# How to read a chest x-ray – a step by step approach

This article is an attempt to give the reader guidance how to read a chest x-ray. There is no perfect way to read an x-ray. However, the important message I would like to give is, to adopt one or the other approach, and to use the chosen approach consistently.

## General Checklist

- Check patient details
  - First name, surname, date of birth.
- Check orientation, position and side description
  - left, right, erect, ap, pa, supine, prone
- Check additional information
  - inspiration, expiration
- Check for rotation
  - measure the distance from the medial end of each clavicle to the spinous process of the vertebra at the same level, which should be equal
- Check adequacy of inspiration
  - nine pairs of ribs should be seen posteriorly in order to consider a chest x-ray adequate in terms of inspiration
- Check penetration
  - one should barely see the thoracic vertebrae behind the heart
- Check exposure
  - one needs to be able to identify both costophrenic angles and lung apices

## Specific Radiological Checklist

### A - Airway

- Ensure trachea is visible and in midline
  - trachea gets pushed away from abnormality, eg pleural effusion or tension pneumothorax
  - trachea gets pulled towards abnormality, eg atelectasis
  - trachea normally narrows at the vocal cords
  - view the carina, angle should be between 60 –100 degrees
  - beware of things that may increase this angle, eg left atrial enlargement, lymph node enlargement and left upper lobe atelectasis
  - follow out both main stem bronchi
- Check for tubes, pacemaker, wires, lines foreign bodies etc
  - if an endotracheal tube is in place, check the positioning, the distal tip of the tube should be 3-4cm above the carina
- Check for a widened mediastinum
  - mass lesions (eg tumour, lymph nodes)
  - inflammation (eg mediastinitis, granulomatous inflammation)
  - trauma and dissection (eg haematoma, aneurysm of the major mediastinal vessels)

### B – Bones

- Check for fractures, dislocation, subluxation, osteoblastic or osteolytic lesions in clavicles, ribs, thoracic

spine and humerus including osteoarthritic changes

- At this time also check the soft tissues for subcutaneous air, foreign bodies and surgical clips

- Caution with nipple shadows, which may mimic intrapulmonary nodules
  - compare side to side, if on both sides the “nodules” in question are in the same position, then they are likely to be due to nipple shadows

## C - Cardiac

- Check heart size and heart borders
  - appropriate or blunted
  - thin rim of air around the heart, think of pneumomediastinum

- Check aorta
  - widening, tortuosity, calcification

- Check heart valves
  - calcification, valve replacements

- Check SVC, IVC, azygos vein
  - widening, tortuosity

## D – Diaphragm

- Right hemidiaphragm
  - should be higher than the left
  - if much higher, think of effusion, lobar collapse, diaphragmatic paralysis
  - if you cannot see parts of the diaphragm, consider infiltrate or effusion

- If film is taken in erect or upright position you may see free air under the diaphragm if intra-abdominal perforation is present

## E – Effusion

- Effusions
  - look for blunting of the costophrenic angle
  - identify the major fissures, if you can see them more obvious than usual, then this could mean that fluid is tracking along the fissure

- Check out the pleura
  - thickening, loculations, calcifications and pneumothorax

## F – Fields (Lungfields)

- Check for infiltrates
  - identify the location of infiltrates by use of known radiological phenomena, eg loss of heart borders or of the contour of the diaphragm
  - Remember that right middle lobe abuts the heart, but the right lower lobe does not
  - The lingula abuts the left side of the heart

- Identify the pattern of infiltration
  - interstitial pattern (reticular) versus alveolar (patchy or nodular) pattern
  - lobar collapse
  - look for air bronchograms, tram tracking, nodules, Kerley B lines
  - pay attention to the apices

- Check for granulomas, tumour and pneumothorax

## G – Gastric Air Bubble

- Check correct position
- Beware of hiatus hernia
- Look for fee air
- Look for bowel oops between diaphragm and liver

## H – Hilum

- Check the position and size bilaterally
- Enlarged lymph nodes
- Calcified nodules
- Mass lesions

- Pulmonary arteries, if greater than 1.5cm think about possible causes of enlargement

## *Extended Radiological Checklist – Lateral Film*

### B – Bones

- check the vertebral bodies and the sternum for fractures or other osteolytic changes

