CHAPTER 11

# Left heart failure

## Cardiomegally

- Long standing left heart failure results in a progressive enlargement of the left ventricle and left atrium, the latter particularly when mitral valve disease is present.
- Enlargement of the left ventricle, which forms the left heart border on a CXR, results in an increase in size of the cardiac silhouette (Fig 11.1).

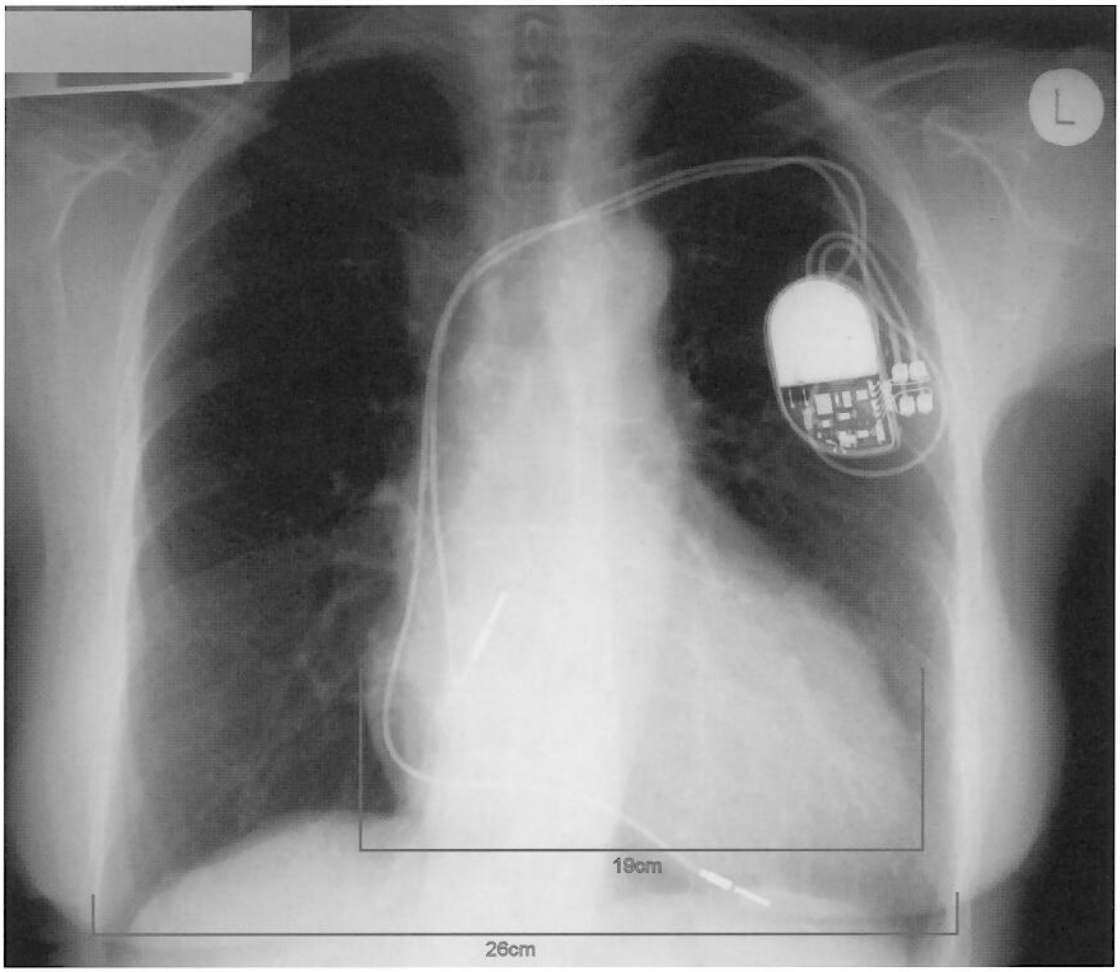


**Figure 11.1**
Frontal (PA) CXR of an adult female patient with a dual chamber pacemaker. The cardiac diameter is 19 cm (normal up to 14.5 cm) and the cardiothoracic ratio (CTR) is 19/26.

