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Atrial Septal Occluder Device Embolization to an Iliac Artery: A Case Highlighting the Utility of Three-Dimensional Transesophageal Echocardiography during Percutaneous Closure

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Percutaneous closure of secundum atrial defects has become an accepted treatment in part because it is minimally invasive and relatively low risk. Despite recent advances in implantation technique and device improvements, complications occur. Here, we report a case of device embolization during percutaneous repair of an atrial septal defect (ASD) with multiple fenestrations. We highlight the value of using live/real time three-dimensional transesophageal echocardiography to help plan the percutaneous procedure and detect complications. (Echocardiography 2012;29:1128-1131)

Key words: real time three-dimensional transesophageal echocardiography, three-dimensional echocardiography, two-dimensional transesophageal echocardiography, percutaneous closure, atrial septal defect, secundum atrial septal defect, device embolization

Percutaneous closure of secundum atrial septal defects (ASDs) has become an accepted treatment in part because it is minimally invasive and relatively low risk.¹ Device embolization, a rare but serious complication of percutaneous closure, occurs in 0.5–3% in Amplatzer septal occluder devices (ASOD) (St. Jude, St. Paul, MN, USA).^{2–4} ASD with multiple fenestrations present technical challenges that make preprocedure evaluation and patient selection important to prevent complications.¹ Here, we report a case of device embolization to an iliac artery highlighting the ability of three-dimensional echocardiography to evaluate complicated anatomy during device implantation and detect device embolization.

Patient Presentation:

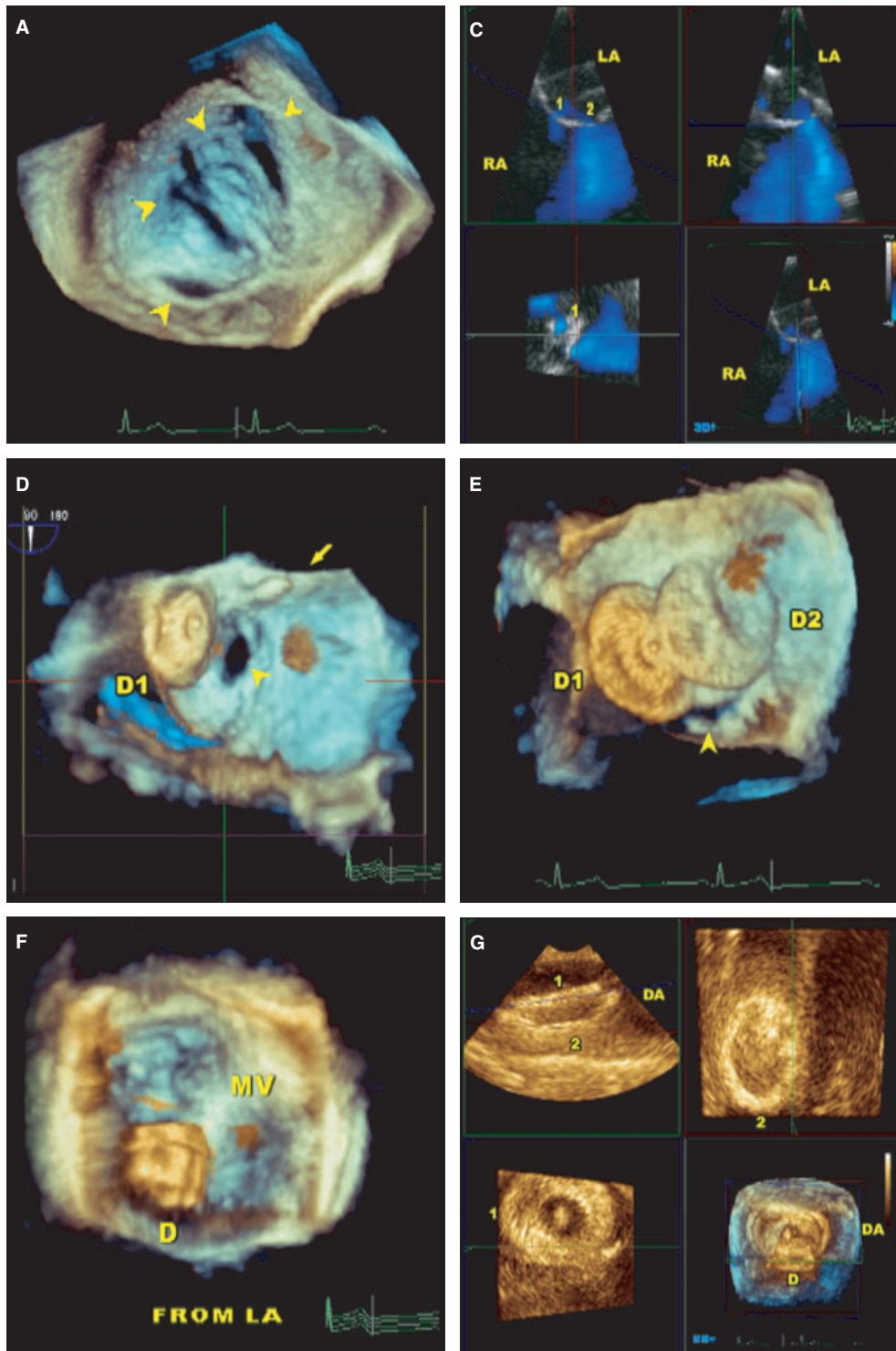
A 43-year-old man who was incidentally diagnosed with a secundum ASD presented for further evaluation. Two-dimensional transesophageal echocardiography (2DTEE) revealed two

