Manage TB
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Lecture – 16
Radiology in diagnosis of Tuberculosis
Session 01

So, welcome to the session Radiology in the diagnosis of Tuberculosis, I am Dr Chitra Kumar professor of thoracic medicine, Madras Medical College under Rajiv Gandhi Government general hospital; Institute of Thoracic Medicine, Chennai. Since time immemorial, TB has been a phenomenal (Refer Time: 00:31) to mankind causing high morbidity and mortality.

So, early diagnosis of tuberculosis is mandatory for effective treatment and control of TB, but relying on the conventional sputum microscopy and microbiological culture tests which are less sensitive in paucibacillary and early stages of disease, lead to inherent delay in the diagnosis and treatment of TB. So, imaging plays a major role in screening, diagnosing and follow up of patients put on treatment for TB.

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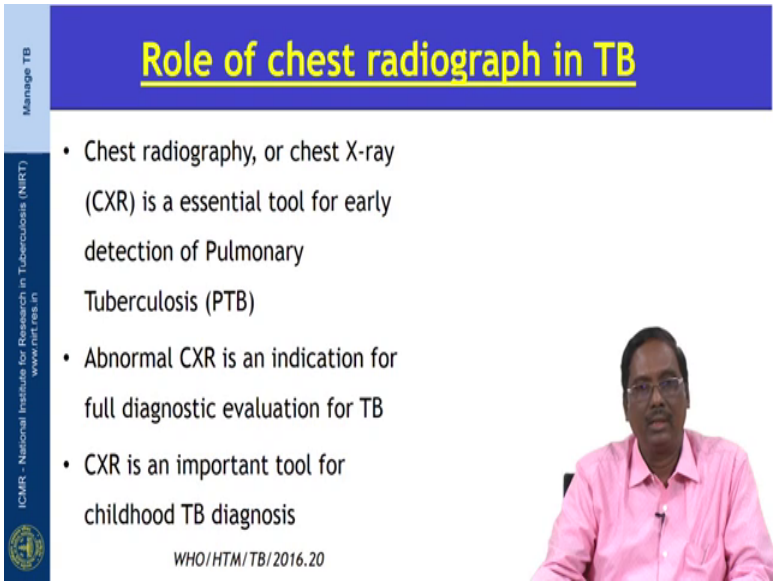

Role of chest radiograph in TB, chest X-ray is an essential tool for early detection of pulmonary tuberculosis.

Abnormal chest X-ray is an indication for full diagnostic evaluation for TB; including bacteriological diagnostic test. X-ray is an important tool for childhood TB diagnosis with history evidence of TB infection and microbiological test.

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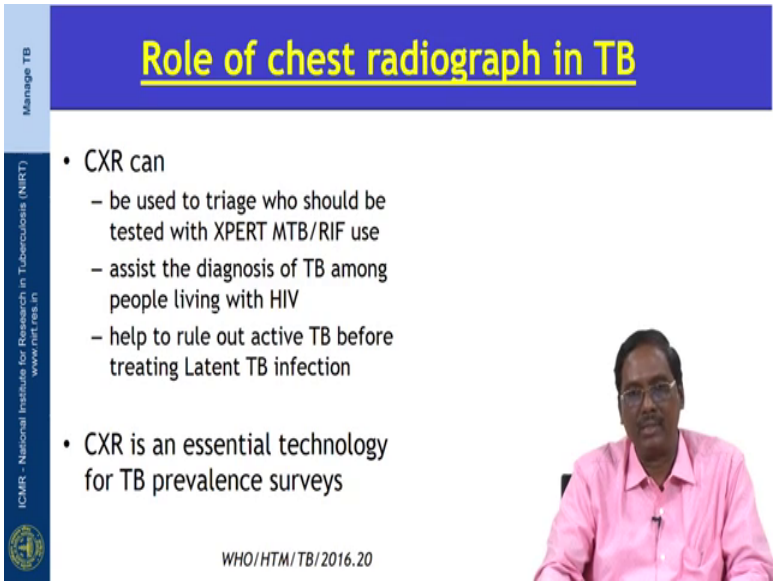

CXR can be used to triage who should be tested with gene XPERT to reduce the number of individuals to be tested and also to improve the pretest probability for TB and predictive value for gene XPERT. It can assist the diagnosis of TB among people living with HIV, it helps to rule out active TB before treating latent TB infection.

CXR is an essential technology for TB prevalence survey to identify survey participants eligible for bacteriological examination.

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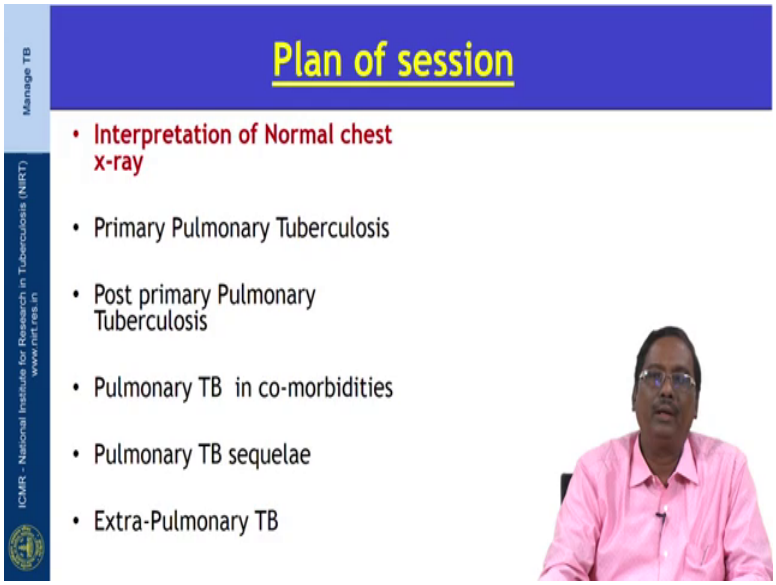

So, we divided the session into following headings; first we are going to start the interpretation of the normal chest X-ray.

