Surgical treatment for double-valve destruction after balloon aortic valvuloplasty in a patient with porcelain aorta

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Abstract

We report a rare case of surgical treatment for double-valve destruction after balloon aortic valvuloplasty in a 90-year old female with severe aortic calcification. The patient underwent aortic balloon valvuloplasty for symptomatic aortic stenosis, resulting in severe aortic regurgitation because of injury to the right coronary cusp of the aortic valve and severe mitral regurgitation because of rupture of the chordae tendineae. She became haemodynamically unstable and required treatment with mechanical ventilation and assisted circulation. Urgent surgical treatment was planned. The patient’s porcelain aorta increased the difficulty of surgery, but the procedure was carefully planned, and aortic valve replacement and mitral valve repair were performed successfully without major complications. The patient had a satisfactory postoperative course and was transferred to another hospital for rehabilitation on the 8th postoperative day.

Keywords: Balloon aortic valvuloplasty • Acute aortic regurgitation • Acute mitral regurgitation • Porcelain aorta

INTRODUCTION

Although balloon aortic valvuloplasty (BAV) can reduce the cardiac symptoms in patients with severe aortic stenosis (AS), it is not usually considered a therapeutic option for AS because of the high risks of restenosis and severe complications [1, 2]. However, BAV is sometimes used as a bridge to transcatheter aortic valve implantation (TAVI) for AS. We experienced an extremely elderly patient with double-valve destruction after BAV and a severely calcified aorta, who required complex surgical treatment. To the best of our knowledge, this is the first report of such a case.

CASE REPORT

A 90-year old female underwent BAV at another hospital for symptomatic AS with a calculated aortic valve area of 0.25 cm². BAV was chosen because of the surgical risks associated with her advanced age and porcelain aorta. Post-procedural echocardiography showed severe aortic regurgitation because of injury to the right coronary cusp (RCC) of the aortic valve, and severe mitral regurgitation because of rupture of the chordae tendineae of the P1 component of the posterior mitral leaflet (Fig. 1A and B). As the preprocedural echocardiography examination did not show significant valvular regurgitation, the new regurgitation was thought to have resulted from the BAV procedure. The patient was initially treated conservatively, but her heart failure worsened. Mechanical ventilation was started and she was transferred to our hospital by helicopter for consideration of TAVI or surgery. On arrival, she was haemodynamically unstable and needed percutaneous cardiopulmonary bypass (CPB) to maintain her circulation. TAVI was denied because of the severe mitral regurgitation, and urgent surgical treatment was planned.

A median sternotomy was performed. CPB was established by cannulation of the left femoral artery and the superior and inferior vena cava. The ascending aorta was not suitable for clamping because of severe calcification (Fig. 1C). Short-term moderate hypothermic circulatory arrest was planned for decalcification of the aorta, as previously described [3]. CPB was started with moderate hypothermia (29°C), and decalcification of the aorta was performed under circulatory arrest with retrograde cerebral perfusion. The decalcification focused on the aortic cross-clamping site, aortic suture line and sinotubular junction. No local repair of the aortic wall was needed. After aortic cross-clamping, the injured valves were observed. In the aortic valve, the RCC was almost detached from the annulus on the side adjacent to the non-coronary cusp (Fig. 2A). In the mitral valve, the chordae tendineae of the P1 component were ruptured (Fig. 2B). Mitral valve repair with artificial chordae was performed without mitral annuloplasty, because of severe mitral annular calcification (Fig. 1D). Aortic valve replacement (AVR) was performed using a 21-mm bioprosthetic valve, followed by tricuspid valve annuloplasty using a 26-mm annuloplasty ring for functional severe tricuspid regurgitation. The patient was weaned off CPB without the need for percutaneous CPB. The CPB time was 183 min, circulatory arrest time was 16 min, aortic cross-clamping time was 134 min and operation time was 297 min.

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Continuous haemodialfiltration was needed after the operation for the treatment of anuria with progressive metabolic acidosis. The patient’s renal function subsequently improved, and, on day 4, the continuous haemodialfiltration was stopped and she was extubated. There was no neurological or major organ dysfunction. Postoperative echocardiography showed preserved left ventricular...
function with no significant valvular regurgitation, and the patient was transferred to another hospital for rehabilitation on the 8th postoperative day.

**DISCUSSION**

Since BAV was described by Cribier et al. in 1986 [1], it has become a useful method of relieving the symptoms of AS. However, BAV is now indicated exclusively as a bridge to TAVI, because of the high risks of restenosis and unacceptable complications. The Balloon Valvuloplasty Registry of The National Heart, Lung and Blood Institute reported that complications occur in about 31% of patients who undergo BAV, with a cardiac mortality rate of 8% before discharge [2]. Acute valvular insufficiency is reported to occur in 1% of patients who undergo BAV, especially aortic insufficiency [2]. Poor long-term outcomes have been reported after BAV without additional surgical treatment [4].

As the population ages, an increasing number of elderly patients seek surgical treatment for severe AS, and BAV followed by TAVI has become the treatment of choice for these patients. However, some studies reported that AVR was a feasible option for high-risk patients, with acceptable outcomes [5]. AVR should therefore be considered for the treatment of AS, even when TAVI is available.

Porcelain aorta increases the difficulty of cardiac surgery because of the increased risks of cerebrovascular accidents and other complications. Some strategies to minimize these complications have been described, including implantation of an apico-aortic conduit, graft replacement of the aorta and aortic cross-clamping after decalcification of the aorta under circulatory arrest [3]. The latter strategy was chosen in our case for anatomical reasons and to minimize the cardiac arrest time.

Our patient was in a critical state preoperatively, with a predicted operative mortality rate of 68.8% according to the EuroSCORE II interactive calculator. Fortunately, she had a satisfactory postoperative recovery without critical complications. However, the estimated risk was increased by the delay before surgery. When structural injury to the valves is detected after BAV and there is no clinical improvement, planning for further treatment (including surgical treatment) should start immediately. As the BAV procedure is associated with some risk, the heart team plays an important role in facilities where BAV is performed.

In summary, we present a rare case of double-valve destruction after BAV in an extremely elderly patient with a porcelain aorta, who underwent complicated surgical treatment. As BAV is performed with increasing frequency as a bridge to TAVI, the importance of involving the heart team in patient care is increasing.

**Conflict of interest:** none declared.

**REFERENCES**