

11.1 The Aortic Arch

11.1.1 General Anatomy of the Ascending Aorta and the Aortic Arch

Surgery of the aorta is one of the most challenging areas of cardiac and vascular surgery, from the management of emergency situations to the treatment of degenerative diseases. To achieve an optimal surgical result, it is essential not only to have an exhaustive knowledge of the pathological mechanisms involved, but also to be familiar with the anatomy of the aorta. Hence, we are dedicating an entire chapter to this great vessel of the human body.

In this chapter, we will focus on the anatomy of the aorta, but not including the aortic root. In the past, the aortic root (also known as the bulb of the aorta) was considered to be an integral part of the ascending aorta. However, since the introduction of reconstructive procedures of the aortic root, this part of the ascending aorta is now regarded as an independent morphological and functional unit. The detailed morphology of the aortic root has been discussed elsewhere (Chap. 5), and so only the segments of the aorta positioned superior to

the aortic root are discussed herein. A morphological description of the ascending aorta, aortic arch, thoracic aorta, and supraceliac part of the aorta will be provided. A discussion of the abdominal part of the aorta is outside the scope of this book.

The human aorta commences at the upper part of the aortic root at the level of the sinotubular junction, where it is about 3 cm in diameter, and after ascending for a short distance, it arches backward and to the left side, over the root of the left lung. It then descends within the thorax on the left side of the vertebral column, passes into the abdominal cavity through the aortic hiatus in the diaphragm, and ends by dividing into the right and left common iliac arteries. Thus, the aorta can be described as having several portions: the ascending part, the arch, and the descending part, the latter of which is again divided into the thoracic and abdominal aortae.

