TEE Echo Board Review 2

QUESTION 1

A transesophageal echocardiogram is performed on a critically ill patient who has intermittent hypoxia despite mechanical ventilator support (Figure 3–29). The image provided is most consistent with:

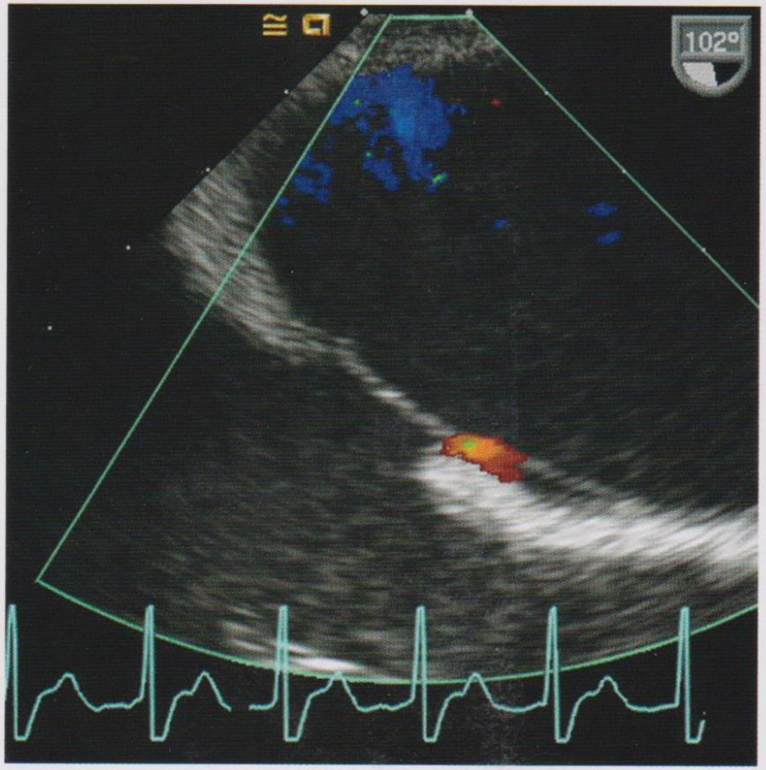

Figure 3–29.

A. Anomalous pulmonary vein
B. Sinus venosus septal defect
C. Patent foramen ovale
D. Thrombus in transit

ANSWER 1: C

This image is taken from a bicaval view (100 degree mid-esophageal view) where the SVC and IVC are seen at their entry into the RA. In this case, color Doppler flow is shown in the mid-portion of the intraatrial septum, adjacent to the thin tissue layer that overlays the fossa ovalis, consistent with a patent foramen ovale (PFO). If RA pressure transiently increases over LA pressure, intra-atrial right to left shunting may occur across the PFO, leading to systemic hypoxia. A sinus venosus septal defect is a shunt at the base of the atrial septum, near either the inferior or superior vena cava, and is also best seen from the bicaval view with the probe slightly withdrawn. An anomalous pulmonary vein would not cause hypoxia because the pulmonary vein enters into the RA (left to right shunt only), with no channel that would allow right to left intra-cardiac flow. An anomalous pulmonary vein is identified by showing the absence of one view entering the LA and then identifying the location of the vein entry into the RA, SVC, or IVC. This patient is also incidentally noted to have mild lipomatous hypertrophy of the base of the interatrial septum (adjacent to the SVC), a benign finding that is not consistent with intracardiac thrombus.

QUESTION 2

A 50-year-old man with a history of dilated cardiomyopathy presents with fever and *Staphylococcus* bacteremia. TEE is performed. An image of the mitral valve is shown in Figure 3–30. This is most consistent with:

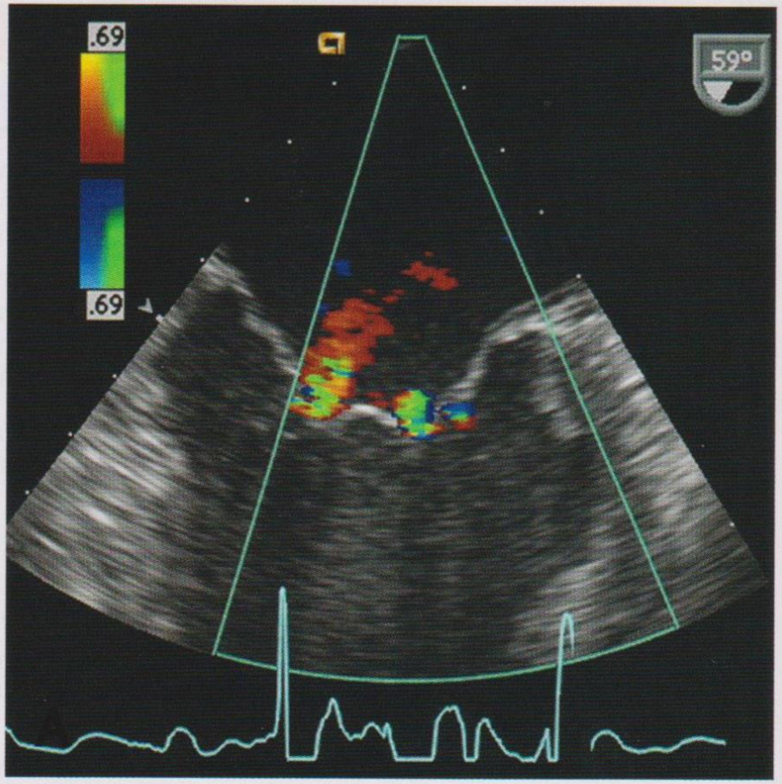

Figure 3–30.

A. Paravalvular abscess
B. Mitral leaflet perforation
C. Mitral valve prolapse
D. Functional mitral regurgitation

ANSWER 2: D

In the normal mitral valve, leaflet size is asymmetric. The anterior mitral valve leaflet occupies less of the mitral annular circumference than the posterior mitral valve leaflet and "sits within" the posterior leaflet during leaflet coaptation. This normal anatomy is seen in Figure 3–36, a parasternal short axis view of the mitral valve taken during diastole.

In the transesophageal 60-degree view of an anatomically normal mitral valve, the image plane cuts horizontally through the tip of the anterior mitral valve leaflet. The two commissures are seen on either side of the valve, producing the two regurgitant jets. The tip of the anterior mitral valve leaflet is seen in the center of the two regurgitant jets. In this case, the dilated LV leads to leaflet tethering and mild, functional mitral regurgitation. There is no prolapse or flattening of the valve leaflets in systole. TEE is reasonable to evaluate for endocarditis in this patient who presents with fever and bacteremia. Leaflet perforation is usually the result of endocarditis or iatrogenic leaflet trauma (as would occur during cardiac surgery or cardiac catheterization) and would appear as regurgitation distant from expected commissures, within the body of the leaflet. Paravalvular abscess is another potential complication of endocarditis. This is usually seen along the aortic mitral intervalvular fibrosa, appearing as an echolucent space at the base of the anterior mitral valve leaflet adjacent to the aortic valve annulus, and is not seen in this case.

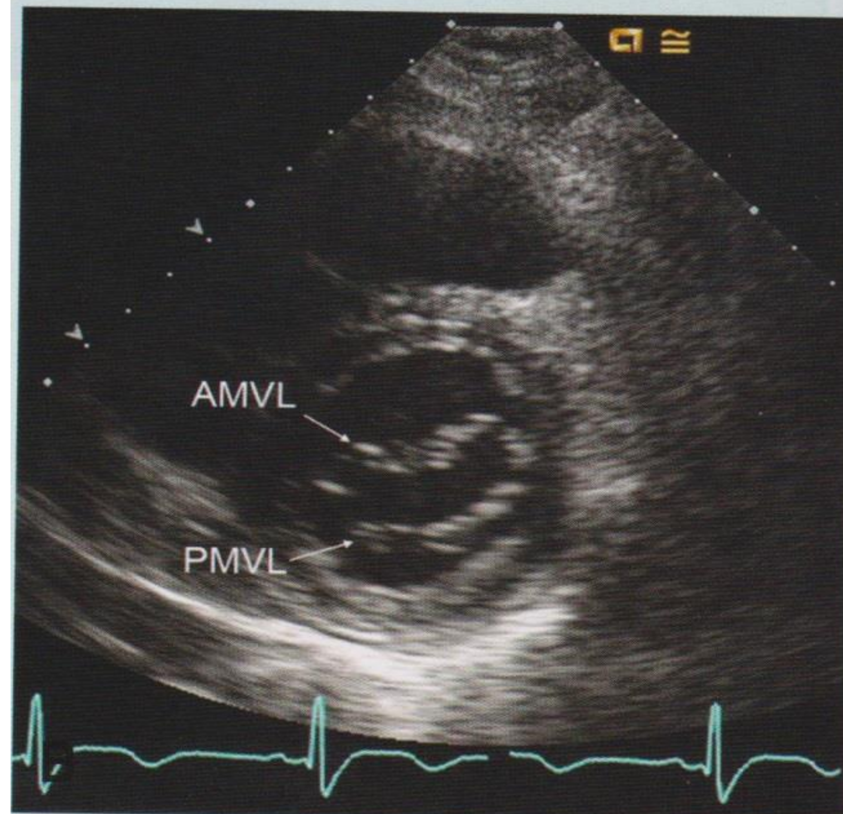

Figure 3–36.

