Chest x rays made easy

In the fourth of a five part series, Elizabeth Dick compares collapse and consolidation of the lung and looks at pleural effusions

The basics of looking at a chest x ray (recap):

- First look at the mediastinal contours—run your eye down the left side of the patient and then up the right.
- The trachea should be central. The aortic arch is the first structure on the left, followed by the left pulmonary artery; notice how you can trace the pulmonary artery branches fanning out through the lung.
- Two thirds of the heart lies on the left side of the chest, with one third on the right. The heart should take up no more than half of the thoracic cavity. The left border of the heart is made up by the left atrium and left ventricle.
- The right border is made up by the right atrium alone. Above the right heart border lies the edge of the superior vena cava.
- The pulmonary arteries and main bronchi arise at the left and right hila. Enlarged lymph nodes can also occur here, as can primary tumours.
- Now look at the lungs. Apart from the pulmonary vessels (arteries and veins), they should be black (because they are full of air). Scan both lungs, starting at the apices and working down, comparing left with right at the same level, just as you would when listening to the chest with your stethoscope. The lungs extend behind the heart, so look here too. Force your eye to look at the periphery of the lungs—you should not see many lung markings here; if you do then there may be disease of the air spaces or interstitium. Don’t forget to look for a pneumothorax.
- Make sure you can see the surface of the hemidiaphragms curving downwards, and that the costophrenic and cardiophrenic angles are not blunted—suggesting an effusion. Check there is no free air under the hemidiaphragm.
- Lateral films: if the area anterior or superior to the heart is opacified, suspect disease in the anterior mediastinum or upper lobes respectively. If the area posterior to the heart is opacified suspect collapse or consolidation in the lower lobes.

Abnormality: lobar collapse

Collapse of a lobe is caused by proximal obstruction—for example, by a neoplasm, mucus plug, such as in a postoperative patient, or foreign body, such as in a child. Always mention that you are looking for the cause of the collapse.

When the lobe is not aerated it will lose much of its volume and collapse to a predictable location depending on whether it is an upper, middle, or lower lobe. Figure 1 shows the normal site of the lobes of the lung; figures 2 to 5 and their accompanying line diagrams show where the lobes collapse to. The collapsed lobe itself can be very difficult to see—there may simply be a little extra shadowing on the film. A collapsed lobe is a cause of volume loss; the other cause is a pneumothorax. The signs that should alert you to a collapse are due to the loss of lung volume:

- The mediastinum may be shifted towards the side of collapse
- The hilum is pulled up or down from where it normally lies
- The horizontal fissure will also be pulled up (in a right upper lobe collapse) or down (right lower lobe collapse)
- The remaining (non-collapsed) lung on the side of the collapse has to expand to fill the hemithorax, thus “spreading” its contained vessels; therefore the abnormal side will seem blacker with fewer lung markings than the opposite normal side
- The proximal obstruction may be
visible—for example, a large carcinoma arising from the right upper lobe.

**Abnormality: confluent opacification of the hemithorax**

There are four main causes of confluent opacification of a hemithorax—consolidation (fig 6) (that is, material within the air-spaces—see November *studentBMJ*) and pleural effusion—that is, material within the pleural space, which could be serous fluid, blood, or pus (fig 7). Complete collapse of one lung with the mediastinum shifting over the abnormal side can also cause a “white out” on the abnormal side (fig 8). Finally, after a pneumonectomy the mediastinum shifts to the empty hemithorax and the residual pleural space fills with fluid and fibrotic material leaving the patient with a complete “white out” on the side that has been operated on (fig 9). Consolidation and pleural effusion are the two most common, and it can be difficult to distinguish between them—of course, they can coexist.

The key features of an effusion are:

- If the patient is erect there should be a fluid level and meniscus visible.
- If the effusion is large the mediastinum will be shifted to the opposite side. Compare this with pure consolidation in which there is

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**Fig 3a** Antero-posterior chest radiograph, left upper lobe collapse.

**Fig 3b** Lateral. Left upper lobe collapse. Increased shadowing in the left upper and mid zone with a blunted lower border. The left heart border is also lost, because the lung collapses adjacent to it. On the lateral view the upper lobe can be seen to have collapsed anteriorly and lies anterior to the oblique fissure (arrow).

**Fig 4a** Antero-posterior chest radiograph. Right middle lobe collapse. The right middle lobe lies adjacent to the right heart border, so the right heart outline is lost.

**Fig 4b** Lateral, same patient. The right middle lobe collapses anteriorly in a wedge shape over the heart. The upper border of the wedge is the horizontal fissure (arrowhead), the lower border is the oblique fissure (arrow).

**Fig 5a** Antero-posterior chest radiograph. Left lower lobe collapse. The lower lobes collapse posteriorly and inferiorly so that the contour of the hemidiaphragm is lost. The collapsed left lower lobe may form a “sail” shape behind the heart border on the Antero-posterior film (arrow).

**Fig 5b** On the lateral film there is extra shadowing posteriorly over the vertebrae due to the collapsed lobe (arrow).
no change in volume of the hemithorax and therefore no mediastinal shift. There is one caveat to bear in mind, which is that if collapse of the lung is accompanied by a pleural effusion the loss of volume (caused by the collapse) may be balanced out by the increase in volume of the hemithorax (caused by the effusion) and therefore it may seem as if the volume of the hemithorax overall is equivalent to the opposite side.

As we discussed in November the key feature of consolidation is an air bronchogram. In infective causes of consolidation the process may affect a lobe (lobar pneumonia in a distribution according the normal anatomy shown in fig 1) or spread in a more patchy distribution (bronchopneumonia). Now test yourself with our web quiz at studentbmj.com.

Next month: we will look at lung nodules and masses.

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