Chest X-ray Interpretation

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General Principles

- 80% of all diagnostics are radiographs
- CXR most commonly performed
  - 45% of all radiographs
- Order film based on indications
- Use a systematic approach
- Concentrate on one thing at a time

Chest X-ray: Standard Views

- Postero-anterior (PA):
  - On inspiration – diaphragm descends to 10th rib posteriorly
  - If diaphragm is not at the 8th rib = lung hypoinflation (e.g., respiratory depression)
  - If diaphragm is past the 12th rib = hyperinflation (e.g.,

Lateral Film

- Lateral (LAT): L side placed a/the cassette

PA Film

- PA view is better to comment on accuracy of the heart size
- More accurate representation of the cardiac size

Lateral Film

- (LAT) view can determine the anterior-posterior structures along the axis of the body

Normal LAT film
AP View - Portable

- When the patient is unable to tolerate routine views with pts sitting or supine
- No participation from the patient
- Film is against the patient's back (supine)

Chest radiograph

- Counting ribs – 1 & 2 are above the clavicle
- Full inspiration:
  - 8 ribs (10 ideal) – Posterior
  - 5-6 ribs - Anterior
- Sharp costophrenic angles

Chest radiograph

- Left and right heart borders well defined
- Both hemidiaphragms visible to midline
  - Right - higher
- Heart less than 50% of diameter of the chest
Normal PA CXR

Chest Landmarks

- A - costophrenic angle
- B - L diaphragm
- C - heart
- D - aortic arch-superior left bend of the aorta between the ascending and descending portions
- E - trachea
- F - hilum
- G - carina - cartilaginous ridge within the trachea that runs anteroposteriorly between the two primary branches at the site of the tracheal bifurcation at the lower end of the trachea (usually at the level of the 4th or 5th thoracic vertebrae)
- H - stomach bubble
- J - ascending aorta

Rotation – Centered?

http://www.lumen.luc.edu/lumen/meded/medicine/pulmonar/cxr/cxr_f.htm
### Normal CXR

- pleura
- trachea
- aortic arch
- heart border

[Image: http://api.ning.com/files/VEP*rteXGuTGsYbWuPlRWI3Dz6DzrmACh4zN23hQ3K6tNrgblFcUyCuER6JOHNihAHI2Z1q6dL4yLM6dE8Lzq6mY9pWY/normallung.jpg]

### Lateral Films

- Retro cardiac apex space
- Lung 1/2 distal of aorta and 1/2 over mid clavicle

[Image: http://www.lumen.luc.edu/lumen/meded/medicine/pulmonar/cxr/cxr_f.htm]

### Dextrocardia

- **Dextrocardia situs inversus:** heart is a mirror image of normal placement
- **Dextrocardia situs totalis:** all visceral organs are mirrored
- Incidence: 1 in 12,000 people

### Lobes of the Lungs

- **Right lung** (three lobes):
  - Superior lobe
  - Middle lobe
  - Inferior lobe

- **Left lung** (two lobes):
  - Superior lobe
  - Inferior lobe

[Diagram: Lobes of the Lungs]

### Surface Anatomy

[Diagram: Surface Anatomy]

Clues to consolidation

<table>
<thead>
<tr>
<th>Ill Defined</th>
<th>Consolidation suspected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right heart border</td>
<td>Middle lobe</td>
</tr>
<tr>
<td>Left heart border</td>
<td>Left upper lobe (lingula)</td>
</tr>
<tr>
<td>Right hemidiaphragm</td>
<td>Right lower lobe</td>
</tr>
<tr>
<td>Left hemidiaphragm</td>
<td>Left lower lobe</td>
</tr>
</tbody>
</table>

- Loss of a cardiac border may indicate a lung abnormality adjacent to that anatomical structure.
- Obscuration of right border of heart (arrows) due to density of another tissue.
Silhouette Sign

Snowball Sign
Is nodule arising from lung or surrounding structure?

