The Heart and Pericardium

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KEYWORDS

• Heart • Pericardium • Anatomy • Cardiothoracic surgery

This article describes the normal anatomy of the heart and pericardium. Included is a detailed description of the pericardium, mediastinal nerves, cardiac chambers, valves, coronary arteries and veins, and the conduction tissues. A thorough knowledge of the anatomy of these structures is essential for the cardiothoracic surgeon.

THE PERICARDIUM

The heart lies within the pericardium, which is attached to the walls of the great vessels and to the diaphragm (**Fig. 1**). The inner layer, the visceral pericardium, is in direct contact with the heart. The outer layer forms the parietal pericardium, which lines the surface of the fibrous pericardial sack. A thin layer of fluid lies within the pericardial cavity between the 2 serous layers. Two recesses lie within the pericardium and are lined by the serous layer. The transverse sinus is delineated anteriorly by the posterior surface of the aorta and main pulmonary artery, and posteriorly by the anterior surface of the interatrial groove. The oblique sinus is a cul-de-sac located behind the left atrium, which is delineated by serous pericardial reflections from the pulmonary veins and the inferior vena cava.

The vagus and phrenic nerves descend through the mediastinum in close relationship to the heart. They enter through the thoracic inlet with the phrenic nerve located on the anterior surface of the anterior scalene muscle and posterior to the internal thoracic artery at the level of the thoracic inlet. On the right side, the phrenic nerve courses on the lateral surface of the superior vena cava. The nerve then descends anterior to the pulmonary hilum before reflecting onto the right diaphragm, where it branches to provide its innervation. In the case of a left-sided superior caval vein, the left phrenic nerve is located on its lateral surface. The nerve passes anteriorly to the pulmonary hilum and eventually branches on the surface of the diaphragm. The vagus nerves enter the thorax posterior to the phrenic nerves and course along the carotid arteries. On the right, the vagus gives off the recurrent laryngeal nerve that passes around the right subclavian artery before ascending out of the thoracic cavity. The right vagus nerve continues posterior to the pulmonary hilum, gives off branches of the right pulmonary plexus, and exits the thorax along the esophagus. On the left, the vagus nerve crosses the aortic arch, where it gives off the recurrent laryngeal branch. The recurrent nerve passes around the ligamentum arteriosum before ascending in the tracheoesophageal groove. The vagus nerve continues posterior to the pulmonary hilum, gives rise to the left pulmonary plexus, and then continues inferiorly out of the thorax along the esophagus. A delicate nerve trunk, the subclavian loop, carries fibers from the stellate ganglion to the eye and head. This branch is located adjacent to the subclavian arteries bilaterally. Excessive dissection of the subclavian artery may lead to injury of these nerve roots and cause Horner syndrome.

CARDIAC CHAMBERS AND THE GREAT ARTERIES

The surgical anatomy of the heart is best understood when the position of the cardiac chambers and great vessels is known in relation to the cardiac silhouette (**Fig. 2**). The atrioventricular junction is oriented obliquely, lying much closer to the vertical than to the horizontal plane. This