- The ratio of cardiac diameter to the maximum diameter of the thoracic cage (cardiothoracic ratio or CTR) gives a gauge of the amount of cardiac enlargement and is of most use on serial measurements.
- CXR evidence for enlargement of the left atrium includes (Fig 11.2, 11.3):
  - — enlargement of the left atrial appendage affecting the left heart border
  - — a double right heart border caused by the projection of the right wall of the left atrium behind the silhouette of the right atrium
  - — widening of the carina

**Figure 11.2**
Frontal CXR of a patient with early left heart failure. The magnified view demonstates the double heart border, right atrial wall (white arrow) and left atrial wall (black arrow).

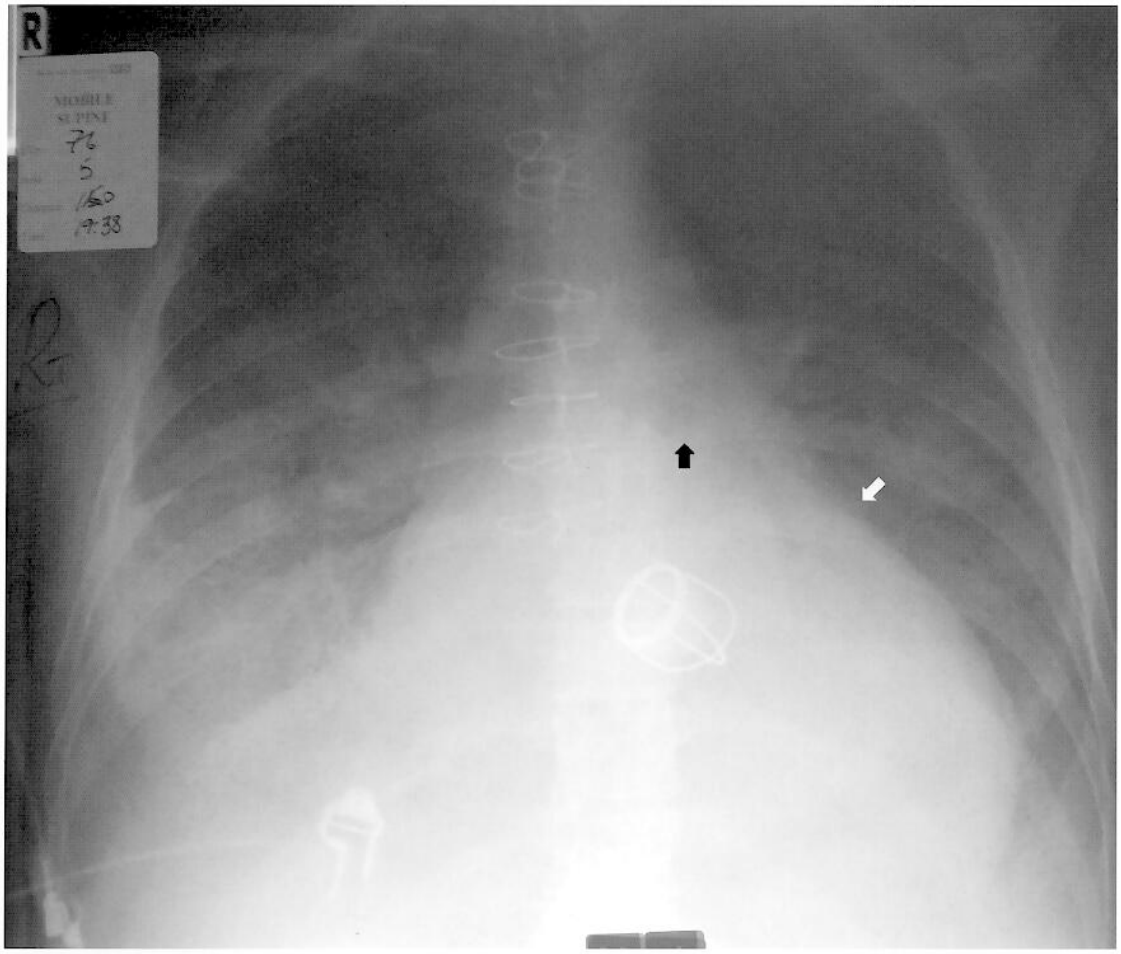

**Figure 11.3**
AP semi-erect CXR of an adult patient in heart failure. Note the prosthetic mitral valve and cardiomegally. Elevation of the left main bronchus (black arrow) and loss of the normal concavity of the left heart border at the level of the left atrial appendage indicate left atrial enlargement.