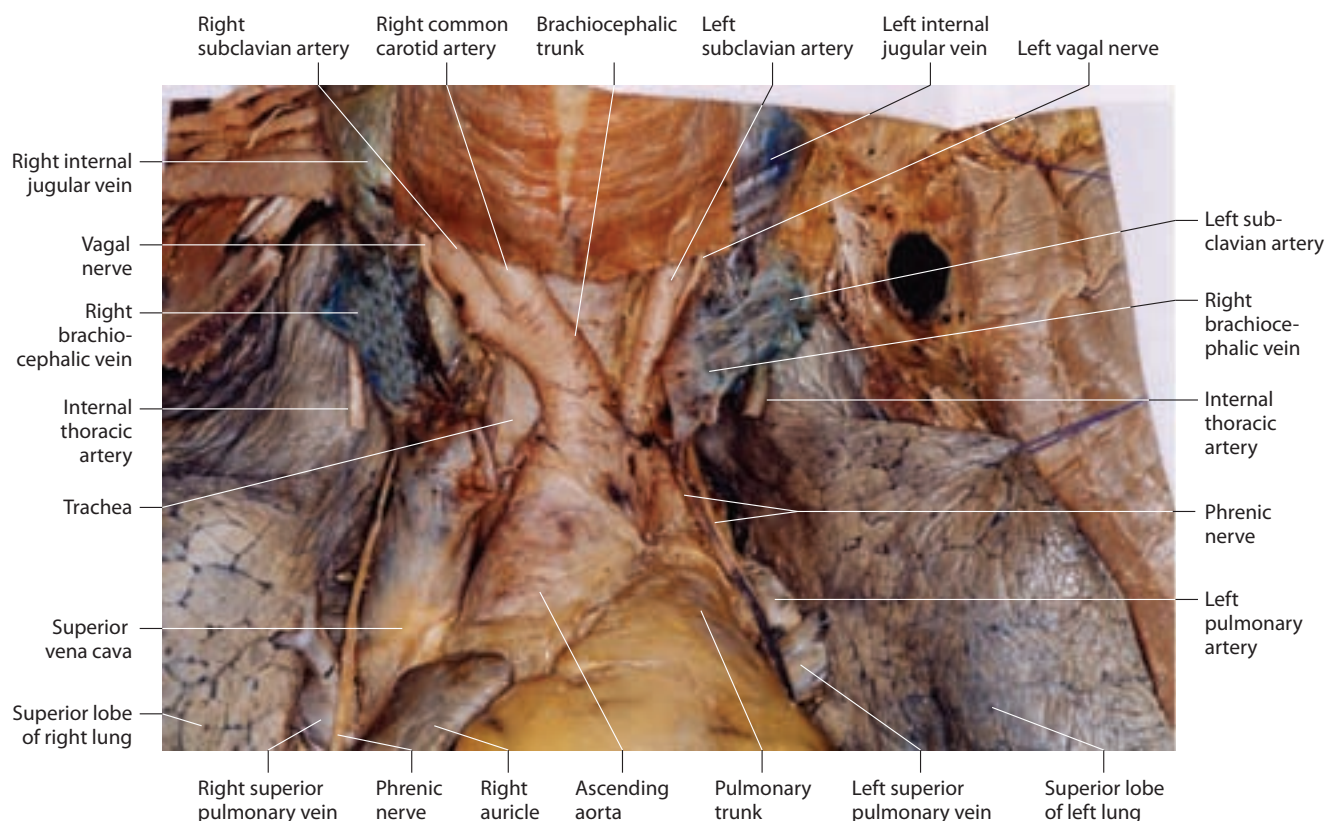


Fig. 11.1. Supracardiac mediastinum, with exposure of the great vessels

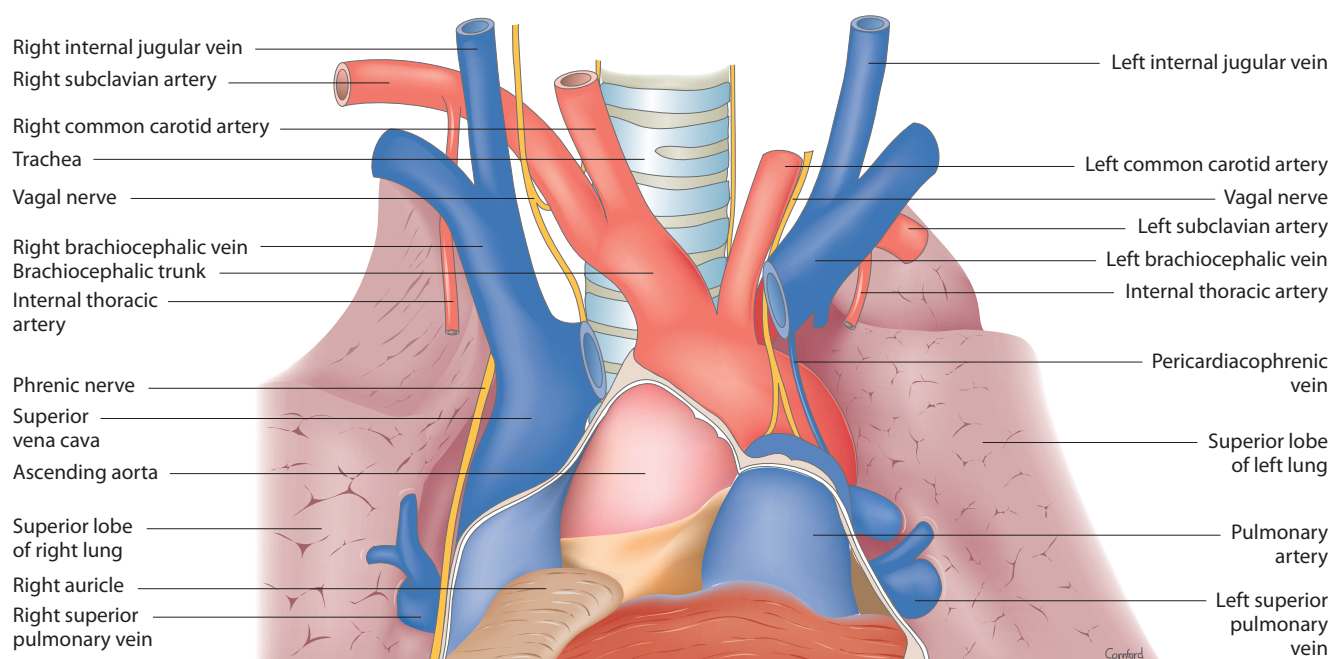


Fig. 11.2. Supracardiac mediastinum, with exposure of the great vessels, schematic drawing

