



3D Echocardiography of the Atrial Septum

Anatomical Features and Landmarks for the Echocardiographer

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A DETAILED UNDERSTANDING OF THE ANATOMY of the atrial septum (1) is increasingly important for the echocardiographer. This relates to the need to assess suitability for device closure of atrial septal defects (ASDs), echocardiographically guided transeptal puncture, and surgical planning for lesions such as atrioventricular septal defects.

We describe views of the atrial septum which can be achieved with current 3-dimensional (3D) techniques. The anatomical features of the normal atrial septum and morphology of different types of defects are described. Crucially, we present 3D images in a consistent, anatomically correct, orientation to retain useful landmarks of surrounding structures in the cropped images. Transesophageal and transthoracic images were obtained using the Philips 3D X3-1, X7-2 and X7-2t ultrasound probes on the Philips IE33 imaging system and analyzed using Q lab software (Philips Medical Systems, Andover, Massachusetts).

The normal features of the atrial septum and its associated defects are demonstrated in the order listed below, with images presented in a consistent anatomical format. A marker defining the anterior, posterior, superior, and inferior relationships of the images are noted. See [Figures 1, 2, 3, 4, 5, 6, and 7](#).

3D echocardiography allows demonstration of living anatomy with moving images from novel projections not seen with standard 2-dimensional imaging. In this series, the whole septum can be presented in 1 image, where the anatomic relationships are self-evident.

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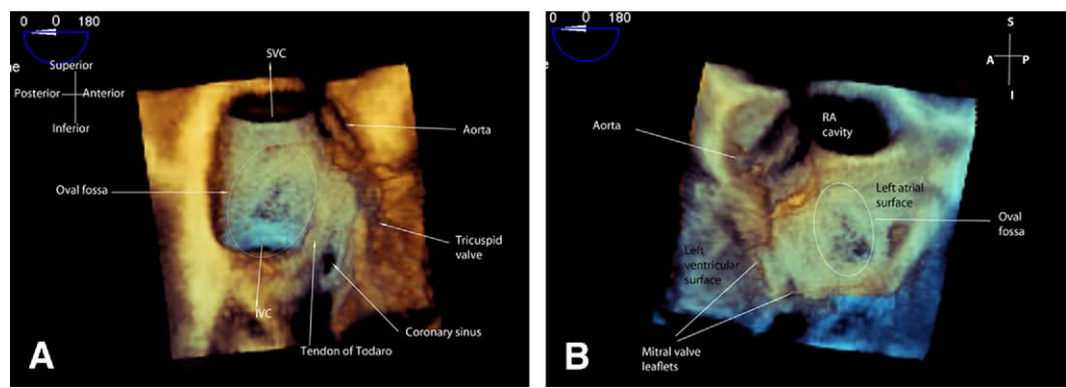


Figure 1. Normal Atrial Septum—3D TEE Views

(A) The normal atrial septum as viewed from the right atrium. The surrounding structures that define the margins of the defect are outlined. (B) The normal atrial septum as viewed from the left atrium. See Online Videos 1 and 2. 3D = 3-dimensional; TEE = transesophageal.

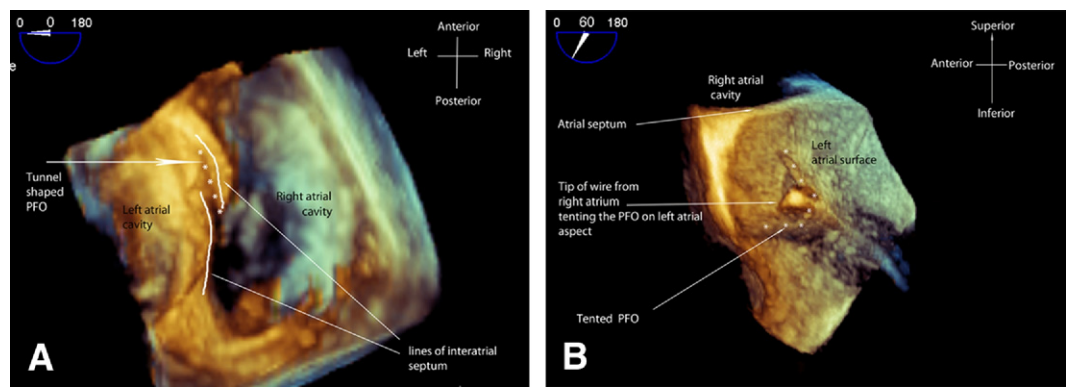


Figure 2. PFO—3D TEE Views

(A) The * mark out the tunnel shaped patent foramen ovale (PFO) as viewed from a “surgical” perspective with the superior margins of the atriums cropped away. (B) Left atrial view of PFO tented open by wire from right atrium during an interventional cardiac catheter. See Online Videos 3 and 4. Abbreviations as in Figure 1.

