

Urgent Balloon Aortic Valvuloplasty for Worsening Heart Failure in a Patient with Acute Myocardial Infarction and Critical Aortic Stenosis

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A 91-year-old man was admitted to our hospital with dyspnea and chest pain. His electrocardiogram showed ST-segment elevation in the V₁₋₄ leads, and an emergency coronary angiogram revealed subtotal occlusion in the left descending coronary artery. A successful primary percutaneous coronary intervention was subsequently performed using aspiration thrombectomy and bare metal stent implantation. However, his hemodynamic condition deteriorated with severe pulmonary congestion. Administration of inotropes with diuretics and mechanical ventilation were not effective, and an echocardiogram showed coexisting severe aortic stenosis. As a bailout procedure, we performed balloon aortic valvuloplasty (BAV) with a 12- and 14-mm balloon on the next day. After BAV, the patient's condition improved, and he was weaned from the ventilator. It is commonly understood that onset of acute myocardial infarction may trigger worsening of heart failure in patients with compensated aortic stenosis. However, emergency balloon aortic valvuloplasty, when timely administered, is considered a simple and effective procedure for such patients, and can lead to substantial clinical improvement.

Key Words: Acute coronary syndrome • Balloon aortic valvuloplasty • Congestive heart failure • Valvular heart disease

INTRODUCTION

Aortic stenosis (AS) is most commonly caused by age-related progressive calcification in elderly patients.¹ The progression of the stenosis is usually gradual; therefore, most AS patients remain compensated for an extended period of time before valve replacement is required. Many patients with AS also have comorbidities such as hypertension, coronary heart disease, and atrial fibrillation, all of which may influence the symptoms of AS.² If the patient's condition deteriorates rapidly be-

cause of one of these comorbidities, acute decompensated heart failure may occur, resulting in a serious condition. We report the case of a patient with long-standing compensated AS who required emergency aortic valvuloplasty after sudden hemodynamic decompensation occurring immediately after acute myocardial infarction (AMI).

CASE REPORT

A 91-year-old man with a history of cerebral infarction was admitted to our hospital with dyspnea and chest pain. His blood pressure was 109/77 mmHg, his heart rate was 102 bpm, and his oxygen saturation was 94% with an oxygen mask. An electrocardiogram showed ST-segment elevation in the V₁₋₄ leads, and echocardiography showed severe hypokinesis of the left ventricular anterior wall and AS, with an aortic valve area of

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0.48 cm². His myocardial enzyme levels for creatine kinase (CK), CK-MB, and troponin T were 296 IU/L, 33.5 IU/L, and 2.39 ng/mL, respectively. Subsequent coronary angiography revealed subtotal occlusion with a thrombus in the proximal left descending coronary artery (LAD) and thrombolysis in myocardial infarction (TIMI) grade 2 flow. Percutaneous coronary intervention (PCI) was performed with a door-to-balloon time of 103 minutes, and a bare metal stent (Integrity 2.5 × 22-mm, Medtronic, Minneapolis, MN, USA) was implanted into the LAD after aspiration thrombectomy and predilatation with a 2.5 × 14-mm balloon catheter (Figure 1). The maximum level of CK was 561 IU/L, and that of CK-MB was 84.6 IU/L. PCI did relieve the patient's chest pain; however, his pulmonary congestion worsened, and biphasic positive airway pressure support was initiated. Continuous administration of 3 mg/kg/h of dopamine, 2 mg/kg/h of dobutamine, and 10 mg/h of furosemide was not effective, and he was intubated on the second day after admission. Balloon aortic valvuloplasty (BAV) was performed 32 hours after primary PCI. A 7-Fr sheath introducer was inserted into the left femoral artery, and the aortic valve was crossed with a 0.035-inch super stiff guide wire via a retrograde approach using a 4-Fr diagnostic catheter. Balloon dilatation was performed using a 12 × 20-mm balloon catheter and then a 14 × 20-mm balloon catheter (XXL, Boston Scientific, Natick, MA, USA). To stabilize the balloon position during inflation, the right ventricle was paced at 180 bpm. A subsequent hemodynamic study showed improvement of mean trans-aortic pressure gradient from 54 mmHg to 40 mmHg (26% decrease) and aortic valve area from 0.48 cm² to 0.65 cm² (35% increase). Cardiac output also in-

