1

Vascular

Question 1.1

Name the structures labelled on this chest radiograph.

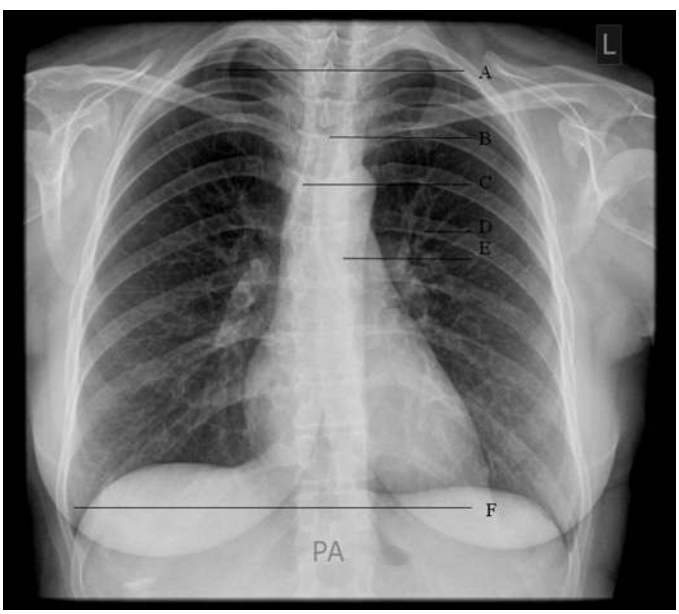

Figure 1.1

Answer

A: Right 1st rib.
B: Trachea.
C: Right main bronchus.
D: Posterior rib.
E: Left main bronchus.
F: Right costophrenic angle.

Anatomical notes

The thorax is divided into two lateral compartments each containing a lung and associated pleura, and a central compartment, the mediastinum, which contains the other thoracic structures. Each lung is surrounded by a pleural sac, created by two pleural membranes in close apposition. Pleural membranes:

- Visceral: lies in contact with the lung.
- Parietal: lies in contact with the diaphragm (innervated by vagus nerve), pericardium and chest wall (innervated by intercostals nerves).

The pleural cavities are potential spaces between the pleura and contain a layer of serous fluid that allows the layers to glide over each other during respiration. The parietal pleura produces pleural reflections as it changes direction. Reflections occur where the costal pleura becomes continuous with the mediastinal pleura anteriorly and posteriorly, and with the diaphragmatic pleura inferiorly. The visceral and parietal layers of pleura are continuous at the root of the lung. The pulmonary ligament, a double layer of parietal pleura, suspends from this region.

The lung root contains:

- Main bronchus.
- Pulmonary artery.
- Pulmonary vein.
- Bronchial arteries.
- Lymph nodes.

The **vagus nerve** lies **posterior** to the root of the lung and the **phrenic nerve** lies **anterior** to the root of the lung.

During expiration the lung does not completely occupy the thoracic cavity, creating potential pleural cavities.

- Costodiaphragmatic recess (diaphragmatic pleura in contact with costal pleura).
- Costomediastinal recess (posterior to the sternum).

Question 1.2

What type of image is shown below?
What thoracic level is it showing?
Name the labelled lobe/structure.

