CHEST

Difference between PA and AP views
- **PA View**
  - Spine and post ends of ribs clearly seen
  - Ribs obliquely oriented
  - Scapulae not overlapping the thorax
  - Clavicles are horizontal
  - Normal sized cardiac silhouette

- **AP View**
  - not visualized clearly
  - More horizontal
  - They do overlap
  - More oblique
  - enlarged

CENTRALISATION
- Medial ends of both the clavicles are equidistant from the spinous processes.

- Effects of rotation:
  * apparent (false) cardiomegaly.
  * apparent hilar enlargement.

EXPOSURE
- If first 3-4 thoracic vertebra are seen, the exposure is good.

- If > 4 thoracic vertebrae are seen, it is suggestive of an overexposed film.

NORMAL CXR

NORMAL ANATOMICAL LOBES
WHAT IS TO BE SEEN?

- 1) Trachea.
- 2) Lung fields.
- 3) Cardiophrenic & costophrenic angles.
- 4) Hila.
- 5) Cardiac silhouette.
- 6) Ribs.
- 7) Diaphragm.
- 8) Soft tissue of the neck & axilla.
- 9) Free gas under diaphragm is better seen on chest PA standing view, than on abdomen standing view.

TRACHEA

- Look whether it is centrally placed, or displaced to one side.
- Normal carinal angle is 60 degrees. It is widened in LA enlargement & enlarged subcarinal LN.
- The left main bronchus is lower, longer & slender than the right.
- Trachea may look displaced to one side if:
  * Obliquity of the patient while the film is taken.
  * Real displacement of the trachea, due to pulling or pushing of the trachea due to the pathology.

TRACHEA PUSHED:

- Abnormality in the lung, on the side, opposite to the tracheal shift.
  e.g. Mass, pneumothorax, pleural effusion etc.

TRACHEA PULLED:

- Abnormality in the lung, on the same side, as that of the tracheal shift.
  e.g. Collapse, fibrosis

LUNG FIELDS

- Look for the normal lung parenchyma.
- The lung fields are divided in three zones only for convenience of the description of the lesion. However, they do not correspond to the anatomical lobes.
- **Upper zone**: from apex to the lower border of posterior end of fourth rib.
- **Middle zone**: from the lower border of the fourth rib to the lower border of the posterior end of seventh rib.
- **Lower zone**: below the lower border of the posterior end seventh rib.
Look for the normal broncho-vascular pattern. (branching pattern.)

- The pulmonary arteries are more vertically oriented in both the lower zones, near the heart.
- The pulmonary veins are more vertically oriented in the upper zones.
- The bronchovascular pattern is seen upto peripheral 2/3 rd of the lung fields.

NORMAL CHEST X RAY

COSTOPHRENIC ANGLES:

- On PA view, we can seen the lateral CP angle.
- Normally it should be very sharp & clearly lucent.
- It is blunted in the pleural effusion, pleural thickening.

CP angles: normal & obliterated

HILA

- Normal radiographic pulmonary hilal are formed by:
  * pulmonary arteries.
  * upper lobe pulmonary veins.
- The normal LN, normal airways, lymphatics do not contribute to the radiographic hila.
- The lower lobe pulmonary veins do not contribute in the radiographic hila, as they enter directly into the LA.

Thus, on a radiograph, hilar prominence can be due to the following:

- dilated central pulmonary arteries.
- dilated upper lobe pulmonary veins.
- hilar lymphadenopathy.

- Normally left hilum is higher than the right.
- For hilar evaluation, look for the following:
  * position.
  * size.
  * shape.
  * density.
NORMAL HILA

BILATERAL HILAR LYMPHADENOPATHY

ECS. IN TB. & SARCOIDOSIS

HILAR LYMPHADENOPATHY

CARDIAC SILHOUTTE.

LEFT CARDIAC BORDER:
- Aortic knuckle.
- Pulmonary bay.
- Left atrial appendage.
- Left ventricle.
- Cardiac Apex

RIGHT CARDIAC BORDER:
- SVC.
- Right atrium.
- IVC.
ANTERIOR CARDIAC BORDER ON LATERAL VIEW:
- Right ventricle.

POSTERIOR CARDIAC BORDER ON LATERAL VIEW:
- Left atrium.

Look for the cardio-thoracic ratio, to exclude cardiomegaly.

