1. The septum spirium is formed when
   a. The right upper pulmonary vein develops
   b. The AV valves form and divide the atria and the ventricles
   c. The venous valves encircle the sinoatrial orifice, project into the primitive right atrium, and are dorsocranially fused
   d. The semilunar valves form in the primitive great vessels

   In the fifth week of cardiogenesis, embryonic venous drainage reaches the primitive right atrium through the sinus venosus. Both cavities are connected through the sinoatrial orifice, which is flanked by two valvular folds: the right and left venous valves. These venous valves encircle the orifice, project into the atrial cavity, and are dorsocranially fused, forming a ridge known as the septum spirium.

2. Between the 6th-8th weeks of embryologic development, the right valve of the sinus venosus grows large enough to divide the right atrium (RA) into 2 cavities. At this stage of development, the function of the right venous valve is
   a. To accommodate tricuspid regurgitation
   b. To direct oxygenated blood from the inferior vena cava (IVC) via the foramen ovale to the left side of the heart throughout fetal development
   c. To direct returning deoxygenated blood to the lungs
   d. To fuse with the left venous valve and the septum spirium to form the septum secundum

   Between the 6th and 8th week of embryologic development, the larger right valve of the sinus venosus grows to reach two thirds of the right atrium, dividing the right cavity into two chambers. The right valve of the sinus venosus extends from the lateral margin of the superior vena cava to the orifices of the inferior vena cava (IVC) and the coronary sinus (CS). At this stage of embryologic development, the right venous valve functions to direct oxygenated venous return from the IVC via the foramen ovale to the left side of the heart throughout fetal development.

3. From the 9th-15th week of cardiogenesis, the smaller left venous valve and septum spirium fuse. The right sinus venosus valve atrophies. The cranial part remains as the Eustachian valve; the caudal part remains as the crista terminalis.
   a. True
   b. False

   From the 9th-15th weeks of development, the smaller left venous valve and septum spirium fuse with the developing interatrial septum and form part of the septum secundum. Furthermore, the right sinus venosus valve atrophies and mostly involutes; the cranial part remains as the crista terminalis, and the caudal part fuses with the septum between the orifices of the IVC and the CS. Remnants of the inferior part of the right valve are the Eustachian valve adjacent to the IVC, and the Thebesian valve at the orifice of the CS.
4. Cor triatriatum dexter (CTD) is a rare malformation in which a large membrane divides the RA into two chambers.
   a. The proximal chamber receives the coronary sinus flow and the distal chamber receives flow from the IVC and the superior vena cava (SVC)
   b. The proximal chamber receives flow from the SVC/IVC and the distal chamber receives flow from the coronary sinus
   c. The proximal chamber contains the tricuspid valve and the RA appendage; the distal chamber receives SVC/IVC flow
   d. The proximal chamber receives blood from the SVC/IVC and the distal chamber contains the tricuspid and the RA appendage

Cor triatriatum dexter (CTD) is a rare malformation in which a large membrane divides the right atrium into two chambers: the proximal chamber usually receives blood from the superior vena cava and the IVC, while the distal chamber contains the tricuspid valve and the right atrial appendage, although four types of CTD have been reported depending on the relative position of the IVC, SVC, and the CS, in relation to the interatrial septum.

5. The symptoms of true CTD depend on
   a. Age, BSA, and the gender of the patient
   b. The status of the interventricular septum and the pulmonary valve
   c. The degree of obstruction of the membrane and the status of the interatrial septum
   d. The function of the mitral valve and the left ventricle

   The prevalence of CTD is not known given the rarity of this anomaly, as it represents approximately only 0.025% of cases of congenital heart disease reported in the literature. Symptoms depend on the degree of obstruction caused by the membrane, which is usually fenestrated, and the status of the interatrial septum. This lesion is often asymptomatic, and may be an incidental finding on routine echocardiography. Cyanosis may occur due to shunting of IVC blood into the left atrium through a PFO or an ASD