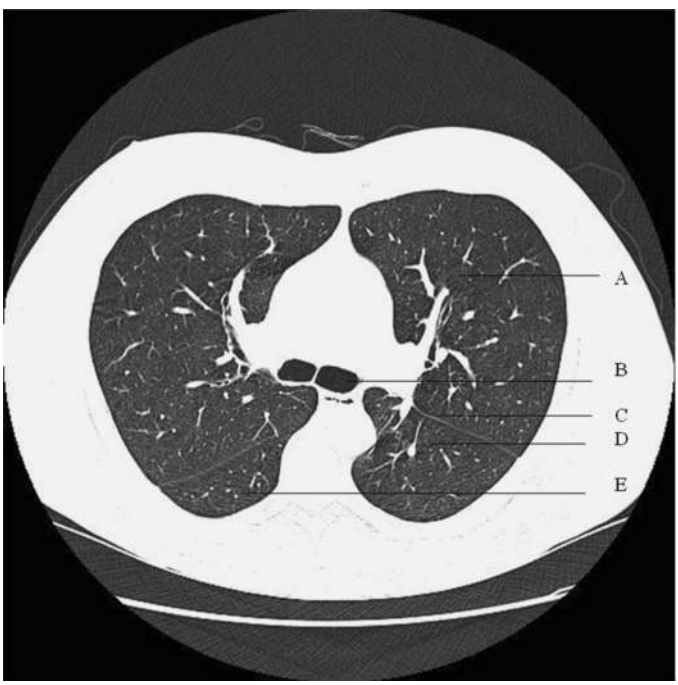

Figure 1.2

Answer

This is an axial lung CT (computed tomography) scan taken at the level of the carina (T4/5).

A: Left upper lobe.
B: Left main bronchus.
C: Left oblique fissure.
D: Left lower lobe.
E: Right lower lobe.

Anatomical notes

The trachea begins at the level of C6 and continues inferiorly from the cricoid cartilage to the carina (bifurcation) at the vertebral level of T4/5 (angle of

Louis). The right and left main bronchi pass inferolaterally from this level and branch within the lungs to form the bronchial tree, consisting of secondary (lobar) and tertiary (segmental) bronchi. Each bronchopulmonary segment has an apex that faces the root of the lung and a base at the pleural surface.

The right main bronchus is shorter, wider and leaves the main bronchus at a more vertical angle than the left main bronchus. The left main bronchus passes inferolaterally, inferior to the arch of aorta and anterior to the oesophagus and thoracic aorta to reach the root of the lung. C-shaped cartilage rings support the bronchi.

The right lung is divided into three lobes by the oblique and horizontal fissures. The left lung has two lobes, divided by the oblique fissure. Each lung has the following surfaces:

- Costal surface.
- Mediastinal.
- Diaphragmatic.

The lung borders are as follows:

- Anterior.
- Inferior.
- Posterior.

Clinical notes

Due to the vertical course and greater width of the right main bronchus there is a greater tendency for foreign bodies and aspirated material to pass into it.

Antoine Louis (1723–1792) – French surgeon and physiologist.

Question 1.3

Name the vascular structures identified on the chest radiograph.

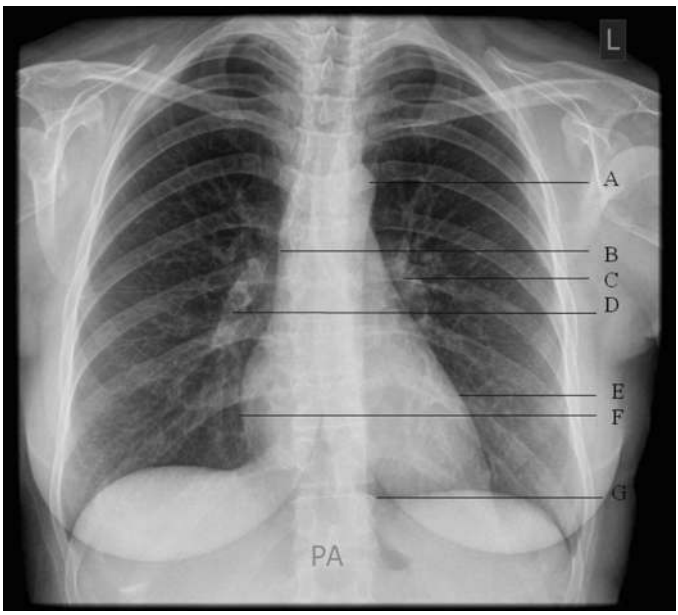

Figure 1.3

Answer

A: Aortic knuckle.
B: Superior vena cava (SVC).
C: Left pulmonary artery.
D: Right pulmonary artery.
E: Left heart border: left ventricle.
F: Right heart border: right atrium.
G: Inferior heart border: right ventricle.

