

The clinical anatomy of pericardiocentesis

The heart and the roots of the great vessels are contained within the conical fibrous pericardium, the apex of which is fused with the adventitia of the great vessels and the base with the central tendon of the diaphragm. Anteriorly it is closely related to the body of the sternum, inferior to the angle of Louis, and is tethered to the back of the sternum by the sternopericardial ligament. On either side of the sternal body, it relates to the third–sixth costal cartilages and it is overlapped by the anterior borders of the lungs. Posteriorly lie the oesophagus, the descending aorta and vertebrae T5–T8, while on either side lie the roots of the lungs, the mediastinal pleura and the phrenic nerves.

The inner aspect of the fibrous pericardium is lined by the adherent parietal layer of pericardium, which, in turn, is reflected around the roots of the great vessels to become continuous with the visceral layer of pericardium, or epicardium. Between these layers lies the pericardial cavity, containing a thin film of serous pericardial fluid.

Surface anatomy

The outline of the pericardium can be represented on the chest surface by an irregular quadrangle bounded by four points (*Figure 1*):

1. The second left costal cartilage
2. The third right costal cartilage
3. The sixth right costal cartilage
4. The fifth left intercostal space 3.5 " (9 cm) from the midline, i.e. the apex beat of the heart.

In clinical practice the size and position of the heart and pericardium can be marked out by placing the subject's closed right fist palmar surface down immediately below the manubrio-sternal junction (the angle of Louis). Note how this bulges over to the left side to correspond with the apex beat. Note also that the anterior surface of the heart consists principally of the low pressure chambers of the right atrium and right

Professor Harold Ellis is Clinical Anatomist, Guy's, King's and St Thomas' School of Biomedical Science, London SE1 1UL

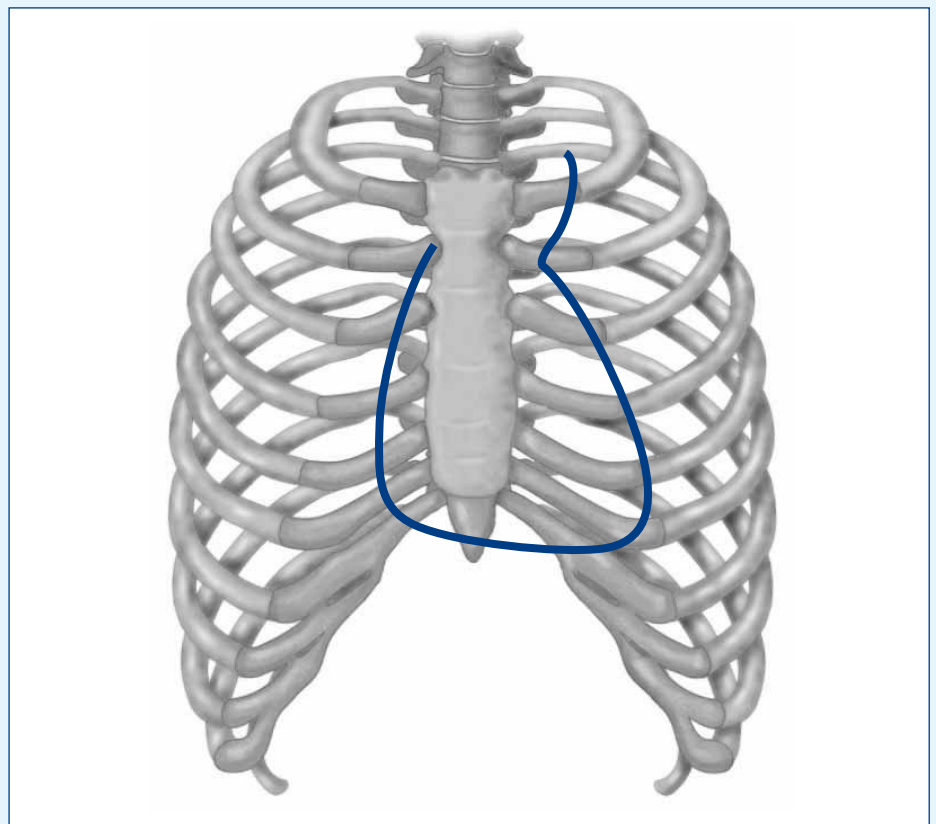


Figure 1. The surface markings of the heart.

