Chest Xray is one of the most routinely performed investigations in medical and surgical practice. It's vital to understand normal lung Xray. To differentiate abnormal findings, one has to know how to read a normal chest x-ray. The chest X-ray (CXR) is performed to evaluate the lungs, heart and chest wall. Normal CXR is taken with the patient in an upright position, taking a deep breath and holding it for a few seconds to reduce the possibility of a blurred image. Routine CXR is taken in a frontal view (referred to as posterior-anterior or PA). The other views which may be taken as required are:

- Lateral view (right or left)
- Apical view
- Lateral decubitus view

In neonates, the films are always taken as AP views for better visualization of the lung fields and heart.

Interpretation of the film taken in expiration is difficult because the lung bases appear hazy and the heart looks enlarged. However, a pneumothorax is more clearly seen in an expiratory film rather than in the inspiratory film. In a CXR, carefully observe the following points. Always remember to assess the technical quality of the film, such as incorrect exposure or faulty centering or projection, which may either hide, mimic or confuse with the disease diagnosis.

- Position of the patient (look for kyphoscoliosis)
- Side of X-ray (look for right "R" and left `V markers on the top of the film)
- Soft tissue shadow (outside skeleton)
- Bony configuration
- Position of trachea
- Outline of the diaphragm (both right and left domes)
- Costophrenic and cardiophrenic angles on both sides
- Borders of the heart including upper mediastinum
- Lung fields (including hilar shadow, pulmonary vessels, and fissures of the lung)
- Heart size
- Look for the integrity of ribs, clavicles, scapula, and spine
- In females, look for breast shadow
- Look for any shadow in the neck, subcutaneous tissue in the chest wall, any abnormality in the humerus and subcutaneous emphysema

Radiological Checklist: **Easy Way to Remember**

1. A=Airway
2. B=Bones
3. C=Cardiac
4. D=Diaphragm
5. E=Effusion
6. F=Fields (Lungfields)
7. G=Gastric Air Bubble
8. H=Hilum, Hernia (congenital diaphragmatic hernia)

Understanding Basics and How to Read Head CT Scan

On all X-rays check the following:

1. Patient details: First name, surname, date of birth.
2. Orientation: position and side description
3. Additional information: inspiration, expiration
4. 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
5. Adequacy of inspiration: Nine pairs of ribs should be seen posteriorly in order to consider a chest x-ray adequate in terms of inspiration
6. Penetration: one should barely see the thoracic vertebrae behind the heart
7. Exposure: One needs to be able to identify both costophrenic angles and lung apices
8. Position of the Patient

Position of the Patient

Observe the medial ends of both clavicles in relation to the pedicles of the thoracic vertebrae. The medial end of the clavicle should be equidistant from the spinous process at the level of T4 and T5 thoracic vertebrae. If the position is not correct the heart may appear shifted in the radiograph. Also, the scapular shadow may be seen.

Side of the X-ray

Always look at the top of the film for the "R" or "L" markers which indicate the patient's position (right or left). Dextrocardia or situs
inversus may be missed if the correct position is not noted at the beginning.

The other points which will help to find the side/position in addition to the markers on the top of the film are

**Diaphragm**—usually the right dome is 2.5 cm above the left dome.

Fundal gas is on the left side.

Heart—normally one-third lies on the right side and two-third on the left. Look at the cardiac apex, which is on the left side.

Soft Tissue Shadow (Outside Skeleton) - This appears as opacity outside the bony skeleton. In females, check for breast shadow (may be absent due to mastectomy)

**Bony Configuration**

Look for the cervical rib, maybe small or rudimentary (missed in many cases).

Check the ribs (normal, crowding, wide-spaced, erosion, notching, fracture or healed fracture).

Check the clavicle, spine and vertebral column, scapula and humerus.

Look for kyphoscoliosis.

**The position of Trachea**

The trachea is seen as a dark column (due to air) with the cartilaginous ring not being visible. Observe whether the trachea is central or deviated to the right or left (normally, or trachea lies midway or slightly deviated to the right).