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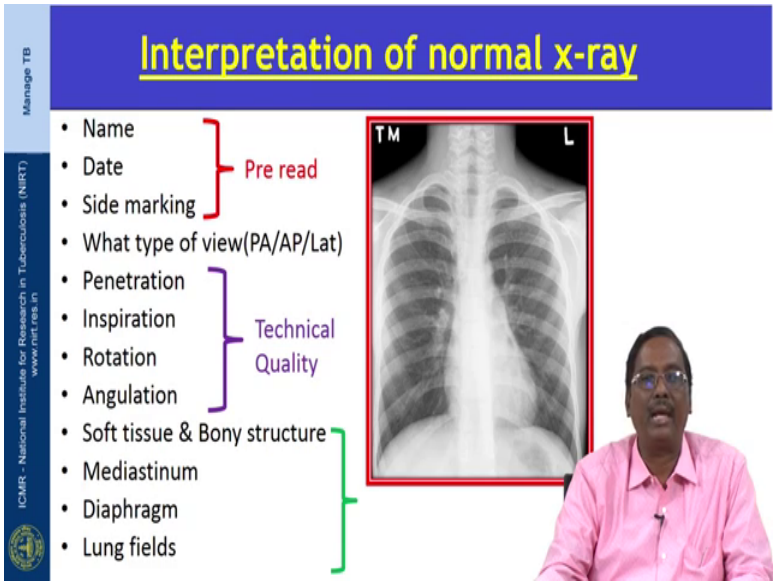

While interpreting an X-ray a systematic approach with sound knowledge of chest anatomy and pathology is essential to gain optimal diagnostic information and to avoided potential error in interpretation. Before reading an X-ray; first we have to check the ownership, age, date and side marking; this is known as a pre read. Next we have to check whether it is the type of X-ray, whether it is a PA or lateral, then we have to check

the quality control of the X-ray; that is penetration, inspiration, rotation and angulation. Next we have to start interpret the findings of the X-ray like soft tissue bony structures, mediastinum, diaphragm and lung fields.

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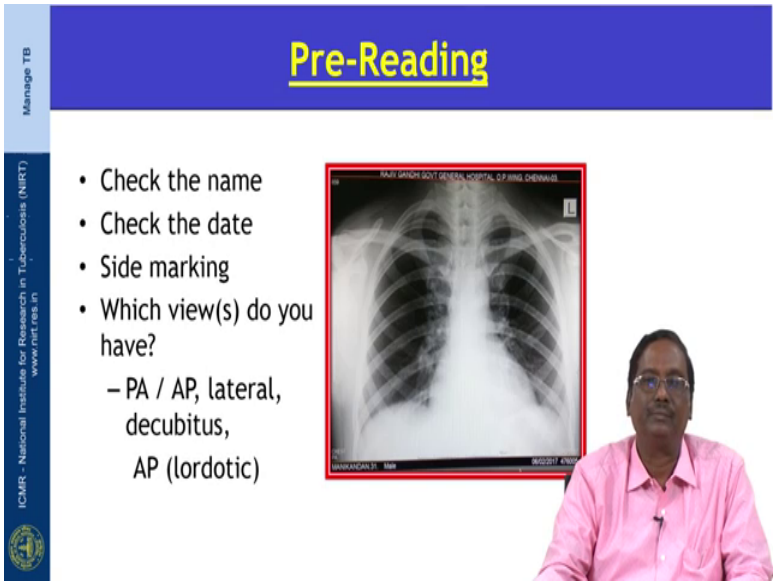

Before starting interpretation of the X-ray, first we have to check whether it is a right flim for a right patient, then you check the name, age and sex. Sometimes name may be shared by many individuals; so, we have to look for date of birth and hospital number. Then side marking is also important; a misplaced side marker is more common than the true dextrocardia. Then there have been chest report of insertion of the ICD on the wrong side of pneumothorax because of a false side marking.

Then we have to check the type of the X-ray whether it is PA view, AP view, lateral view or lateral decubitus.

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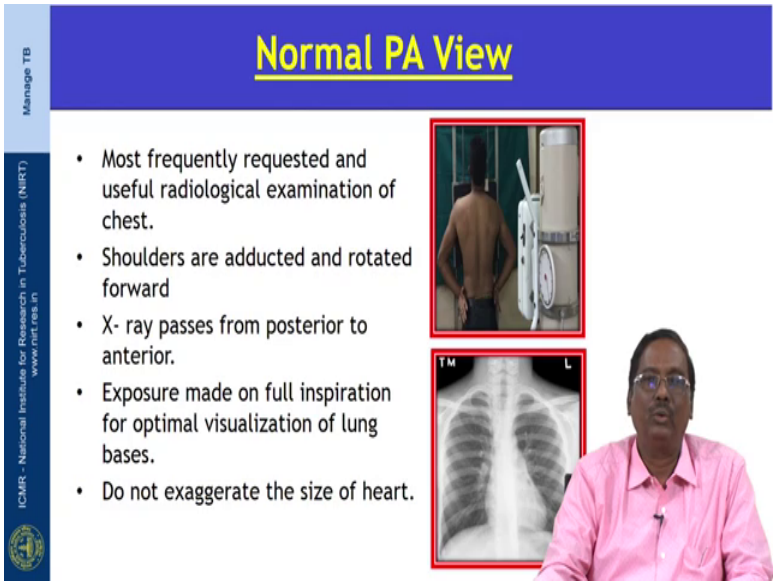

So, this is the normal PA view it is a most frequently requested and useful radiological examination of the chest. Patient is made to stand direct and shoulders are adducted and rotated forward to displays the scapula away from the lung fields. X-ray passes from posterior to anterior and the exposure is made on full inspiration for optimal visualization of the lung bases.

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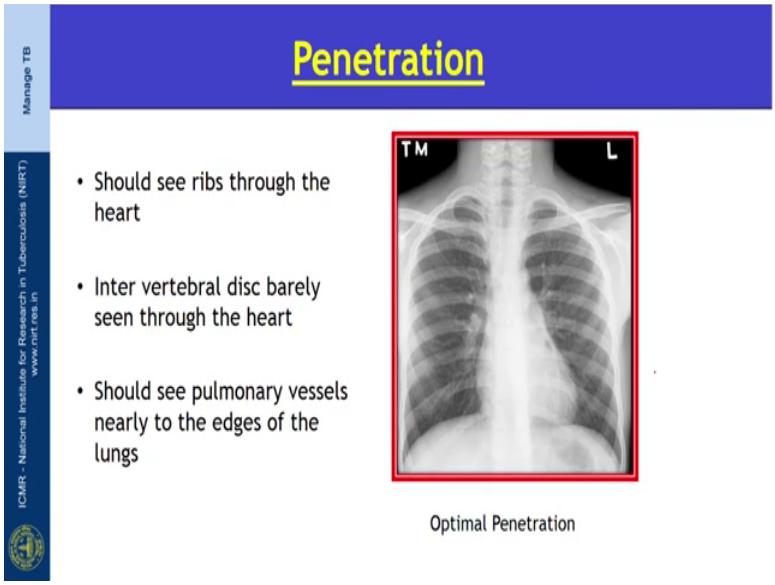

A PA view, do not exaggerate the size of the heart, coming to penetration; penetration is the degree to which the X-ray was passed through the body. A optimal penetrated X-ray

we should able to see the rib through the heart. And inter vertebral disc barely seen through the heart and we should also able to see pulmonary vessels nearly to the edges of the lungs.