## Interstitial oedema

- In left heart failure, there is an increase in the pressure within the capillary bed of the lung resulting in the accumulation of fluid in the lung interstitium.
- On a CXR, this is visualized as reticulation and may be too subtle to detect with confidence (Fig 11.4).

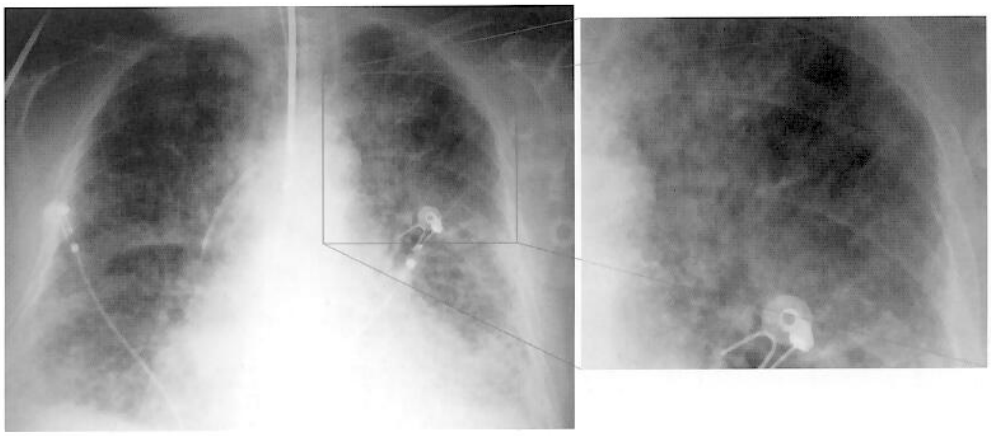

**Figure 11.4**
Semi-erect CXR of an adult patient developing severe left heart failure. Note the bilateral peri-hilar shadowing, which falls short of consolidation and has a reticular pattern. This is interstitial oedema and progressed to frank perihilar consolidation within hours.

## Blood diversion

- The increase in pressure in the interstitium causes compression of the capillary bed; due to gravity the effect is more marked in the lower lobes causing shunting of blood into the upper lobes.
- The result is upper lobe blood diversion, enlargement of the upper lobe pulmonary veins, and lower lobe vasoconstriction such that the lower lobe pulmonary veins are smaller than those of the upper lobes, a reversal of the normal state (Fig 11.5).

