1. Lipomatous atrial septal hypertrophy (LASH) is associated with
   a. Coronary artery disease and giant negative T waves on the ECG
   b. Mitral regurgitation and ventricular dysrhythmias
   c. Advanced age, obesity, and atrial arrhythmias
   d. Athletes with small thick hearts

   LASH is a histologically benign lesion of the heart characterized by excessive fat deposition in the region of the interatrial septum. The magnitude of fat accumulation is defined as >2cm in thickness. First described in postmortem specimens, LASH is encountered in a significant number of individuals, although actual prevalence is unknown. LASH is associated with advanced age and obesity, and may be associated with an increased risk for atrial arrhythmias.

2. Which of the following is not true?
   a. LASH typically has a “dumbbell” shape echocardiographically
   b. Fat accumulates cephalad and caudad to the fossa ovalis
   c. The caudad thickening is usually more extensive than the cephalad
   d. The cephalad component is contiguous with the rest of the subepicardial fat

   LASH has a pathognomonic “dumbbell” shape, as fat accumulates cephalad and caudad to the fossa ovalis, with sparing of the fossa itself. The cephalad thickening is usually more extensive than the caudad, and both masses project into the right atrial cavity. The cephalad component is contiguous with the rest of the subepicardial fat, which is generally markedly increased in patients with LASH.

3. Progressive disruption of myocardial fibers results from fat accumulation and infiltration into pathways that ordinarily facilitate atrial depolarization. This may lead to fibrosis and impairment of electrical conduction.
   a. True
   b. False

   The presence of LASH increases with age and obesity. In an elderly and/or obese patient with an atrial dysrhythmia without other causative factors (congenital disease, valvular disease, or sick sinus syndrome) the arrhythmia may be due to LASH. A possible explanation for this association is the progressive disruption of myocardial fibers that result from fat
accumulation and infiltration into pathways that ordinarily facilitate orderly atrial depolarization. This disorganization of fibers leads to fibrosis, with impairment of contractility and electrical conduction.

4. The finding which is sufficient to establish the diagnosis of LASH on an echocardiogram is
   a. It has a stalk originating from the fossa ovalis
   b. Smooth non-enhancing margins
   c. Dumbbell appearance with sparing of the fossa ovalis
   d. Mass with well encapsulated cystic appearance

   Multiple imaging modalities, including echocardiography, CT, and MRI, can be used to diagnose LASH. Irrespective of the imaging modality, LASH has a characteristic dumbbell appearance of the interatrial septum with sparing of the fossa ovalis. This typical appearance is often sufficient to establish the diagnosis by echocardiography.

5. The differential diagnosis of LASH includes
   a. Primary cardiac tumors and thrombi
   b. Secondary (metastatic) tumors
   c. MAC
   d. Aortic aneurysm
   e. A and B
   f. C and D

   LASH can be mistaken for various intracardiac masses but echocardiography, CT, and MRI have made diagnosis possible without biopsy and histologic analysis. The differential diagnosis includes benign and malignant tumors, especially myxomas and lipomas. Myxomas typically arise from the interatrial septum near the fossa and typically have a stalk, whereas lipomas are encapsulated. Imaging techniques thus can differentiate these entities from LASH, which is nonencapsulated and always spares the fossa.

6. Anatomically the true interatrial septum is
   a. Confined to the sinus venosus portion near the right upper pulmonary vein
   b. The rim surrounding the fossa ovalis
   c. The region of the fossa ovalis and the area just below the fossa near the orifice of the tricuspid valve
   d. The infolding which extends into the right atrial cavity with epicardial fat on the outside

