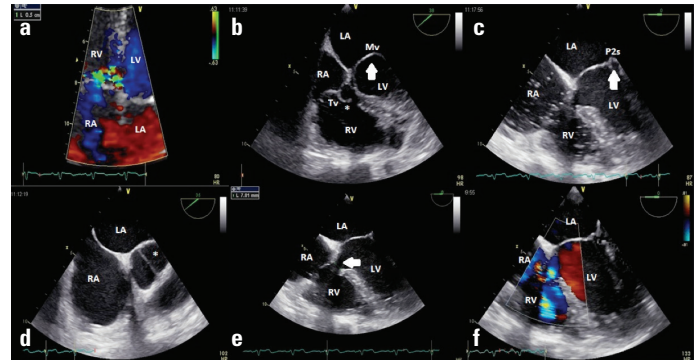


## Unusual combination of mitral valve prolapse, bicuspid aortic valve, and ventricular septal defect restricted by the tricuspid septal leaflet

A 35-year-old woman presented at the emergency department with the symptoms of shortness of breath and palpitations. Her medical history was unremarkable. Auscultation revealed a localized, high frequency, 2/6 pansystolic murmur at the third and fourth left intercostal spaces. The 12-lead electrocardiogram indicated a normal sinus rhythm. Transthoracic echocardiography revealed mild mitral regurgitation with late systolic left atrial prolapse of mitral leaflets in the parasternal long axis view, and congenital bicuspid aortic valve (CBAV) was seen in the parasternal short axis view, without any significant stenosis or regurgitation findings. In the apical 4-chamber view, a 5-mm, membranous ventricular septal defect (VSD) was seen in the baseline portion of the interventricular septum (Fig. 1a). Transesophageal echocardiography revealed prolapse of the anterior mitral leaflet in the 38° view (Fig. 1b, arrow), prolapse of the P2L scallop of the posterior mitral leaflet in the mid-esophageal 0° view according to the modified Carpentier classification (Fig. 1c, arrow), and CBAV in the 35° view (Fig. 1d, asterisk). In the mid-esophageal 0° view, a 7-mm, small VSD in the membranous septum with a left-to-right shunt was observed (Fig. 1e, 1f, arrow). The VSD and left-to-right shunt were restricted by the tricuspid septal leaflet (Fig. 1b, asterisk). The patient's Qp/Qs ratio was <1.5; moreover, her mitral and aortic valvular functions, right heart volume, and systolic pulmonary arterial pressure were normal. The patient was diagnosed with mitral valve prolapse, CBAV, and membranous VSD, and a follow-up program was arranged.

**Informed consent:** Informed consent was obtained from the patient.



**Figure 1.** (a) Transthoracic color Doppler echocardiography demonstrating a ventricular septal defect with a left-to-right shunt in the apical 4-chamber view. (b) Transoesophageal echocardiography revealed prolapse of the anterior mitral leaflet (arrow) and restriction of the ventricular septal defect by the tricuspid septal leaflet (asterisk) in the 38° view, (c) prolapse of the P2L scallop of the posterior mitral leaflet (arrow) in the mid-esophageal 0° view, and (d) bicuspid aortic valve (asterisk) in the mid-esophageal 35° view. (e, f) Transoesophageal echocardiography revealed a membranous ventricular septal defect with a left-to-right shunt in the mid-esophageal 0° view (arrow)

LA - left atrium; LV - left ventricle; Mv - mitral valve; RA - right atrium; RV - right ventricle; Tv - tricuspid valve

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