Images and Case Reports in Heart Failure

Effective Cibenzoline Treatment in a Patient With Midventricular Obstruction After Transcatheter Aortic Valve Implantation

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An 80-year-old woman with severe aortic stenosis was admitted to our hospital for transcatheter aortic valve implantation (TAVI). She had New York Heart Association functional class III congestive heart failure. Her comorbidities included multiple myeloma, idiopathic thrombocytopenic purpura treated with chronic steroids, hypertension, diabetes mellitus, and persistent atrial fibrillation. Echocardiography demonstrated a calcified tricuspid aortic valve with leaflet restriction consistent with severe aortic stenosis (Figure 1A; Movie I in the Data Supplement). The instantaneous peak velocity across the aortic valve on Doppler imaging was 5.0 m/s, and the mean pressure gradient was 53 mm Hg (Figure 1B). The aortic valve area calculated by using the continuity equation was 0.49 cm². A concentric left ventricular (LV) hypertrophy was observed in the septum, measuring 13 mm, and in the posterior wall, measuring 14 mm. The LV cavity was small, with an LV internal dimension of 39 mm at end diastole. LV ejection fraction was 80%. Late peaking of the midcavitary LV pressure gradient of 25 mm Hg at rest was observed, without LV outflow tract obstruction and systolic anterior motion of the mitral valve leaflet (Figure 1C). Coronary angiography revealed no significant coronary artery stenosis. Given her severe aortic stenosis and heart failure symptoms with comorbidities of severe thrombocytopenia (platelet count: 15,000 per μL), the patient underwent TAVI via the transfemoral approach. A 23-mm Sapien valve (Edwards Lifesciences, Irvine, CA) was successfully implanted. The hemodynamic profile of the patient throughout and after the procedure was stable. Her symptoms improved, and she was discharged and prescribed with a β-blocker, vasodilators, and diuretics as outpatient treatments.

Two months later, she was admitted to our hospital for recurrent exertional dyspnea. Her physical examination revealed jugular venous distension, bilateral legs edema, and a 3 of 6 systolic ejection murmur at the lower left sternal border. Electrocardiography showed atrial fibrillation with bradycardia (heart rate: 30–50 beats per minute). Given her conditions of heart failure with volume overload and bradycardia, intravenous furosemide was administered and the dose of the β-blocker was reduced. However, her symptoms worsened with hypotension and renal dysfunction. Echocardiography revealed that the Edwards Sapien valve prosthesis was functioning properly with minimal paravalvular regurgitation. LV systolic function was hyperdynamic, and significant midventricular obstruction was observed with concentric LV hypertrophy during systole, with a peak pressure gradient of 69 mm Hg at rest (Figure 2A and 2B). No significant LV outflow tract obstruction and systolic anterior motion of the mitral valve were observed. Given the above-mentioned findings, the patient’s deterioration was attributed to hypertrophic obstructive cardiomyopathic physiology with the development of midventricular obstruction after the removal of the LV pressure overload. Therefore, the diuretics and systemic vasodilators were suspended. The β-blocker dose could not be increased because of bradycardia, and the patient refused surgical myectomy and alcohol septal ablation because of her comorbidities. Thus, we decided to start cibenzoline, a class Ia antiarrhythmic drug, which is used as a second-line therapy for patients with hypertrophic obstructive cardiomyopathy (HOCM). After starting the cibenzoline therapy, her hemodynamics improved and the peak pressure gradient at the midventricular level decreased to 35 mm Hg on echocardiography (Figure 2C). Her dyspnea improved, and she was discharged without any complications.

