CT VERSUS CONVENTIAL X-RAY IN DIAGNOSIS OF PERIPHERAL PULMONARY OPACITY

THESIS

Submitted for partial fulfillment of Master Degree in Radiodiagnosis

By

Khalid Mohamed Aly Al-Marsafy
(M.B.,B.CH.)

Supervisors

DR.AHMED MOSTAFA OUF
PROF.OF RADIODIAGNOSIS
FACULTY OF MEDICINE
AL-AZHAR UNIVERSITY

DR SALAH M. KORAYEM
ASS.PROF OF RADIODIAGNOSIS
FACULTY OF MEDICINE
AL-AZHAR UNIVERSITY

1999

بسم الله الرحمن الرحيم

Acknowledgement

Acknowledgement

First and foremast thanks are due to **GOD**, the beneficent and merciful.

I would like to express my deepest gratitude to Prof. Dr. Ahmed moustafa ouf Prof. of radiodiagnosis faculty of medicine Al Azhar university for his patient supervision valuable guidance and constant help

I am also deeply grateful to Prof. Dr salah M koraiyem Ass.prof of radiodiagnosis faculty of medicine Al Azhar university for his advise , suggestions, knowledge continuous help and moral support

Finally I would like to thank all who have helped me to complete this work.

CONTENT

Aim Of Work

INTRODUCTION AND AIM OF WORK

Peripheral pulmonary opacity could be caused by a great number of chest diseases ,which makes it a great task for the radiologist to reach a correct diagnosis ,but since the introduction of CT such diagnosis has become much easier as CT is a non invasive procedure that has high contrast resolution , it provides valuable diagnostic information in a number of diseases and clinical situation, it can accurately localize abnormalities and give the precise shape and position and size of a lesion , it can also differentiate between solid , cystic, vascular or fatty lesion and visualize lesions in the apices and in the subpleural regions which may be obscured in conventional studies even when they are relatively large, all this will narrow the differential diagnosis

So the aim of this work is to assess the accuracy of C.T compared with conventional x-ray in diagnosis of peripheral pulmonary opacity and to squeeze the confusion between wide range of differential diagnosis up to minimal

CT and Radiological Anatomy of The Lung

CT And Radiological Anatomy Of The Lung

TRACHEA

The trachea begins in the neck as an airway continuous with the lower border of the cricoid cartilage of the larynx, it occupies a midline position in the body as it descends through first the neck and then the superior mediastinum to its termination in the posterior mediastinum at the carina (Frank slaby,1990) The carinal angle on inspiration is of 60-70 degrees (Sutton,1987).

The trachea passes behind the aortic arch as it descends in the superior mediastinum (franky slaby,1990). The trachea may be regarded as the center around which the major arteries are distributed as they arise from the arch of the aorta (Meschan,1987).

It ends at the upper border of the fifth to eighth thoracic vertebra, where it bifurcates into right and left main bronchi (Meschan,1987).

BRONCHO-PULMONARY SEGMENTS

The main stem bronchi lie exclusively in the posterior mediastinum, they extend from the tracheal bifurcation to the roots of

the lungs .The right main stem bronchus is more vertical ,larger ,and shorter than the left main stem bronchus.

RIGHT BRONCHIAL TREE : fig 1

Divisions

1)Upper lobe bronchus :

Lies above the pulmonary artery and gives :

1- Apical segmental bronchus .

2- Posterior segmental bronchus.

3- Anterior segmental bronchus.

(Panskey,1984)

2) Middle lobe bronchus :

Lies below the pulmonary artery and gives two branches.

1- Lateral segmental bronchus .

2- Medial segmental bronchus.

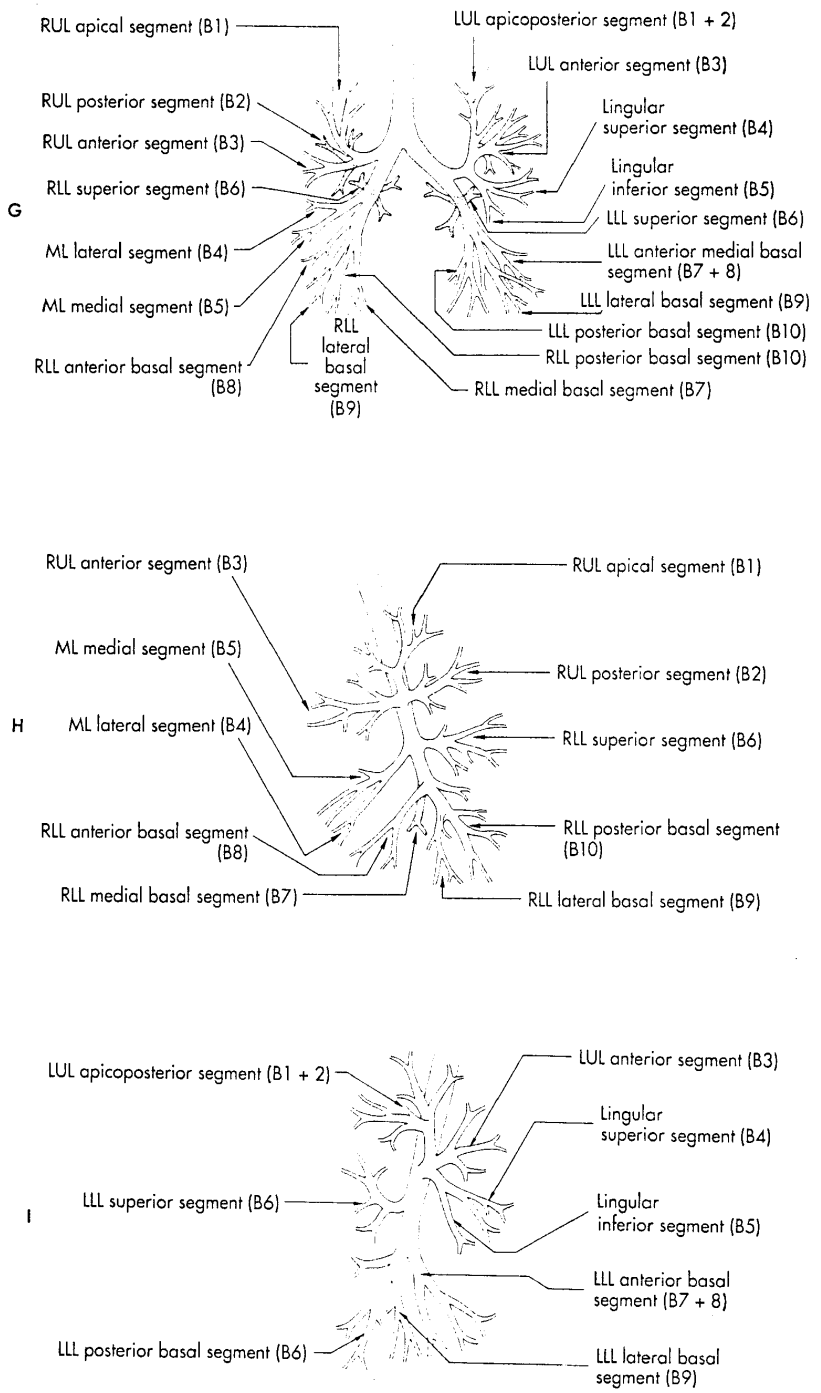

G
RUL apical segment (B1)
RUL posterior segment (B2)
RUL anterior segment (B3)
RLL superior segment (B6)
ML lateral segment (B4)
ML medial segment (B5)
RLL anterior basal segment (B8)
RLL lateral basal segment (B9)
LUL apicoposterior segment (B1 + 2)
LUL anterior segment (B3)
Lingular superior segment (B4)
Lingular inferior segment (B5)
LLL superior segment (B6)
LLL anterior medial basal segment (B7 + 8)
LLL lateral basal segment (B9)
LLL posterior basal segment (B10)
RLL posterior basal segment (B10)
RLL medial basal segment (B7)
H
RUL anterior segment (B3)
ML medial segment (B5)
ML lateral segment (B4)
RLL anterior basal segment (B8)
RLL medial basal segment (B7)
RUL apical segment (B1)
RUL posterior segment (B2)
RLL superior segment (B6)
RLL posterior basal segment (B10)
RLL lateral basal segment (B9)
I
LUL apicoposterior segment (B1 + 2)
LLL superior segment (B6)
LLL posterior basal segment (B6)
LUL anterior segment (B3)
Lingular superior segment (B4)
Lingular inferior segment (B5)
LLL anterior basal segment (B7 + 8)
LLL lateral basal segment (B9)

Fig 1

3) Lower lobe bronchus.

Lies below the pulmonary artery and gives

1- Superior segmental bronchus.

2- Medial basal segmental bronchus.

3- Posterior basal segmental bronchus.

4- Lateral basal segmental bronchus .

5- Anterior basal segmental bronchus.

(Pansky,1984)

LEFT BRONCHIAL TREE

It is 5 cm long it leaves the trachea at an angle of about 45 degree and enters the left lung opposite the upper border of the 5th thoracic vertebra (Brash, 1963)

1) Upper lobe bronchus:

Gives two major branches

1- Superior division bronchus , which in turns gives two branches

a) Apico-posterior segmental bronchus.

b) Anterior segmental bronchus.

2- Inferior division (Lingual) bronchus , which in turn gives two branches:

a) Superior lingual segmental bronchus.

b) Inferior lingual segmental bronchus .

II) Lower lobe bronchus :

Gives four branches

1- Superior segmental bronchus .

2- posterior basal segmental bronchus.

3- lateral basal segmental bronchus .

4- Anterior basal segmental bronchus.

(Pansky, 1984)

FISSURES

Visualization of the fissures occurs when the X-ray beam is tangential.(sutton,1987). The left lung is divided into two lobes ; upper and lower ,by an oblique fissure which extend from the 4th thoracic spine to the diaphragm 1.5 inch behind the sternum.The right lung is divided into three lobes upper,middle ,and lower by two fissures an oblique fissure similar to that of the left lung separates the lower from the middle and upper lobes, the other the horizontal fissure separates the middle from the upper lobe (Pansky,1984)

Accessory fissures:

The azygos fissure is shaped like a comma with a triangular base peripherally .It forms in the apex of the lung and consists of paired folds of of parietal and visceral pleura plus the azygos vein which has failed to migrate normally.

The superior accessory fissures:

Separates the apical from the basal segments of the lower lobes.

The inferior accessory fissure:

Appears as an oblique line running cranially from the cardiophrenic angle and separating the medial basal from the other basal segments.

The left sided horizontal fissure :

Separates the lingula from the other upper-lobe segments (Sutton,1987).

mediastinum: fig 2

The mediastinum is the median region of the thorax it is bounded above by the thoracic inlet and below by the diaphragm.