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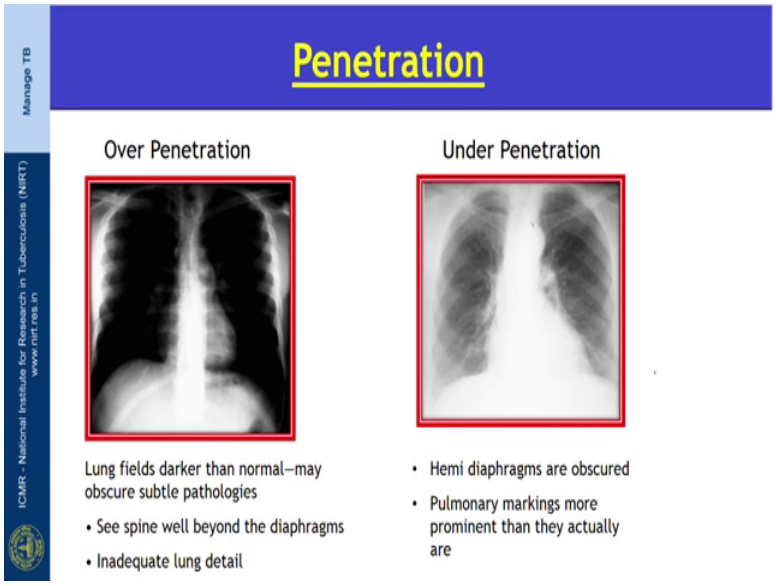

So, this X-ray shows the over penetrated film; here the lung fields are darker than normal. So, they may obscure the subtle pathologies you can see the spine beyond the diaphragm from and leads to inadequate lung detail.

So, the over penetration X-ray leads to under reporting and this is the under penetration here the hemi diaphragms are obscured and pulmonary markings are more prominent than they are actually are. So, here it leads to over diagnosis.

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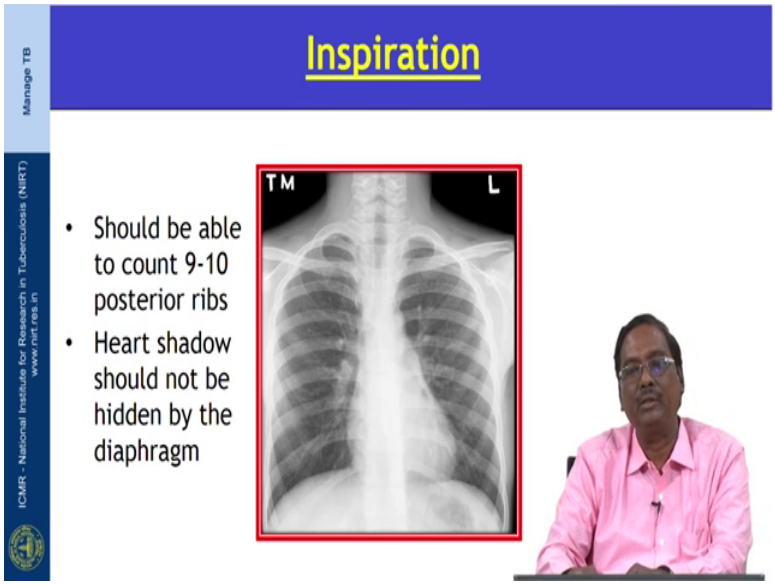

So, next is the inspiration; conventionally all the X-ray have been acquired in a erect posterior in a maximal inspiratory phase. To assess the degree of inspiration, we have to count conventionally the rib from top to bottom; in a normal X-ray you should be able to count nine ribs nine to ten posterior ribs, the diaphragm should intersect between ninth and tenth posterior ribs.

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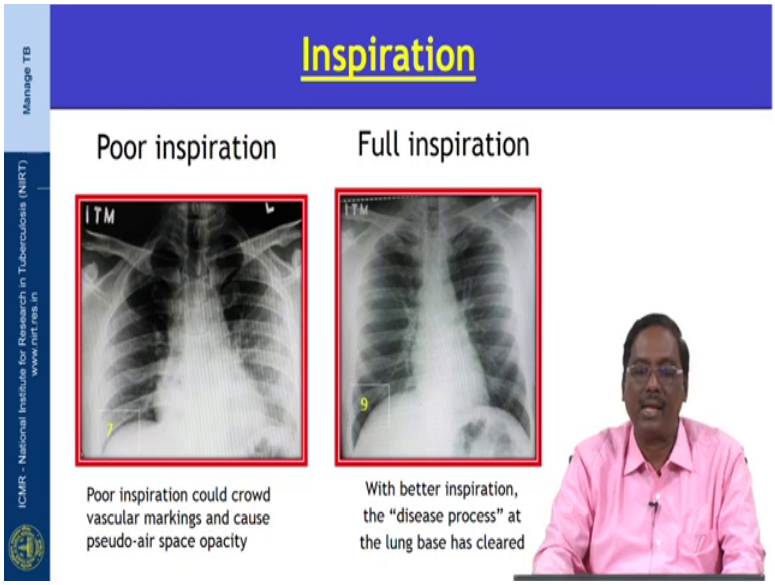

Heart shadow should not be hidden by the diaphragm means a X-ray showing poor inspiration.

Poor inspiration could crowd the vascular markings and cause pseudo air space opacity; it is a X-ray taken in the maximum inspiration with better inspiration the disease process at the lung base has cleared.