   Anatomically the true interatrial septum is confined to the region of the fossa ovalis and the area just below the fossa near the orifice of the tricuspid valve (the septum primum). The muscular rim surrounding the fossa in the superior, anterior, and posterior margins (the embryologic septum secundum) is in fact an infolding of the atrial wall extending into the right atrial cavity with epicardial fat on the outside.
7. Studies have suggested the presence of brown fat (brown adipose tissue, or BAT) in LASH. The role of BAT is subject to debate but theories include which of the following?
   a. Focally increased fluorodeoxyglucose (FDG) uptake occurs as a result of the metabolic activity of the brown tissue
   b. FDG uptake in LASH is the same as brown fat uptake elsewhere in the body
   c. Increased FDG uptake is secondary to an inflammatory response
   d. All of the above
   e. A and C

   The exact role of brown adipose tissue (BAT) is a subject of debate. Some investigators have shown that focally increased FDG uptake occurs in LASH and postulated that the metabolic activity of the brown tissue is the reason for this finding. However, more recent studies have questioned this theory, arguing that the mechanism of FDG uptake in LASH differs from that of brown fat elsewhere in the body. This research suggests that the increased uptake may be secondary to an inflammatory process in LASH.

8. Risks posed by LASH in percutaneous procedures requiring transseptal puncture include
   a. LASH may interfere with directing the needle to the fossa ovalis
   b. Excessive force is needed to accomplish the puncture
   c. Puncture of the hypertrophied area of the septum may reduce the maneuverability of the catheter once in the left atrium
   d. All of the above

   Any procedure requiring transseptal puncture through the hypertrophied septum area carries additional challenges and risks. Ideally the septum should be crossed through the thin portion of the septum. LASH may interfere with directing the needle to the fossa ovalis. Transseptal punctures attempted through the fatty area would require a higher degree of force than normally required to cross the atrial septum. If excessive force is applied, it is possible that the needle will pierce the roof or posterior wall of the left atrium or the aortic root. Puncturing the hypertrophied area can reduce maneuverability of the catheter after entering the left atrium.

9. Waterston’s groove is
   a. A fenestrated indentation at the os of the inferior vena cava
   b. A fenestrated indentation near the thebesian valve of the coronary sinus
   c. An infolding of the atrial wall extending into the right atrial cavity with epicardial fat on the outside
   d. An obstructive membrane within the left atrium

   The interatrial groove, known as the Waterston groove, marks the epicardial aspect of the infolded muscle rim surrounding the fossa. It is not a true septal structure. It can become
quite thick, especially in its superior, posterior and inferior margins. In some patients the epicardial fat may increase the thickness of the infolding to 1-2cm in the normal heart. The fat accumulation of LASH does not occur within the true septal tissue but rather in infoldings of the atrial wall adjacent to the true interatrial septum.

10. Which of the following are FALSE in regard to challenges that interventionalists can face during transseptal puncture in patients with LASH?

a. LASH may interfere with directing the needle to the fossa ovalis
b. LASH may increase the risk of wall rupture or intracardiac shunting
c. 3D trans-esophageal echocardiography may help to minimize risk associated with transseptal puncture in the setting of LASH
d. All commercially available atrial septal occluder devices provide similar outcomes in patients with LASH

LASH may interfere with directing the needle to the fossa ovalis. Transseptal puncture attempted through the lipomatous area would require a higher degree of force than is normally required to cross into the left atrium. If excessive force is applied to the puncture apparatus, it is possible that the needle will pierce the roof or posterior wall of the atrium or an adjacent structure such as the aortic root.27 Additionally, puncturing of the hypertrophied area can reduce maneuverability of the catheter after entering the left atrium.1 This may lead to dangerous consequences, for example, needle puncture of the heart past the epicardium, resulting in pericardial effusion or an intracardiac shunt. Three-dimensional transesophageal echocardiographic imaging modalities may improve safety and prevent complications related to transseptal puncture in these patients.

Identifying the exact location of septal tenting before actual puncture is key. There is limited data regarding outcomes with the various ASD closure devices. However, the current data suggests that ASD closure devices with thicker transverse waist diameters may provide more effective apposition of the device to the hypertrophied rims of the interatrial septum.