1-The **superior mediastinum** is the part of the mediastinum which lies above the level of the sternal angle .

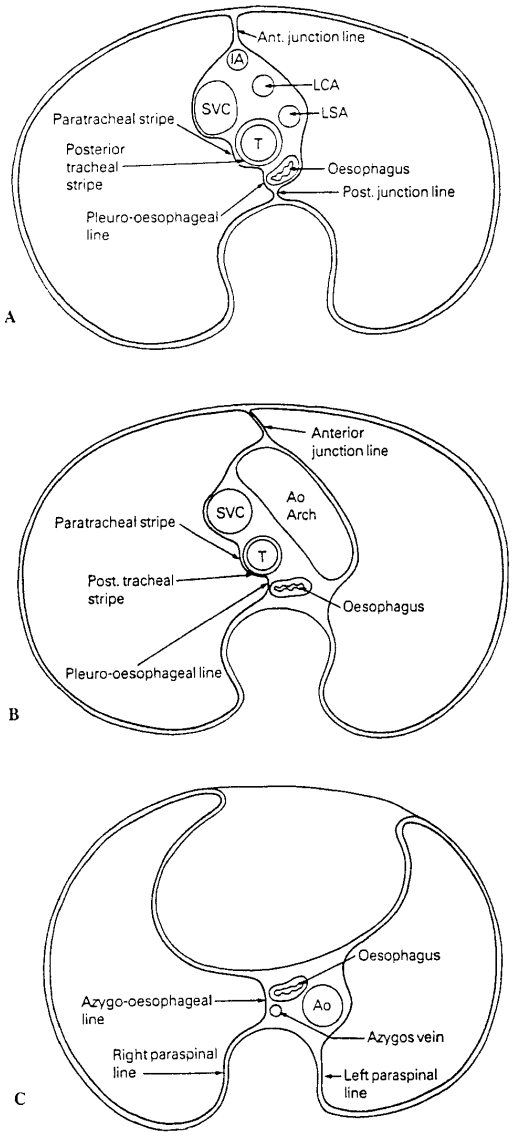


Diagram illustrating the mediastinal boundaries
(A) Section just above the level of the aortic arch; (B) Section through the aortic arch; (C) Section through the heart

Fig 2

2- The **inferior mediastinum** is the part of the mediastinum which lies below the level of the sternal angle .The inferior mediastinum has three subdivisions.

a)The **anterior mediastinum** is the region which lies between the sternum and the pericardial sac.

b) The **middle mediastinum** is the region which contains the heart and its pericardial sac.

c) The **posterior mediastinum** is the region which lies between the pericardial sac and the vertebral column (Frank slaby,1990).

Normal contents

Anterior mediastinum

Contains the thymus gland, the anterior mediastinal lymph nodes and the internal mammary arteries and veins in the parasternal areas bilaterally.

Middle mediastinum

Contains pericardium and the heart ,the ascending aorta and transverse arch of the aorta , the superior and inferior vena cave ,the brachiocephalic arteries and veins,the phrenic nerves and upper portion of the vagus nerves,the trachea and main bronchi and their contiguous lymph nodes and the pulmonary arteries and veins

Posterior mediastinum

Contains the descending thoracic aorta,esophagus,thoracic duct, azygos and hemiazygos veins ,sympathetic chains and the lower portion of the vagus nerves and the posterior groupof mediastinal lymph nodes.

The pulmonary vessels

The arteries and veins accompany the corresponding bronchi.The artery lying posterolateral to the bronchus and the veins lying near the arteries but are anterior and inferior to them(Warwick&williams,1973).

The right pulmonary artery divides while still in mediastinum giving a superior branch supplying most of the upper lobe and an inferior branch supplying middle and lower lobe.The left pulmonary artery splits into two branches within the left hilum which is usually higher and posterior to the right hilum (Fraser&Pare,1978).

There is always one slice through the hila at the level of the minor fissure where no vessels are seen on the right .This is normal and should not be mistaking for chronic obstructive pulmonary disease (Haaga and Alfidi,1988).

The upper and smaller branch divides into two or more branches to upper lobe while the lower branch (interlobar artery) gives rise to

lingular and superior segmental arteries similar in number and name to the basal bronchi they accompany (Fraser&Pare,1978).

The bronchial vessels

They arise from the ventral surface of the descending aorta at the T5-6 level .Their anatomy is variable .Usually there are two branches one on the left and one on the right which often shares a common origin with an intercostal artery .On entering the hila the bronchial arteries accompany the bronchi .The veins drain into the pulmonary veins and to a lesser extent the azygos system.(Sutton, 1987).

Pulmonary veins

Pulmonary veins are formed of tributaries which tend to run in the inter segmental septa,two pulmonary veins leave each hilum one above and one below the oblique fissure (Last,1987).

CT anatomy of the chest

The Pleura and Extrapleural space

They are never visualized unless pathological changes as thickened mass or pneumothorax occurs (Haaga and Alfidi ,1988).

The lung parenchyma

It is not homogeneous being composed of lobules of air containing alveoli separated by water containing septa and vessels.

Parenchyma density in full inspiration is near that of air,with a C T number of 810 Hu .For unknown reasons right lung density is more than that of left in 70 percent of cases . No significant variation in CT number occurs between base and apex.

There is definite gradient caused by gravity in lung with the most dependent parts approximately 10 Hu denser than the highest part of the lung in full inspiration .

This gradient is not dependent on patient position .The normal density gravity gradient is accentuated in expiration, The gravity dependent density gradient is lost in diffuse parenchymal diseases as fibrosis or emphysema.(Haaga and Alfidi ,1988).

Bronchi

We will review contiguous sections from level of carina to the level of segmental bronchi of the lower lobes.

Right lung

a) Carino apical bronchus : fig 3

The level of the carina includes the right and left main bronchi the apical segment bronchus of the right upper lobe is seen in cross-section between the artery medially and right upper lobe ,pulmonary vein laterally.

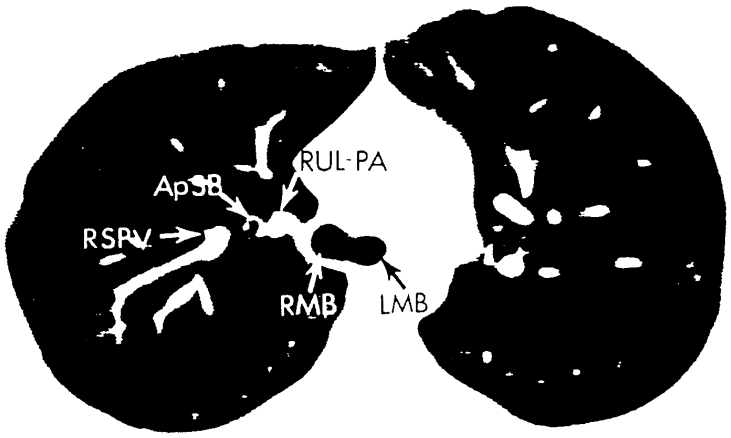
b) Right upper lobe bronchus : fig 4

It originates more cephalad then left upper lobe bronchus, the truncus anterior (pulmonary artery branch) lies anterior to it , The anterior and posterior segmental bronchi of right upper lobe are visible on CT scans .

c) Bronchus intermedius: fig 5

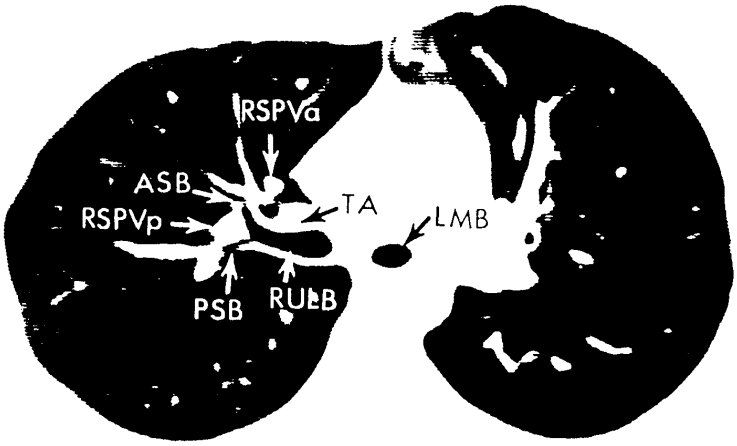
It is about three cm long extending between the origins of right upper lobe and right middle lobe bronchi

Section through its lower portion may reveal some irregularity along its lateral aspect because of the small pulmonary veins entering the right superior pulmonary vein which lies at the lateral aspect of right pulmonary artery which in turn is anterior to the bronchus intermedius, its posterior wall is thin and bounded by lung (Godwin,1984).



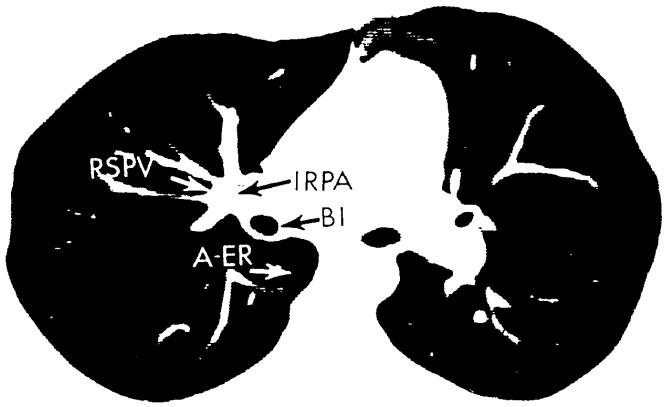
Level of carina and apical bronchus . Right main bronchus (RMB); left main bronchus (LMB) ; apical segmental bronchus of the right upper lobe (APSB) ; right superior pulmonary vein (RSPV) ; right upper lobe pulmonary artery (RUL-PA).