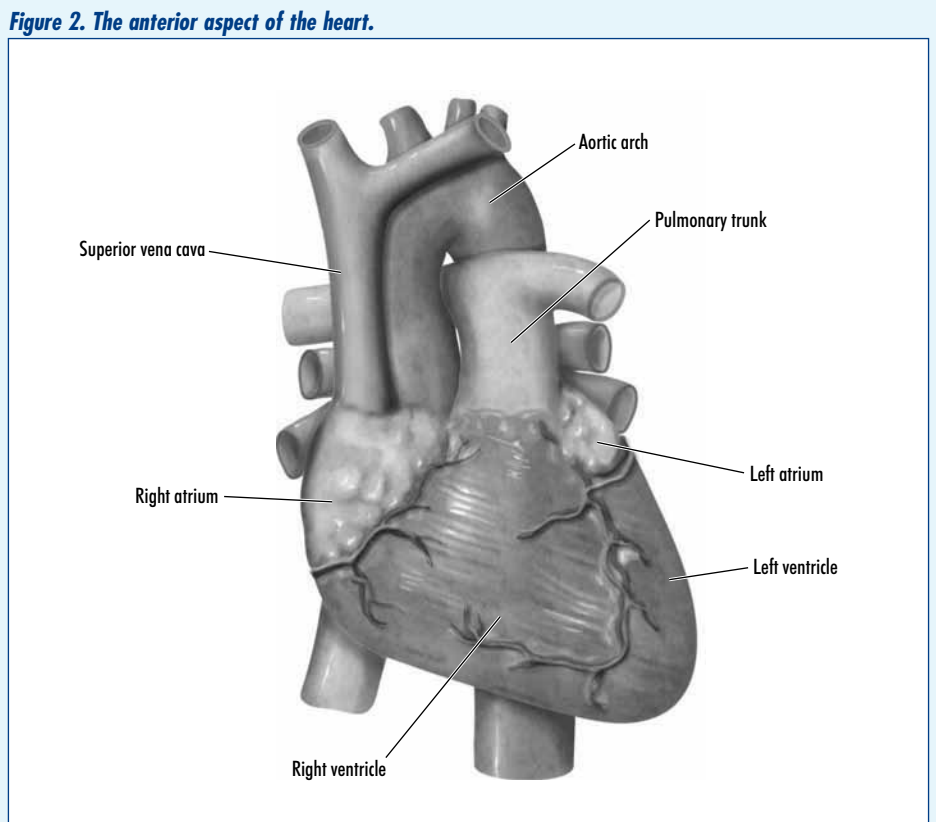


Figure 2. The anterior aspect of the heart.

ventricle, with the high pressure left ventricle forming its left margin (*Figure 2*). A stab wound of the heart is statistically more likely to involve a low pressure chamber.

Haemopericardium

The clinical consequences of a fluid accumulation within the pericardial cavity depend on the amount of fluid and the speed of its accumulation. If slow, this can be tolerated, but if blood rapidly collects – in penetrating cardiac injury, cardiac rupture after an infarct or following cardiac surgery, it is life-threatening. The clinical features are shock, tachycardia, hypotension, distended neck veins and muffled heart sounds. If a chest X-ray is available, it shows that the heart shadow is enlarged and globular. The electrocardiogram shows low voltage complexes.

Pericardiocentesis

Treatment is immediate drainage. This is best achieved through a left fifth space thoracotomy, which also allows the underlying injury to be repaired. As a life-saving temporary measure, needle aspiration may be performed. Its disadvantages are danger of laceration of the underlying heart and a 50% false negative rate.

A large needle, such as a central venous cannula, should be used. This is inserted through a scalpel nick at the angle between the xiphoid cartilage and the left costal margin (*Figure 3*) and is directed from the midline upwards, at an angle of 15–20° from the abdominal wall, aimed at the direction of the left shoulder tip, aspirating continuously. If blood is reached, a central venous catheter is passed along the cannula to provide pericardial drainage.