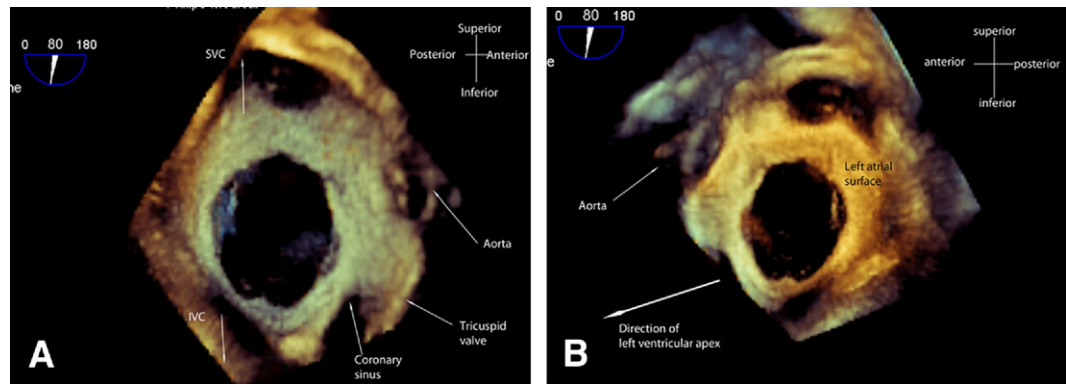


Figure 3. Secundum ASD—3D TEE Views

(A) Right atrial view of secundum atrial septal defect (ASD). The SVC, IVC, aortic, and coronary sinus margins of the defect should be noted. (B) Left atrial view of secundum ASD. See Online Videos 5 and 6. IVC = inferior vena cava; SVC = superior vena cava; other abbreviations as in Figure 1.

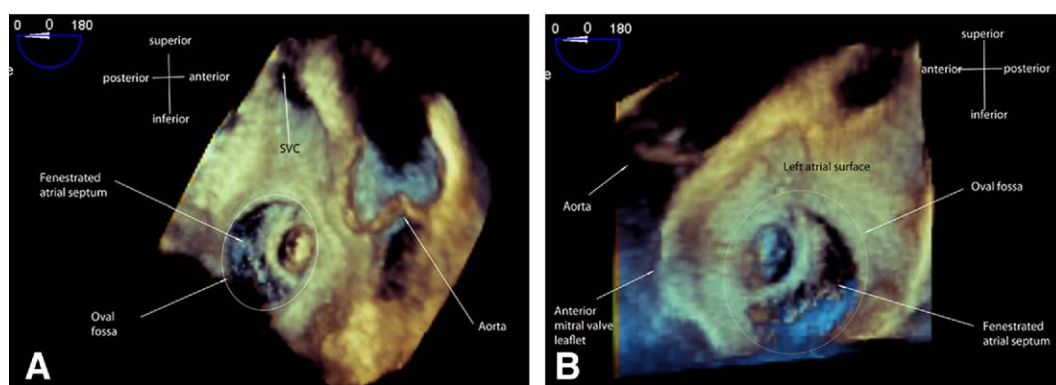


Figure 4. Fenestrated ASD—3D TEE Views

(A) Right atrial view of fenestrated ASD. The margins of the true oval fossa are marked by an ellipse. (B) Left atrial view of fenestrated ASD. See [Online Videos 7 and 8](#). Abbreviations as in [Figures 1 and 3](#).

