior mitral leaflet was excised. Finally, a mitral valve replacement with a 25-mm ATS mechanical prosthesis was performed. The aortic cross-clamp time was 195 min and cardiopulmonary bypass time was 225 min. Because complete hemostasis was obtained, continuous hemofiltration was introduced on the postoperative day 1. Postoperative maximum MB fraction of serum creatinine kinase was 64 U/l (normal range <25 U/l).

Postoperative course was uneventful and the patient was discharged on the 19th postoperative day.

3. Discussion

The MAC is a degenerative process which is related to arterial sclerosis, chronic renal failure and aging. Although, the most popular cause of mitral stenosis is rheumatic valvular disease, the MAC can also cause severe mitral stenosis. In patients having MAC, the calcification usually extends from the lateral to the medial fibrous trigones along the posterior mitral annulus, unlike rheumatic mitral
stenosis [1]. Calcification extending to the valve ring, chordae tendinea, papillary muscle, left ventricle cardiac muscle is a characteristic of MAC [2]. Progressive calcification of the base of the posterior leaflet eventually restricts its mobility and also prevents contraction of the atrioventricular annulus [1].

In the present case, the mitral annulus was obliterated by a severely calcified bar bulging from the posterior mitral annulus. Therefore, removal of the calcified nodule was necessary. Complete debridement using rongeur forceps or surgical scissors may result in atrioventricular rupture, injury of the left circumflex artery and embolization of calcium [3]. When extensive resection of the posterior mitral annulus and the left ventricular wall is performed, reconstruction of the defect is technically demanding and the risk of the left ventricular rupture is not inconsequential. Therefore, a variety of different surgical techniques have been proposed to find a safe procedure. Di Stefano and colleagues reported that they passed pledgeted mattress sutures between the free edges of the leaflets and the atrial wall to create a new ring inside the native annulus [4]. El-Amin and colleagues reported that they used extra pledgeted sutures to plicate the left atrial tissue over the posterior aspect of the sewing ring. In the case of severe mitral regurgitation due to MAC, Atoui and colleagues reported intra-atrial insertion of the mitral prostheses leaving the native mitral valve untouched [5].

In our case, intra-annular insertion of the prosthetic valve was impossible due to a huge calcified bar on the posterior mitral ring. To relieve mitral stenosis, excision of the calcified bar was necessary. We eliminated only a core of MAC using CUSA to maintain left atrium and left ventricular continuity. By this method, the volume of calcific node was reduced gradually and softened tissue remained so the risk of left ventricle perforation was decreased. In-situ mitral valve replacement was possible without leaving subvalvular stenosis. To reinforce the posterior annulus we also put an equine pericardium on the part where calcification was removed, and rebuilt a mitral ring. CUSA was useful to crack and crush the calcium nodule without injuring the posterior left ventricular wall and mitral annulus.

We conclude that enucleation of calcium core using CUSA and reconstruction of posterior mitral annulus is helpful in this case.

References