### C – Cardiac

- check for enlargement of the right ventricle and right atrium (retrosternal and retrocardiac spaces)
- trace the aorta

### D – Diaphragm

- check for fluid tracking up, costophrenic blunting and the associated hemidiaphragm

### E – Effusions

- check to see the fissures here as well – both major fissures and the horizontal may be found in the lateral view

### F – Fields

- check the translucency of the thoracic vertebrae in the lateral view, when there is a sudden change in transparency, then this is likely to be caused by infiltrate
- also try to find the infiltrate that you think you saw on the pa-film to verify existence and anatomical location
- pay special attention to the lower lung lobes

I would like to close with a clarification of two important radiological findings, whose understanding is very useful for a correct interpretation of chest x-ray findings. The first is the silhouette sign, which can localise abnormalities on a pa-film without need for a lateral view. The loss of clarity of a structure, such as the hemidiaphragm or heart border, suggests that thee is adjacent soft tissue shadowing, such as consolidated lung, even when the abnormality itself is not clearly visualised. The reason is, that borders, outlines and edges seen on plain radiographs depend on the presence of two adjacent areas of different density, Roughly speaking, only four different densities are detectable on plain films; air, fat, soft tissue and calcium (five if you include contrast such as barium). If two soft tissue densities lie adjacent, then they will not be visible separately (eg the left and right ventricles). If, however, they are separated by air, the boundaries of both will be seen.

The second important x-ray finding is the lung collapse. A collapse usually occurs due to proximal occlusion of a bronchus, causing subsequently a loss of aeration. The remaining air is gradually absorbed, and the lung loses volume. Proximal stenosing bronchogenic carcinoma, mucous plugging, fluid retention in major airways, inhaled foreign body or malposition of an endotracheal tube are the most common reasons for a lung collapse. Tracheal displacement or mediastinal shift towards the side of the collapse is often seen. Further findings are elevation of the hemidiaphragm, reduced vessel count on the side of the collapse or herniation of the opposite lung across the midline.