The direction and the topographical positions of the ascending aorta are presented on the dry-dissected specimen of the superior mediastinum in **Fig. 11.1** and the corresponding drawing (**Fig. 11.2**), wherein the ascending aorta is viewed from the anterior aspect. The anterior chest wall has been removed and the pericardium opened to secure adequate exposure of the anterior surface of the heart. In the presented case, the entire anterior sheath of the pericardium has been removed, sparing the left and right phrenic nerves on the lateral surfaces of the pericardium. The superior lobes of the right and left lungs have been retracted. The initial part of the ascending aorta is positioned behind the infundibulum (**Figs. 11.1** and **11.2**). This initial part is viewed from the posterior aspect and is surrounded by the left and right atria. Here, the ascending aorta causes a furrow on the surfaces of both atria. The incisure on the right medial wall of the right atrium is particularly prominent and is seen clearly on the cross section of the mediastinum presented in **Fig. 11.3** and the corresponding drawing (**Fig. 11.4**). Note here that the ascending aorta is inspected from the superior aspect. The same situation is seen on **Figs. 12.4** and **12.5**, wherein the ascending aorta is seen from an inferior view.

The part of the ascending aorta positioned inferior to the pulmonary artery is covered by the epicardial fat tissue. The presence of this condensation of fat is characteristic and is found in every heart, independent of the

habitus. At this level, the ascending aorta is joined on the right to the superior vena cava and on the left to the pulmonary trunk. Anteriorly, the ascending aorta is covered by the appendage of the right atrium, from the left by the pulmonary trunk, and from the right by the superior vena cava. The aforementioned fat-tissue condensation elevates the epicardium from the anterior wall of the aorta, forming a semicircular plica, as seen clearly on **Fig. 11.1**. The fold of the transition between the pericardium and the epicardium may be found on the superior part of the ascending aorta, just before the junction with the aortic arch. Note that the ascending aorta is contained within the pericardium and is enclosed in a tube of serous pericardium, which it shares with the pulmonary artery. On the presented specimen, this is seen as oblique line running along the anterior wall of the ascending aorta, from right to left, from inferior to the brachiocephalic artery, inferior toward the pulmonary trunk (**Figs. 11.1** and **11.2**).