1) Measure maximum transverse cardiac border:
   - draw a midline, joining the spinous processes.
   - measure the maximum transverse distance between the midline & the left cardiac border. (X)

2) measure the maximum transverse thoracic diameter: (A + B)
   - similarly, measure the maximum transverse distance from the midline to the lateral thoracic wall,

   \[
   \text{CARDIO-THORACIC RATIO} = \frac{(X + Y)}{(A + B)}
   \]

NORMAL CARDIO-THORACIC RATIO
- Adults: < 55 %.
- child: < 60 %

If the CTR is increased, it suggests presence of cardiomegaly / pericardial effusion.
- Identify the sternal & vertebral ends of the ribs.
- Look for any fracture of the ribs in a traumatized patient.
- Look for the inferior rib notching at the posterior ends, in a case of coarctation of the aorta.
- Look for the presence of the cervical ribs.

- BIFID RIBS ARE NORMAL VARIANTS.
- Crowding of ribs will occur in volume loss of the lung.
- Increased distance between the ribs will occur in emphysema.

- LEFT CERVICAL RIB

- DIAPHRAGM
- Normally, both the hemi-diaphragms are convex upwards.
- The right hemi-diaphragm is higher than the left hemi-diaphragm by < 2.5 cm, or <2 intercostal spaces.
- Sometimes, the left hemi-diaphragm may be at the level of the right one, or may even be slightly higher than it.
- The diaphragm may be flattened in emphysema, massive pleural effusion, large pneumothorax, phrenic nerve palsy.
The diaphragm may be abnormally elevated by:
- phrenic nerve palsy.
- collapse of the lung.
- massive ascitis.
- large abdominal pathology.
- subphrenic abscess.
- diaphragmatic hernia.

Free gas under diaphragm is best seen in the chest film; & not in the x-ray abdomen standing.

Causes of free gas under diaphragm:
- Peptic perforation of stomach or duodenum.
- Enteric perforation, due to trauma, typhoid ulcer.
- Colonic perforation due to trauma, UC, malignancy.

After procedures: tubal ligation, HSG, laparoscopy.
Chiladity syndrome: colonic interposition between the diaphragm & liver or stomach.

Free gas vs. chiladity

SOFT TISSUES OF THE NECK & AXILLA
- Look for any calcified lymphadenopathy in the axillae & in the neck.
- Look for presence of any subcutaneous emphysema.
- Normal shadows of pectoral muscles extend beyond the confinement of the bony thorax.

Absence of pectoral muscles, as in MRM surgery for CA breast, will produce hyperlucency.

Normal nipple shadows may mimic a solitary pulmonary nodule. Therefore, look for bilateral symmetry.
NORMAL NIPPLE SHADOWS MUST NOT BE CONFUSED AS PULMONARY NODULES

NORMAL CXR LATERAL VIEW.
- Erect / decubitus:
  * diaphragm of dependent side is higher in decubitus.
- Areas of NORMAL lucency:
  * Retro-sternal & retro-cardiac.
- Cardiac silhouette:
  * anterior border is formed by right ventricle
  * posterior border is formed by left atrium & IVC.

Mediastinum – superior & inferior [proper]
- SUPERIOR mediastinum is separated from INFERIOR mediastinum, by a line drawn from sternal angle to lower border of T 4 vertebral body.
- Inferior mediastinum [classical] is divided into
  * anterior mediastinum – from sternum to ant. Margin of cardiac silhouette & trachea.
  * middle mediastinum – contains heart & trachea.
  * posterior mediastinum – from posterior border of cardiac silhouette & trachea.

As we go down, the vertebral density must be gradually reduced.

MEDIASTINAL COMPARTMENTS
- CONVENTIONAL
- FELSON
- SUTTON
- NAIDICH
- ZYLAK [CT METHOD]
- HEITZMAN

FELSON
- In this, anterior → pericardium & its contents.
- middle → includes trachea & extends upto a line drawn connecting a point on each vertebral body 1cm. posterior to its anterior margin.
- posterior → paravertebral gutters.
**Sutton**

- Multiple areas on lateral radiographs, where common lesions occur with their differential diagnosis – best for practical use.