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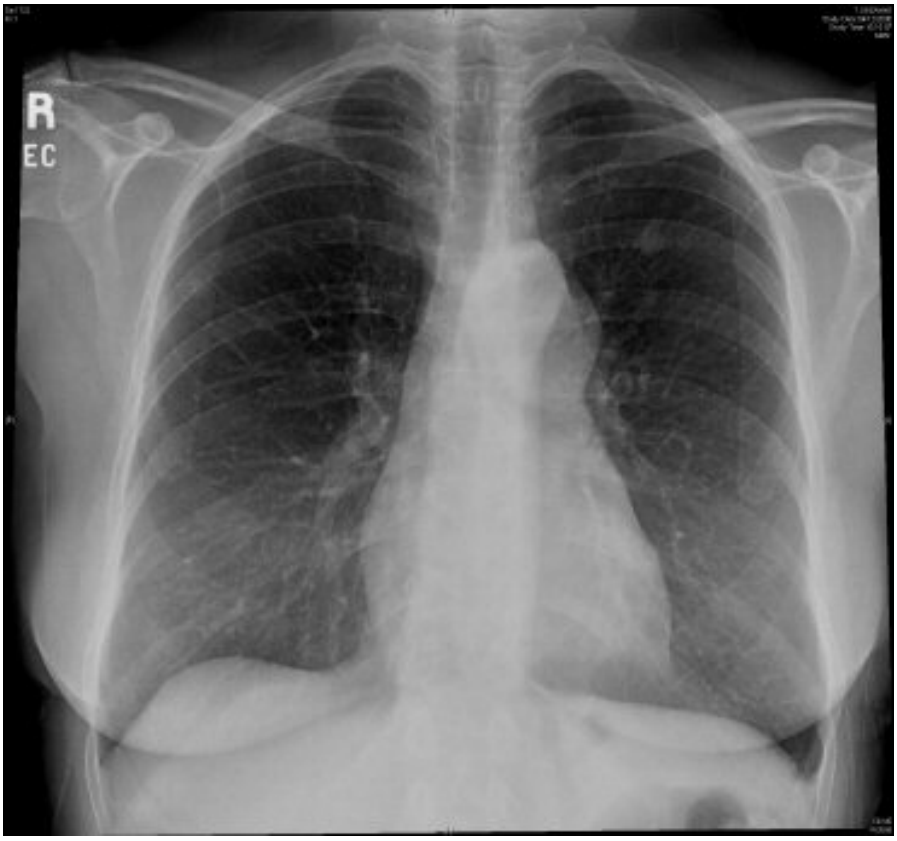
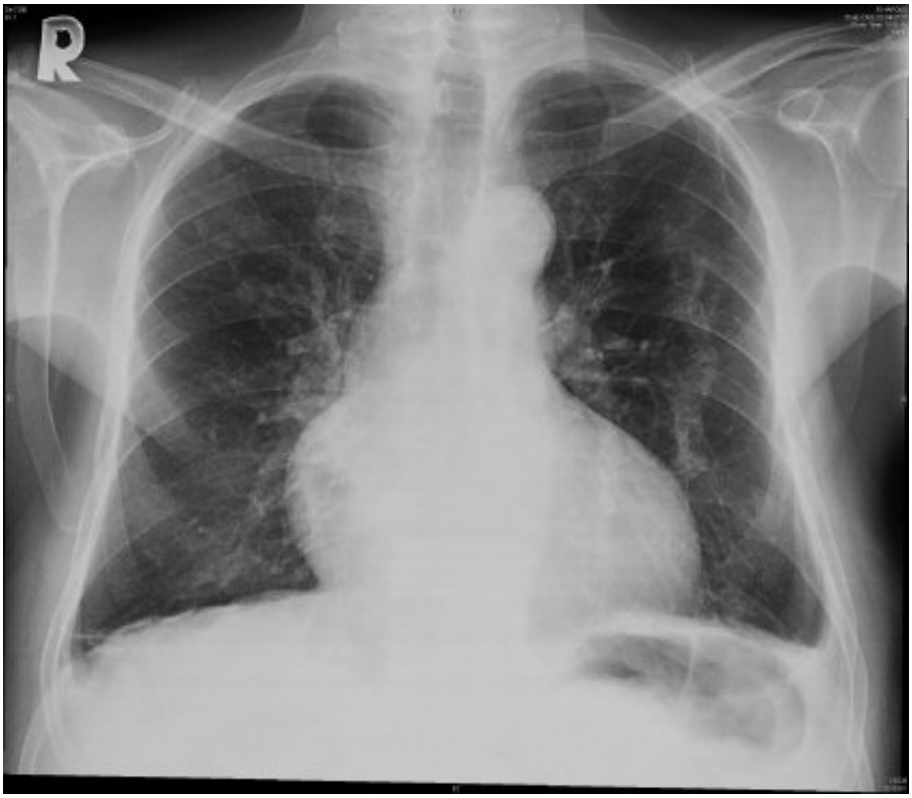