QUESTION 3

An 86-year-old woman presents with dyspnea. Electrocardiography demonstrates newly diagnosed atrial fibrillation, and a transesophageal echocardiogram is ordered to evaluate for LA appendage thrombus before direct current cardioversion. An image of the LA appendage is shown in Figure 3–31. It is consistent with:

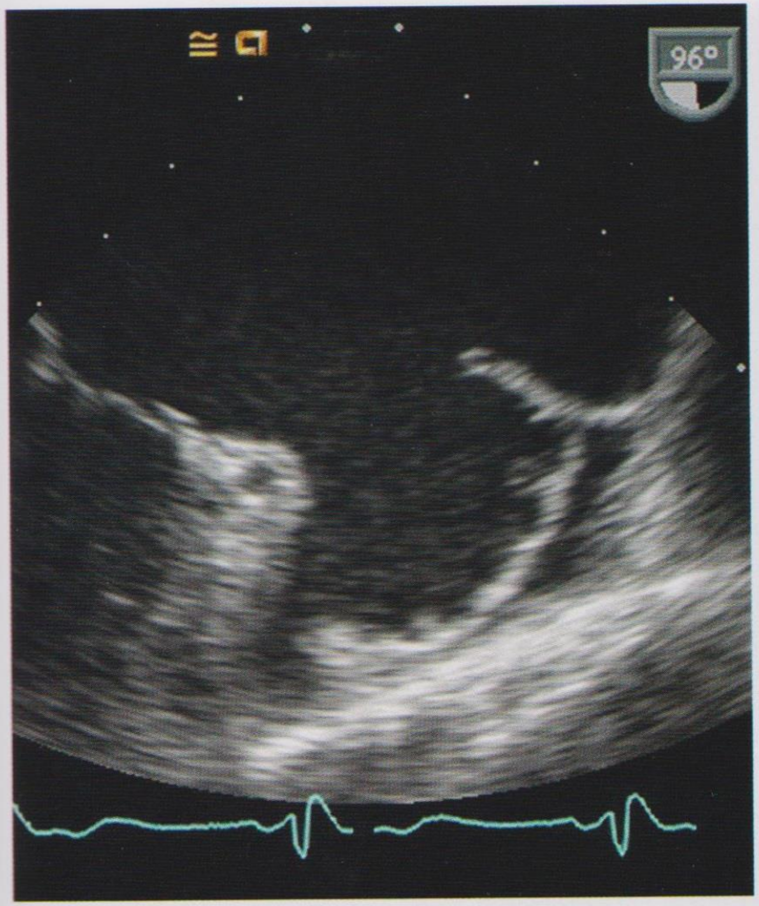

Figure 3–31.

A. Reverberation artifact
B. LA appendage thrombus
C. Atrial trabeculation
D. Spontaneous echo contrast

ANSWER 3: C

In patients with atrial fibrillation undergoing evaluation for direct current cardioversion who have not been on chronic anticoagulation, TEE is needed to visualize the LA appendage. The appendage should be visualized from several views. In this image, atrial trabeculations, atrial muscle seen in cross section, are seen protruding along the lateral wall of the appendage. Because trabeculations are contiguous with the atrial wall, contractile motion of the trabeculations should be seen with atrial activity and make thrombus less likely. A thrombus, if present, should be seen from multiple views to confirm its presence. A second view in this patient (Figure 3–37) shows no evidence of thrombus.

The normal ridge (*arrow*) between the LA appendage and left superior pulmonary vein is seen in both views. Spontaneous echo contrast appears as swirling echodensities within the body of the appendage and is consistent with low velocity flow. Often, spontaneous echo contrast coexists with a true appendage thrombus. A reverberation artifact from the ridge between the appendage and the left upper pulmonary vein is common and often difficult to differentiate from a thrombus. Artifact is more likely if the abnormality cannot be demonstrated from multiple image planes.