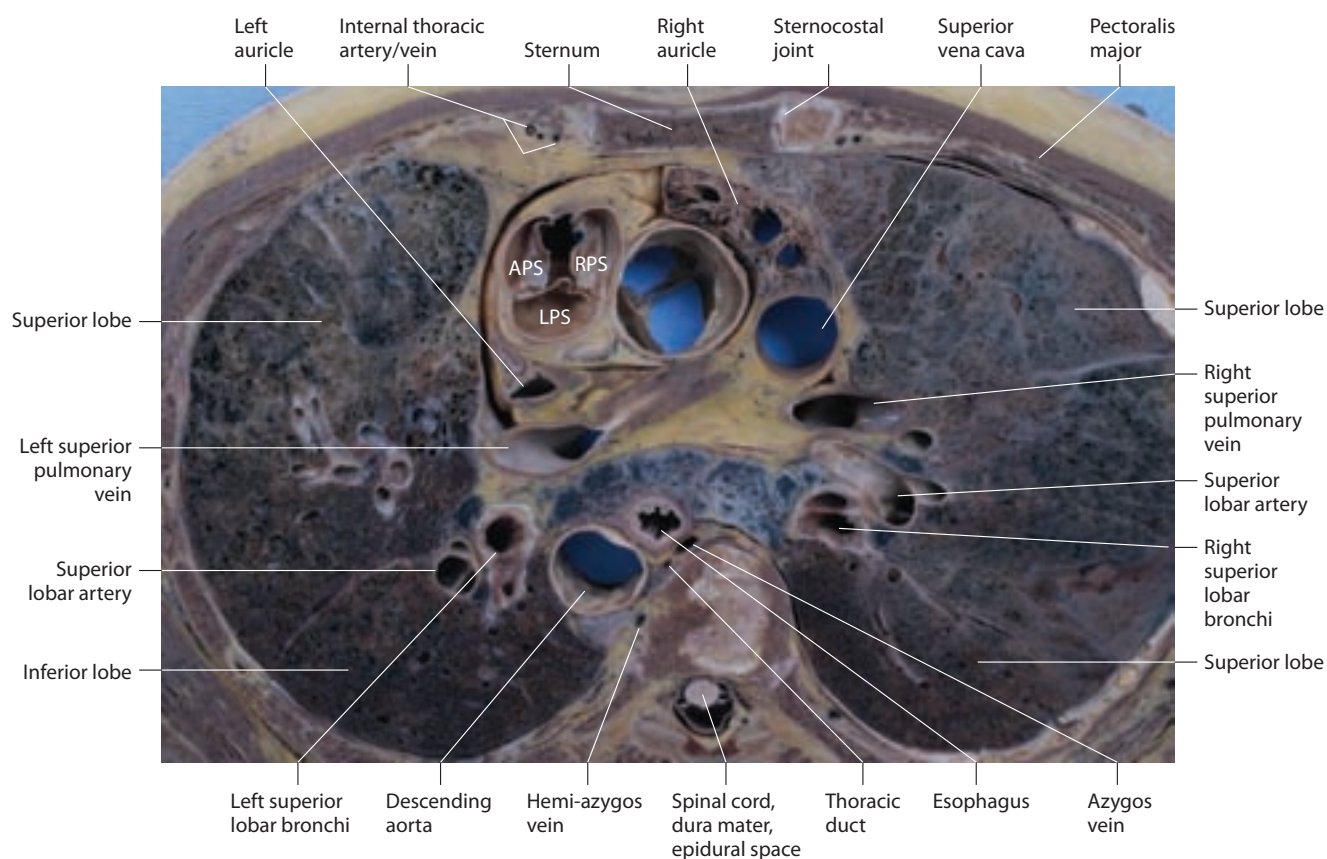


Fig. 11.3. Horizontal cross section of the thorax at the level of the sinotubular junction, superior view