We describe a patient with significant intraventricular obstruction and HOCM physiology that became apparent after relief of severe aortic stenosis after TAVI. Medical treatment, including cibenzoline, a negative inotropic agent, improved the intraventricular pressure gradient and patient’s symptoms. Recognition of the potential to unmask intraventricular...
obstruction with TAVI is important in patient selection for the procedure and postoperative treatment. Suh et al\(^1\) reported a case in which HOCM physiology and immediate clinical deterioration developed soon after TAVI was performed. In their case, intravenous fluid administration and treatment with a \(\beta\)-blocker were sufficient to improve the patient’s conditions. Alcohol septal ablation may be an effective approach to reduce dynamic intraventricular obstruction after TAVI in patients who are not successfully treated with \(\beta\)-blockade.\(^2\) However, such percutaneous therapy may not be feasible in some patients because of various technical issues (eg, no candidate septal artery) and patients’ frailty. Class Ia antiarrhythmic agents, including cibenzoline, are a well-established second-line therapy for patients with HOCM who are resistant to \(\beta\)-blockers.\(^3\) Hence, we treated our patient with addition of cibenzoline. Given that the efficacy of cibenzoline for reducing the LV pressure gradient in HOCM was equivalent to that of disopyramide and pilsicainide, other class Ia antiarrhythmic drugs could be equally effective at treating intraventricular obstruction arising after TAVI.\(^4\) To our knowledge, this is the first reported case of a patient in whom intraventricular obstruction appeared after TAVI was treated with addition of a class Ia antiarrhythmic drug. Given that patients who undergo TAVI have comorbidities and high risk for invasive therapy, this strategy can be a useful option to relieve intraventricular obstruction and patient’s symptoms.

**Disclosures**

Dr Hayashida is a proctor for transfemoral-transcatheter aortic valve implantation for Edwards Lifesciences. The other authors report no conflicts.

**References**

Figure 1. Transthoracic echocardiogram obtained before transcatheter aortic valve implantation. A, Parasternal long-axis view images showing the calcific aortic stenosis, concentric left ventricular (LV) hypertrophy, and small LV cavity. Left, systole; right, diastole. B, Continuous wave Doppler image across the aortic valve showing a peak velocity of 5.2 m/s, with a mean gradient of 53 mm Hg. C, Color Doppler image in the apical 4-chamber view showing turbulent flow at the midventricle during systole (left). Pulse wave Doppler image at the midventricle showing a late-peaking flow gradient of 25 mm Hg (right).
Figure 2. Transthoracic echocardiogram obtained 2 months after transcatheter aortic valve implantation (TAVI; A and B) and marked improvement of the midventricular obstruction (MVO) after cibenzoline treatment (C). A. Parasternal long-axis view images showing the left ventricular (LV) hypertrophy, LV hypercontraction, and cavitary obliteration at the midventricular level after TAVI. Left, systole; right, diastole. B. Color Doppler image in the apical 2-chamber view showing flow acceleration at the midventricle during systole (left). A late-peaking gradient can be observed across the MVO, with a peak pressure gradient of 69 mm Hg. C. The pressure gradient across the MVO was decreased to 35 mm Hg after treatment with cibenzoline. See Movies II-IV in the Data Supplement.
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Circ Heart Fail. 2016;9:e002629
doi: 10.1161/CIRCHEARTFAILURE.115.002629

Circulation: Heart Failure is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
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Print ISSN: 1941-3289. Online ISSN: 1941-3297

The online version of this article, along with updated information and services, is located on the World Wide Web at:
http://circheartfailure.ahajournals.org/content/9/1/e002629

Data Supplement (unedited) at:
http://circheartfailure.ahajournals.org/content/suppl/2015/12/23/CIRCHEARTFAILURE.115.002629.DC1

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SUPPLEMENTAL MATERIAL

**Movie 1.** Transthoracic echocardiography of the parasternal long-axis view shows severe AS, concentric LVH, and small LV cavity before TAVI.

**Movie 2.** Transthoracic echocardiography of the parasternal long-axis view shows normally functioning Sapien valve, concentric LVH, and LV constriction after TAVI.

**Movie 3.** Transthoracic echocardiography of the apical two-chamber view shows flow acceleration at the mid-ventricle after TAVI.

**Movie 4.** Transthoracic echocardiography of the apical two-chamber view shows decreased flow acceleration after treatment with cibenzoline.