Case Report

Transvenous Transseptal Concurrent Inoue Balloon Mitral and Aortic Valvuloplasty in an Octogenarian With Severe Aortic and Mitral Stenosis

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ABSTRACT

An octogenarian was admitted because of severe aortic stenosis (AS) and mitral stenosis (MS). He declined surgical double-valve replacement and underwent intracardiac echocardiography–guided transseptal puncture and concurrent Inoue (Toray, Tokyo, Japan) balloon aortic valvuloplasty (BAV) and balloon mitral valvuloplasty (BMV). Nine months later, he had worsening pulmonary edema and received a second session of Inoue BAV and BMV. Our case shows that concurrent transseptal Inoue BAV and BMV can treat severe AS and mitral stenosis with adequate safety and efficacy. However, the durability is limited in elderly persons with calcified AS. The procedure should be reserved for patients who refuse surgery.

In decision making, fiscal constraint remained an issue for TAVI because many public insurances did not reimburse for expensive devices.

We present an octogenarian with severe MS and AS who strongly declined surgical double-valve replacement. Within 1.5 years, he underwent 2 rescue sessions of intracardiac echocardiography (ICE)-guided transseptal and concurrent transvenous transseptal BAV and BMV for relieving pulmonary edema.

REFERENCES

Combined severe aortic stenosis (AS) and mitral stenosis (MS) is double obstruction of blood flow at the left side of the heart, resulting in a lower cardiac output and pulmonary edema. In the coexistence of MS and AS, the severity of valve stenosis can be underestimated because of the low-flow and low-gradient situation. The standard management should be combined surgical aortic and mitral valve replacement. Other options include transcatheter aortic valve implantation (TAVI) plus percutaneous transseptal Inoue (Toray, Tokyo, Japan) balloon mitral valvuloplasty (BMV), concurrent transvenous transseptal Inoue balloon aortic valvuloplasty (BAV) and BMV, or transvenous transseptal BMV and retrograde transarterial BAV.

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He strongly declined surgical double valve replacement after a full discussion with the cardiac surgeons. The heart team rejected him as a candidate for TAVI because of combined severe MS. The patient had pulmonary edema and persistent heart failure signs, so we decided to perform transvenous transseptal concurrent BAV and BMV on December 30, 2013. We followed the protocol proposed by Abdou et al., except that we modified the procedure using ICE to guide the transseptal puncture (Fig. 1). In brief, the transatrial septal puncture was performed using a Brockenbrough needle and Mullins sheath with ICE guidance (Figs. 1 and 2A). After transseptal puncture, the Mullins sheath was advanced from the right atrium (RA) to the left atrium (LA) (Fig. 2B) and positioned in the left ventricle (LV) (Fig. 2C). A Swan-Ganz balloon catheter was then advanced through the Mullins sheath to reach the LV and looped around the LV apex (Fig. 2G).2 Afterward, the BMV was done with the same Inoue balloon inflated up to 24 mm at the mitral annulus level (Fig. 2H).2 The transaortic valve mean pressure gradient decreased from 35 to 10 mm Hg, and the transmitral valve mean pressure gradient decreased from 15 to 5 mm Hg after intervention. Pulmonary edema resolved in the following days, and the patient was discharged uneventfully. Nine months after the first intervention, he developed pulmonary edema and was again admitted to our hospital (Taichung Veterans General Hospital). The echocardiogram showed moderate severe AS with a transaortic valve mean pressure gradient of 23 mm Hg and moderately severe MS with transmitral valve mean pressure gradient of 8 mm Hg. A repeated session of concurrent transvenous/transseptal Inoue BAV and BMV was performed successfully in September 2014. Pulmonary edema improved, and a few days later the patient was discharged. In January 2015, TAVI was scheduled, but the patient had tarry stool and coffee-grounds vomitus on the admission day and the plan was postponed. In February 2015, the patient fell accidentally, resulting in a bad head trauma with severe subdural hematoma. He died after neurosurgery.

Discussion

Antegrade transseptal concurrent Inoue balloon concurrent BAV and BMV has been proposed as an effective alternative treatment for subjects with combined AS and MS since 1998.3 The method has been modified in various versions over the past 20 years. The differences among those changes include the following: BMV first5 or BAV first,6 leaving the transvenous/transseptal wire in the descending aorta,7 or fixing it with a snare8 or snaring it and externalization9 outside the left femoral artery. We have modification of the procedure in adopting an ICE guidance in transseptal puncture, which could help visualize the atrial septum clearly and improve its safety.9 Other than this modification, we closely followed the protocol proposed by Abdou et al.,2 with BAV first strategy, and snaring the transvenous/transseptal wire and externalizing it outside the left femoral artery to achieve better wire support and stability.

Previous reports showed a 0.5% systemic embolic event rate for transvenous BMV and a 1% stroke rate for retrograde transarterial BAV. There were also reports of a 1% event rate of aggravated severe mitral regurgitation requiring surgery after transvenous BMV and a 0.5% event rate of increasing 2 grades of aortic regurgitation (vs baseline) after transarterial BAV. The small-scale (N = 14) study for transvenous, transseptal concurrent Inoue BAV/BMV reported no systemic thromboembolism or worsening regurgitation.2 To decrease thromboembolic complications, we suggested intraprocedure unfractionated heparin to maintain the activated clotting time over 250 seconds and postprocedure oral warfarin use for subjects with rheumatic heart disease and atrial fibrillation. Compared with transarterial retrograde BAV, transvenous/transseptal BAV has less entry site

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**Figure 1.** Intracardiac echocardiogram image showing tenting of transseptal needle on fossa ovalis. **Arrow:** transseptal needle. LA, left atrium; RA, right atrium.
vascular injury and less LV wiring injury. Inoue balloon, compared with conventional balloons, also confers better aortic annulus sealing and dilatation effect for aortic valve stenosis.6,7 Regarding the efficacy and durability of transseptal concurrent BMV and BAV, past case series or registries usually reported better efficacy and durability in younger subjects with rheumatic AS and MS.8 Older adults with calcified degenerative AS had less favorable efficacy and treatment durability. For case selection, the concurrent transvenous transseptal BAV and BMV should be performed in younger subjects with rheumatic heart disease—related AS and MS with commissure fusion but without severe leaflet or annulus calcification and without preexisting more than moderate regurgitations.2 Our case is an elderly man aged 82 years with rheumatic MS but calcified AS, and thus had restenosis and clinical worsening 9 months after the first intervention.

**Conclusion**

Our case showed that transvenous/transseptal concurrent Inoue BAV and BMV may be safe and effective in relieving pulmonary edema and heart failure in subjects with combined severe AS and MS. However, the durability is limited in elderly patients with calcified aortic valves. The procedure should be reserved only for those who are unable to tolerate standard surgical double-valve replacement.

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**Disclosures**

The authors have no conflicts of interest to disclose.

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