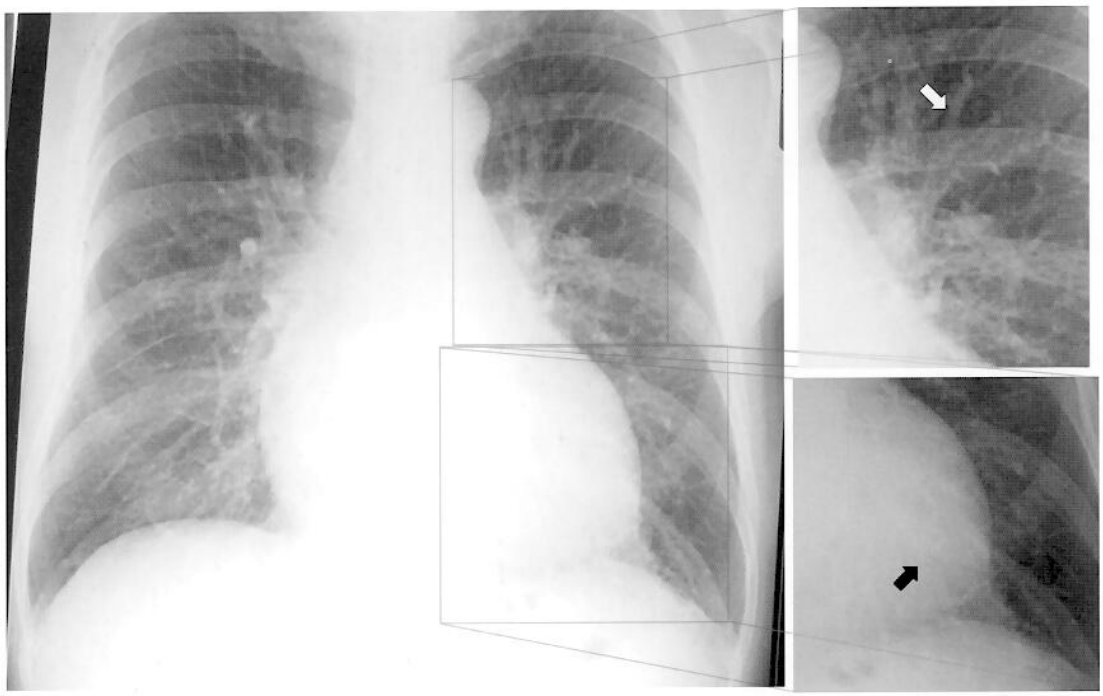

**Figure 11.5**
Frontal CXR of an adult patient with early left heart failure. The magnified views demonstrate dilated upper lobe veins (white arrow) and constricted lower lobe veins (black arrow).

## Consolidation

- As the degree of interstitial oedema increases, fluid accumulates in the alveolar air spaces and interlobular septa initially causing ground glass opacity, an increase in lung opacity, progressing to consolidation/pulmonary oedema, where air-bronchograms may be seen.
- Pulmonary oedema classically has a bilateral perihilar distribution (Fig 11.6).

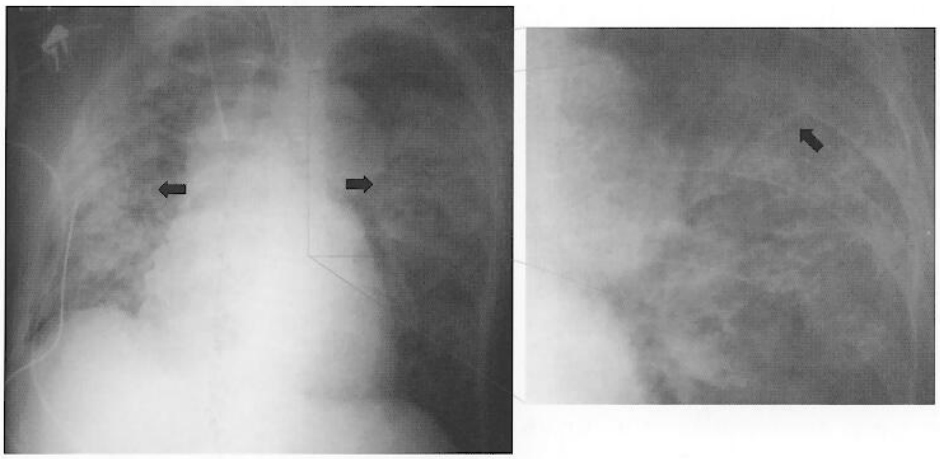

**Figure 11.6**
Frontal CXR of a patient with pulmonary oedema in a classic perihilar distribution (horizontal black arrows). The magnified view demonstrates air-bronchograms (diagonal black arrow).

## Septal lines

- The accumulation of fluid in the interlobular septa, septal lines, may be difficult to distinguish from the interstitial reticulation or obscured by the air-space opacification.
- Septal lines are best seen at the costophrenic angles, where each diaphragm joins the chest wall. Septal lines are 2–3 mm in thickness around 10 mm in length and extend to the pleural surface where they contact it at 90 degrees.
- In more severe pulmonary oedema, more central septal lines may be found, which radiate from the hila.

## Effusions

- Ultimately fluid accumulates in the pleural space causing a pleural effusion, which, in the earliest stages, may only be visible on an erect CXR through "blunting" of the costophrenic angle being the most dependent area of the pleural space (Fig 11.7).