Fig 3



Level of right upper lobe bronchus (RULB). Anterior segmental bronchus (ASB) ; Posterior segmental bronchus (PSB) ; superior pulmonary vein , posterior (RSPVp) and anterior (RSPVa); trunchus anterior (TA) branch of right pulmonary artery ; left main bronchus(LMB)

Fig 4



Level of bronchus intermedius (BI). Right superior pulmonary vein (RSPV); interlobar branch of right pulmonary artery (IRPA); azygoesophageal recess (A-ER)

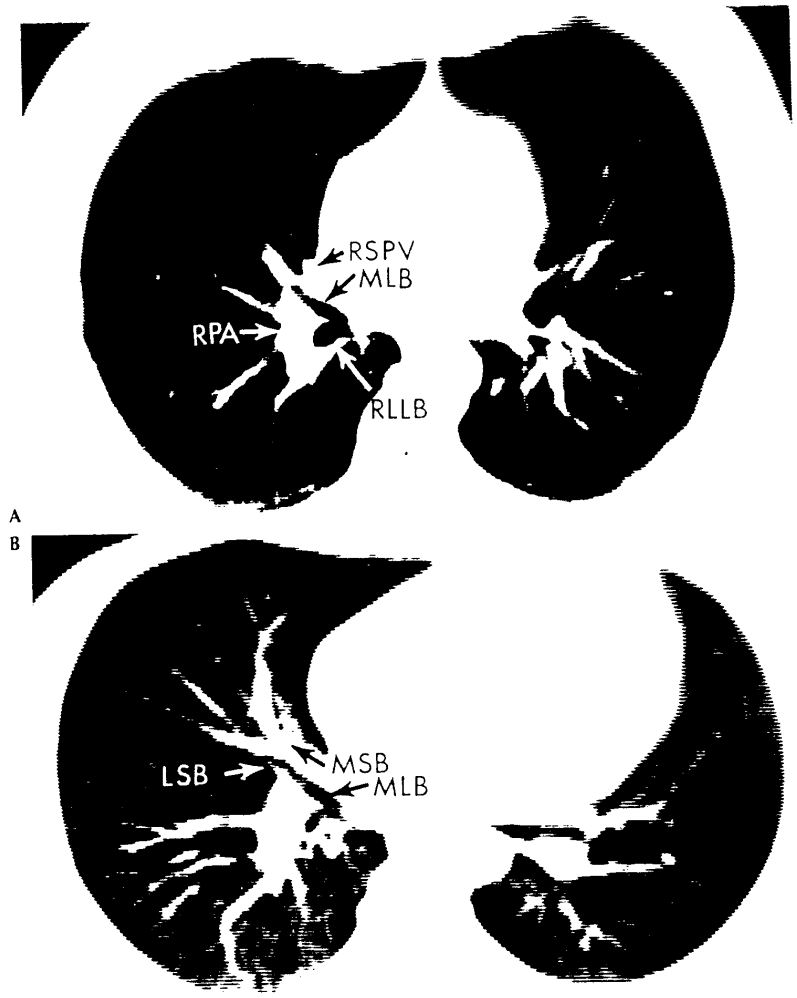
Fig 5

d) Middle lobe bronchus : fig 6

The middle lobe bronchus arises from the anterolateral surface of the intermediate bronchus 4 to 5cm below the tracheal carina. It courses anteriorly laterally and inferiorly for 1 to 3cm before dividing into its segmental bronchi . The middle lobe bronchus is routinely visible at this level usually on two adjacent images the medial and lateral segmental bronchi of the middle lobe however cannot always be seen on CT scans. The bronchus to the superior segment of the right lower lobe is usually visible at the level of the orifice of the right middle lobe bronchus or 1cm superiorly. It arises from the posterolateral right lower lobe bronchus. The interlobar pulmonary artery forms a convex soft tissue density lateral to the bronchi between the right middle lobe bronchus anteriorly and the superior segmental bronchus posteriorly The middle pulmonary vein tributary of the superior pulmonary vein can be seen between the right middle lobe bronchus and the mediastinum approximately 50 percent of the time(Moss, et al., 1983).

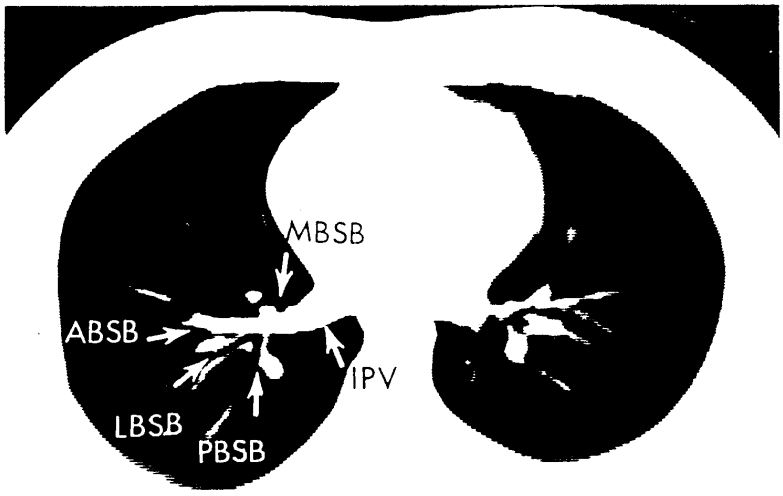
c)Right lower lobe basal bronchi : fig 7

It divides into its four basal segmental bronchi (medial ,posterior, anterior and lateral) approximately 1cm.below the level of the origin of the right middle lobe bronchus .CT scans at about the level of origin of the segmental bronchi always show the right inferior pulmonary



(A) Level of right middle lobe bronchus (MLB) .Right superior pulmonary vein(RSPV) ; right pulmonary artery (RPA) ; right lower lobe bronchus (RLLB) . (B) segmental bronchi of middle lobe. Right middle lobe bronchus (MLB) ; medial segmental bronchus (MSB) ; lateral segmental bronchus(LSB).

Fig 6



Level of basal right lower lobe bronchi : medial (MBSB); lateral (LBSB) ; anterior (ABSB); posterior (PBSB); inferior pulmonary vein (IPV).

Fig 7

vein which lies medial to the basilar segmental bronchi as the vein courses horizontally at the left atrium (Moss .et al.,1983).

Left lung

a) Apical-posterior segmental bronchi: fig 8

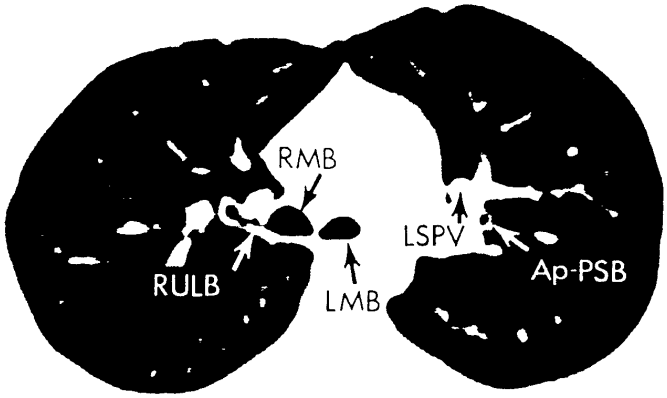
At the level of the tracheal carina or 1 cm cephalic the apical-posterior bronchus is always visible in cross-section(Moss. et al.,1983)The left pulmonary artery is seen between it and the left main bronchus The left superior pulmonary vein lies anteromedial to the artery (Godwin.1984).

b)Lingular bronchus: fig 9

Arises from the distal portion of the left upper lobe bronchus and courses caudally and anteriorly .The origin of left lower lobe bronchus at the posterior aspect of the lingular bronchus is an important anatomical landmark for identifying these two structures The left interlobar pulmonary artery courses caudally behind the lingular bronchus lateral and anterior to the lower lobe bronchus (Naidiche. et al ., 1980).

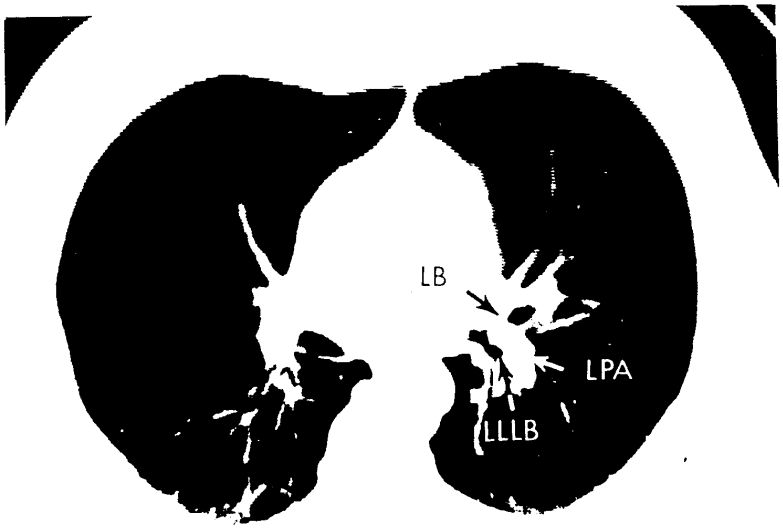
c) Left upper lobe bronchus: fig 10

The posterior wall of it is frequently concave with the left pulmonary artery in this concavity the left superior pulmonary vein is anterior to the bronchus the anterior segmental bronchus may originate as a branch of apical posterior bronchus or less often arises between apical posterior segment and lingular bronchus creating a trifurcation



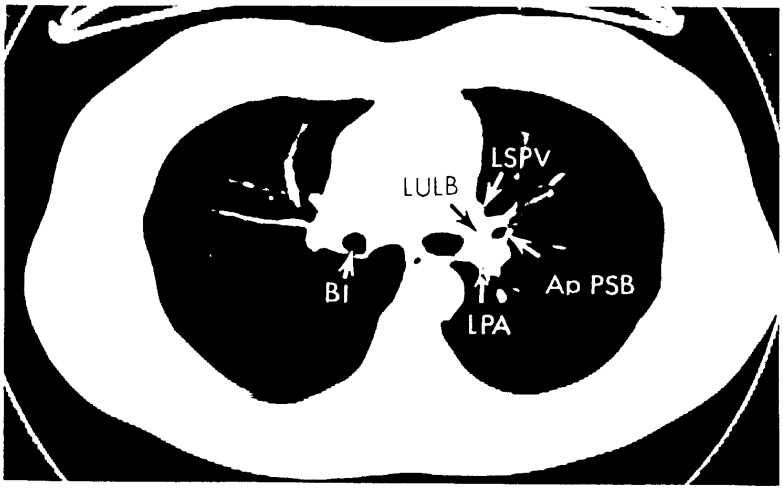
Level of apical-posterior segmental bronchus (Ap-PSB) . Right upper lobe bronchus (RULB) ; right main bronchus (RMB) ; left main bronchus (LMB) ; left superior pulmonary vein (LSPV).

Fig 8



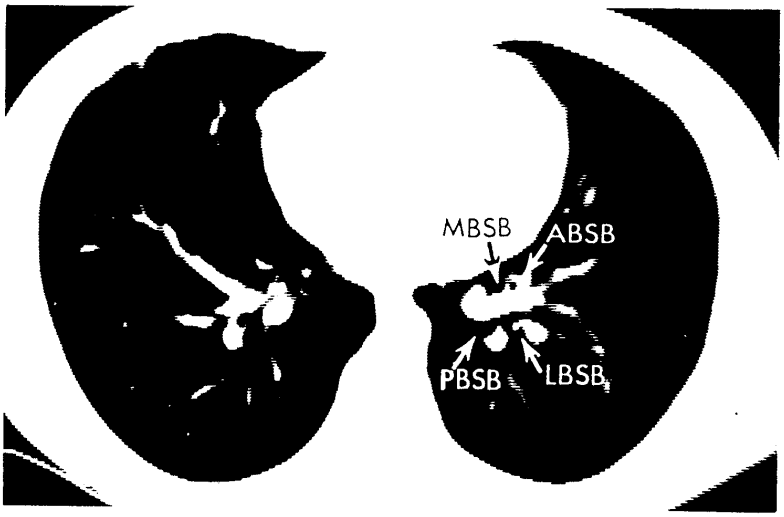
Level of lingular bronchus (LB) . Descending branch of left pulmonary artery (LPA) ; left lower lobe bronchus (LLLB).