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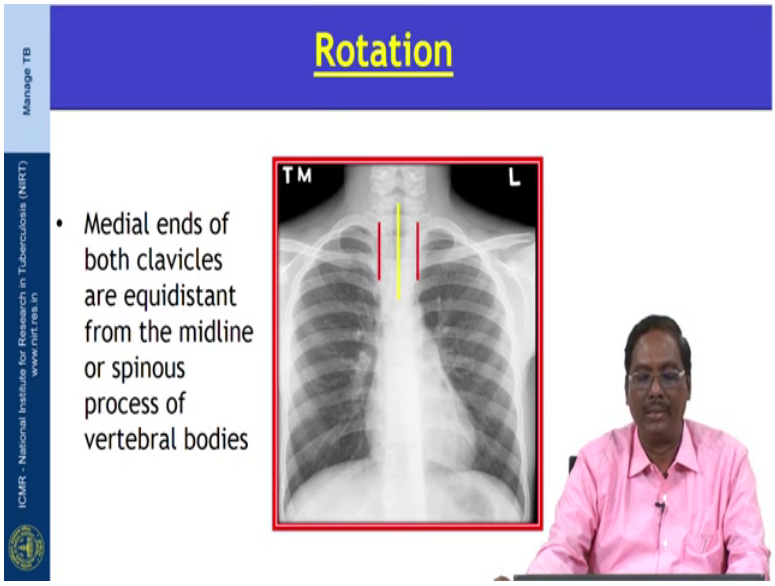

Rotation means the patient was not positioned flat on the X-ray film in a properly placed patient the medial ends of both clavicles are equidistant from the midline or spinous process of the vertebral bodies.

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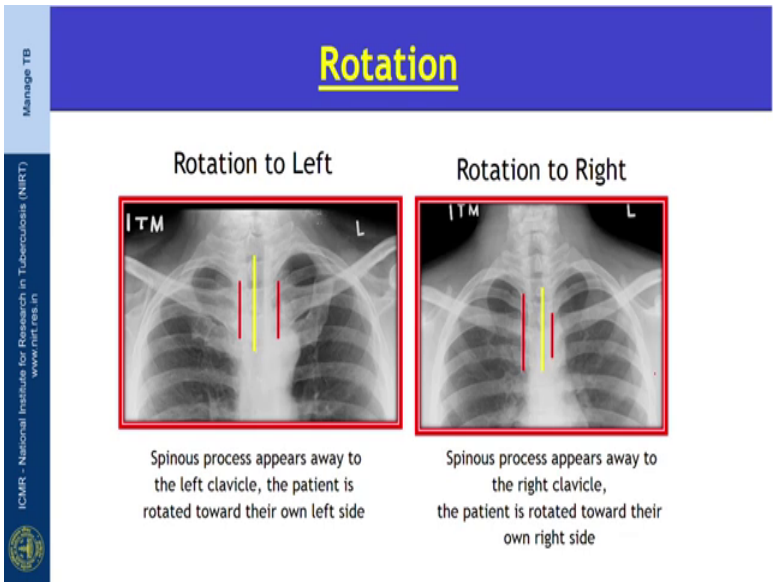

So, here this is a rotation to right the spinous process appear away to the left clavicle. So, the patient is rotated towards their own left side is a rotation to right the spinous process appear away to the right clavicle the patient is rotated towards their own side.

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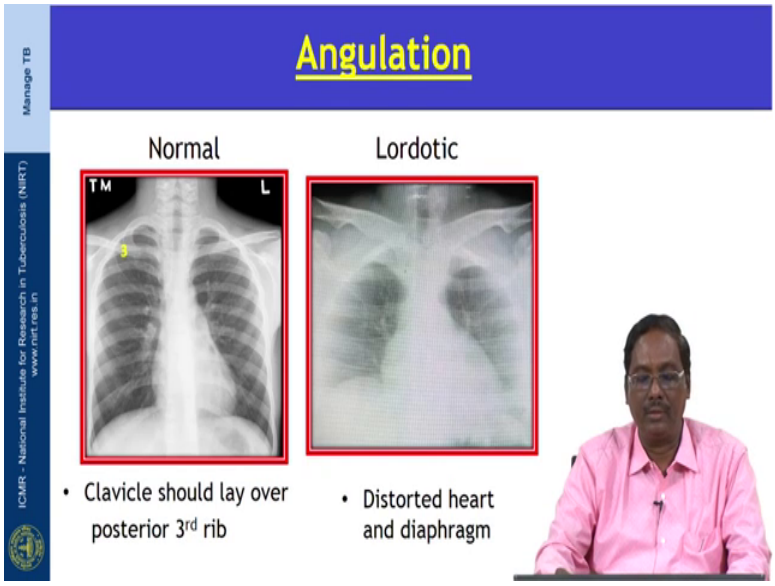

Angulation in a properly angulated X-ray the patient is made to stand erect in X-ray process from posterior to anterior in a horizontal; in a horizontal line without any angulation either tilted up or down centering T 5.

In a properly angulated film, the clavicles should lay over posterior third rib. This is a lordotic view where there is a angulation; the X-ray tube has been tilted up. So, in a lordotic view there is a distortion of the heart and diaphragm.

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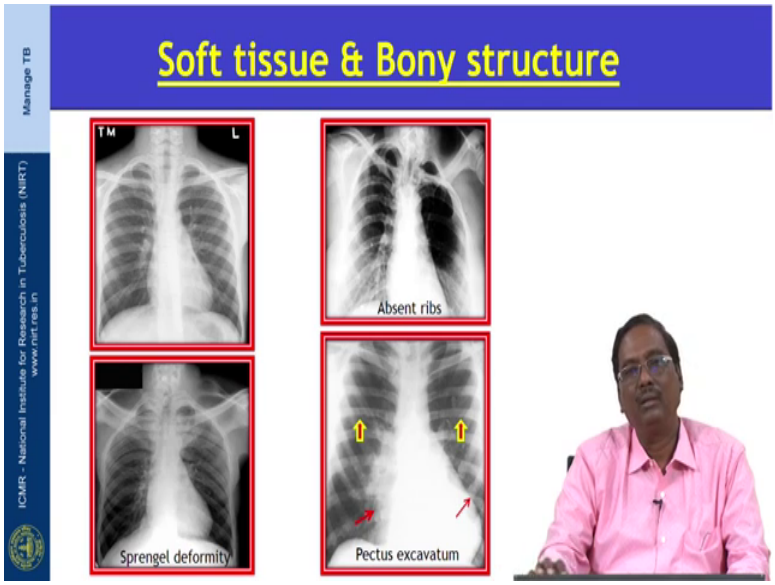

Then after completing after verifying the quality of the X-ray then we have to start interpreting the findings.

First we have to concentrate on the soft tissue and bony structures. So, first we have to look for a any bony abnormality; so you have to check the ribs you have to look for clavicle to look for the scapula. So, this X-ray showing missing ribs; so, here ribs are missing and the clavicle is missing.

So, this is a patient connoisseur sprengel deformity where this a; this scapula is placed in a higher position this is a congenital problem. So, X-ray can detect the abnormality, but; however, MRI is very useful to confirm the extent of pathology. And this is a pectus excavatum here there is a backward displacement of the sternumso; so here the posterior aspect of ribs are more horizontal and anterior ribs are more vertical.