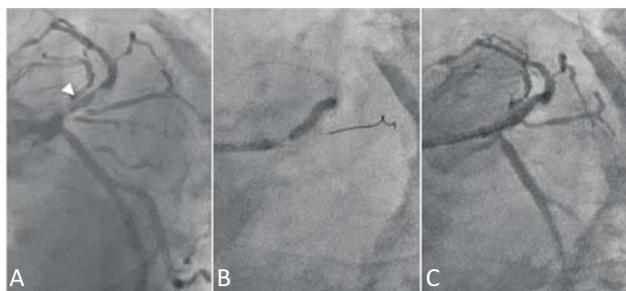


Figure 1. Angiogram on admission revealed subtotal occlusion with a thrombus (white arrow) in the proximal left anterior descending coronary artery (A) stent deployment, (B) led to a good angiographic result, (C) without any complication.

creased from 3.4 L/m to 4.4 L/m after final balloon dilatation. Mild aortic regurgitation had not worsened upon echocardiographic follow-up, and left ventricular ejection fractions before and after BAV were 32% and 28%, respectively. The patient's critical heart failure was gradually brought under control, and severe pulmonary edema was alleviated after BAV (Figure 2). The patient was successfully weaned from the ventilator on the eighth day and discharged to a rehabilitation hospital on the 39th day.

DISCUSSION

Here, we report a successful bailout procedure with valvuloplasty after primary PCI in a 91-year-old patient with severe AS who showed rapid decompensation after AMI of the anterior ventricular wall. The patient had a long-standing compensated AS, but his condition deteriorated after the AMI. Even after prompt primary PCI, his condition remained uncontrollable regardless of inotrope administration and use of mechanical ventilation. Therefore, release of the AS was considered mandatory. However, because of the patient's age, he was considered a high-risk surgical patient, and there was risk of renal, respiratory, and left ventricular dysfunction. In fact, his predicted mortality rate was 28.67% according to the European System for Cardiac Operative Risk Evaluation (EuroSCORE) II,³ and 64.2% according to the Society of Thoracic Surgeons (STS) score.⁴ Therefore, although the standard procedure for AS is valve replacement, surgery was considered unrealistic for this patient. As an alternative solution, we performed BAV.

The American College of Cardiology and the American Heart Association (ACC/AHA) guidelines suggest that BAV is a reasonable palliative treatment option in adult patients with AS, in whom aortic valve replace-



Figure 2. Chest radiograph on admission (A), 24 hours after primary PCI (B), and 4 days after BAV (C). BAV, balloon aortic valvuloplasty; PCI, percutaneous coronary intervention.

ment cannot be performed because of serious comorbidities (Class IIb, Level of Evidence: C).⁵ In accordance with this guideline, we believed that performing a palliative BAV would be a good treatment option for our patient.

In the BAV procedure, there is some concern about the approach site and balloon size used. In this case, BAV was performed under emergency circumstances using a conventional retrograde approach that involves a simple and brief procedure. However, an antegrade approach, which is reported to have fewer vascular complications than a retrograde approach, should also be considered.⁶

A palliative BAV was performed to control the decompensated heart failure. We tried to avoid overdilatation of the aortic valve; in the worst-case scenario, overdilatation may not only lead to an increase in aortic regurgitation but also to aortic sinus rupture. In this patient, dilatation with a 14-mm balloon decreased the transaortic pressure gradient by > 25% and did not increase aortic regurgitation. Nevertheless, there is concern about restenosis that requires repeated BAV procedures.^{7,8}

In the contemporary management of aortic stenosis, surgical valve replacement still remains the gold standard even if such patients have a substantially elevated level of surgical risk. Yet the indication for use of BAV should be decided carefully because of its limitations as well. For such patients, transcatheter aortic valve replacement is a potential alternative option.^{9,10} However, the limited approach site with a large puncture hole (the apical approach is difficult after AMI), the longer procedure time with larger volume of contrast medium, and the additional cost burden may be problematic in an AMI patient over 90 years of age.

CONCLUSIONS

Heart failure may occur in patients with AMI and AS, even if the long-standing AS had been compensated. In such patients, emergency aortic valvuloplasty may be an effective bailout procedure.

DISCLOSURE STATEMENT

The authors report no financial relationships or conflicts of interest regarding the content herein.

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