6. The (1)Chiari network, (2) Eustachian valve, and the (3) thebesian valve, respectively, are:
   a. (1) reticulated network of fibers originating from the Eustachian valve or thebesian valve, connecting to different parts of the RA; (2) a remnant of the caudal part of the right sinus venosus valve at the opening of the IVC; (3) a remnant of the caudal part of the right sinus venosus valve at the opening of the coronary sinus
   b. (1)a remnant of the caudal part of the right sinus venosus valve at the opening of the IVC; (2)a reticulated network of fibers originating from the Eustachian valve to the wall of the RA; (3) a remnant of the caudal part of the right sinus venosus valve at the opening of the coronary sinus
   c. (1) a remnant of the caudal part of the right sinus venosus valve at the opening of the coronary sinus; (2) a remnant of the caudal part of the right sinus venosus valve at the opening of the IVC; (3) reticulated fibers inserting from the RA wall to the Eustachian valve
   d. (1) a remnant of the morphologic septum spirium; (2) the valve between the ductus arteriosus and the right pulmonary artery; (3) the one-way valve of the IVC

   The Chiari network is a reticulated network of fibers originating from the Eustachian valve or the Thebesian valve, connecting different parts of the right atrium. It results from incomplete resorption of the right valve of the sinus venosus and the septum spirium. The Eustachian
valve is a remnant of the caudal part of the right sinus venosus valve located at the orifice of the IVC. In the fetal heart it directs oxygen-rich caval flow toward the interatrial septum and the left atrium. After birth it has no specific function and usually involutes. The Thebesian valve is a remnant of the caudal part of the right valve of the sinus venosus located at the orifice of the coronary sinus. Its function is not well understood but it may prevent reflux of blood into the sinus during contraction of the atrium.

7. The structure least likely to be identified by TTE, TEE, CMR, or CT is:
   a. Cortriatriatum dexter
   b. Eustachian valve
   c. The thebesian valve
   d. The Chiari network

   The Eustachian valve is the most commonly observed remnant in routine echocardiographic studies, as its high prevalence and morphology permit the correct diagnosis to be made. The Thebesian valve is seldom detected on transthoracic echocardiography because of its location and small size; imaging of the thebesian valve on CT, MRI, and TEE is at best currently only fair.

8. Persistence of remnants of the right valve of the sinus venosus has four major issues of clinical importance in adults. According to the authors, these issues include all but which of the following?
   a. Remnants simulating other disorders or serving as sites of attachment for mass lesions
   b. Interaction with a PFO
   c. Need for coronary bypass surgery compounded by persistence of the thebesian valve
   d. Invasive treatment of right sinus venosus valve remnants or percutaneous invasive procedures involving instrumentation of the RA

   Different implications are described in relation to persistence of remnants of the right valve of the sinus venosus in adults. Most are related to the differential diagnosis, because these remnants can simulate other illnesses or serve as sites of attachment for masses, can interact with a PFO, can necessitate invasive treatment because of their obstructive behavior, or can complicate invasive procedures in patients with other heart disease. Four issues are of principal importance in adults. (1) The chaotic motion of the chiari network can be confused with other disorders or serve as a site of attachment for thrombus, vegetations of infective endocarditis, or tumors. (2) Because of the embryologic origin and function of the right sinus valve remnants, a close association exists between some of these structures and PFO. This association presents significant clinical implications because of the relationship described between PFO and recurrent embolus, platypnea-orthodeoxia, and decompression syndrome. (3) Occasionally invasive treatment is needed because of the obstructive nature of the remnant (4) The increase in invasive percutaneous procedures that involve the right atrium requires clear knowledge of these structures and identification by imaging techniques.
9. In cardiac surgery, difficulties with IVC cannulation and obstruction of right atrial inflow resulting from suturing of this structure to the interatrial septum in ASD closures, with subsequent cyanosis, have been described. Also, when this structure is prominent, percutaneous interventions, particularly ASD closures, are complicated. This structure is:
   a. Thebesian valve
   b. Eustachian valve
   c. Crista terminalis
   d. Coronary sinus

In cardiac surgery, difficulties with IVC cannulation and obstruction of right atrial inflow resulting from suturing the Eustachian valve to the interatrial septum in ASD closures, with subsequent cyanosis, have been described. A prominent Eustachian valve complicates percutaneous interventions, especially those directed at ASD closure during the procedure.

10. According to the authors, the echocardiographic identification with either TTE or TEE of a highly mobile structure in the right atrium is most typical of:
   a. Cor triatriatum dexter
   b. Chiari network
   c. Eustachian valve
   d. Thebesian valve

On echocardiographic imaging (TTE or TEE) the Chiari network appears as a free-floating web-like structure that is highly mobile and nonobstructive, with multiple insertions in the upper part of the right atrium.