Aspiration of even a small amount of blood should improve the patient's haemodynamic condition and allow transfer to the operating theatre for definitive treatment.

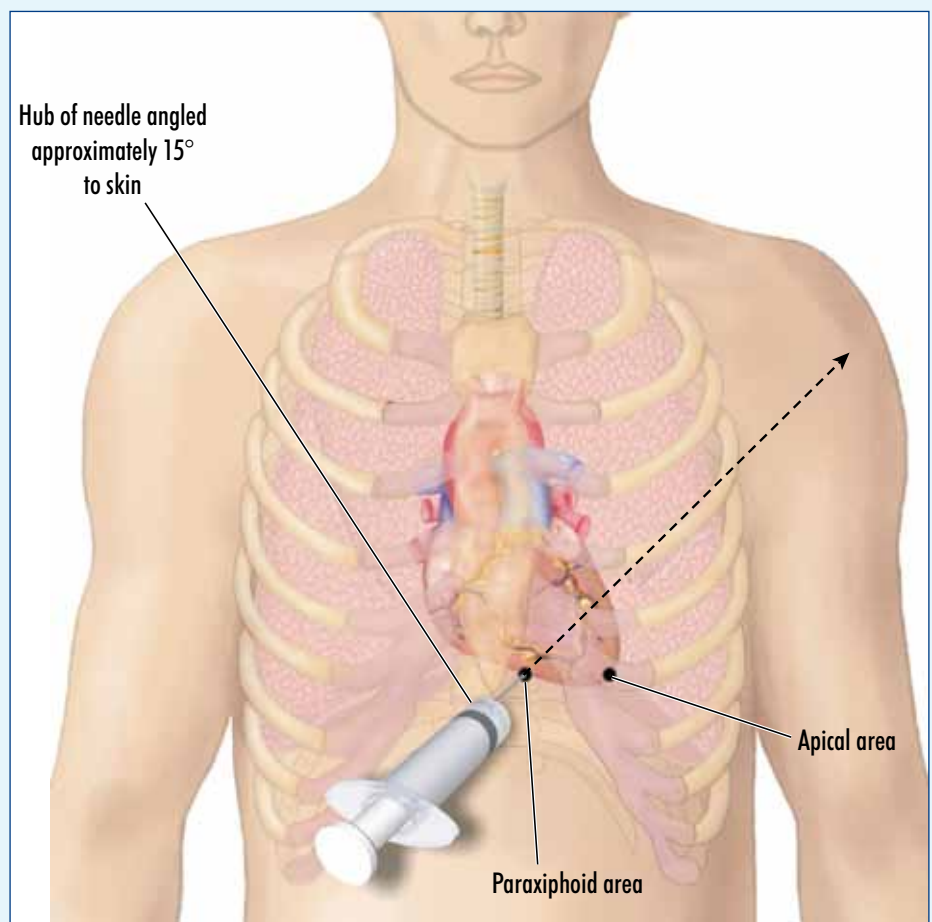


Figure 3. Pericardiocentesis.

Refinements such as the use of ultrasound guidance or the use of an electrocardiogram electrode attached to the needle as a warning device if the needle touches

the myocardium are probably almost never possible given the urgency of this procedure in clinical practice. **BJHM**

Conflict of interest: none.

KEY POINTS

- The pericardial sac and heart can be outlined by the subject's clasped right fist placed immediately below the angle of Louis.
- Haemopericardium may result from penetrating cardiac injury, cardiac rupture after infarction or following cardiac surgery.
- Pericardiocentesis is carried out in the angle between the xiphoid and left costal margin.
- The large bore needle is directed at an angle of 15° and aimed at the left shoulder tip.

Forthcoming articles in this series

- The applied anatomy of appendicectomy
- Examination of the thyroid gland
- The applied anatomy of rectal examination

Previous articles in the series can be accessed via our website www.bjhm.co.uk