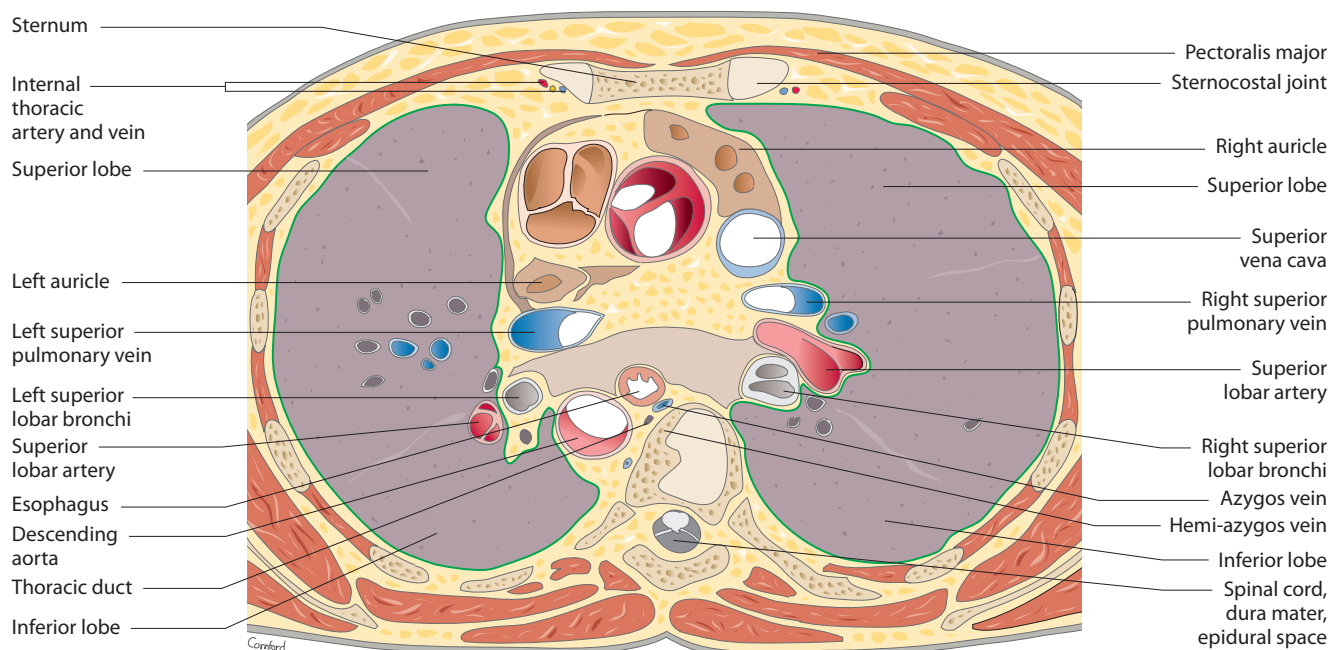


Fig. 11.4. Horizontal cross section of the thorax at the level of the sinotubular junction, superior view, schematic drawing

In the next specimens, the ascending aorta will be viewed from the left aspect in order to establish the detailed topography and its relationship to the other anatomical structures (**Figs. 11.5** and **11.6**). On the dry-dissected specimen in **Fig. 11.5** and the corresponding schematic drawing in **Fig. 11.6**, the ascending aorta and the aortic root are seen from the left anterolateral view. The pulmonary trunk has been dissected so that the superior dissection line is positioned inferior to its bifurcation into the left and right main pulmonary arteries. The inferior dissection line is positioned in the pulmonary root. The sinuses of the pulmonary bulb have been removed, leaving only the three intervalvular triangles and the commissures in situ. Thus, the space behind the pulmonary trunk may be investigated. This is effectively the space of the transverse pericardial sinus, which is inspected from the anterior direction (**Fig. 11.6**). Note that the left main stem and the bifurcation have also been brought into the view using this exposure. The appendage of the left atrium has been retracted. In this specimen, it is clear that the pulmonary root and the infundibulum are positioned in front of the aortic root and the conjoined part of the ascending aorta. Here, the ascending aorta is a direct continuation of the aortic root and the axis of the left ventricle. From here on, the course of the ascending aorta describes a slight curve, which is directed upward, forward, and to the right (**Fig. 11.5**). At the level of the junction between the superior vena cava and the right atrium, the ascending aorta reaches the most extreme right position, from which point the aorta travels in the frontal plane upward and to the left, toward the aortic arch. The mentioned