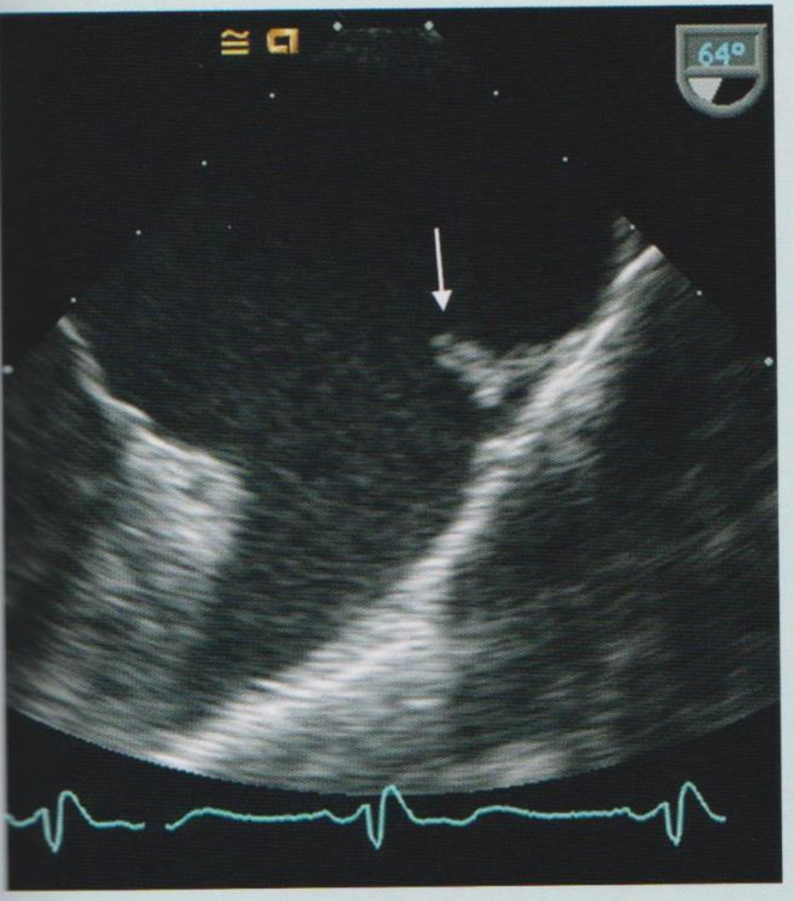

Figure 3–37.

QUESTION 4

A 55-year-old man with recent history of an ST elevation anterior myocardial infarction presents with acute ischemia of the right lower extremity. Transthoracic echocardiogram images done at the time of his infarction demonstrated poor image quality. The best option for further diagnostic evaluation to evaluate the source of limb ischemia in this patient is:

A. Microbubble transpulmonary contrast
B. Transesophageal echocardiogram
C. Abdominal vascular ultrasound
D. Lower extremity venous Doppler

ANSWER 4: A

This patient is presenting with acute limb ischemia, concerning for peripheral embolism. In the setting of a recent anterior wall myocardial infarction, an embolic source from apical thrombus should be considered. The cardiac apex is usually anteriorly situated and is generally well seen by transthoracic imaging. However, recent transthoracic images in this patient documented poor image quality. Microbubble transpulmonary contrast enhances endocardial border definition, allowing for improved visualization of the LV apex. An apical thrombus, if present, may displace microbubble contrast, creating a negative filling effect. Image planes for TEE imaging are constrained by esophageal anatomy. With TEE, the LV is foreshortened and the apex is not optimally seen to exclude thrombus. In a patient with limb ischemia, complications of the cardiac catheterization should be considered; however, any complication identified at the abdominal aorta level would cause bilateral limb ischemia, not unilateral limb ischemia as seen in this case. Lower extremity Doppler would diagnose a venous thrombus and might document the arterial blockage but would not aid in evaluation of the source of the arterial occlusion.

QUESTION 5

The Doppler tracing shown in Figure 3–32 was acquired on TEE imaging. This signal is most consistent with:

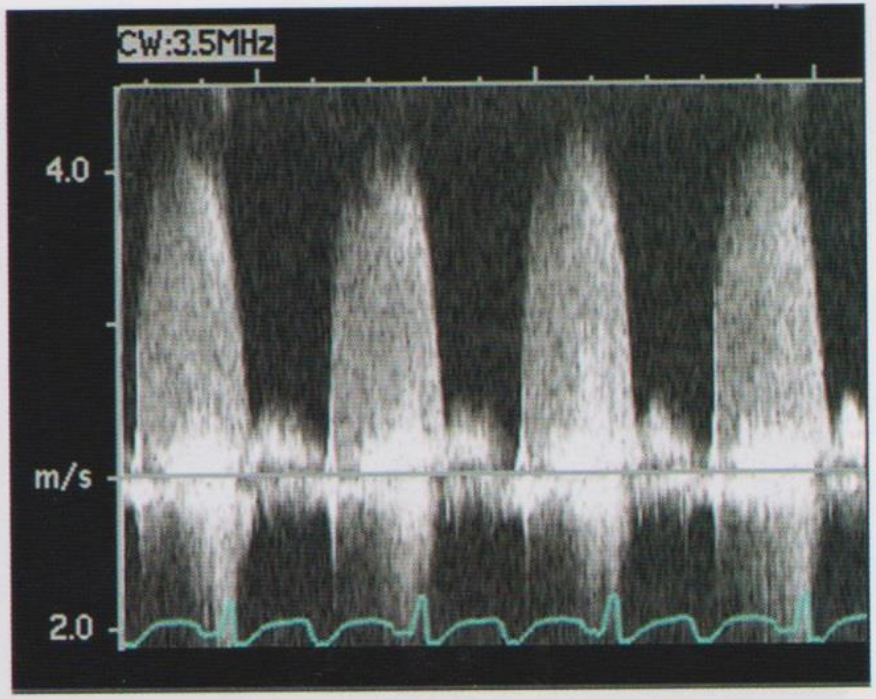

Figure 3–32.

