Role of real-time three-dimensional transoesophageal echocardiography for guiding transcatheter patent foramen ovale closure

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Case report
We report the case of a 64-year-old man presenting with recurrent cryptogenic strokes. A two-dimensional transoesophageal echocardiography (2D TEE) was performed and a patent foramen ovale (PFO) with a giant atrial septal aneurysm was diagnosed. The patient was referred to our institution for percutaneous closure of the patent foramen ovale. An Amplatzer PFO occlusion system (ASO, AGA Medical, Golden Valley, MN, USA) was placed, guiding by fluoroscopy and (2D and real-time 3D) TEE. Real-time 3D TEE was performed using a Philips IE33 (Andover, MA, USA) ultrasound system with the X7-2t TEE transducer. Prior to the catheterization procedure, the PFO and its adjacent structures were identified utilizing a combination of 2D and 3D TEE. Careful attention was given to define the PFO and its relation to the superior and inferior vena cava inflow (superior–posterior and inferior–posterior aspects of the interatrial septum), the atrioventricular valves (inferior–anterior), the right pulmonary vein, and the retro-aortic region (superior–anterior).

Initially, the atrial septal size was measured using 2D TEE and the PFO stretch diameter in the long-axis was 5–10 mm (Figure 1A) unlike 3D TEE, that estimated the PFO stretch in 20 mm (Figure 1B). Then, the PFO was too measured using a semicompliant balloon; NuMed sizing balloon (NuMed, Hopkinton, NY, USA), filled with a diluted contrast agent over a 260 cm, 0.035 in. Amplatzer superstiff wire (Cook, Bloomington, IN, USA) that confirmed the PFO size estimated by 3DTEE. So, a 25-mm ASO device was chosen to match the PFO stretch diameter.

The device delivery system was advanced through a haemostatic valve sheath from the right common femoral vein through a transseptal sheath (Figures 2A and 3A and B). Under fluoroscopic guidance, the ASO device was advanced through the delivery sheath into the left atrium. The left atrial disc was then deployed in the left atrium (Figure 2B). Alignment of the left atrial disc and deployment of the right atrial disc were performed under 3D TEE guidance (Figures 2C and 3C). Finally, device release was performed under fluoroscopic and real-time 3D TEE guidance without any complications (Figure 2D and 3D).

Discussion
Real-time two-dimensional transoesophageal echocardiography has traditionally been the method of choice for guiding transcatheter PFO closure.
As of September 2007, a new 3D TEE probe capable of
live/real-time 3D imaging became commercially available
for clinical practice. This electronically steered transducer
permits conventional multiplane 2D TEE image acquisition;
but also offers live 3D, 3D zoom, full volume 3D, and 3D
colour Doppler imaging, utilizing the matrix array technol-
ogy employed in its 3D TTE predecessor.1,2 Potentially
improved visualization, and therefore, better understanding
of the intricate anatomic details of atrial septal defects and
devices,3 may improve the results of device closure. Thus,
three-dimensional echocardiography may provide important
information in several aspects. First, 3D TEE view depicts
the anatomy of the atrial septal more clearly and shows
in depth perception and resolution of adjacent structures,
Secondly, 3D echocardiography will aid in pre-selection of
patients for atrial septal defect device closure. Thirdly,
such imaging may help in appropriate selection of the type
and size of the atrial septal defect occluder device.4
Fourthly, 3D echocardiography may provide unique imaging
planes and projections to better comprehend successful
device placement. Fifthly, 3D echocardiography will
enhance our understanding of the atrial septal defects,
and devices that will improve our understanding of standard
2D studies for planning and performing percutaneous device
closure. For all these issues, 3D TEE visualization of these
devices may be potentially superior to 2D TEE in the assess-
ment of device deployment, malposition and relation to
adjacent strucutures like the valve and the aortic root.5

Figure 1 Transoesophageal view of the patent foramen ovale; (A) two-dimensional transoesophageal echocardiography in four chambers view showed a small patent foramen ovale (white arrow). (B) Three-dimensional transoesophageal echocardiography from left atrium view showed a patent foramen ovale higher (red arrows).

Figure 2 Three-dimensional transoesophageal echocardiography from left atrium view during transcatheter closure of the patent foramen ovale: (A) delivery sheath in the left atrium, (B) the left atrial disc (arrow) deployed in the left atrium with the right atrial disc still within the delivery sheath, (C) alignment of the left atrial disc and deployment of the right atrial disc (arrow), (D) Amplatzer septal occcluder once released both atrial septal disc.
Therefore, real-time 3D TEE and transcatheter patent foramen closure are two complementary techniques.

References