Fig 9



Level of left upper lobe bronchus (LULB). Apical – posterior segmental bronchus (Ap-PSB); left descending pulmonary artery (LPA) ; left superior pulmonary vein (LSPV); bronchus intermedius(BI)

Fig 10



Level of basal left lower lobe bronchi: medial (MBSB) and anterior (ABSB), probably arising from a single trunk ; lateral (LBSB) ; and posterior (PBSB)

FIG 11

consisting of apical posterior , anterior and lingular bronchi(Godwin .1984)

D)Left lower lobe bronchi : fig 11

They are similar to right lower lobe bronchi except that the superior segmental bronchus on the left originates at a slightly higher level and the anterior and medial basal segmental bronchi usually arise as a single structure (Godwin. 1984).

The fissures

The fissures are usually visualized on the chest CT The major fissures may appear as lucent bands .About 70 percent of the time a line or dense band also can be seen especially in the upper portion of the fissure it is thought that the fissures appear as lines only when perpendicular to the CT slice .Major fissures are curved structures, superiorly the lateral segment is posterior to the medial segment ,inferiorly the reverse is seen and at midlung the fissure runs a horizontal course .

The minor fissure is seen as a triangular or oval region of decreased density , devoid of vessels at the level of the bronchus intermedius(Haaga and Alfidi, 1988).

The diaphragms and crura

The domed diaphragms are most often seen together but the right hemidiaphragm apex is typically higher than the left

The diaphragmatic crura are identified almost 100 percent of the time on CT They form the anterior and lateral margins of the aortic hiatus which also contains the azygos vein .The right crus is longer and larger than the left (Haaga and Alfidi,1988).

Lymph node anatomy: fig 12

The classic description by Rouviere divides nodes into the following

1- Intrapulmonary nodes are found at major bronchi and vessel bifurcations beyond the hilum .

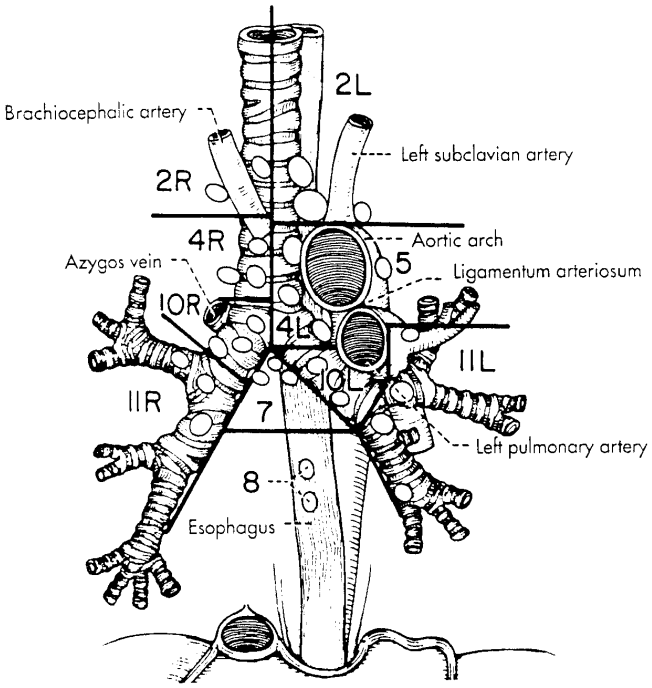
2-Anterior mediastinal nodes are situated on the right in front of the superior vena cave along the phrenic nerve and thymus .On the left they follow the main pulmonary artery extending up the phrenic and vagus nerves .

3- Peribronchial nodes are multiple.

a- A right paratracheal nodal chain .

b- A left paratracheal nodal chain.

c- Tracheal bifurcation nodes are largest under the carina but smaller nodes extend along the major bronchi.



X: Supraclavicular nodes
2R: Right upper paratracheal nodes
2L: Left upper paratracheal nodes
4R: Right lower paratracheal nodes
4L: Left lower paratracheal nodes
5: Aortopulmonary nodes
6: Anterior mediastinal nodes
7: Subcarinal nodes
8: Paraesophageal nodes
9: Right or left pulmonary ligament n.
10R: Right tracheobronchial nodes
10L: Left peribronchial nodes
11: Intrapulmonary nodes

fig 12

d- Pulmonary root nodes surround the major bronchi.

4- Posterior mediastinal nodes are present in the lower part of the mediastinum along the esophagus .They are also found along the aorta(Haaga and Alfidi,1983) .On CT images mediastinal lymph nodes are identified as non-enhancing soft tissue densities in characteristic anatomic locations(Glazer. et al . , 1985).

Technique of CT and Radiological Examination

1) Plain films

includes

Postero-Anterior

Antero-posterior

Lateral

lordotic

Oblique projections

Right anterior oblique

Left anterior oblique

Left posterior oblique

Right posterior oblique

(Swallow. et al .,1986)

Postero-anterior

The patient is positioned facing the cassette with the chin extended and centered to the middle of the top of the cassette . The feet are placed slightly apart so that the patient is able to remain steady

. The median sagittal plane is adjusted at right angles to the middle of the film, the shoulders are rotated forward and pressed downward in contact with the cassette.. This is achieved by placing the dorsal aspect of the hands behind and below the hips with the elbows brought forward or by allowing the arms to encircle the cassette.

Direction and centering of the X-ray Beam

The horizontal central ray is directed firstly at right angles to the film at the level of the fourth thoracic vertebra , and then angled approximately 5 degrees caudally to bring the central ray coincident with the middle of the film.

Anterior-posterior

The patient may be standing or sitting with their back against the cassette which is supported vertically with the upper edge of the cassette above the lung apices. The median sagittal plane is adjusted at right angles to the middle of the film . The shoulders are brought downward and forward, with the back of the hands below the hips and the elbows well forward

Direction and centering of the X-ray Beam

The central ray is directed first at right angles to the film and towards the sternal notch . The central ray is then angled until it is coincident with the middle of the film , thus avoiding unnecessary exposure to the eyes (Swallow. et al .,1986)

Lateral view

Patient position : Stand the patient erect in the true lateral position with feet apart Place the affected side against the cassette raise the arms and fold over the head immobilize the patient place marker collimate beam and apply protection

Centering point : To the middle of the film through the axilla

Direction of central ray : Horizontal at 90 degree to the film

(Bell&Finally, 1986)

Oblique projections :-

Right anterior oblique

Position of the patient and film : With the patient positioned initially facing the cassette the right side of the trunk is kept in contact with the cassette and the patient is rotated to bring the left side away from the film so that the coronal plane is at an angle of 10-60 degrees to the film

Direction and centering of the X-ray Beam: Direct the central ray at right angles to the middle of the film

Right posterior oblique

With the patient positioned initially with the back to the cassette the right side of the trunk is kept in contact with the cassette and the patient is rotated to bring the left side away from Th film so that the coronal plane is at an angle of 45-55 degrees to the film

Direction and centering of the X-ray Beam

Direct the central ray at right angles to the middle of the film

(Swallow. et al .,1986)

Technique of CT Examination

Computer tomography has become useful in the early detection and evaluation of all aspects of lung ,mediastinal ,pleural and chest wall disease . (Indira,1993)

1-Patient preparation:

Usually no preparation is needed in case of pulmonary parenchymal CT scanning

2-Patient position and gantry angle:

The patient is placed in a supine position on the table head first into the gantry with the arms over the head to reduce streak artifacts from the shoulder girdle.(Hagge and Alfidi 1988)

Coronal representation of the thorax can be of value This can be done by either reconstruction techniques by the use of special CT soft ware or direct coronal projections using specially designed gantries and tables .Chest scanning is usually performed with the gantry in the vertical plane and the patient horizontal(Naidich .et al .,1984)

3-scan distance :

Examination is usually carried out from the thoracic inlet till the level of the posterior costophrenic angle but this may vary according to the lesion to be examined(Naidich.et al .,1984)

4- Respiration :

Examination during full inspiration is best where total lung capacity is at its maximum .Full inspiration also reduces the crowding of vascular structures(Naidich. et al .,1984) In older or dyspneic patients a few deep breaths before each scan can help with breath holding for the required time with slow scanners some patients may not be able to suspend respiration for the time required to complete a single scan in such instances good quality CT scans can still be obtained during quiet breathing (Moss. et al ., 1983)

5-Scanogram

At the start of the examination a scanogram is done(topogram) in the AP and sometimes in the lateral position The topogram is used to place the first cut and to document all the cuts at the end of examination The principle of the topogram is that the patient s bed

with the patient lying on it is moved through the gantry opening while the tube detector array is fixed (Hamdy, 1983)

6- Slice spacing

The chest radiograph is the guide to proper slice spacing when the size of the abnormality is larger than the slice thickness interspacing of slices by one slice width will be adequate All too often contiguous slices are obtained regardless of pathologic presentation which unnecessarily increases patient exposure examination time and maintenance costs (Naidich. et al .,1984)

7- Slice Thickness

For detection of a lesion by CT this depends upon the density gradient between the lesion and the surrounding normal tissue The larger the density difference the less the pathologic tissue needs to be included in the slice to create a significant difference in CT number between lesion and normal tissue .In the low density lung parenchyma a large slice thickness is very advantageous because most pulmonary pathologic processes are of much higher density than normal lung There is another significant advantage in using large section for the lungs structures such as vessels that run obliquely to the plane of the scan are better appreciated using thick sections which makes their differentiation from pathology easier(Naidich. et al .,1984)

8- CT guided needle biopsy

The choice of needle in chest biopsy should be tailored to the situation In most cases an aspiration biopsy is the appropriated first step, if this is non diagnostic and if the lesion in non vascular adjacent to pleural edge and only under CT guidance large cutting needle biopsy is recommended as an alternative to the riskier and more invasive surgical procedures that might be required (Goralink. et al.,1988). CT has the advantage of showing the bulk of viable tumor tissue for percutaneous biopsy (Pinstein et al, 1983) .It also demonstrates the relationship of a mass to the fissures in order to avoid puncturing through them .CT guidance is also used when the lesion cannot be seen by fluoroscopy or because it is very near to vital structures (Naidich. et al .,1984)