A. Aortic stenosis
B. Aortic regurgitation
C. Mitral stenosis
D. Mitral regurgitation
E. Tricuspid regurgitation

ANSWER 5: B

This is a CW Doppler tracing (note velocity scale) with a maximum velocity of about 4 m/s and with flow occurring in diastole, directed toward the transducer, consistent with aortic regurgitation. Aortic stenosis, mitral regurgitation, and tricuspid regurgitation might have a similar velocity, but all occur in systole. Mitral stenosis would be a lower velocity diastolic signal, usually directed away from the transducer from a high TEE 4-chamber view. The tracing was obtained in a patient with a bicuspid aortic valve in whom the aortic regurgitant jet was directly posteriorly (Figure 3–38).

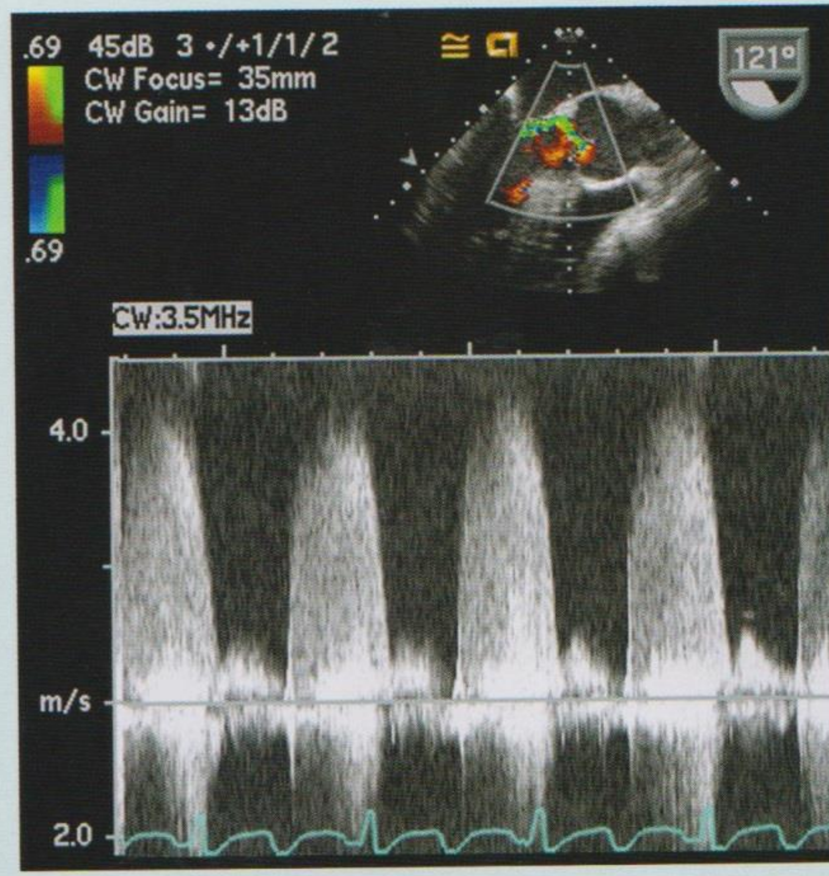

Figure 3–38.

QUESTION 6

TEE was requested for evaluation of mitral regurgitation in a 64-year-old man with dyspnea, and the images shown in Figure 3–33, *A* and *B*, were obtained. Why does the mitral regurgitation jet look larger in image *B* compared with image *A*?

A. Different image plane
B. Later in cardiac cycle
C. Higher transducer frequency
D. Lower Nyquist limit
E. Faster frame rate