secundum type ASDs with color Doppler showing left to right shunts, Qp:Qs = 1.7:1, dilated right atrium and right ventricle, and normal left and right ventricular ejection fractions. Three-dimensional transesophageal echocardiography (3DTEE) was performed, which demonstrated more than four defects (“Swiss cheese” type secundum ASD), each of which was measured with the results as follows: defect 1 = 1.29 × 0.30 cm, defect 2 = 1.09 × 0.43 cm, defect 3 = 0.50 × 0.28 cm, and defect 4 = 0.98 × 0.43 cm.

After the patient refused surgical repair, percutaneous closure was done under general anesthesia with continuous 3DTEE. Two devices, an 11 mm ASOD and a 25 mm Amplatzer Cribri-form Occluder were chosen for closure. The size of the left atrial disk is similar in both devices, but the right atrial disk is smaller in the 11 mm septal occluder device. After implantation of the devices, overlapping was detected, but color flow mapping by 3DTEE showed two 5 mm residual defects with significant shunting.

The decision was made to implant a third device to close the residual defects, but during catheterization before the third device could be implanted 3DTEE revealed embolization of the

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11 mm septal occluder device to the left atrium (Fig. 1). The device quickly migrated to the right iliac artery which was confirmed by fluoroscopy. Emergent surgery was planned, but before retrieval the device was pushed back to the proximal descending thoracic aorta intravascu-

larly and confirmed by 3DTEE (Fig. 1). This was done from the femoral approach using an Amplatzer goose neck snare kit (4 French). The device was retrieved from the descending aorta by making a horizontal cut in the ascending aorta, and a bovine pericardial patch was used

