Learning Outcomes

- Understand role of chest x-rays in acute care
- Review surface anatomy of the lungs
- Identify normal structures on an x-ray
- Recognise the types of densities in chest x-ray
- Understand the steps involved in interpreting a chest x-ray
- Interpret examples of X rays you may be asked to review
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**X ray in acute care**

- Used to evaluate for:
  - NORMALITY
  - Consolidation (Pneumonia)
  - Pneumothorax
  - Atelectasis
  - Pleural effusion (including haemothorax)
  - COPD
  - TUBERCULOSIS
  - MALIGNANCY
  - POSITIONING OF MEDICAL DEVICES

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**Be systematic**

- Some anatomical structures in the chest should be assessed on every chest x-ray
- Each of these anatomical structures should be viewed using a systematic approach
- There are also important structures that are obscured or become visible only when abnormal

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**Mnemonic**

- **Some**: S=Skin
- **Body**: B=Bones
- **Lost**: L=Lungs and pleura
- **My**: M=Myocardium (Heart)
- **Toy**: T=Trachea
- **Dinosaur**: D=Diaphragm
Visible structures

- How many anatomical structures can you see on this x-ray?
- Can you think of any important structures in the chest that are difficult to see on the x-ray?

1. Trachea
2. Aortic knuckle
3. Scapulae
4. Hila
5. Lungs
6. Heart
7. Ribs
8. Breasts
9. Diaphragm
10. Stomach

Obscured structures

- Important obscured structures
  - Sternum
  - Oesophagus
  - Spine
  - Pleura
  - Fissures
  - Aorta

Chest x-ray anatomy

- Many structures of the chest are readily visible.
- Others are difficult to see.
- Some important structures, such as the phrenic nerve, are not visible at all.
- The pleura, only become clearly visible when abnormal.
- Trachea and major bronchi
  - Are visible on most good quality chest x-rays.
  - Contain air and so are of lower density (blacker) than the surrounding soft tissues.
  - The trachea branches at the carina, into the left and right main bronchi, and these can often be followed as they branch beyond the hila and into the lungs.
- TRACHEA SHOULD BE CENTRAL
Assessing airways

- Normal chest x-ray
  - The trachea and bronchi are visible - branching at the carina
  - The trachea passes to the right of the aorta and so may be slightly off mid-line to the right

Normal chest x-ray

- If the trachea is deviated, is this because:
  - The patient has been incorrectly positioned (rotated).
  - There is pathology.
  - If the trachea is genuinely deviated you should then try to decide if it has been pushed or pulled by a disease process.

Hilar structures

- Each hilum contains major bronchi and pulmonary vessels
- There are also lymph nodes on each side (not visible unless abnormal)
- The left hilum is often higher than the right
- If a hilum is out of position, ask yourself if it has been pushed or pulled
- As well as position - check the size and density of the hila
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**Pleura & pleural spaces**

- The pleura and pleural spaces are only visible when abnormal.
- Lung markings should reach the thoracic wall.
- Trace round the entire edge of the lung where pleural abnormalities are more readily seen.
- Start and end at the hila.
- Is there pleural thickening?
- Is there a pneumothorax? The lung markings should be visible to the chest wall.
- Is there an effusion? The costophrenic angles and hemidiaphragms should be well defined.

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**Chest X ray anatomy**

- The left lung has two lobes and the right has three.
- Each lobe has its own pleural covering.
- The horizontal fissure (right) is often seen on a normal frontal view.
- The oblique fissures are often seen on a normal lateral view.

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**Surface anatomy R Lung**

- Apex
- Superior lobe
- Middle lobe
- Inferior lobe
- Base
- Horizontal fissure
- Oblique fissure

ANTERIOR SURFACE  
RIGHT LUNG
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Costophrenic angles

• The costophrenic angles are limited views of the costophrenic recess
• On a frontal view the costophrenic angles should be sharp

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Diaphragm

• The hemidiaphragms are domed structures
• Each hemidiaphragm should be well defined
• The left hemidiaphragm should be visible behind the heart
• The hemidiaphragm contours do not represent the lowest part of the lungs

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Cardiac assessment

• The heart size is assessed as the cardiothoracic ratio (CTR)
• A CTR of >50% is abnormal - PA view only
• The left hemidiaphragm should be visible behind the heart
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Soft tissue

- Assess the soft tissues on every chest x-ray
- Thick soft tissue may obscure underlying structures
- Black within soft tissue may represent gas

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Bones

- Assess the bones on every chest x-ray
- Check for abnormalities of single bones and for diffuse bone disease
- The bones are helpful in assessing the quality of the chest x-ray

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Clavicles, spinous processes and ribs

- Clavicles are clearly seen on a chest x-ray
- Spinous processes of the vertebrae (posterior structures) should lie midway between the medial ends of the clavicles (anterior structures).
- If the spinous processes are not central, the patient is rotated, that is, positioned obliquely to the x-ray beam.
- The anterior and posterior ends of the 5th rib are also shown.
Ribs

- The anterior end of approximately 5-7 ribs should be visible above the diaphragm in the mid-clavicular line.
- Less than this indicates an incomplete breath in, and more than 7 ribs or flattening of the diaphragm, suggests lung hyper-expansion.

Assessing the lungfields

- The lungs are assessed and described by dividing them into upper, middle and lower zones
- Refer to ‘zones’ not ‘lobes’
- Compare left with right
- Compare an area of abnormality with the rest of the lung on the same side
- Note that the lower zones reach below the diaphragm. This is because the lungs pass behind the dome of the diaphragm into the posterior sulcus of each hemithorax.

Densities

- Different tissues have different density on X ray
- Bones are white
- Lung tissue is 99% air and is black
- Blood vessels give the lacy pattern (1%)
Interpretation of CXR

- Basic interpretation is EASY. They are either:
  - TOO WHITE
  - TOO BLACK
  - TOO LARGE
  - IN THE WRONG PLACE

Technical details

- Check the patient name
- Date of X ray
- Whether its PA or AP
- Check Left/Right marker
- Check for Rotation (clavicles not equally positioned)
- Check exposure/penetration

Consolidation

- Compare the left and right upper, middle and lower lung zones
- Decide which side is abnormal
- Compare an area of abnormality with the rest of the lung on the same side
- The whiter side is not always the abnormal side
Pleural disease - too white

- Pleura only become visible when diseased

Air fluid interface too white/black

Too black
Checklist 1
• Check patient name, position, technical quality.
• Soft tissue including breast, chest wall, companion shadow.
• Review soft tissues and skeletal structures of shoulder girdles and chest wall.
• Review abdomen for bowel gas, organ size, abnormal calcifications, free air, etc.
• Review soft tissues and spine of neck.
• Review spine and rib cage: check alignment, disc space narrowing, lytic or blastic regions, etc.

Checklist 2
• Review mediastinum:
  – overall size and shape
  – trachea: position
  – margins: SVC, ascending aorta, right atrium, left subclavian artery, aortic arch, main pulmonary artery, left ventricle
  – lines and stripes: paratracheal, paraspinal, parasegmental (azygospleural), parasegmental (azygospleural), retrosternal clear space
• Review hila:
  – normal relationships
  – size
Checklist 3

- Review lungs and pleura:
  - compare lung sizes
  - evaluate pulmonary vascular pattern:
    compare upper to lower lobe, right to left, normal tapering to periphery
  - pulmonary parenchyma
  - pleural surfaces
    - fissures - major and minor - if seen
    - compare hemidiaphragms
    - follow pleura around rib cage
Example 10

Example 11

References