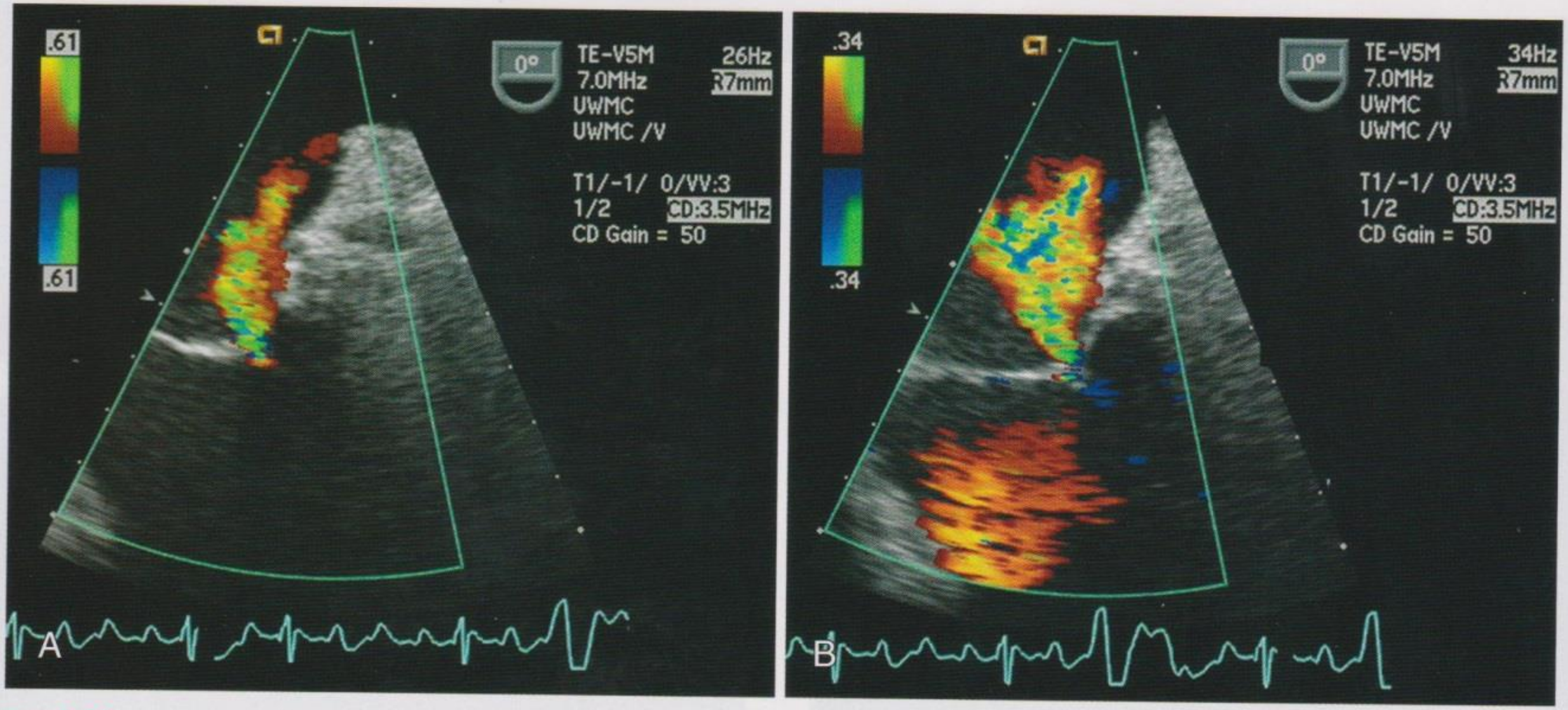

Figure 3–33.

ANSWER 6: D

These two images are in the same image plane (0 degrees) with an enlarged image of mitral valve closure in a TEE 4-chamber view. The Nyquist limit in *A* is 0.61 m/s, compared with 0.34 m/s in *B*, so that the mitral regurgitant jet appears larger as a result of lower velocities in the regurgitant jet coded as color flow at the lower aliasing velocity. Although mitral regurgitant severity may vary from frame to frame during the cardiac cycle, particularly with late systolic prolapse in mitral prolapse, both these frames were recorded in early systole, as seen by the break in the ECG signal at the bottom of the image. The transducer frequency is the same on both images (7 MHz); a higher transducer frequency would result in a smaller regurgitant jet color area. The frame rate is slightly faster (34 vs. 24 Hz) on the second image, but this is unlikely to affect the color jet size because both frame rates are adequate for diagnosis. Notice that the size of the jet as it crosses the mitral valve, the vena contracta, is similar on both images. Vena contracta size is a better measure of regurgitant severity than jet area because it is less dependent on imaging parameters, as shown in this example.

QUESTION 7

The structure indicated by the question mark in Figure 3–34 is:

