A 91-year-old woman presented with worsening exertional dyspnea. Her previous medical history included hypertension, percutaneous coronary intervention with drug-eluting stent placement to the mid left anterior descending coronary artery, moderate bilateral carotid atherosclerosis, and moderate chronic obstructive pulmonary disease. Transesophageal echocardiography revealed a normal left ventricular ejection fraction with asymmetric upper septal hypertrophy (posterior wall, 1.3 cm; interventricular septum, 2.0 cm; Figure 1A) but without left ventricular outflow tract (LVOT) obstruction (Figure 1B) at rest or with a Valsalva maneuver. There was severe aortic valve calcification and stenosis (Figure 1A and 1C).

The patient was referred for transcatheter aortic valve replacement (AVR) via the transfemoral approach. Upon crossing the stenotic aortic valve, the peak-to-peak left ventricle–aorta (LV-Ao) pressure gradient was recorded at 60 mm Hg (Figure 2A). After deployment of a 23-mm Edwards SAPIEN prosthesis, the patient became hypotensive and the peak-to-peak LV-Ao gradient was recorded at 120 mm Hg (Figure 2B). Transesophageal echocardiography demonstrated a properly functioning aortic prosthesis and revealed a dynamic obstruction in the LVOT attributable to systolic anterior motion of the mitral valve (Figure 3A), associated with severe mitral regurgitation (Figure 3B).

After review of the preprocedural coronary angiogram (Figure 4A), the decision was made to proceed emergently to alcohol septal ablation to relieve the dynamic LVOT obstruction. Isopropyl alcohol (1.5 mL) was infused in the septal perforator, and subsequent angiography revealed occlusion of the vessel (Figure 4B). Transesophageal echocardiography revealed marked reduction in systolic anterior motion and in the degree of LVOT obstruction and mitral regurgitation, as well (Figure 5). Hemodynamic tracings demonstrated almost-complete resolution of the LV-Ao gradient (Figure 6).

The patient was successfully extubated at the conclusion of the case and was discharged from the hospital 5 days later. At 1-month follow-up, transthoracic echocardiography revealed continued reduction in the LV-Ao gradient at rest (15 mm Hg) and minimal increase with provocation by a Valsalva maneuver (18 mm Hg).

Discussion

In patients with aortic stenosis, hypertrophy of the left ventricular myocardium often occurs as a result of the increased myocardial load imposed by the valvular obstruction. In most cases, the hypertrophy is concentric, although some patients present with an asymmetric upper septal hypertrophy with or without dynamic LVOT obstruction.

Our patient demonstrated severe asymmetric upper septal hypertrophy, but had no evidence of LVOT obstruction on dynamic preoperative testing. Upon implantation of the transcatheter prosthesis, however, she developed significant LVOT obstruction. This is likely the result of a number of physiological and anatomic changes. The relationship between afterload and LVOT obstruction has been elucidated by numerous investigators. Interventions to increase afterload (the Mueller maneuver, phenylephrine infusion), reduce dynamic LVOT obstruction, whereas maneuvers that decrease afterload (vasodilators or intraaortic balloon counterpulsation) result in augmented LVOT obstruction.

AVR leads to an immediate reduction in fixed afterload, which contributes to an increased LVOT flow velocity. The resulting convective acceleration of blood in the LVOT may produce a Venturi effect, drawing the mitral valve anteriorly and creating LVOT obstruction. Additionally, decreased filling pressures after AVR in patients with a small and hypertrophied/hypercontractile LV cavity are likely to further contribute to systolic anterior motion and obstructive physiology.

Another hypothesis is that patients with hypertrophic cardiomyopathy, elderly patients, and those with longstanding hypertension (as in the case presented here) demonstrate an increase in the angulation of the aorta to the LV outflow axis. This produces a greater degree of flow turbulence in the LVOT and is associated with dynamic obstruction and an increasing LVOT gradient. Therefore, in the case presented, it is possible that physiological changes in LVOT flow after transcatheter AVR, hypercontractility, and anatomic changes in the LV-Ao geometry with age and hypertension together resulted in severe, clinically threatening acute LVOT obstruction, which was promptly treated by the emergent alcohol septal ablation.

In cases of preoperatively diagnosed dynamic obstruction, obstructive anatomy/physiology observed at the time of operation, or with the unmasking of the dynamic obstruction after AVR, concomitant septal myectomy is indicated at the time of surgical AVR. However, controversy exists in surgical practice whether or not septal myectomy should be performed.
on patients undergoing surgical AVR when the upper septal hypertrophy does not cause dynamic LVOT obstruction. In the current era of transcatheter therapies for patients with severe aortic stenosis and inoperable or high surgical risk, it is important to recognize that alcohol septal ablation either before, or concomitant with, the transcatheter AVR procedure may be necessary. It is also important to understand the physiological changes that can occur as a result of relieving valvular obstruction, and imperative that operators vigilantly monitor the hemodynamic tracings and adjunctive imaging to respond emergently and appropriately, as illustrated in this case.

Disclosures
None.

References
Figure 5. Post-TAVR and ASA transesophageal echocardiogram (120° view). Resolution of LVOT obstruction and SAM. Ao indicates aorta; ASA, alcohol septal ablation; LA, left anterior; LV, left ventricle; LVOT, left ventricular outflow tract; SAM, systolic anterior motion; and TAVR, transcatheter aortic valve replacement.

Figure 6. Final hemodynamics after TAVR and ASA shows improved blood pressure and substantial reduction in LV-Ao gradient. Ao indicates aorta; ASA, alcohol septal ablation; LV, left ventricle; SBP, systolic blood pressure; and TAVR, transcatheter aortic valve replacement.
Combined Transcatheter Aortic Valve Replacement and Emergent Alcohol Septal Ablation
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