So, big it looks like a figure of 7; so, because of the displacement the heart is being tilted and left side and produces straight line and there is a sloping of the right cardiac body also.

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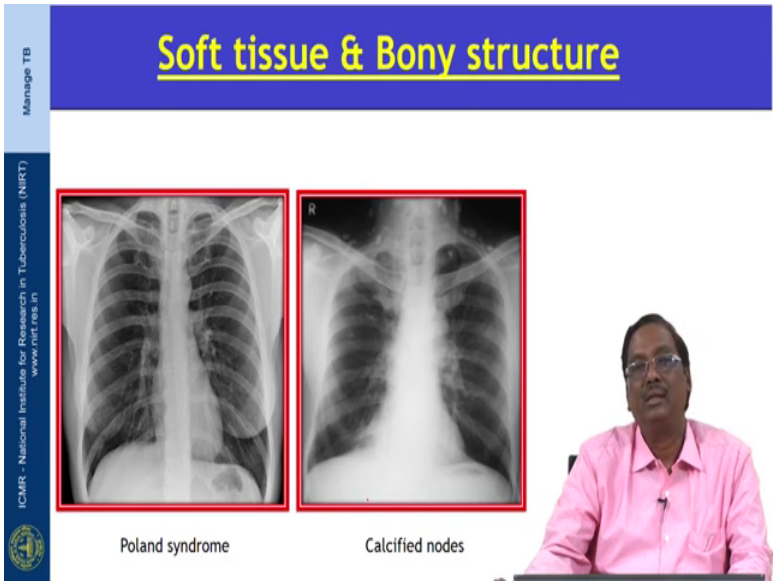

Next is the soft tissue abnormality; in this X-ray the right side there is a increase lucency here there is a absence of breast and a mal-development of the pectoralis major, this syndrome is known as the poland syndrome. The second X-ray where we can see the calcified nodes in the (Refer Time: 11:05) space; it is a moisture seen in a calcification of T nodes in a tuberculosis patient.

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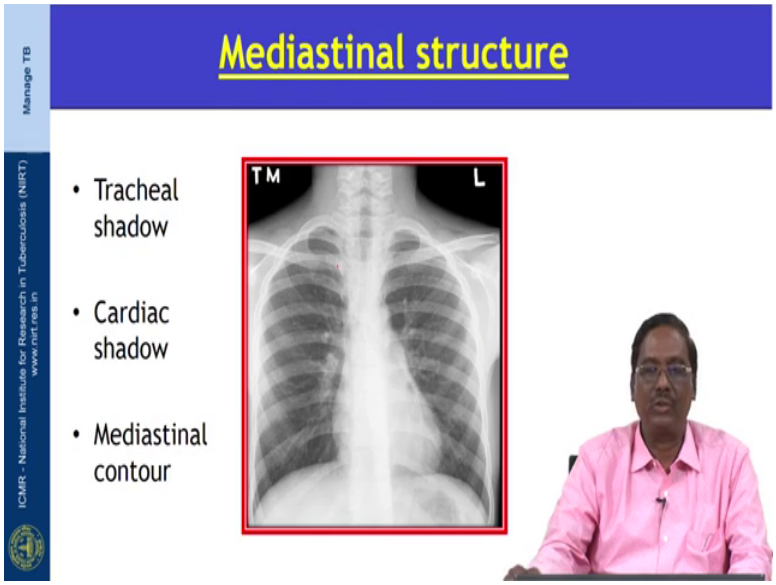

Next we have to see the mediastinal structures, the upper part of the mediastinum this is of the tracheal the tracheal we have to see the tracheal shadow, cardiac shadow under mediastinal contour.

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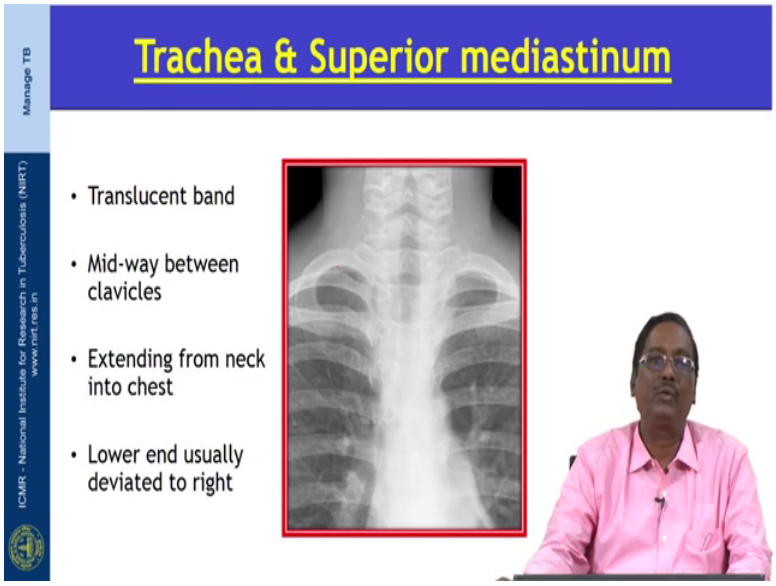

First we have to inspect the tracheal shadow and superior mediastinum; trachea occupy in the superior mediastinum it appear as a translucent band. So, it like mid way between the two clavicle it extends from neck into the chest; the lower end of the trachea, there is a deviated to the right side this is the normal.

Then mediastinal width is also more important, the upper mediastinal width should not exceed more than 6 centimeter. If it is more than 6 centimeter, so there is a you have to suspect it should be AP view or mediastinal enlargement or any structures abdominal; AP window or any unfolding of aorta all will lead to widening of the upper mediastinum.