**Outline of Diaphragm (Both Right and Left Domes)**
Normally the right dome of the diaphragm is at the level of the anterior end of the 6th rib and posterior end of the 10th rib near the vertebral column.

Left dome is 2.5 cm below the right dome.

Costophrenic and Cardiophrenic Angles on Both Sides.

The angle between the diaphragm and the rib is called the costophrenic angle (maybe obliterated due to pleural effusion).

Angle between the diaphragm and the cardiac border is called the cardiophrenic angle.

**Heart Size**

The cardiothoracic ratio is used for measuring the heart size (which may vary with respiration). The maximum transverse diameter of the heart is slightly less than half of the maximum transverse diameter of the chest (<0.5). Diameter of the heart is measured as follows.

From the midline, take the maximum diameter of the right and left borders of the heart. The sum of these two diameters is the maximum transverse diameter of the heart. Alternately, it can be measured by taking the distance between two vertical tangents of the heart outline, which is the maximum diameter. The diameter of the chest is measured from the maximum distance on both sides (such as from both costophrenic angles).

The heart may be enlarged in transverse diameter. Occasionally, enlargement may be of either the left ventricular (LV Type) or the right ventricular type (RV Type).

In LV type enlargement, the apex is displaced downwards and to the left. Cardiophrenic angle is obtuse and merges with the diaphragm.
In RV type enlargement, apex is round and elevated above the diaphragm.

In left atrial enlargement, there is a double border or contour in the right border of the right atrium (which is visible as a double border adjacent to the right border of the heart. In addition, widening of the carina and left main bronchus is horizontal).

In right atrial enlargement, there is an increased curvature in the right border of the heart.

There may be calcification of valves (better seen in a lateral or oblique view). In a PA view, it is obscured by the spine. Calcification is best detected by echocardiography.

Outline of the Mediastinum

Normally, one-third lies on the right side and two-third on the left. Look at the cardiac apex, which is on the left side (look for cardiomegaly, straightening of the left border and double border on the right side)

Right superior mediastinal shadow is usually straight or slightly curved and left superior mediastinal shadow is ill-defined above the aortic arch.

Look for any widening of the superior mediastinal shadow (maybe due to lymphoma, retrosternal goiter, aneurysm of the aorta, etc).

Borders of the Heart

The right border of the heart is formed by (above down-wards) the following:

1. Upper slightly curved portion SVC with ascending aorta.
2. Lower more convex part by an outer border of the right atrium.

The left border of the heart is formed by (above wards) the following:

1. Prominent aortic knuckle (formed by the arch of the aorta)
2. Straight-line due to pulmonary artery
3. Left atrial appendage
4. Left ventricle

**Hilar Shadows**

The hilar shadow consists of:

1. Pulmonary artery
2. Pulmonary veins.
3. Hilar lymph nodes (normally, hilar lymph nodes are too small and not well visible).
4. The left hilum is slightly higher (2.5 cm) in position than the right.
5. The air within major bronchi can be seen, but their walls are not visible.
6. The shadow of the pulmonary vessels does not have any definite measurement. Clinical experience from viewing normal films is required to appreciate them.

**Lung Fields and Fissures of Lung**

Radiologically, lung fields are divided into three zones, all of which are seen in the PA view. The radiological zone does not usually correspond with the lobe of the lung. To see the lobe, a lateral film should always be taken.

The upper zone is the part above a horizontal line through the lower border of the anterior end of the second rib.

Mid-zone is the part between the lower border of the upper zone and a horizontal line through the lower border of the anterior end of the fourth rib.

The lower zone is the part below the mid-zone.

Fissures can be seen only if they lie tangential to the X-ray beam. These are composed of two layers of pleura. Usually, only horizontal fissure
(minor fissure) is visible in the frontal projection, running from right hilum to the sixth rib in the axilla. No equivalent of the horizontal fissure. Sometimes from a PA view, the lobe can be localized in some cases. For example, if a horizontal fissure is seen (on the right side), then the part above this fissure is the upper lobe.