9-Contrast Enhancement

The thorax is the body part with the highest natural contrast.Ribs and vessels are of markedly different density than the surrounding aerated lungs.Mediastinal structures are embedded in usually sufficient amounts of fat.In thoracic CT therefore the role of contrast agents is limited . Knowledge of mediastinal and hilar anatomy is generally sufficient to determine whether a particular structure is abnormal .Contrast enhancement is necessary in the minority of cases in which

mediastinal fat is lacking or a vascular abnormality is suspected and is potentially useful in patients with complex pleuro-parenchymal pathology .A clear distinction should be made between contrast enhancement in the brain and contrast enhancement in the body .(Naidich. et al .,1984) The vascular compartment of the brain is not permeable to intravascular contrast agents when the blood-brain barrier is intact (Saga,1982) .In the body the vascular compartment is freely permeable to contrast medium molecules.(Korman&Dean ,1976).Rapid passage of contrast form the intravascular space into the extracellular extravascular space occurs within seconds.Very shortly after injection (1-2 min)the majority of iodine molecules will be distributed in the extravascular space of tissue rather than in vessels . In the body therefore the differentiation of a lesion from its surrounding depends on several factor

1) Its vascularity

2)The relative size of extravascular space compared to normal tissue

3) The permeability of the contrast agent injected

4) The time elapsed following the end of contrast medium injection

5) Renal excretion

A bolus injection will provide sufficient vascular characterization only for the first few scans after injection with progressively

decreasing differentiation there after.Continous infusion of contrast medium have become more popular because a more contrast can be maintained for the longer period of time to complete scanning .The combination of a bolus injection of contrast medium followed by a rapid infusion can give more satisfactory results (Naidich .et al .,1984)

10-Documention

The images obtained are documented on

X-Ray film, each case is further more stored on floppy discs

11-Artefacts in thoracic CT

Many artifacts can be seen with CT their recognition is important so as not to confuse them with pathological lesions .The most important artifacts are motion artifacts caused by patients motion during the scan (Naidich. et al., 1984)

Indication of CT

Computed tomography is useful for performing detailed morphological analyses of abnormalities of the peripheral portions of the lung(Nakata. et al., 1985)

Indication of CT scan of the lung

*search for pulmonary lesions

_ Detection of occult pulmonary metastases when:

--Extensive surgery is planned for known primary neoplasm with a high propensity for lung metastases or for apparent solitary lung metastasis

_ Detection of primary tumor in patient with positive sputum cytology and negative chest radiography and fiberoptic bronchoscopy

_ Assessment of lung and mediastinum for underlying pleural effusion and the postpneumonectomy fibrothorax for recurrent disease

*Search for diffuse or central calcification in a pulmonary nodule when conventional tomography is indeterminate

*Determination of extent of intrathoracic spread in selected patients with bronchogenic carcinoma including mediastinal or pleural invasion

Indication of CT scan of the chest wall

*Determination of extent of neoplastic disease

_Assess bone ,muscle , and subcutaneous tissues

_Detection of intrusion into thoracic cavity or spinal canal

(Ralph j. et al .,1979)

Pathology

Congenital

Sequestrated segment

This is a partial or complete separation of pulmonary segment or segments from normal continuity with the rest of the bronchial tree(Davidson, 1981).The blood supply of the sequestrated area is usually through systemic vessels arising from the aorta or its branches.

Intralobar sequestration.

Occurs almost equally in adults and children. The usual but not invariable location is in the posterior segment of the left lower lobe and the sequestrated area is incorporated within the pleural investment of that lobe.

Extralobar sequestration

has also been termed accessory lobes .They are completely separate from the pleural covering of the normal lung the usual location of extralobar sequestration is in the left lower hemithorax (Kissane, 1990).

Sequestration communicating with esophagus or stomach is a rare condition in which the sequestration either extra or intralobar type served by bronchus growing directly out of the mid esophagus or lower esophagus or gastric fundus this may be termed bronchopulmonary-foregut wall formation (Davidson ,1981).

Solitary pulmonary nodule

Causes

Malignant tumour	:	primary, secondary, lymphoma, plasmacytoma
Benign tumour	:	Hamartoma , adenoma
Granuloma	:	Tuberculosis, histoplasmosis, paraffinoma, sarcoidosis
Infection	:	pneumonia , abscess,hydatid,amoebic fungi, parasites
Pulmonary infarct		
Pulmonary hematoma		
Collagen diseases	:	Rheumatoid arthritis, Wegener' s granulomatosis
Congenital	:	sequestrated segment
Impacted mucus		
Intrapulmonary lymph node		

Pleural	:	Tumour(e.g, fibroma), loculated fluid
Nonpulmonary	:	Skin and chest wall lesion ,artifacts

(Sutton, 1987)

Benign Tumours

The tumours fall into two main anatomical groups those arising from the larger bronchi and those situated in the periphery of the lung The former are usually visible through the bronchoscope .Peripheral tumours are not visible through a bronchoscope. Two main varieties are found *carcinoid adenoma,* the commonest and most frequently found in the lobar or segmental bronchi *hamartoma* most frequently occurs in the lung but is occasionally found in a large bronchus. Histologically the cells of the carcinoid tumour are regular well formed and consistent in appearance and tend to be arranged in solid acini .Mitosis are infrequent .The hamartoma is a composite tumour composed of two or more tissue elements. They represent an abnormal mixing or development of the normal components of the organs in which they occur.(Baily&Love's, 1986).

Malignant tumours

Primary : Carcinoma (common)

Alveolar-cell carcinoma (rara)

Cylindroma (adenoid cystic carcinoma)usually affects trachea

Sarcoma (rare)

Secondary : Sarcoma

Tertoma of testis

Carcinoma (bowel, breast , thyroid , kidney)

Bronchogenic Carcinoma

Three main macroscopic types are described

(1) Main Bronchus Tumours : These arise in the main bronchus or one of its primary or secondary divisions .

(2) Peripheral Tumours : These arise from the smaller bronchi and may only be visible with the fiberoptic bronchoscope .

(3) Pancost Tumour : These essentially peripheral lung carcinomas arising at the apex of the lung .The tumour extends early along pre-existing apical adhesions to invade the brachial plexus , sympathetic chain , upper ribs and adjacent vertebrae producing the pancost syndrome (lower brachial plexus lesion ,Horner 's syndrome , an apical shadow ,and rib erosion).

Three main histological types are recognized

(1) Squamous cell (epidermoid) carcinoma 50%

(2)Anaplastic a: Small cell 15% (majority are oat cell)

b: Large cell (5%)

(3) Adenocarcinoma 20 %

The anaplastic carcinomas are poorly differentiated tumours often exhibiting rapid growth with early metastases

Clinical Features

Most important are cough ,sputum ,hemoptysis , dyspnea, pain and wheezing (Bailey&Love's ,1986).

Tuberculosis

Derives its name from the characteristic lesion called a tubercle (a collection of inflammatory cells surrounding the organism and later progressing to caseation) which is the response of the body to invasion by tubercle bacilli (mycobacterium tuberculosis). Mycotuberculosis may be human or bovine in type and is spread by airborne infection by the human type from open tuberculous cases , and by milk from infected cows in cases of the bovine bacillus .

Routes of primary infection

(1) By direct spread to the lungs where a primary focus occurs and hence by lymphatics to the hilar lymph nodes .

(2) Via the tonsils to the lymph nodes of the neck .

(3) Via the lower ileum probably in peyer's patches , to the lymph nodes of the ileocecal angle where they later show as calcified areas on x-ray (Bailey&love's,1986).

Primary Pulmonary Tuberculosis

Primary pulmonary tuberculosis is the type of tuberculous disease which follows the first infection of the lung with tuberculous bacilli, it occurs most frequently in children .In countries where effective vaccination and other preventive measures, the primary infection often does not occur until adult life and there is an increasing number of the primary infection taking place in middle age .The initial or primary tuberculous infection usually occurs in the lung but occasionally in the tonsil or in the alimentary tract especially the iliocoecal region . The primary infection differs from later infections in that the primary focus in lung ,tonsil or bowel is almost invariably accompanied by a caseous lesion in the regional lymph nodes (Davidson , 1981)

Post -Primary Pulmonary Tuberculosis

This follows the primary infection after a latent interval however short or long and could conceivably be either a reactivation or reinfection (Sutton ,1987). In most cases it occurs in the subapical region as an area of lobar tuberculous pneumonia .It is characterized by intraalveolar exudate of fibrin, neutrophils and lymphocytes .At this stage the lesion is still encapsulated and it may resolve completely or it

may undergo liquefaction and slough through patient bronchus leading to cavitary tuberculosis .Cavities are usually spherical and have a thick wall and their main complications are aneurysms of the arteries crossing the cavity and extension to the pleura (Kissane,1990).

Pulmonary infarct

Pulmonary infarcts are typically wedge shaped pleural based and usually locate in the lower lung zones .Alveolar walls undergo necrosis and over the next few weeks granulation tissue appears surrounding the necrotic tissue which becomes encapsulated ,gradually organizes, and is converted to a linear fibrous scar .Ordinarily ,emboli to the pulmonary arteries do not produce infarcts since the lung can obtain its oxygen form the alveolar gas and has a second blood supply through the bronchial arteries .Tissues distal to the obstructed artery may be normal or merely show congestion , hemorrhage and intra-alveolar fibrin with intact alveolar walls. Emboli often produce tissue infarcts in presence of congestive heart failure or chronic pulmonary disease (Kissane,1990).

Rheumatoid arthritis

Rheumatoid arthritis is an inflammatory synovitis of unknown etiology .While the predominant symptoms and signs may involve virtually all synovial joints ,RA is often associated with extra-articular

involvement of other organ systems .The organs frequently affected include the skin, eye ,cardiovascular system ,bronchopulmonary system, spleen and nervous system .Thus RA is a systemic inflammatory disorder.It affects the lung in the form of pleuritis , diffuse interstitial fibrosis , vasculitis, rheumatoid nodules, caplan's syndrome(Cecil ,1986)

Wegner's Granulomatosis

Wegners 's granulomatosis is a systemic necrotizing vasculitis primarily involving the medium and small muscular arteries .It is characterized by (a) granulomatous vasculitis of the upper and lower respiratory tract and (b) a necrotizing glomerulonephritis.The majority of individuals in whom the diagnosis of Wageners granulomatosis is eventually made present with symptoms of upper respiratory tract disease .The commonest complaints include nasal ulcer ,rhinorrhea, and sinus pain .The lungs become involved in the majority of patient . Common symptoms of pulmonary disease include hemoptysis ,cough , and pleurisy (Cecil,1986).