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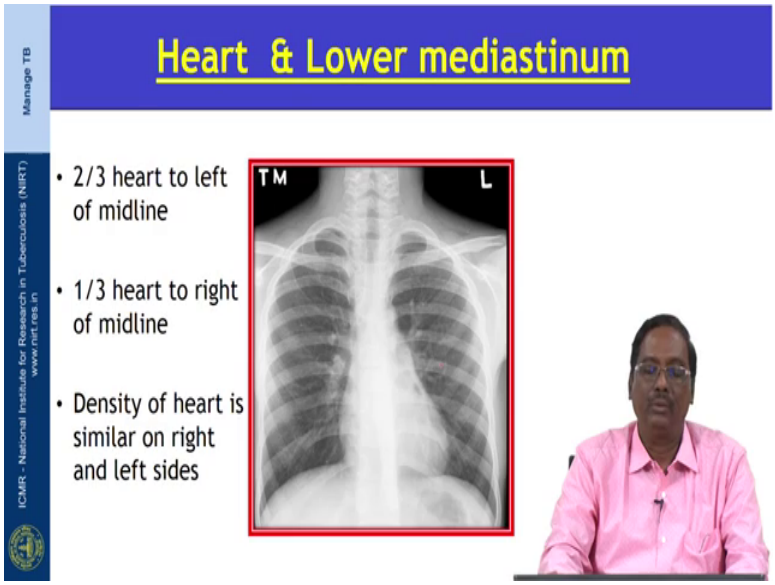

Next we have to assess the heart and lower mediastinum. So, heart is positioned in the lower mediastinum; two third of the heart is on the left side and one third of the heart is on the right side. You have to compare the density of the heart, it should be equal on both sides. And the right cardiac border is formed by the right atrium and left cardiac border is formed by the left ventricle.

So, when the poor distinction of the right cardiac border; you can suspect right middle lobe disease and when the lingular left cardiac boarder is silhouetted; look it in a left lower lingular consolidation. And in dextrocardia two third of heart is at the right side, but the apex is mret important, in dextrocardia the apex is facing towards the left side, in echo dextrocardia the apex is oriented to the right side. Next is the diaphragm there are two diaphragm right diaphragm and left diaphragm.

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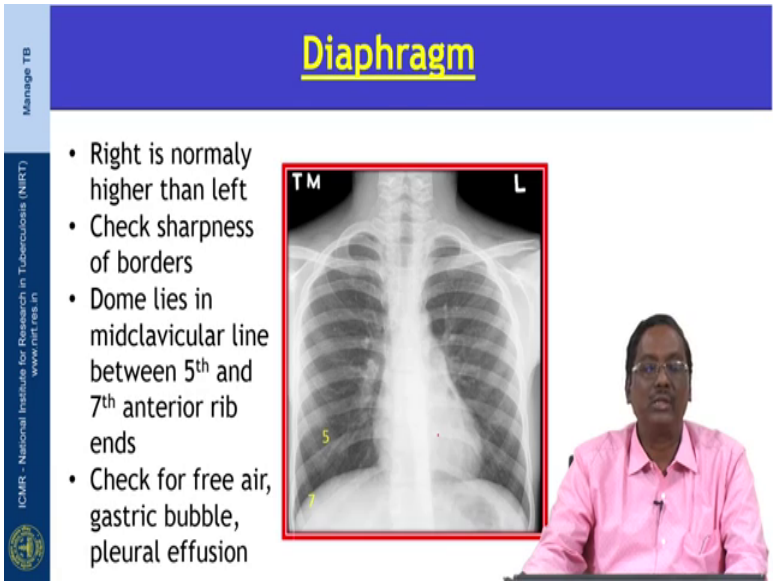

So, right diaphragm is slightly higher than the left and we have to check the sharpness of the borders, dome lies in the midclavicular line between fifth and seventh anterior rib.

And we have to check the free air gastric bubble and pleural effusion; the left diaphragm the lower than the rib because of the constant thrust of the left ventricle.

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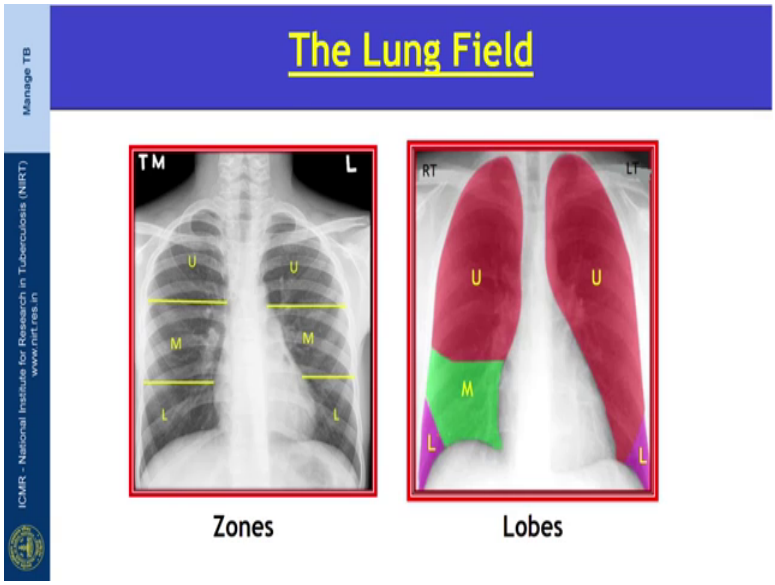

Next coming to the lung fields; the radiologically lung fields has been roaded into zones; upper zone, mid zone and lower zone. The upper zone starts from the apex to the lower end of the anterior; anterior second rib. The mid zone starts from the lower end of second

rib to the fourth rib and mid zone; the lower zone start from the fourth rib to the diaphragm.

And the zones do not equate the lung lobe because on the left side, there are three lung zones, but there are the lobes are only two. So, whenever you have to describe a opacity; you have to describe in related to the lung zones not the lobe.

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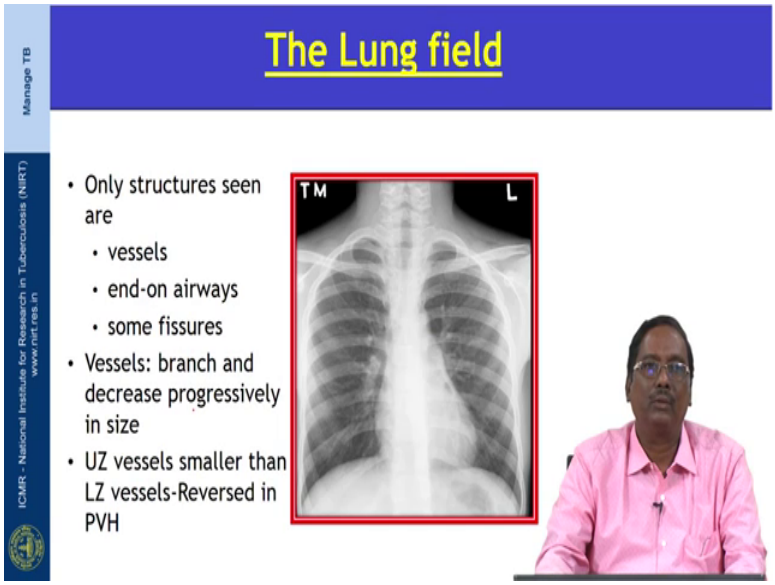

Coming to the lung fields; the only structures seen are vessels, end on airways and some fissures. Vessels; branch and decreases progressively in size upper vessels are smaller than lower zone vessels, but it is reversed in pulmonary vascular hypertension.

