A 9-year-old girl underwent transesophageal echocardiography (TEE) to determine whether there was an indication for transcatheter closure of her secundum atrial septal defect (ASD). She had been diagnosed as having a single defect by transthoracic echocardiography at 6 months of age. During previous clinic visits, her parents often complained that she had occasional episodes of central cyanosis, although her oxygen saturation by pulse oximeter was 98 in the outpatient clinic. Two-dimensional TEE revealed 2 secundum ASDs, 1 at the fossa ovale and the other near the junction of the inferior vena cava, with a prominent eustachian valve. Three-dimensional (3D) echocardiographic images from the right atrium clearly demonstrated a large eustachian valve that covered a large portion of the atrial septum (Figure 1). The inferior defect could not be seen from the right atrium, even with a steep angle, looking down toward the orifice of the inferior vena cava (Figure 2). A 3D image from the right atrium after erasure of the eustachian valve (Figure 3) and an image from the left atrium (Figure 4) clearly demonstrated the position of the inferior defect. Despite this, the 3D information was not reviewed with the surgical group before intervention, because this technique is still in its infancy with regard to decision making. At surgery, through a ministernotomy, the fossa ovalis defect was closed; however, the inferior defect was missed. A subsequent intraoperative TEE using Doppler and contrast confirmed the presence of the inferior defect with bidirectional shunting. This defect was then closed through the same incision.
Figure 1. A 3D echocardiographic image looking from right atrium toward atrial septum. Large eustachian valve (*) covers more than half of atrial septum. AO indicates ascending aorta; ASD, (superior) atrial septal defect; CS, coronary sinus; SVC, superior vena cava; sup., superior; and ant., anterior.

Figure 2. View from right atrium with a steep angle looking down toward orifice of inferior vena cava. Only small superior portion of inferior defect can be seen (small arrow) behind eustachian valve (*). TV indicates tricuspid orifice; other abbreviations as in Figure 1.

Figure 3. Eustachian valve was removed with computer graphics. A 3D image from right atrium demonstrates a large, oval inferior defect (*) close to junction of inferior vena cava (IVC) and an orifice of coronary sinus. Abbreviations as in previous figures.

Figure 4. A 3D echocardiographic image looking from left atrium toward atrial septum demonstrates both ASD and inferior defect (arrows). MV indicates mitral valve; other abbreviations as in previous figures.
Three-Dimensional Transesophageal Echocardiography for Secundum Atrial Septal Defects With a Large Eustachian Valve
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