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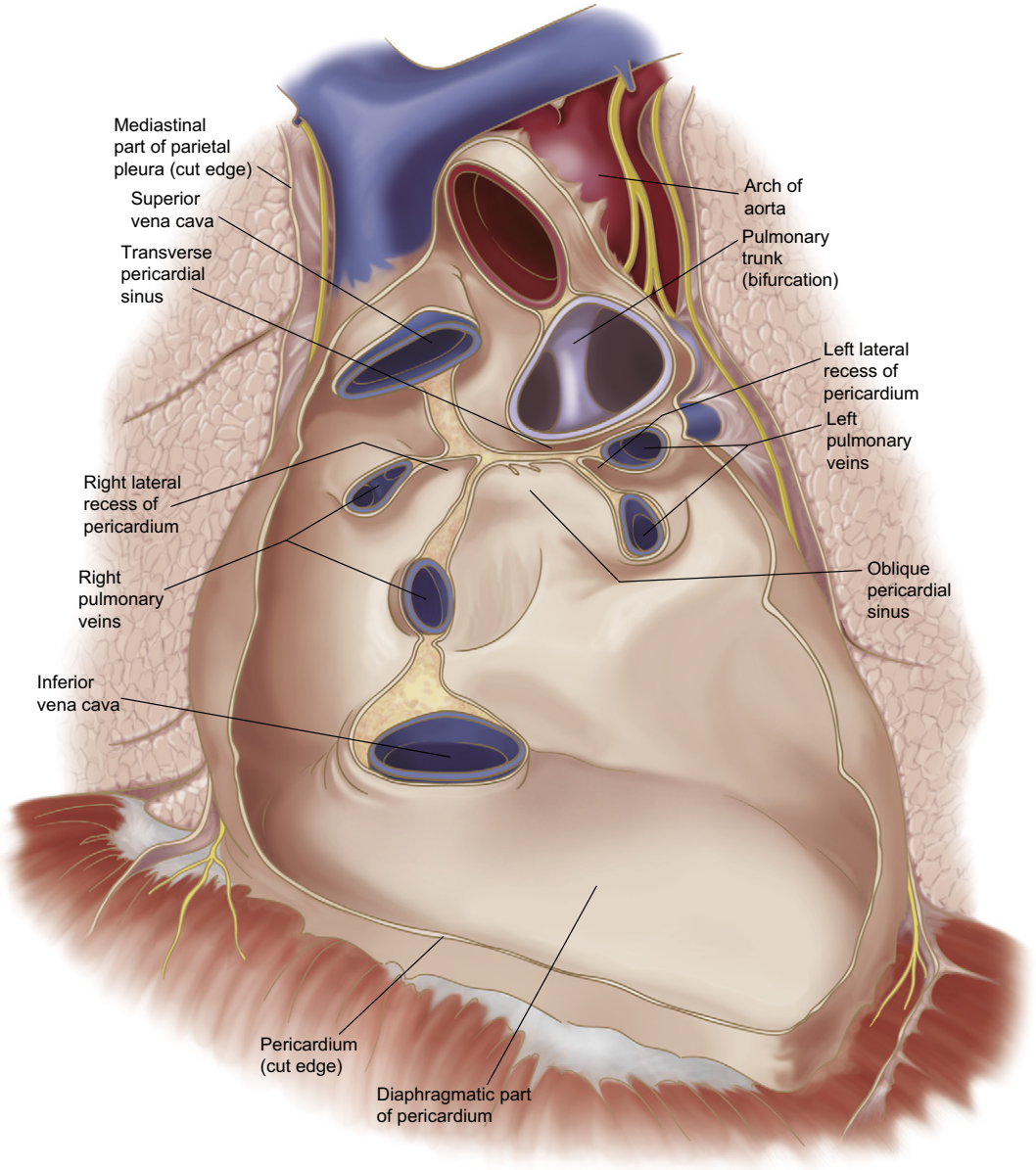

Fig. 1. Anterior view of the pericardial sac including vascular structures and mediastinal nerves.

plane can be viewed from its atrial aspect if the atria and great arteries are removed by a parallel cut above the atrioventricular junction. The tricuspid and pulmonary valves are separated by the inner curvature of the heart lined by the transverse sinus. The mitral and aortic valves lie adjacent to one another, with fibrous continuity of their leaflets. The aortic valve occupies a central position, wedged between the tricuspid and pulmonary valves. There is also fibrous continuity between the leaflets of the aortic and tricuspid valves through the central fibrous body.

The atrial chambers lie to the right of their corresponding ventricles. The right atrium and ventricle lie anterior to the left atrium and ventricle. The septal structures between them are obliquely oriented. By virtue of its central position, the aortic valve is directly related to all of the cardiac chambers. The position of the aortic valve minimizes the area of septum where the mitral and tricuspid valves attach opposite each other. Because the tricuspid valve is attached to the septum further toward the ventricular apex than the mitral valve, a part of the septum is interposed between the

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