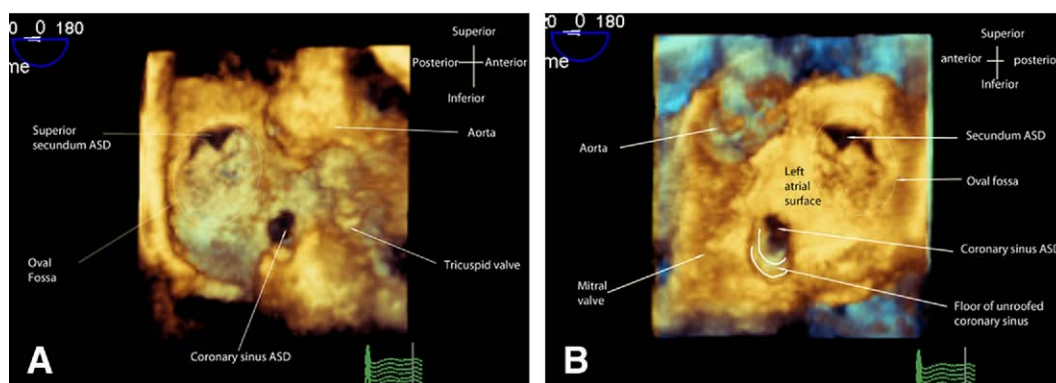


Figure 5. Coronary Sinus ASD—3D TEE Views

(A) Right atrial view of coronary sinus ASD with an additional secundum ASD at superior margin of the oval fossa. (B) Left atrial view of the coronary sinus defect. The floor of the unroofed coronary sinus can also be seen. See [Online Videos 9 and 10](#). Abbreviations as in [Figures 1 and 3](#).

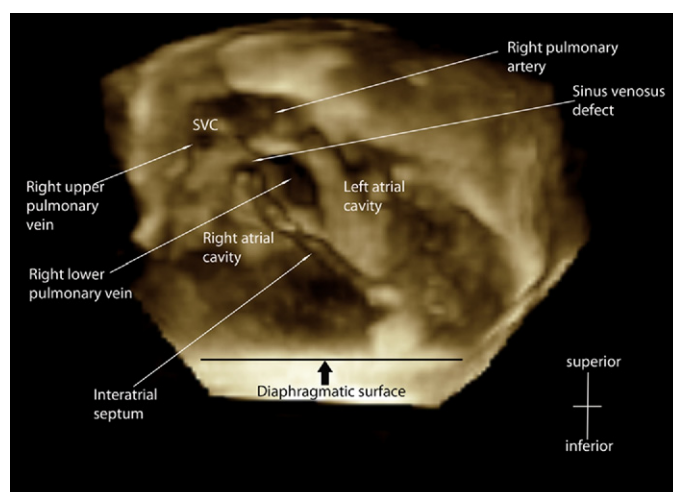


Figure 6. Sinus Venosus ASD—3D Transthoracic Subcostal View

Sinus venosus ASD demonstrating the anomalous right upper pulmonary vein and superior ASD. The right pulmonary artery can also be seen in this view. See [Online Video 11](#). Abbreviations as in [Figures 1 and 3](#).

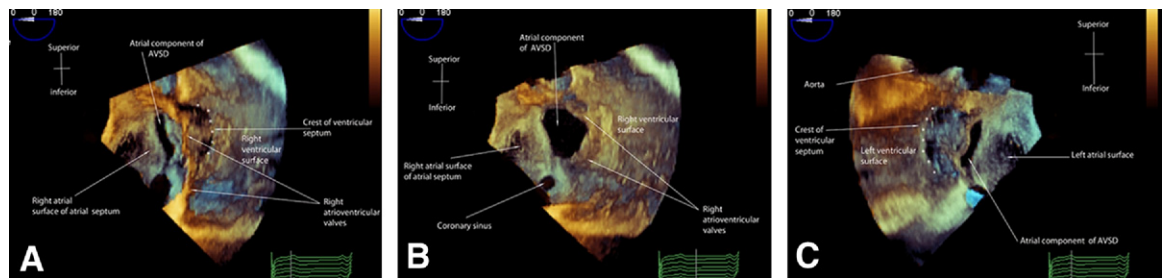


Figure 7. Atrial Component of AVSD—3D TEE View
(A) Atrial component of atrioventricular septal defect (AVSD). Right atrial view as seen in ventricular systole with closed atrioventricular valves. (B) Right atrial view of AVSD as seen with AV valves open. (C) Left atrial view of AVSD. See Online Videos 12 and 13. Abbreviations as in Figure 1.

REFERENCE

1. McCarthy KP, Ho SY, Anderson RH. Defining the morphologic phenotypes

of atrial septal defects and interatrial communications. *Images Paediatr Cardiol* 2003;15:1–24.

APPENDIX

For supplementary videos and their legends, please see the online version of this article.