The granuloma consists of necrotic tissue ,fibrinoid necrosis and a dense infiltrate of polymorphonuclear,mononuclear cells, and multinucleated giant cells (Kissane,1990).

Kidney disease which occurs in about 85 percent of cases is a later manifestation of wegner's granulomatosis ,The pathologic lesion are a focal or diffuse proliferative glomerulonephritis and interstitial nephritis.The diagnosis of Wegner' s granulomatosis is on the basis of clinical signs of upper and lower respiratory tract disease (i.e sinusitis, rhinitis,otitis, pulmonary nodules, or infiltrates) associated with glomerulonephritis and a biopsy demonstrating necrotizing vasculitis with granuloma formation.(Cecil ,1986).

Pneumonia

Pneumonia is an inflammatory process involving the alveolar tissue of the lung.

A causative organism is only likely to be found in 50% of cases usually because of prior treatment with antibiotics or an inability to provide a satisfactory sputum specimen . Of the bacterial causes the pneumococcus (streptococcus pneumoniae)is most common with much smaller numbers of Staphylococcus aureus ,Haemophilus influenza ,Klebsiella pneumonia .Of the non bacterial causes Mycoplasma pneumoniae is most common .Other non bacterial causes found in small numbers are Chlamydia psittaci (psittacosis)and (Coxiella burnetti (Q fever).The viruses are almost all influenza and cold viruses .Mixed infections are found in approximately 10% of cases(Sutton,1987) .

Diagnostic approach to the patient

A critical historical point in the differential diagnosis of pneumonia is the duration of symptoms .Pneumonia due to the pneumococcus ,Mycoplasma or virus is usually an acute illness . Symptoms are measured in hours to a few days .Symptoms of pneumonia lasting 10 days or more are rarely due to the common aerobic pulmonary pathogens and should raise suspicion of mycobacterial fungal or anaerobic pneumonia .Occupational ,exposure ,and travel history often provide clues to the etiology of some less common pneumonias .A history of rhinitis or pharyngitis suggests respiratory virus or Mycoplasma pneumonia .Diarrhea had been associated with Legionnaires pneumonia in some but not all outbreaks A persistent nonproductive cough characterizes some mycoplasma infection,symptoms of malaise and myalgias are common in influenza and may also be seen with mycoplasma pneumonia .A true rigor is very suggestive of a bacterial(often pneumococcal) pneumonia .Where as pleural effusions may be seen in nonbacterial pneumonias ,severe pleuritic pain in a patient with pneumonia is suggestive of bacterial infection .Night sweats are seen in chronic pneumonias and suggests tuberculous or fungal disease.Most patients with pneumonia have fever and tachycardia .Fever without rise in pulse rate may be seen in Legionnaires disease Mycoplasma infections and other

nonbacterial pneumonia .Patient with pulmonary tuberculosis often maintain high fevers in relative comfort when compared to patients with acute bacterial pneumonia .Foul breath suggests anaerobic infection .Jaundice maybe seen in any bacterial infection and occurs frequently in pneumococcal pneumonia (Cecil,1986).

Pneumococcal pneumonia: is the archetype of classical lobar pneumonia with homogeneous lung opacification limited by fissures . Affected lobes retain normal volume and often show air bronchogram The onset is so acute that opacification is often at its maximum on the initial radiograph .However consolidation is not always obvious on the radiograph and its presence may be revealed more by the silhouette sign..

Staphylococcal pneumonia : is usually a hematogenous dissemination and the lesions are therefore likely to be oval or round and multiple the Staphylococcus can be a secondary invader and then the lesions will be bronchopneumonia irregular and patchy.

Friedlander (Klebsiella) pneumonia : is typically a disease of elderly men .So voluminous is the inflammatory exudate that the affected lobe may be swollen and the fissures then bulge

Haemophilus influenzae: .Any pulmonary opacities found in Haemophilus infection are disseminate and bronchopneumonic there are no characteristic radiographic appearances. (Sutton,1987)

Clinical / radiographic dissociation is seen often in patient with mycoplasma pneumonia .Chest radiographs of patients with mycoplasma infection often suggest a more serious infection than does the appearance of the patient or the physical examination .The converse is true in patient with pneumocystis carinii infection who may appear quite ill despite normal or nearly normal chest radiographs .This may also be true early in the course of acute bacterial pneumonias when pleuritic chest pain , cough , purulent sputum may precede specific x-ray findings by many hours . A negative x-ray can never rule out the possibility of acute bacterial pneumonia when the patients symptoms and signs point to this diagnosis .A lobar consolidation suggests a bacterial pneumonia however patients with chronic lung disease often fail to manifest clinical or radiographic evidence of consolidation during the course of bacterial pneumonia .Interstitial infiltrates suggest a nonbacterial process but may also be seen in early staphylococcal pneumonia .Enlarged hilar lymph nodes suggest a concomitant lung tumor but may also be seen in primary tuberculous ,viral ,or fungal pneumonias .Large pleural effusions

should suggest streptococcal pneumonia or tuberculosis . ,The presence of cavitation identifies the pneumonia as necrotizing .This virtually excludes viruses and mycoplasma and marks pneumococcal infection unlikely (Cecil,1986).

Lung abscess:

A lung abscess is a localized area of lung infection with tissue necrosis ,it is associated with thrombosis of the segmental artery and vein. A large proportion of lung abscesses are secondary to chronic upper respiratory tract infection .They most commonly occur in the axillary subsegments of the upper lobe or the apical segment of the lower lobe .

Infected material is inhaled into the bronchial tree and obstructs one of the smaller bronchi .The resulting atelectatic segment is invaded by pathogenic organisms producing pneumonic consolidation .The commonest organisms are Haemophilus influenzae and pneumococci but invasion by mouth organisms (anaerobic streptococci and spirochetes)coliform organisms and cross infection with drug-resistant staphylococci sometimes occur and may be detected by microscopy and culture of the sputum .Suppuration and necrosis develop in varying degrees within the involved segment first with the production of a suppurative pneumonitis which later matures into an

abscess .As pus accumulate ,tension rises and eventually the abscess ruptures into the bronchus .

Classification - Here based on etiology

a) Due to specific pneumonias

-Streptococcal

-Staphylococcal

-Pneumococcal

-Friedlander

- Anaerobic

b)Due to bronchial obstruction.

-Carcinoma

-Carcinoid

- Foreign body

c)Chronic upper respiratory tract infection

d) septicemia ((Bailey&Loves,1986)

Hydatid Disease

Dogs are the principal reservoir of the adult worm Echinococcus granulosus and most mammals serve as intermediate host for the larvae (Sutton,1987).In the duodenum the larvae are freed and find their way into the lumen of blood vessels till they lodge in capillaries at almost any site .In 60% of cases they are in the sinusoids of liver and 20 %

are retained in the lung, the others gain access to the systemic circulation . The embryos of E.granulosus that survive develop into hydatid cysts containing numerous scolices which represent the future heads of tapeworms .The cysts have an outer laminated elastic layer and inner germinal one .Abundant clear fluid is contained within the cysts (Kissan,1990).

Daughter cysts are formed if the viability is threatened, but in the lung the cyst is unilocular .Smoothly spherical and of homogeneous density the cyst may grow to the size of a grapefruit .Rupture may take place into the pleural cavity or into a bronchus .Communication with a bronchus leads to a detachment of the ectocyst from the adventitia and a crescent of air separates the two .Should the cyst itself rupture the partial replacement of the fluid results in a fluid level .Rupture of a liver hydatid into the right lung produces a characteristic combination of radiological signs . (Sutton,1987).

Amoebic abscess:

The infection is caused by ingestion of food or water containing the cysts . The alkaline content of the small intestine destroys the wall of the cyst and the parasite is liberated and then travels down and colonizes the large intestine and can behave as a commensal or as a highly invasive parasite and causes amoebic colitis .In 40% of cases of

amoebic colitis the parasites enter the circulation and are filtered in the liver where they produce solitary or multiple abscesses (Kissane,1990)

The amoebic hepatic abscess located in the dome of the liver is prone to penetrate the diaphragm and produce an amoebic lung abscess of the right lung.The vast majority of amoebic lung abscesses are solitary abscesses but multiple abscesses may occur when dissemination of the amoebas by blood stream had occurred. Most amoebic lung abscesses are located in the right lower lobe of the lung adjacent to the diaphragm .In cases of hematogenous dissemination of the organism the diaphragm may not be involved and the abscess may lie within the parenchyma of the lung at some distance from the diaphragm .with this type of spread the left lung may also be affected (Ten Broeke et al,1967)

Tumours of the pleura:

Mesotheliomas may be localized, they are almost always associated with asbestos exposure. More commonly neoplasms of the pleural space are due to adjacent spread (bronchogenic carcinoma) or metastatic disease (carcinoma of the breast , ovary and kidney and lymphoma) these produce bloody pleural effusions although chylous effusions resulting from lymphatic obstruction are also seen.(cecil, 1986).

Pleural effusion:

Causes of pleural effusions are best considered in terms of the underlying pathophysiology : transudates due to abnormalities of hydrostatic or osmotic pressures and exudates resulting form increased permeability or trauma.(cecil,1986). Causes of pleural effusion are infection, malignant neoplasm,cardiac failure, pulmonary infarction, collagen vascular disease, nephrotic syndrome , renal failure ,and ascites. (Peter and Martin, 1996).

Non pulmonary:

The chest wall should be examined for evidence of soft tissue swelling or rib abnormality, soft tissue swelling occurs with a number of rib lesions ; fracture , infections and neoplasm.(Peter and Martin, 1996).

Sequestrated Segment

The sequestrated segment appears as a solid , well-circumscribed mass may be irregular or multilobular and may contain one or more fluid level in solitary cysts. Occasionally the lesion has radiographic appearance of a solitary thin walled, air filled cyst. The aberrant arterial vessel often be delineated by tomography or thoracic aortography but is rarely visible on standard chest film.(Lillington and jamplis, 1987) . The CT findings of such a case were oval , slightly lobulated soft-tissue masses , dynamic CT is of special importance as it can show the systemic blood supply to the lung even when the feeding vessels are not demonstrated.(Moss et al, 1983.)

Tuberculoma

Tuberculoma refers to a tuberculous granuloma in the form of a spherical mass, usually less then 3 cm in diameter the edge is usually sharply defined and these lesions are often partly calcified(Peter and Martin, 1996). Cavitation is characteristic feature of pulmonary tuberculosis the wall of the cavity is usually 2 to 5 mm in thickness and it's contour may be smooth or irregular.(Lillington and Jamplis, 1987)

Pulmonary infarction

Single or multiple triangular areas of which the obstructed artery forms the apex and the pleural aspect the base (sutton,1987).

Pulmonary infarct occasionally becomes infected and cavities to form a lung abscess.(Lillangton and jamplis ,1987).