**Left mid mediastinal / paraaortic tumour and left upper lobe satellite lesion**

**Left basal pleural effusion and consolidation**

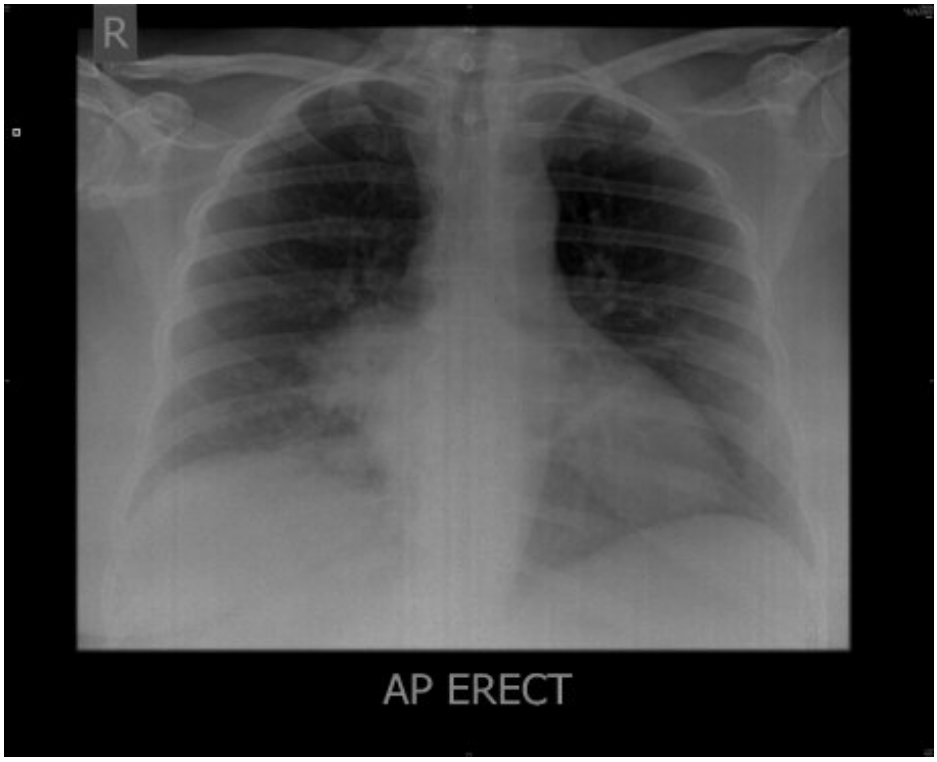

**Left upper lobe tumour**

**Right pleural metastases and pleural effusion due to carcinoma of the ovary**




**Pleural calcifications and adhesions due to asbestos exposure**


**Pulmonary fibrosis and superimposed infection**




**Right middle lobe pneumonia**

## *Undernutrition in Adults and Children: causes, consequences and what we can do*

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**Undernutrition**[a] occurs when people do not eat (or absorb) enough nutrients to cover their needs for energy and growth, or to maintain a healthy immune system. **Micronutrient deficiencies** are a sub-category of undernutrition and occur when the body lacks one or more micronutrients (e.g. iron, iodine, zinc, vitamin A or folate). These deficiencies usually affect growth and immunity but some cause specific clinical conditions such as anaemia (iron deficiency), hypothyroidism (iodine deficiency) or xerophthalmia (vitamin A deficiency).

Undernutrition is an important underlying cause of illness and death in Africa especially among women and young children – probably contributing to more than half the deaths among under-five year olds[1]. In this article we examine the causes and effects of undernutrition at different ages, and give a brief overview of key actions. We hope that this will help you to plan preventive activities and obtain necessary resources.

### Causes of undernutrition

We can divide the causes of undernutrition into *immediate, underlying* and *basic*.

*Immediate causes* are:

- **Poor diets**. Meals may be low in quantity, nutrient density or variety, or eaten infrequently. Infants may get insufficient breastmilk.
- **Disease** – particularly HIV/AIDS, diarrhoea, respiratory tract or ear infections, measles, hookworms and other gut parasites – see Box 1.

*Underlying causes* are family food insecurity, inadequate care of vulnerable household members (e.g. 'unfair' sharing of food within families), unhygienic living conditions (e.g. poor water supplies and poor sanitation) and inadequate health services.

*Basic causes* may include poverty, lack of information, political and economic insecurity, the aftermath of war, lack of resources at all levels, unequal status of women, and/or natural disasters.

**Box 1. Undernutrition and infection 'make each other worse'**

*Infections* increase the risk of undernutrition because sick people eat less, absorb fewer nutrients, lose nutrients (e.g. in diarrhoea) and/or have increased nutrient needs (e.g. fever).

*Undernutrition* makes infections worse because:

- The body lacks anti-oxidants (to mop up harmful free radicals) and the nutrients needed to maintain immunity.
- The linings of the gut and respiratory systems are weak so pathogens can easily invade.

### Undernutrition at different ages

The period during which undernutrition has the most severe consequences that often cannot be fully reversed is from conception until the age of two years.

#### Unborn and newborn babies

Undernutrition in the womb results in retarded growth and low birth weight (<2500g). A foetus is at risk if the mother was undernourished or anaemic *before* conception or if, during pregnancy, her diet is inadequate or she suffers from malaria, HIV or other infections. Specific maternal micronutrient deficiencies in early pregnancy can lead to severe disabilities such as brain damage of varying degrees (lack of iodine) and neural tube defect (lack of folate).

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[a] The term 'malnutrition' is also used but this can include conditions related to 'over-nutrition' such as diabetes type 2 and cardiovascular disease. We no longer use the term 'protein-energy malnutrition' because undernutrition is the result of many nutrient deficiencies usually interacting with infection.