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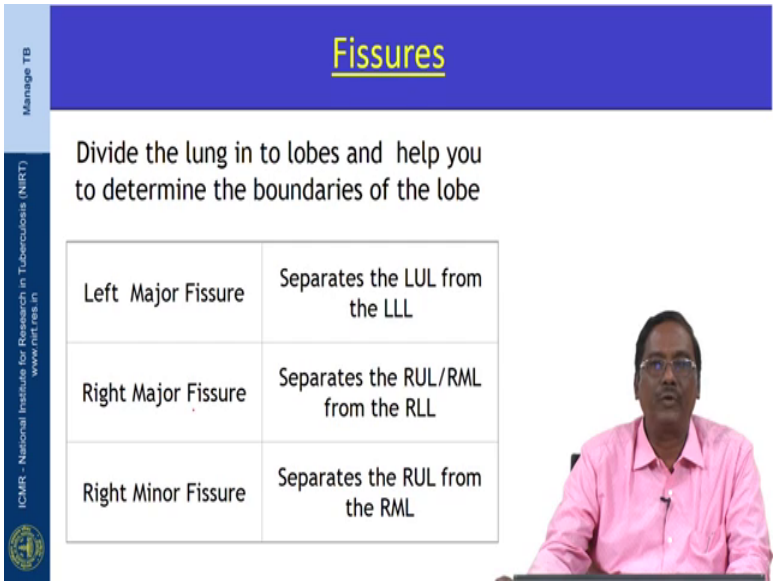

Coming to the fissures, fissures divide the lung into lobes and help to determine the boundaries of the lobe.

Left major fissure separate the left upper lobe from the left lower lobe right major fissure separates the right upper lobe, right middle lobe from the right lower lobe right minor fissure separates the right upper lobe from right middle lobe.

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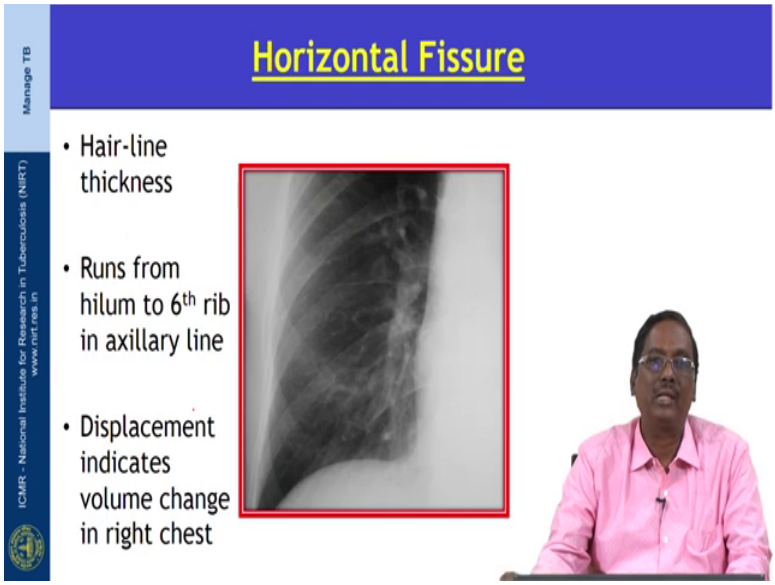

So, here is horizontal fissure it looks like a hair line thickness in PA view. So, horizontal fissure alone is seen in a frontal view because it is tangential to the X-ray beam; it runs

from the hilum to sixth rib in the axillary line. So, displacement of the fissure indicates volume change in the right side.

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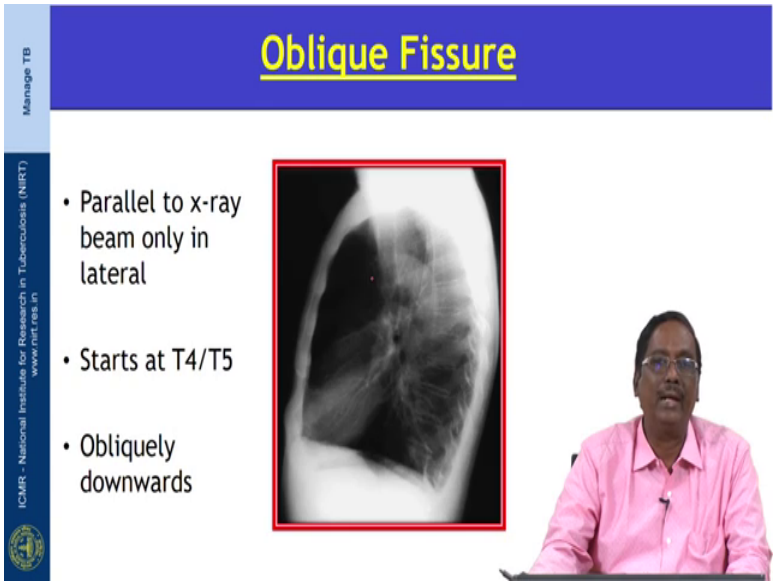

Next is a oblique fissure; usually oblique fissure is not seen in the frontal view. So, it is seen only in the lateral because it is parallel to the X-ray; it starts at T 4 and T 5.

And runs downwards and cuts the hilum obliquely and reaches the diaphragm.

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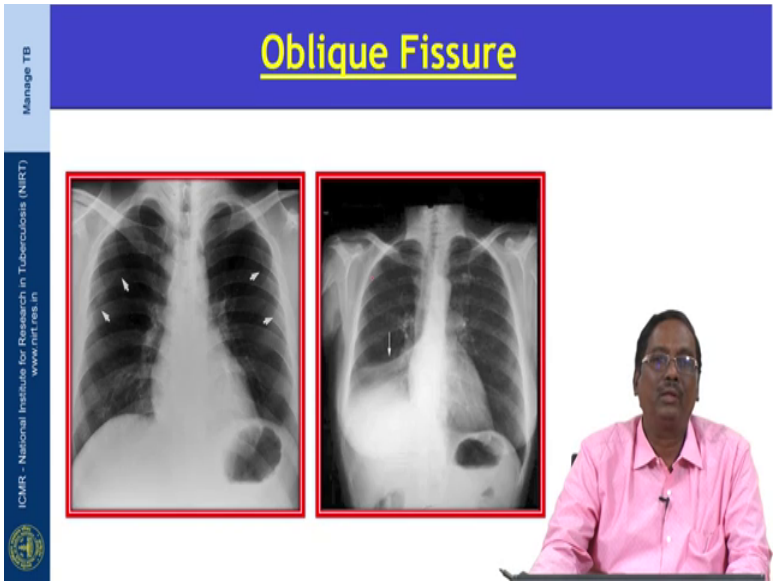

So, here the frontal view showing the you can see the oblique fissure; usually oblique fissure is not depicted in the PA view, but when the there is a underline lung is a diseased; we can see the oblique fissures. This is two or upper lip of the oblique fissure and here it is a oblique fissure, this is X-ray showing right lower lobe of class in a right lower lobe class the oblique fissure come into the picture.