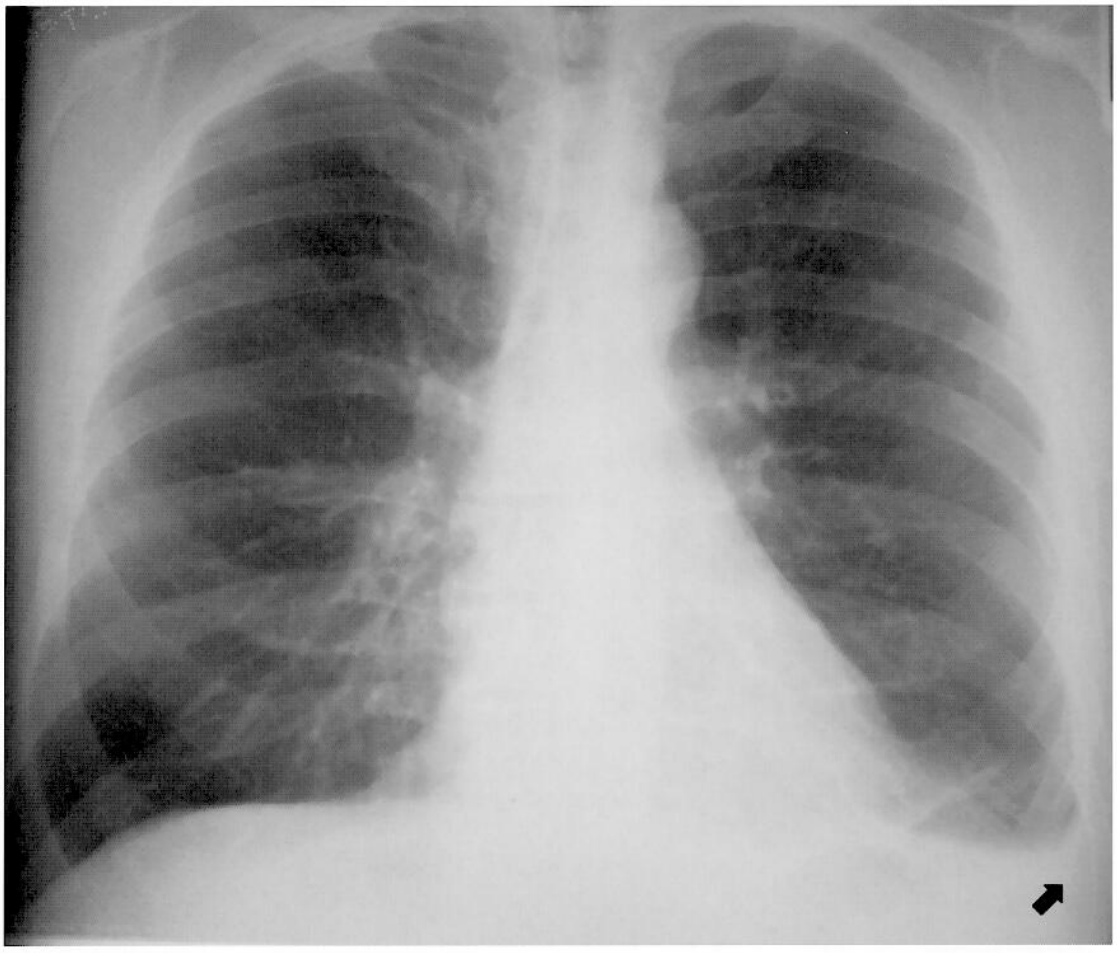

**Figure 11.7**
Frontal CXR of an adult male with a small left pleural effusion secondary to developing heart failure. Note the "blunting" of the costophrenic angle (black arrow).

- As the amount of fluid increases the pleural space gradually fills up causing increased opacity and obscuring the diaphragmatic silhouette.
- On a frontal CXR, the effusion will typically have a meniscal appearance.
- Effusions secondary to heart failure are usually bilateral, rarely symmetrical and can be unilateral, particularly in a patient who favours lying on one side.