Anatomical notes

The mediastinum is the central part of the thoracic cavity which lies between the pleural sacs. It extends from the superior thoracic aperture to the diaphragm and from the sternum and costal cartilages to the thoracic vertebrae. An arbitrary line formed between the sternal angle to the inferior border of T4 divides the mediastinum into superior and inferior parts. The inferior mediastinum is subdivided by the

pericardium into anterior, middle and posterior parts. The heart and great vessels lie within the middle mediastinum.

The heart has a base, apex, three surfaces and four borders. The base of the heart is located posteriorly and formed mainly by the left atrium. The apex is normally located in the left fifth intercostal space, mid-clavicular line in adults and is formed by the left ventricle.

The three surfaces are:

- Sternocostal (right ventricle).
- Diaphragmatic (left ventricle and part of right ventricle).
- Pulmonary (left ventricle).

The borders comprise:

- Right heart border: formed by the right atrium and located between the superior and inferior vena cavae.
- Left heart border: formed by the left ventricle and partly by the left auricle.
- Superior border: formed by the right and left auricles.
- Inferior border: formed mainly by right ventricle, partly by left ventricle.

Question 1.4

What does the image below show?
Name the labelled structures.

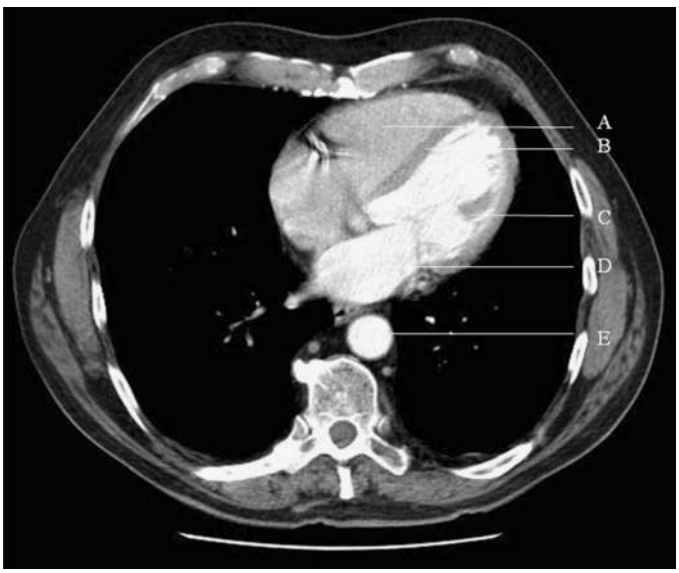

Figure 1.4

Answer

The image shows a CT axial slice through the thorax, demonstrating the chambers of the heart.

A: Right ventricle.
B: Interventricular septum.
C: Left ventricle.
D: Left atrium.
E: Descending aorta.

Anatomical notes

The heart has four chambers: two atria and two ventricles. The right atrium receives blood from the superior and inferior vena cavae, the coronary sinus and anterior cardiac vein. The crista terminalis is a muscular ridge which runs vertically downwards between the vena cavae and separates the smooth-walled posterior part of the atrium (derived from the sinus venosus) from the

rough-walled anterior portion (derived from true fetal atrium). It is also the site of the sino-atrial node (SAN), the pacemaker of the heart.

The right ventricle is separated from the right atrium by the tricuspid valve and from the pulmonary trunk by the pulmonary valve. The inflow and outflow tracts of the ventricle are separated by a muscular ridge, the infundibuloventricular crest. The inner aspect of the inflow tract has a number of irregular muscular elevations (trabeculae carneae), whereas the outflow is smooth-walled. A muscular bundle, termed the moderator band, crosses the ventricular cavity from the interventricular septum to the anterior wall and conveys the right branch of the atrioventricular bundle.