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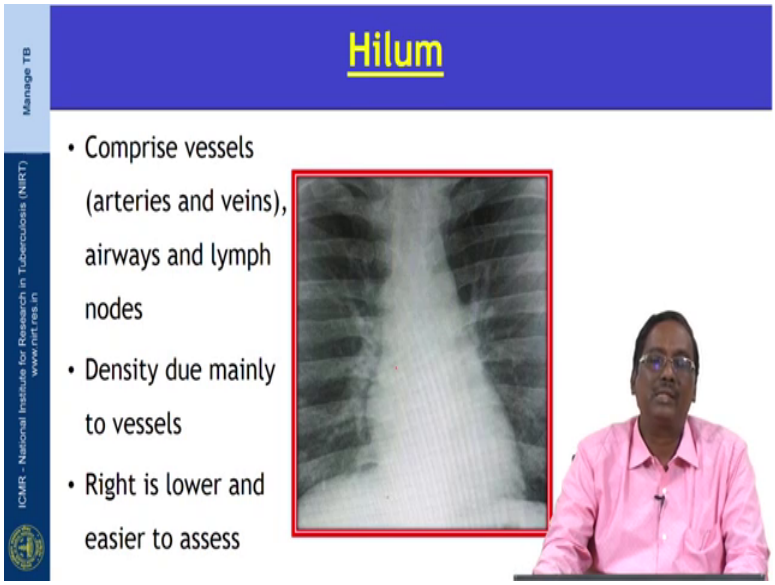

Next is the hilum; hilum comprises vessels, arteries and veins airways and lymph nodes.

The density of the hilum is mainly due to the vessels; it is a v shaped structure; the upper lymph of the v is formed superior pulmonary vein. And inferior lymph of the hilum is formed by the descending pulmonary artery both are intercept for the hilum point right; hilum is slightly lower than the left. So, any distortion of the hilum indicates the pathology in the hilum.

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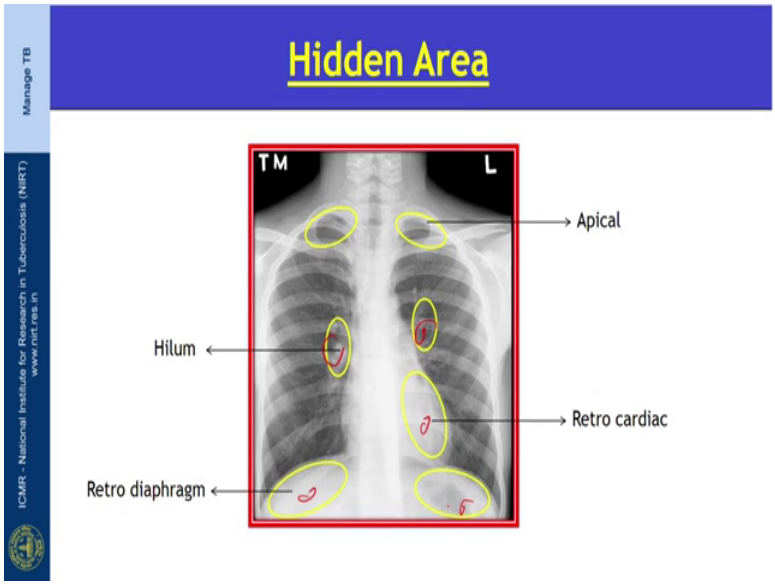

Now, after completing the integration; we have to check whether we have completed the interpretation the hidden area or review area. So, these are the important area we call apical area, hilum and retro cardiac and retro diaphragm area.

So, any pathology in the left posterior lobe; you can see in the retro cardiac area. And apical lesions for example, as I go fissure; we have to concentrate on the apical area any opacity in the retro diaphragm, this could be due to lower lobe consolidation.

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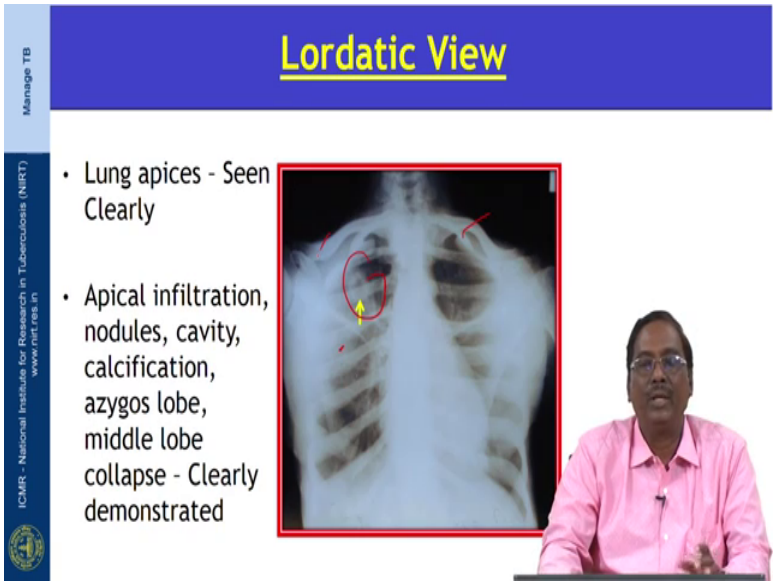

Next coming to the lordatic view; it is usually the optional it is not routinely done. If you want to see the apices we can order for a lordatic view its nothing, but it is an AP view. So, in a lordatic view the apical infiltration, nodules, cavity, calcifications, azygos lobe, middle lobe collapse are clearly demonstrated.

Now we can see the cavity in a apical area it is clearly seen in a lordatic area because the this is a small area is be covered by the clavicle under ribs. So, by position in the lordatic view; the two clavicle is being shifted superiorly; so, you can able to see clearly see the apical area. Thank you with this we are finishing the interpretation of the normal chest X-ray.

Thank you.