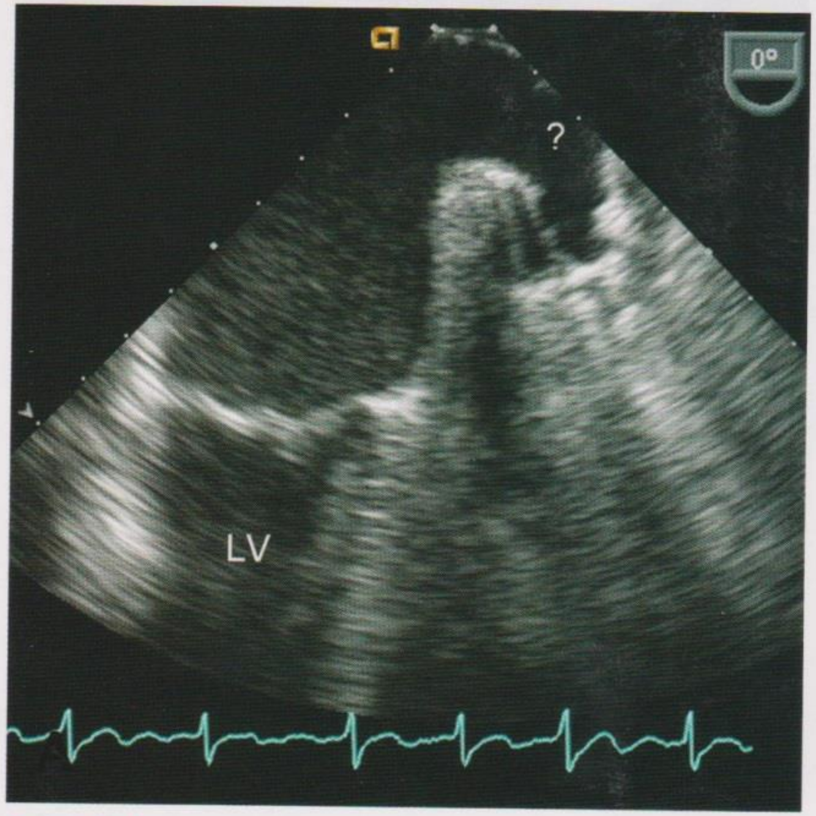

Figure 3–34.

A. Left atrial appendage
B. Pulmonary vein
C. Coronary sinus ostium
D. Right lower pulmonary vein

ANSWER 7: B

The entrance of the pulmonary veins to the LA is easily seen by TEE. This is the left upper pulmonary vein which is typically the easiest to image and enters the LA superior to the LA appendage. This is not the LA appendage because a ridge of tissue separates the left upper pulmonary vein and the atrial appendage and would be seen adjacent to the transducer. The LA appendage lies just superior to the posterior mitral valve leaflet long the atrial wall, as seen in the image shown in Figure 3–39, taken from the same patient. The left lower pulmonary vein is best seen with the probe at 0 degrees and slightly advanced, where it enters the LA at a horizontal angle from the transducer. The right pulmonary veins are also seen best with the probe at 0 degrees and turned toward the patient's right side. The coronary sinus drains into the RA, adjacent to the inferior vena cava, and is best seen in the 0 degree view with the probe advanced to the gastroesophageal junction.

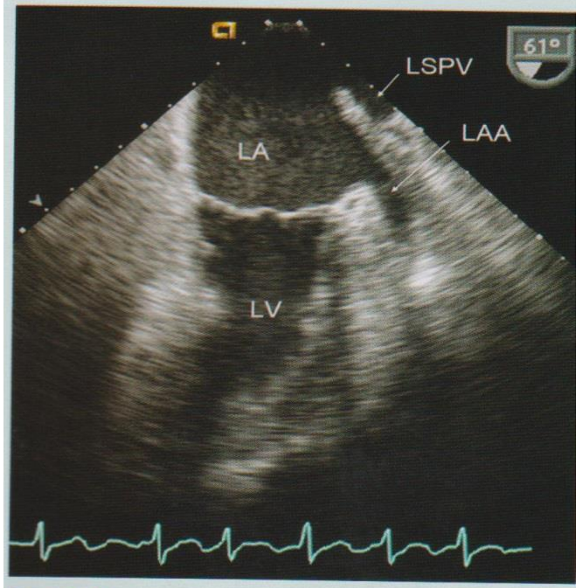

Figure 3–39.

QUESTION 8

A transesophageal echocardiogram is performed to evaluate for endocarditis. The procedure is completed and all views are obtained. After recording the transgastric view, the probe is withdrawn back into the esophagus. In this position, there is resistance to further withdrawal of the probe. The next best step is to:

A. Withdraw the probe
B. Retroflex the probe
C. Rotate the probe
D. Advance the probe

ANSWER 8: D

In the transgastric view, optimization of the short axis view of the LV typically involves flexion of the transducer for superior angulation of the probe tip. Once completed, flexion of the probe tip should be relaxed before withdrawal back into the esophagus; otherwise, the tip may be withdrawn in the fully flexed/folded position. In this probe position, withdrawing, retroflexing, or rotating the probe further may perforate the esophagus. The esophagus is too narrow to correct a folded probe within the esophagus. The probe should be readvanced to the stomach, where the tip can be relaxed. If a folded TEE probe is suspected, chest radiography may be used to confirm the suspicion before further probe manipulation.

