BASIC INTERPRETATION OF CHEST X-RAY

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1. Check the name & the date.

2. Check the technical quality of the film.

   A) Projection – Look at the scapulae.
      If the scapulae overlie the lung fields then the film is AP.
      If they do not it is probably PA.

   B) Orientation – Check the Left/Right markings.
      Dextrocardia is a possibility.
Technical quality

The next four X-rays are examples of how the technical quality of a film can be assessed.
C) Rotation – Identify the medial ends of the clavicles & select one of the vertebral spinous process that falls between them.

The medial ends of the clavicles should be equidistant from the spinous process.

If one clavicle is nearer than the other then the patient is rotated & the lung on that side will appear whiter.
D) Penetration - Look at the lower part of the cardiac shadow, the vertebral bodies should only just be visible through the cardiac shadow. If they are too clearly visible then the film is over penetrated & you may miss low density lesions. If you cannot see them at all then the film is under penetrated & the lung fields will appear falsely white.
E) Degree of inspiration – Count the number of ribs above the diaphragm.

The midpoint of the Rt. Hemi diaphragm should be between the 5<sup>th</sup> & 7<sup>th</sup> ribs anteriorly.

The anterior end of the 6<sup>th</sup> rib should be above the diaphragms as should the posterior end of the 10<sup>th</sup> rib.

Poor inspiration will make the heart look larger, give the appearance of basal shadowing & cause the trachea to appear deviated to the right.
Films on pp 6 and 7 show the effect of respiration. The film above has been retaken, under the same conditions, after the patient had breathed in and out.
Scanning the PA film

*Go through the following check list standing first at about 4 feet from the X-Ray & then close up.

1. Lung fields
2. Look at the hilum
3. Look at the heart
4. Check the rest of the mediastinum
5. Look at the diaphragm
6. Look specifically at the costophrenic angles
7. Look at the trachea
8. Look at the bones
9. Look at soft tissues
Scanning the PA film
1. Lung fields-

These should be of equal transradiency. Try to identify the horizontal fissure & check its position. It should run from the hilum to the 6\textsuperscript{th} rib in the axillary line. If it is displaced then this may be a sign of lung collapse. For radiological purposes the lung fields are divided into three zones:

a) Upper zone – from Apex to a line drawn through the lower borders of the anterior ends of the 2\textsuperscript{nd} costal cartilages.

b) Mid zone – extends from this line to one drawn through the lower borders of the 4\textsuperscript{th} costal cartilages.

c) Lower zone - extends from this line to the bases of the lungs.
2. Hilum-

The left hilum should be higher than the right though the difference should be less than 1 inch. Compare the shape & density of the hila. They should be concave in shape & look similar to each other.

3. Heart –

Check the shape of the heart & look for cardiomegaly. Check that there are no abnormally dense areas of the heart shadow.
4. Mediastinum –

The edge of the mediastinum should be clear though some fuzziness is acceptable at the angle between the heart & the diaphragm, the apices & the right hilum.

A fuzzy edge to any other parts of the mediastinum suggests a problem with the neighbouring lung (either consolidation or collapse).

Look for any widening of the mediastinum.
5. Diaphragms –

The right diaphragm should be higher than the left. The difference should be less than 1.2 inches.

The outline of the diaphragm should be smooth.

The highest point of the right diaphragm should be in the middle of the right lung field & the highest point of the left diaphragm slightly more lateral.

6. Costophrenic angles –

They should be well defined acute angles.
7. Trachea –

This should be central but deviates slightly to the right around the aortic knuckle. If the trachea has been shifted it suggests a problem within the mediastinum or pathology within one of the lungs.

8. Bones –

Look at the ribs, scapulae & the vertebrae. Follow the edges of each individual bone to look for #. Look for areas of blackness within each bone & compare the density of the bones which should be the same on both sides.

9. Soft tissues –

Look for any enlargement of soft tissue areas.
For proper interpretation of CXR, one needs patient’s history, findings on clinical examination, and provisional diagnosis, otherwise one may misinterpret it.

A CXR may show the following abnormalities—

1. **Too white**- Consolidation, Collapse, Pleural effusion

2. **Too black**- Pneumothorax, foreign body obstructing the bronchus (ball valve phenomenon), enlarged lymph nodes pressing the bronchus.

3. **Too large**- Hilar lymphadenopathy, large heart e.g., heart failure, pericardial effusion.

4. **In the wrong place**- Air in the soft tissues (surgical emphysema), intestinal shadow in the chest (diaphragmatic hernia), dextrocardia.
A 22 month old boy has a 2 week history of fever and cough, treated with antibiotics by his GP. On examination, he is miserable, febrile, with a tachycardia and tachypnoea.