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**ZYLAK**

- **ANTERIOR --- PREVASCULAR Space.**
- **MIDDLE --- VASCULAR Space.**
  - [pericardium & its contents, great veins, & the ant. Aorta & its branches].
- **POSTERIOR --- POSTVASCULAR Space.**
Basic rules for localizing a chest lesion

- **SILHOUETTE SIGN**

- When two isodense structures are in anatomical contiguity with each other, their interface is obscured.

- Any lesion in ant. Segment of RUL obliterates the ascending aorta

- Lesion in left middle lobe will obliterate the heart border

Other helpful features:

- **LOCATION ON X RAY**
  - Extreme apex of lung
  - Lateral costophrenic angle
  - Right upper lung whose lower border is made by minor fissure
  - Right midlung with sharp upper border made by minor fissure
  - Lesion eroding sternum and spine
  - Well defined opacity seen through cardiac shadow

- **REAL LOCATION**
  - Apical seg
  - Lat./ant basal seg
  - RUL
  - RML
  - Indicates extrapleural ext.
  - LLL collapse

- **THE LESION IS SILHOUTTING WITH THE RIGHT CARDIAC BORDER**

- **THE LESION IS NOT SILHOUTTING WITH THE RIGHT CARDIAC BORDER**
The lesion is not silhoutting with the left cardiac border

RESPIRATORY SYSTEM

1) CONSOLIDATION.
2) COLLAPSE.
3) PLEURAL EFFUSION.
4) D/D of opaque hemithorax.
5) MASS & SPN.
6) PNEUMOTHORAX.
7) HYDROPNEUMOTHORAX.
8) TUBERCULOSIS.
9) EMPHYSEMA.

CONSOLIDATION

- Inhomogenous radiopacity, with airbronchogram within it.
- Borders may be sharply defined, if the consolidation is confined to the lobar or segmental boundaries.
- Presence of the Airbronchogram suggests that: 
  * the lesion is intra-parenchymal.
  * the bronchus, supplying that lobe or segment is patent.
COLLAPSE

1) HOMOGENOUS RADIOPACITY.
2) CROWDING OF THE BRONCHO-VASCULAR MARKINGS.
3) DISPLACEMENT OF THE HILA, FISSURES, DIAPHRAGM, MEDIASTINUM.
4) COMPENSATORY OVER-INFLATION OF THE OPPOSITE LUNG OR THE OTHER LOBES.

Direct roentgen signs of collapse:
- Displaced septa
- Loss of aeration
- Crowding of the vessels and bronchi

Indirect signs of collapse
- Unilateral elevation of hemidiaphragm
- Deviation of trachea
- Shift of heart
- Narrowing of rib cage
- Compensatory overinflation
- Hilar displacement

COLLAPSE OF RUL.

COLLAPSE OF LINGULAR LOBE

COLLAPSE OF LUL.
TRACHEAL SHIFT IN COLLAPSE

COLLAPSE OF RML WITH INFERIOR DISPLACEMENT OF MINOR FISSURE

CT SCAN OF COLLAPSE

PLEURAL EFFUSION
- 1) homogenous radiopacity obliterating the CP angle, & diaphragm.
- 2) concave upper border.
- 3) no broncho-vascular markings.

How to detect a very small quantity of pleural effusion?
* 15 min Lateral decubitus film.

RIGHT PLEURAL EFFUSION
RIGHT PLEURAL EFFUSION IN ERECT & DECUBITUS POSITIONS

D/D of opaque hemithorax
- Mediastinum shifted to opposite side:
  * massive pleural effusion
  * diaphragmatic hernia.
- Mediastinum shifted to same side:
  * massive collapse of the lung
  * massive fibrosis
  * post pneumonectomy.
- Mediastinum central:
  * massive consolidation

Opaque hemithorax with trachea pulled towards the same side

Opaque hemithorax with the mediastinum pushed to opp. side

Opaque hemithorax with the mediastinum in center.
MASS
- PLEURAL / PARENCHYMAL / MEDIASTINAL ?

**PLEURAL MASS**:
- Peripheral location.
- Broad based towards the pleura.
- No broncho-vascular markings within the mass.
- Wide angle with the lung parenchyma.
- Sharp medial border.

**MEDIASTINAL MASS**
- Broad base towards mediastinum.
- Obtuse angle with the mediastinum.
- Sharp lateral borders.
- No broncho-vascular markings.
**PARENCHYMAL MASS**
- Surrounded by the lung parenchyma all around.
- May contain broncho-vascular markings.
- Spiculated borders favor malignancy.