QUESTION 9

Identify the structure indicated by the asterisk or arrow on each of the TEE images shown in Figure 3–35:

A. ________________________

B. ________________________

C. ________________________

D. ________________________

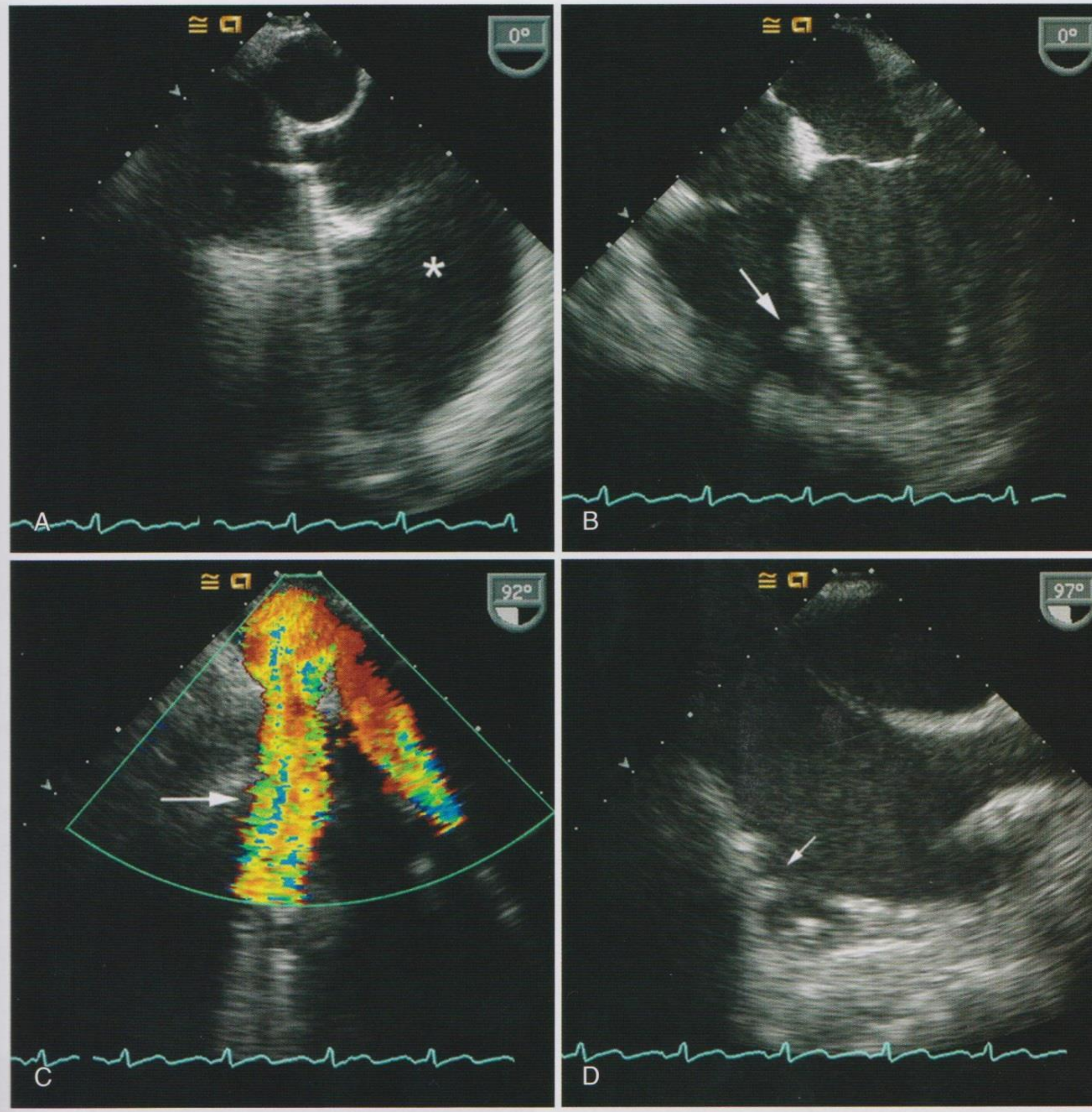

Figure 3–35.

ANSWER 9:

A. Pleural effusion
B. Moderator band
C. Left inferior pulmonary vein
D. RA appendage

Image *A* shows a large echolucent space adjacent to the descending thoracic aorta (seen as a circle as the top of the image), consistent with a large left pleural effusion. Image *B* shows a 4-chamber view with an echodensity in the apex of the RV; this is the typical location for the moderator band. Image *C* shows two veins directed toward the transducer in a 90 degree image plane; these are consistent with a superior (on the right) and inferior (on the left) pulmonary vein—most likely the left pulmonary veins, although the right pulmonary veins may look similar. During an exam, right and left pulmonary veins are easily distinguished by rotating the probe toward the LA. Image *D* is a longitudinal view (at about 90 degrees) of the RA, atrial septum, and superior vena cava. The trabeculated space indicated by the arrow is the normal RA appendage.