1. What does the chest X-ray show?
2. What is the diagnosis?
3. What pathogens are most likely to be implicated?
ANSWERS
1. There is a cavity containing an air-fluid level in the right lower lobe (horizontal fissure visible, and right heart border preserved). There is surrounding consolidation.
2. A lung abscess.
3. Pathogens include staphylococcus, klebsiella, Gram-negative organisms and anaerobes (particularly if there is a history of aspiration).

RADIOLOGY HOT LIST
- Commonest sites: both upper lobes and the apical segments of the lower lobes, as these are dependent in recumbent patients.
- A CT scan may be necessary for exact localisation, and to distinguish an abscess from an empyema or a pneumatocele.
- Rupture of the abscess into the pleural space may cause an empyema or a pyopneumothorax.
- Lung abscesses may evolve into pneumatoceles (thin-walled cystic lesions) and persist for many months.

CLINICAL HOT LIST
- Lung abscesses are uncommon in children and are usually the sequelae of unresolved bacterial pneumonia, aspiration of foreign material, or disorders of host defence.
- Predisposing factors include: cystic fibrosis, endocarditis of the right heart, foreign body, immunodeficiency and ciliary dyskinetic syndromes.
- Management is usually conservative, with intravenous antibiotics and radiological follow-up.
- Failure of resolution warrants bronchoscopy to identify obstructive lesions and to obtain bronchial aspirates for microbiological analysis.
- Drainage procedures are rarely required unless there is an empyema.
This 3 year old boy was seen in A&E with sudden onset of coughing and acute respiratory distress.

1. What does the chest radiograph show?
2. What is the diagnosis?
ANSWERS

1. The left lung is of greater volume and is hyperlucent compared to the right. As the film is deliberately taken in expiration, this implies air trapping on the left. The normal right lung is smaller because it is an expiratory film. (Don’t get caught out – it can be difficult to tell which side is abnormal.)

2. Inhaled foreign body in the left main bronchus (a peanut).

RADIOLOGY HOT LIST

- The normal cross-sectional diameter of the airway increases in inspiration and decreases in expiration. Foreign bodies can cause three radiological appearances according to their size:

<table>
<thead>
<tr>
<th>Size (in %)</th>
<th>Radiological Appearance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small (&lt;5%)</td>
<td>normal CXR, no obstruction to air flow</td>
</tr>
<tr>
<td>Intermediate (50%)</td>
<td>hyperinflation due to air trapping. Occlusion occurs in expiration only, due to normal decrease in bronchial diameter around the foreign body</td>
</tr>
<tr>
<td>Large (20%)</td>
<td>distal consolidation and atelectasis due to complete obstruction of airway</td>
</tr>
</tbody>
</table>

- Children unable to cooperate with expiratory films can be assessed for air trapping with screening or decubitus views (lying on suspect side, which would normally reduce in volume but remains hyperinflated due to presence of foreign body).
- Pneumomediastinum and pneumothorax are potential complications.
- Foreign bodies are often not radio-opaque!

CLINICAL HOT LIST

- Usually occurs in children under 4 years (M > F).
- They commonly present with sudden choking, cough and wheeze, which may subsequently settle. Delayed presentation occurs in up to 30%.
- The treatment of choice is bronchoscopic removal of the foreign body.
This 12 year old girl had a chest infection when this X-ray was taken.

1. What abnormalities are seen on the chest X-ray?
2. What is the diagnosis?
This 16 year old boy presented to A&E with an acute onset of dyspnoea and pleuritic chest pain.

1. What does the chest X-ray show?
2. What is the diagnosis?
ANSWERS

1. The right hemithorax is hyperlucent with complete absence of pulmonary markings. The right hemidiaphragm is depressed and the mediastinum is displaced to the left.
2. Right tension pneumothorax.

RADIOLOGY HOT LIST

- Always assess the pulmonary vascularity when considering unequal lucency on the CXR – is it normal, reduced (implying abnormal lung), or absent (pneumothorax)?
- Look for a free lung edge. Mediastinal shift and/or a depressed diaphragm indicate the presence of a tension pneumothorax.
- Other causes of a unilateral hyperlucent hemithorax include patient rotation, air trapping (e.g., secondary to foreign body, congenital lobar emphysema), reduced pulmonary perfusion, and chest wall abnormalities.