Rheumatoid lung nodules

Rheumatoid lung nodules and subcutaneous nodules have the same histology. The nodules are rounded and well defined but with borders that are slightly irregular The average diameter is 2-4cm but occasional one reaches large size , they occur in any part of the lung and may be single or multiple . Cavitation is common and is a result of evacuation of the necrotic material, they may rupture in to the pleura in which case there will be a pneumothorax or bronchopleural fistula , some nodules resolve leaving a scar . In Caplan's syndrome there are numerous round opacities up to 5 cm in diameter, resembling metastases. (Sutton,1987).

Pneumonia

The basic radiological feature of pneumonia are one or more areas of consolidation . Cavitation may occur within the consolidation area.

Consolidation may be accompanied by loss of volume of the affected lobe , The appearance of consolidation varies from a small ill-defined shadow to a large shadow involving the whole of one or more lobes (lobar pneumonia) . In pneumococcal pneumonia there is dense consolidation of one lobe usually with out loss of volume, there may be associated pleural effusion . When consolidation is patchy , involving one or more lobes it is commonly referred to as bronchopneumonia , the most frequent cause is staphylococcus aureus,(Peter and Martin, 1996). Air bronchogram proves that large mass is produced by pneumonia rather than by a tumor (Haaga and Alfidi, 1988) This air bronchogram is seen to great advantage in CT scans.

Wagner's granulomatosis

The lung may show one or more well-defined consolidation or masses, usually in the mid zones which may cavitate, these lesions are often difficult to distinguish from bronchogenic carcinoma or metastases .(Peter and Martin , 1996). Cavitation may have thick or thin walls depending on how much of the necrotic material is expectorated,

reactive hilar or mediastinal node enlargement can be mistaken for carcinoma..(Sutton,1987)

Lung abscess.

Lung abscess are usually in the apical (superior) segment of the lower lobes or in the posterior segment of the upper lobes , A lung abscess usually seen as spherical shadow containing s central lucency due to air with in the cavity , an air fluid level may be present, it can be difficult to distinguish an infected lung abscess from a cavitating lung neoplasm or cavitation in wegner's granulomatosis (Peter and Martin , 1996) An abscess located in the periphery of the lung assumes an acute angle with the chest wall. Pulmonary bronchi and vessels terminate in the abscess and are not compressed or distorted by the lesion.(Haag and Alfidi, 1988)

Hydatid cyst

These cysts may be solitary or multiple and are seen as spherical shadows with very well-defined borders(Peter and Martin,1996).occasionally the wall of a cyst may become calcified but this is much more common in hepatic hydatid cyst than in pulmonary cysts . A fluid level or ring shadow appearance indicates that the cyst communicate with a bronchus.(Lillington and Jamplis, 1987).on CT they appear as rounded or oval lesion of a density near that of water,

the hyperemic ectocyct may become slightly hyperdense with intravenous contrast enhancement.(Haaga and Alfidi, 1988)

Amebic abscess.

It results from direct extension of infection from an amebic liver abscess, a pleural effusion or frank empyema may also be present , but the formation of pleural adhesions during the extension of the disease through the diaphragm may prevent widespread pleural involvement , the right lower lobe may appear completely consolidated and the abscess may not be recognized as such unless a fluid level is present,(Lillington and Jamplis, 1987.

Histoplasmosis

A tiny calcified dot may be the only indication that previous infection has taken place when may of these are scattered throughout the lung they closely resemble the scars of miliary tuberculosis , progression of one or more of these foci leads to larger nodules. Hilar node enlargement is common and may be the only visible manifestation, locally progressive disease may also take the from of a consolidation ,acute or chronic the latter associated with fibrosis and cavitation. An uncommon late manifestation of histoplasmosis is fibrosing

mediastinitis .The chest radiograph will then show a widened mediastinum with large hilar shadows and opacities fanning out into the lungs . Kerly B lines may appear. (Sutton,1987).

Mycetoma

The fungus Aspergillus Fumigatus may colonize old tuberculous cavities to produce a ball of fungus(mycetoma) lying free within the cavity . since the fungus ball usually occupies only a portion of the available space, air is seen between the mycetoma and the wall of the cavity. The shape and position of this rim varies with the position of the patient . Cavities containing mycetomas are usually surrounded by other evidence of old tuberculous infection, particularly fibrosis and calcification of the adjacent lung.(Peter and Martin,1996)

Aspergillosis

The pulmonary manifestations are grouped into three categories (1.) Aspergilloma which is a ball of fungal hyphae growing in an old pulmonary cavity (2) Invasive aspergillosis – the fungus becomes a pathogen in its own right and invades pulmonary tissue causing necrosis (3) Allergic bronchopulmonary aspergillosis- asthmatics who develop transient pulmonary opacities. In aspergilloma the fungus colonizes any chronic cavity or airspace , the radiographic feature is a crescent of air between the ball and the cavity wall . In invasive

aspergillosis there is no characteristic radiographic pattern , it may take the form of a necrotizing bronchopneumonia with abscess formation organizing lobar pneumonia widespread lesions even miliary spread. In allergic bronchopulmonary aspergillosis there is two types of pathological process 1. Transient pulmonary opacities 2. Bronchopulmonary damage . the size varies from small nodules up to lobar dimensions, they are of low density and have ill-defined borders except at pleural boundaries. A perihilar distribution of the opacity can simulate hilar adenopathy ,within areas previously the site of transient opacities the bronchi dilate and contain plugs of tough mucus mixed with small numbers of the aspergillus . Mucoid impaction is a dilated bronchus packed tightly with this material, because of the thickened walls bronchi may be visible as tubes , rings or cavities . plugging of the central bronchi can lead to collapse of lobes or whole lungs ,continued damage and repair by fibrosis will lead to focal emphysema permanent shrinkage and eventually end-stage upper lobe fibrosis.(Sutton, 1987)

Hematoma

It appears as a spherical mass lesion which may cavitate and cause hemoptysis this hematoma usually disappears spontaneously in a few weeks (Baily and love ,1986)

Lung Nodules

The usual causes of pulmonary nodules are

Bronchial carcinoma, bengin tumor, infective granuloma, metastasis, lung abscess. The following feature may help in making the diagnosis Comparison with previous films, lack of change over a period of 18 months or more is a strong pointer to either a benign tumor or an inactive granuloma. An enlarging mass is highly likely to be a bronchial carcinoma or a metastasis. Calcification : calcification is a common finding in hamartomas , tuberculomas and fungal granulomas. In hamartomas it is often of the popcorn type, CT is of great value in detecting calcification and confirming that the calcification is within the lesion and with CT uniform calcification can be diagnosed and in such cases carcinoma of the lung can be excluded from the differential diagnosis. Involvement of the adjacent chest wall: destruction of the adjacent ribs is virtually diagnostic of invasion by carcinoma. The shape of the shadow: Primary carcinomas nearly always show a lobulated notched or infiltrating outline . If the shadow is perfectly spherical and the edge very well defined it is likely to be a hamartoma , tuberculoma or a metastasis . CT can be used to show the edge of a pulmonary nodule to advantage . Cavitation: It is very common in lung abscess , relatively common in primary carcinomas and occasionally seen with metastases it does not occur in benign tumors or inactive tuberculomas. Size: A solitary lesion over 4cm in diameter

which does not contain calcium is nearly always either a primary carcinoma or a lung abscess. Multiple lesions: Multiple well-defined spherical shadows in the lungs are virtually diagnostic of metastases , occasionally such a pattern is seen with abscesses or with granulomas due to collagen vascular disorders. (Peter and Martin, 1996).

Bengin Tumors

Bronchial adenoma : Eighty percent arise in a lobar segmental or subsegmental bronchus and present as an endobronchial mass with frequent extension beyond the bronchial wall . Postobstructive atelectasis and pneumonitis are the most common presentations , postobstructive hyperinflation is less common. Peripheral adenomas (20%) are well- defined round lesions measuring 2-5 cm in diameter.

Hamartoma: Solitary well-circumscried and often lobulated lesion in the lung periphery measuring up to 10cm in diameter. (Francis and Martti, 1993).two thirds of hamartomas can be correctly diagnosed because of visible fat either focal or diffuse. (W.Richard and William, 1998).

Neoplastic disease:

Bronchial carcinoma is a very common primary malignant tumor , the majority arise in larger bronchi at or close to the hilum, the remainder arise peripherally. Signs of a central tumor , the tumor is present as a hilar mass and /or narrowing of a major bronchus the narrowing may be irregular or smooth , the effect of obstruction by the tumor is usually a combination of collapse and consolidation . Signs of a peripheral primary carcinoma are rounded shadow with an irregular border , lobulation , notching and infiltrating edge are the common patterns, peripheral squamous cell carcinomas show a particular tendency for cavitation , the wall of the cavity are classically thick and irregular . Sign of spread of bronchial carcinoma are Hilar and mediastinal lymph node enlargement due to lymphatic spread of tumor , only greatly enlarged lymph nodes can be recognized on plain chest radiograph ,Computed tomography on the other hand has the ability to show even mildly enlarged nodes. Pleural effusion in a patient with lung cancer is usually due to malignant involvement of the pleura . Invasion of the mediastinum, on plain films the signs are widening of the mediastinal shadow and elevation of the hemidiaphragm suggesting the involvement of the phrenic nerve by tumor. CT is a much more sensitive and accurate method of assessing mediastinal invasion by tumor . Invasion of the chest wall, destruction of a rib immediately adjacent to a pulmonary shadow is virtually diagnostic of bronchial carcinoma with chest wall invasion. Rib metastases , carcinoma of the

lung frequently metastasizes to the ribs where it produces bone destruction. Pulmonary metastases, primary lung carcinoma occasionally metastasis to other parts of the lungs. Lymphangitis carcinomatosa, is the term applied to blockage of the pulmonary lymphatics by carcinomatous tissue , the sign can be identical to those seen in interstitial pulmonary oedema (septal lines, loss of vessel clarity and peribronchial thickening) computed tomography has proved very valuable in demonstrating lymphangitis carcinomatosa

Metastases, pulmonary metastases produce one or more rounded shadows within the lung .Typically metastases are spherical and well defined although irregular borders are occasionally seen.(Peter and Martin, 1996).

Pleural tumors:

Pleural tumors produce lobulated masses based on the pleura. Malignant pleural tumors , both primary (malignant mesothelioma) and secondary ,frequently cause pleural effusions which may obscure the tumor itself. .Since many malignant mesotheliomas are secondary to asbestos exposure the other feature of asbestosis (pulmonary fibrosis, pleural plaques and pleural calcification) may be seen .