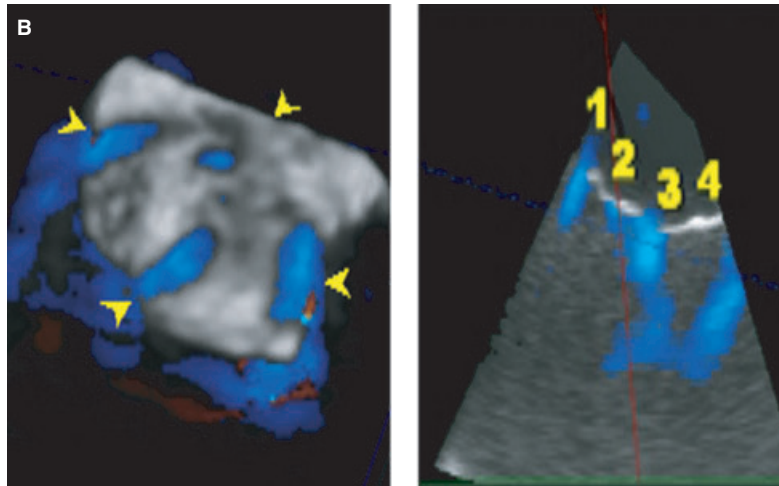


Figure 1. Live/real time three-dimensional transesophageal echocardiographic assessment of device embolization during percutaneous atrial septal defect (ASD) closure. **A.** The arrowheads point to multiple secundum ASDs (“Swiss cheese” appearance) viewed en face from the left atrium (LA). **B.** Color Doppler assessment showing flow signals within the defects viewed en face (left panel). QLAB examination (right panel) showing four defects numbered 1, 2, 3, and 4. **C.** QLAB examination demonstrating en face view of one of the defects (1) using color Doppler. In the upper left panel the cropping plane is positioned exactly parallel to the defect which resulted in en face viewing of the defect in the lower left panel. Subsequently the area was measured by planimetry. **D.** Demonstrates the first ASD closure device (D1) in position (viewed from LA and anatomically correct). Arrowhead shows a large residual defect viewed en face. The arrow points to the device placement catheter. **E.** Shows the second ASD closure device (D2) in position, partially overlapping D1 (viewed from LA and anatomically correct). Arrowhead shows the presence of one of the two significant residual defects. **F.** Shows embolization of one of the closure devices (D) to the LA. **G.** Shows the device (D) in the proximal descending thoracic aorta (DA) after percutaneous manipulation from the iliac artery; 1 and 2 denote the right and the left atrial sides of the device, which are viewed en face in the left lower and the right upper panels. MV = mitral valve; RA = right atrium.

to close the ASD in a standard manner after retrieving the retained closure device. There were no complications.

Discussion:

Percutaneous closure of secundum ASDs with multiple fenestrations present technical challenges that likely increase the risk for complications. Because of these risks, surgical closure was recommended to the patient, but he opted for percutaneous closure. Previous studies have made suggestions for closure of such defects, ensuring that the distance between two defects is at least 7 mm and deploying the left and right atrial disks of the smaller device before deploying the larger device, in addition to the standard guidelines for the deployment of a single device.^{1,5} This case illustrates the incremental value of 3DTEE over 2DTEE in patient selection and monitoring during the procedure.

Three-dimensional TEE proves more useful than 2DTEE in patient selection because it allows en face measurement of size of individual defects, thus increasing accuracy. In addition, the location and measurement of surrounding rims and their size, which is critical for percutaneous clo-

sure, can be done precisely in a similar manner. In this case, 2DTEE did not detect the number of fenestrations that were present before the procedure which would not have allowed appropriate preprocedure planning.

Throughout the closure procedure, 3DTEE was used which guided the physician during device placement and confirmed the exact placement of both devices by viewing them en face. Before the implantation of the third device, the 11 mm septal occluder device, confirmed because one disk of the device was smaller than the other, was noted to have come dislodged and seen in the left atrium by both 2DTEE and 3DTEE. To our knowledge, this is the first published video image of an embolized ASOD in the left atrium. Finally, 3DTEE helped the physicians confirm the position of the dislodged device in the descending thoracic aorta and helped plan for emergent surgical retrieval.

References

1. Cao QL, Radtke W, Berger F, et al: Transcatheter closure of multiple atrial septal defects. Initial results and value of two- and three-dimensional transoesophageal echocardiography. *Eur Heart J* 2000;21:941–947.

2. Dod HS, Reddy VK, Bhardwaj R, et al: Embolization of atrial septal occluder device into the pulmonary artery: A rare complication and usefulness of live/real time three-dimensional transthoracic echocardiography. *Echocardiography* 2009;26:739–741.
3. Losay J, Petit J, Lambert V, et al: Percutaneous closure with amplatzer is safe and effective technique, results of transvenous occlusion of secundum atrial septal defects with the fourth generation buttoned device: Comparison with first, second and third generation devices. *Am Heart J* 2001;142:544–548.
4. Rao PS, Berger F, Rey C, et al: Results of transvenous occlusion of secundum atrial septal defects with the fourth generation buttoned device: Comparison with first, second and third generation devices. International Buttoned Device Trial Group. *J Am Coll Cardiol* 2000;36: 583–592.
5. Podnar T, Martanovic P, Gavora P, et al: Morphological variations of secundum-type atrial septal defects: Feasibility for percutaneous closure using Amplatzer septal occluders. *Cathet Cardiovasc Interv* 2001;53:386–391.

Supporting Information

Additional Supporting Information may be found in the online version of this article:

Movie clips for Figures 1A, 1B. (Part 1 – view from LA, Part 2 – view from RA), 1C, 1D, 1E, 1F – embolized device in LA (Part 1–2D imaging, Part 2–3D imaging. Device appears fragmented due to stitch artifacts) AV = aortic valve; LV = left ventricle, 1G – device in DA (Part 1–2D imaging, Part 2–3D imaging).

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