CLINICAL HOT LIST

- Childhood pneumothorax is associated with trauma, asthma, cystic fibrosis, pulmonary infections (including TB), Marfan’s syndrome and mechanical ventilation.
- Treatment options include observation, simple aspiration and chest drain insertion. The choice will depend on clinical presentation and severity.
- Life-threatening tension pneumothorax needs immediate intervention: do not wait for an X-ray!
Ascites

- Accumulation of serous fluid within the peritoneal cavity

- Causes
  - Tuberculosis
  - CLD
  - Nephrotic Syndrome
  - Heart failure
  - Constrictive pericarditis
  - SLE
Bruises

Causes

- ITP
- Leukemia
- Aplastic anemia
- Platelet function defects
- Child abuse
Clubbing (Hippocratic nails)

- Characterized by swelling of the distal digits, increased angle between the nail plate & the proximal nail fold

- Causes
  - CLD
  - Cystic fibrosis
  - Cyanotic CHD
  - Celiac disease
  - IBD
  - SBE
  - Idiopathic
Cleft Lip & Palate

- Incidence
  - Cleft lip - 1 in 750
  - Cleft palate - 1 in 2500

- Surgical closure of cleft lip is performed at 3 months. The initial repair may be revised at 4-5 yrs of age.

- Closure of palate is done before 1 yr of age to enhance normal speech development.
Megalencephaly

- **Causes**
  - Hydrocephalus
  - Hypothyroidism
  - Achondroplasia
  - Mucopolysaccharidosis
  - Neurocutaneous syndromes
  - Familial
Vesicular rash

**Causes**
- Chicken pox
- Herpes Zoster
- Porphyria
- Acrodermatitis enteropathica
- Erythema multiforme

**Chicken pox**
- Incubation 10-21 days
- Treatment
- Complications
Measles: Incubation period 10-12 days

Incubation stage/ Prodromal stage / Rash
Down Syndrome

- Trisomy 21
- Hypotonia
- Flat face
- Upward & slanted palpalbaral fissures & epicanthic folds
- Brushfield eye spots
- Mental retardation
- Congenital heart disease
- Simian crease & short broad hands
- Brachycephaly
- Depressed nasal bridge
- Low set ears
- Low neck line
Erythema multiformae

- The classical lesion is doughnut shaped, target like papule with an erythematous outer border, an inner pale ring & a dusky purple to necrotic center.

- Causes
  - Infectious agents:
    - Group A streptococcus, Mycobacterium tuberculosis, Mycoplasma pneuminiae, Hepatitis B
  - Neoplasia:
    - Leukemia, Lymphoma
  - Drugs:
    - Penicillins, Sulphonamides, Isoniazid, Cephalosporins, anticonvulsants, Allopurinol, Aspirin

- Treatment
  - Supportive & Symptomatic
  - Offending drug discontinued
  - Role of steroids is controvercial
Lymphadenitis

- **Causes**
  - Tuberculosis
  - ALL
  - Lymphoma
  - Sarcoidosis
  - Mononucleosis

- **Investigations**
Malnutrition (Kwashiorkor)

- Edema is always present
- Thin lean muscles, fat is present
- Puffy, moon face
- Hair changes are present
- Miserable looking & Apathetic
- Poor appetite & anorexic
- Flaky paint dermatitis
Malnutrition (Marasmus)

- Marked muscle wasting & loss of subcutaneous fat
- Alert face, no buccal pad of fat
- Appetite is better
- Skin becomes loose & hangs in folds
- Protuberant abdomen
- Edema is never present
- Skin & hair changes are absent
Mumps

- Incubation period 14-24 days with a peak at 17-18 days.
- Complications:
  - Meningoencephalitis
  - Orchitis & Epididymitis
  - Oophoritis
  - Pancreatitis
  - Myocarditis
  - Arthritis
  - Thyrioiitis
- Prevention
  - MMR vaccine
Anasarca (Generalized body swelling)

- Causes
  - Nephrotic syndrome
  - AGN
  - Malnutrition (Kwashiorkor)
  - CCF
  - SLE
Rickets

- Clinical features
  - Craniotabes
  - Rachitic rosary
  - Widening of wrist
  - Pigeon chest deformity
  - Harrison sulcus
  - Delayed closure of ant. Fontanel
  - Frontal bossing
  - Delayed teething
  - Bow legs & knock knees
  - Greenstick #

- Treatment:
  - Inj. Vit D

- Prevention
  - Exposure to sunlight
Thalassemia

- Anemia & icteric tinge
- Darkening of skin
- Mandibular Prominence
- Depressed nasal bridge
- Frontal bossing
- Massive hepatosplenomegaly
- Growth retardation
Ac. Tonsillitis

- Group A beta hemolytic streptococcus
- Treatment
- Complications
Haemophilia

- Bruise & joint swelling
- Inherited disorder resulting in deficient or defective coagulation factors.
- Hemophilia A, B
- X-linked inheritance
- Lab:
  - APTT ↑, ↓ factor VIII/IX
- Treatment:
  - Prevent trauma
  - Factor concentrate
  - FFP’s
  - Blood transfusion