The left atrium has thicker walls, but is smaller than the right. The pulmonary vein openings lie on its posterior wall, whereas the depression corresponding to the fossa ovalis of the right ventricle lies on the septal surface. The atrium communicates with the left ventricle via the mitral valve. The left ventricular wall is marked by thick trabeculae carnae, with the exception of the fibrous vestibule which lies immediately below the aortic orifice.

Question 1.5

What does the image show and can you name the labelled structures?

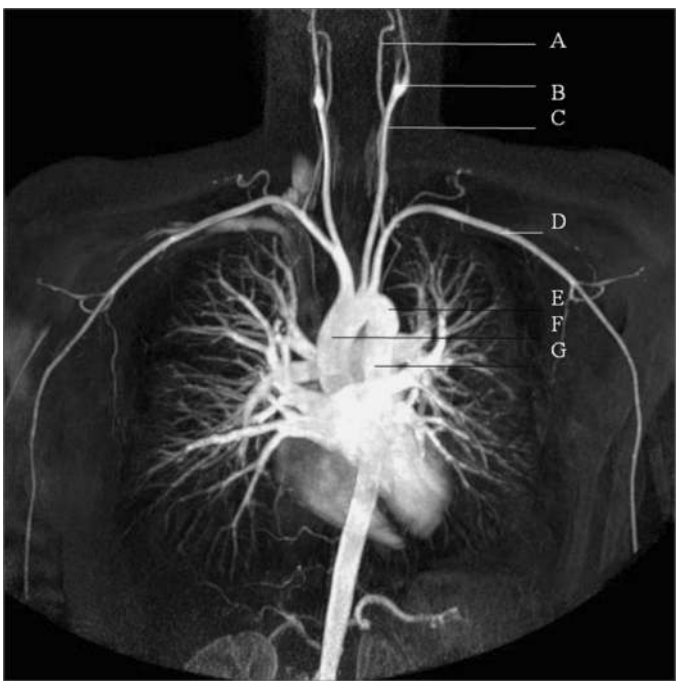

Figure 1.5

Answer

This is a coronal magnetic resonance angiographic image demonstrating the mediastinal aorta and its branches.

A: Left vertebral artery.
B: Common carotid artery bifurcation.
C: Left common carotid artery.
D: Left subclavian artery.
E: Arch of aorta.
F: Ascending aorta.
G: Descending aorta.

Anatomical notes

The arch of the aorta lies at approximately the level of T4. It gives rise to three main branches: the right brachiocephalic (inominate), the left common carotid

and the left subclavian arteries. The right brachiocephalic artery divides into the right subclavian and the right common carotid arteries.

The common carotid artery ascends the neck in the carotid sheath lying medial to the internal jugular vein and anterior-medial to the vagus nerve. It terminates by division into the internal and external carotid arteries at approximately the level of C4. The internal carotid artery has no branches in the neck.

The vertebral arteries originate from the subclavian arteries. They ascend in the neck through the upper six foramina transversaria of the cervical spine. They converge at the junction between the medulla oblongata and the pons to form the basilar artery. (Refer to the neurosurgery chapter for a more detailed description of the cerebral circulation.)

Clinical notes

Occlusion of the subclavian artery proximal to the origin of the vertebral artery may result in compensatory retrograde blood flow in that vertebral artery. This has been termed the subclavian steal phenomenon.

Exercising the arm on the affected side results in a need for increased blood delivery. Since the subclavian artery is occluded the exercising arm achieves this requirement by 'stealing' the blood from the ipsilateral vertebral artery. This leaves the brain momentarily deficient of blood leading to transient neurological symptoms such as dizziness, unsteadiness, vertigo and visual disturbances. The combination of retrograde vertebral artery blood flow and neurological symptoms is termed **subclavian steal syndrome**.