**SOLITARY PULMONARY NODULE**
The D/D may include the following:
- Primary malignancy of the lung.
- Metastasis.
- Tuberculoma.
- Hydatid cyst.
- AV malformation.
- Hamartoma.
PNEUMOTHORAX.
- Radiolucency in the CP angle,
- No broncho-vascular markings.
- Razor-sharp medial border.
- There may be associated changes, as under:
  * collapse of the underlying lung.
  * mediastinal displacement.
  * diaphragmatic displacement.
HYDROPNEUMOTHORAX

- Air fluid level.
- Razor sharp border of the collapsed lung.

EMPHYSEMA

- Hyperlucent lung field.
- Widening of the rib space.
- Flattening of the diaphragm.
- More than 7 visible anterior ends of the ribs.
- Tear drop shaped heart.
LUNG ABSESS
- Air-fluid level.
- Thick wall.
- Surrounding consolidation.

Lung abscess

D/D of miliary opacities
- Miliary opacities are < 2 mm sized, multiple, opacities of uniform sizes & shapes homogenously distributed in both the lung fields.
- D/D of miliary opacities are as under:
  - Miliary tuberculosis.
  - Pneumoconiosis
  - Histoplasmosis.
  - Miliary metastasis in thyroid, pancreas, breast malignancies.
Primary pulmonary tuberculosis
- Occurs in children, who are infected with the tuberculous bacilli for the first time, or who have been given the BCG vaccine.
- Characterized by GHOHN’S COMPLEX, which is made up of:
  * Ghohn’s focus: an area of consolidation.
  * Typically unilateral hilar lymphadenopathy, on the same side as that of the consolidation.

POST PRIMARY TUBERCULOSIS
- Defined as the development of the disease in a patient, who had previous subclinical / clinical infection; or who had been vaccinated with the BCG vaccine.

KEY FEATURES OF POST-PRIMARY TB:
- Predominant involvement of the apices of the lungs by:
  * Consolidation.
  * Cavitation.
  * Fibrosis.
  * Volume-loss.
- **NO HILAR LYMPHADENOPATHY.**
- Pleural involvement in the form of effusion or empyema.
- Bronchiectasis (if present) is typically in the upper lobes.

POST PRIMARY TB

CARDIO-VASCULAR SYSTEM
- **LV CARDIOMEGALY.**
  - Displacement of the apex of the heart downwards & outwards.
  - Wide angle between the apex of the heart & the left hemidiaphragm.
  - In lateral view, the retrocardiac space is obliterated.
LV CARDIOMEGALY

- Only outwards displacement of the apex of the heart. Thus the apex is lifted from the diaphragm.
- Narrow angle between the apex of the heart & the left hemidiaphragm.
- Associated changes in the lung (+/-).
- In lateral view, reduced retrosternal space.

RV CARDIOMEGALY.

- LA ENLARGEMENT:
  - Straightening of the left cardiac border.
  - Double density within the cardiac shadow, giving rise to the “chamber-in-chamber” appearance.
  - On lateral view, prominent posterior cardiac border, which on barium swallow, produces an extrinsic impression on the anterior wall of the oesophagus.
  - Associated changes of PVHT (+/-).

LA ENLARGEMENT
**RA Enlargement:**
- Displacement of the right cardiac border away from the spine.
- In lateral view, prominent antero-superior part of the heart, reducing the retrosternal space.

**Global cardiomegaly**

- D/D of global cardiomegaly.
  - Multi-valvular heart disease.
  - Cardiomyopathy
  - Pericardial effusion.

**Pericardial Effusion.**
- Increased cardio-thoracic ratio.
- Obliteration of the angle between the SVC & RA.
- Obliteration of the angle between aortic knuckle & LV.
- Normal cardio-phrenic angle.
- There may be reduced pulmonary vascularity, if the pericardial effusion is marked.
- On fluoroscopy, there is reduced movement & pulsatility of the heart.
PERICARDIAL EFFUSION

PULMONARY OEDEMA
- Batwing shaped opacity.
- Multiple patchy confluent opacities.
- Middle & lower zone involvement in a mobile patient.

BATWING PATTERN OF PULMONARY OEDEMA

Pulmonary oedema

THANK YOU.....