LUL: Mass vs. Infiltrate

53 yr old female – Fever & Cough

64 yr old with SOB & cough
Rules = RIP

- R – Rotation – clavicles and vertebrae form a cross
- I – Inspiration – minimum of 8 ribs visible
- P – Penetration – interspaces visible; thoracic vertebral bodies not well defined
- Symmetry – right hemidiaphragm higher & aortic knob
- Lung markings all the way out

Cardio-thoracic ratio

Extracardiac causes for CTR > 50%

- Portable AP films
- Obesity
- Pregnancy
- Ascites
- Straight back syndrome
- Pectus excavatum
Cardiomegaly & AP film

- If the heart touches the lateral chest wall, it’s enlarged

Pericardial Effusion

Chest Radiograph

- Both hemidiaphragms seen
- Area behind heart approx as black as area behind sternum
- Lower vertebral bodies darker compared with upper

Steeple sign of croup (subglottic narrowing)
Pleural Effusion

- Need at least 250-500 ml to be able to view

Right Lateral Decubitus film

Pulmonary Vasculature

Normal Pulmonary Artery and Hilar Markings
Kerley B lines
- Cardiomyopathy & interstitial pulmonary edema
- Short 1-2 cm white lines at lung periphery horizontal to pleural surface
- Distended interlobular septa - secondary to interstitial edema.

Kerley lines
- Prominent interstitial markings

Congestive Heart Failure
- Alveolar edema = air sacs (i.e., alveoli)
- Interstitial edema = alveoli + supporting structures

Bat Wing edema
- Bat wing edema = central, alveolar edema
- <10% of cases of pulmonary edema occurs with rapidly developing severe cardiac failure
  - acute mitral insufficiency
  - renal failure

This patient has Bat wing pulmonary edema from CHF. The pattern shown is the "bat wing".
CHF

Widened Mediastinum

Aortic Dissection

Rib fractures
- Chest radiograph obtained solely to exclude complication such as pneumothorax
- Oblique views of the ribs are not necessary; clinical management is rarely altered by seeing rib fx.

Rib Fractures

Unrestrained driver involved in MVC
Shortness of Breath

3 yr old with fever & barky cough

MVC c/o right chest pain

Expiration Views

- Air trapping conditions:
  - Pneumothorax
  - Partial bronchial obstruction
  - Foreign body aspiration – if you hear a unilateral wheeze that does not clear with coughing!

Pneumothorax
Consider expiratory film if small
Key Points

- AP radiograph may magnify the heart, poor inspiration
- Small pneumo – expiration view
- Chest radiograph done with rib fractures used to exclude complication
- Both heart borders & both hemidiaphragms normally clearly visible

Coin vs. Button Batteries
Asthma

- Hyperinflation
- Mucus plugging can lead to atelectasis
- Interstitial inflammation

Hyperinflation – with flat diaphragm down to the 11th rib
Prominent interstitial markings (scarring) – from inflammation

COPD

Hyperinflation (loss of interstitial tissue/darker-more air)
- Low set diaphragm/12th rib
- Increased AP diameter
- Vertical heart
- Increased retrosternal air.
- Blunted costophrenic angles

http://www.meddirector.luc.edu/lumen/MEdEd/Radio/curriculum/Mechanisms/396a1.jpg
Severe COPD with pneumomediastinum and SQ emphysema

MVC high velocity with SOB

Trauma pt, fall from 14 ft, c/o SOB
15 month old suddenly red in face and SOB

Fever, cough, SOB

History CA Lung with SOB

28 yr old female with cough
48 yr old patient wheezing

4 yr old choking episode

2 year old choking episode

Fever, productive cough, SOB
Pt c/o cough and wheezing for 1 month after seizure episode

Fever, cough, noisy respirations

4 yr old with choking episode

Fever, wheezing

Thrown from motorcycle, c/o CP, SOB

7 yr old found with mother’s purse
13 yr playing with blowgun

5 Key Points

- Good Inspiration – minimum 8 ribs
- Ill-defined heart borders & diaphragms – determines location of infiltrates
- Heart should be less than 50% chest
- Lung markings all the way to periphery
- Coin/button batteries – orientation, flat in esophagus