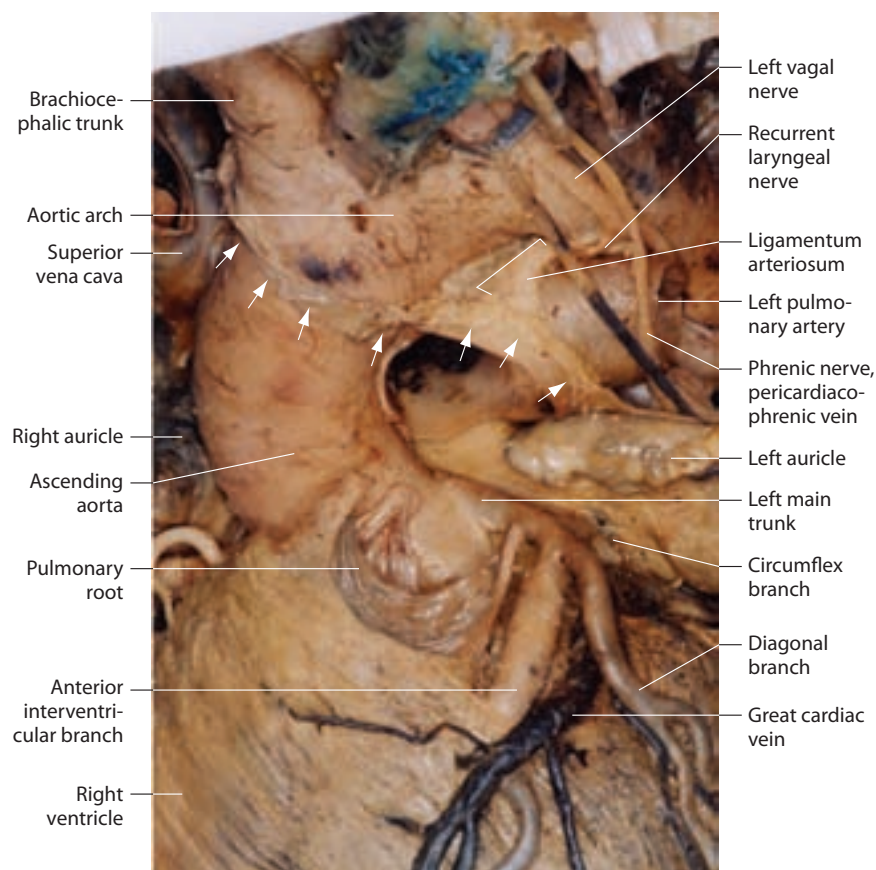


Fig. 11.5. Ascending aorta, left anterior view. Arrows indicate the pericardial transition

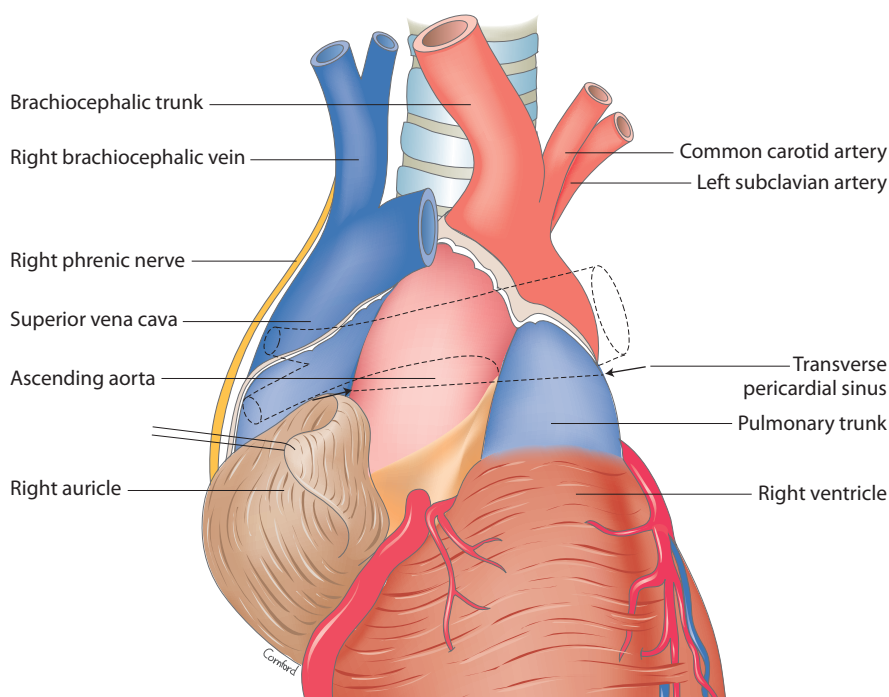


Fig. 11.6. Ascending aorta, anterior view, schematic drawing

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