Loculated pleural fluid:

Loculated effusions occur when the free flow of fluid within the pleural cavity is prevented by pleural adhesions such loculation may either be at the periphery of the lung or within the fissures between the lobes, on lateral film the effusion is lens-shaped lying within the oblique or horizontal fissure. Computed tomography scanning can be utilized to distinguish loculation of pleural from adjacent pulmonary disease a distinction that is particularly valuable when empyme is suspected. (Peter and Martin,1996).

Non pulmonary:

A chest wall tumor may project over the lung field and simulate intrapulmonary nodule. Skin tumors , and nipple shadows also can cause confusion.(Lillington, 1987)

Patient and method

This work was done on 30 patient referred to radiodiagnosis department in Al-Hussien hospital during 1997-1998, with age ranging between 35y-65y presented with various chest complaints 22 patient were males and 8 patients were females

The following were made for each patient

-Full history

-Full clinical examination

-Plain X-ray film PA,LAT

-CT scanning

Computed Tomography : Scan was made by General Electric C.T machine.

IV contrast study was done for 21 patient with slice thickness of 10mm with breath holding during the period of exposure

CASE 1

Female patient 40 years old , complaining of cough and dyspnea with past history of cancer colon

X-ray findings. Fig 1 : a

There is a well-defined coin shadow seen in the middle lung zone.

CT findings. Fig 2: a.

A well defined rounded homogenous shadow is seen in the posterior segment of the right upper lobe most probably metastatic as there is a past history of cancer colon.

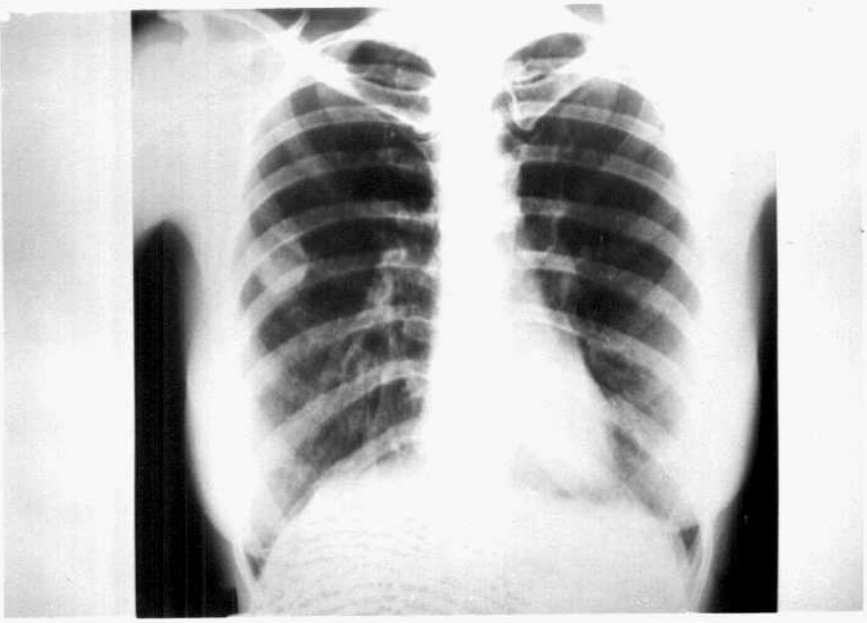


Fig 1 a

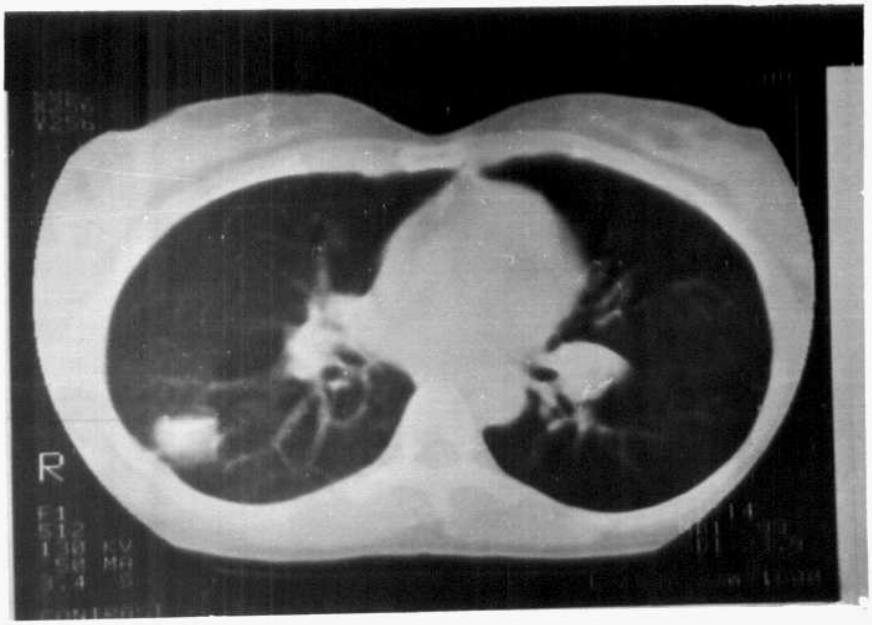


Fig 2 a

CASE 2

Male patient complaining of fever ,night sweating ,productive cough , sputum was +ve for TB, and deterioration of general health.

X-ray findings. Fig 1: a

There is nodular, fibrotic infiltration mainly in the middle and lower right lung zone with a cavity seen in the peripheral part of right middle lung zone

CT findings. Fig 2 : a

The right lung is the seat of extensive fibrotic, nodular infiltrations .A 25x20mm cavity seen in the apical basal segment of the right lung showing smooth regular interior and thick wall. bands of infeltrations are seen connecting between the cavity and the right hilum .so this is a case of pulmonary TB with a cavity in the apical basal segment of the right lung

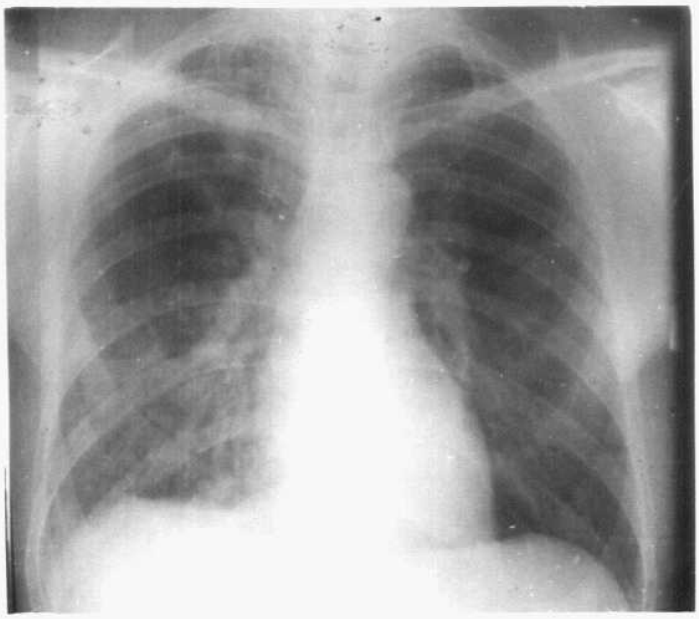


Fig 1 a

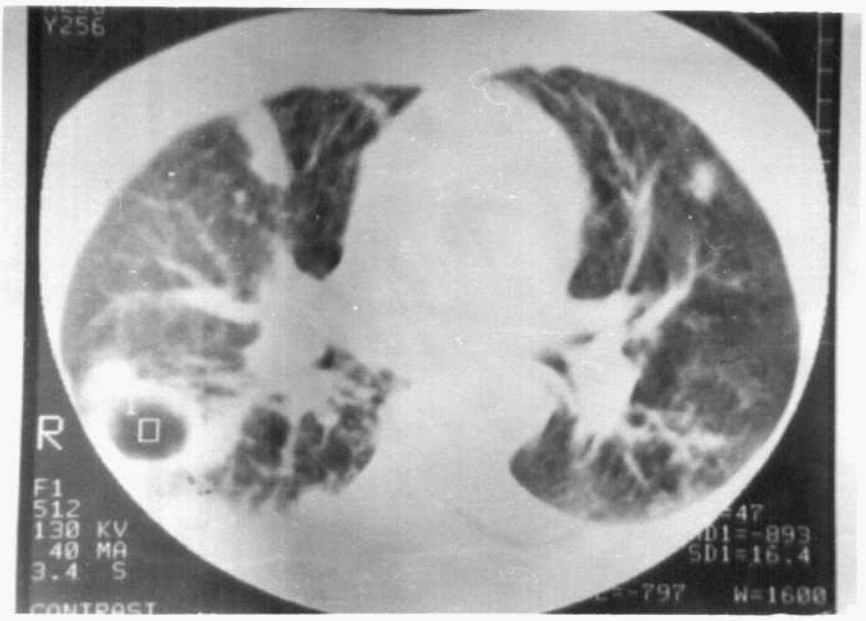


Fig 2 a

CASE 3

Male patient 50 years old complaining of cough with expectoration for about 6 month with dyspnea:

X-ray findings. Fig 1: a

A large rounded well defined cyst is seen in right middle lung zone

CT findings. Fig 2: a

Atypical finding of hydatid cyst is seen in the apical segment of the right lower lobe measuring (74x70x68mm) with ruptured pattern and detached endocyst and consequent shallow undulating fluid level (water-lily sign).
Opinion: hydatid cyst

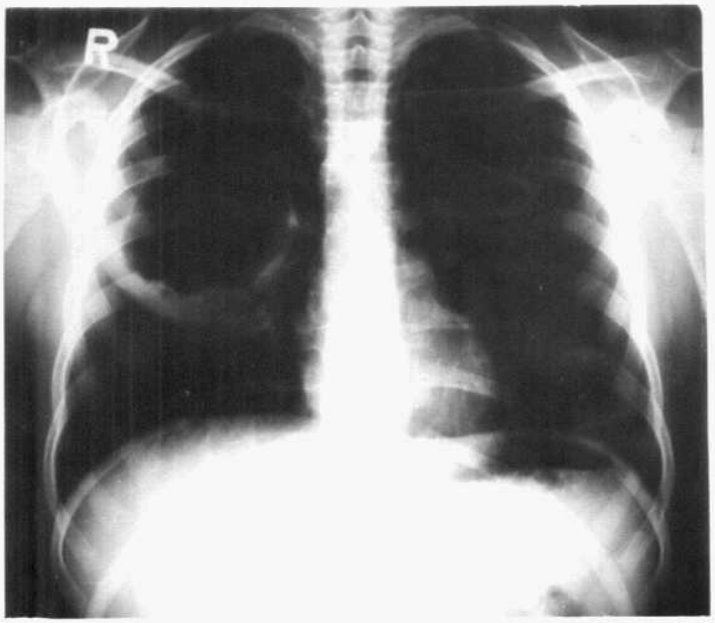


Fig 1 a

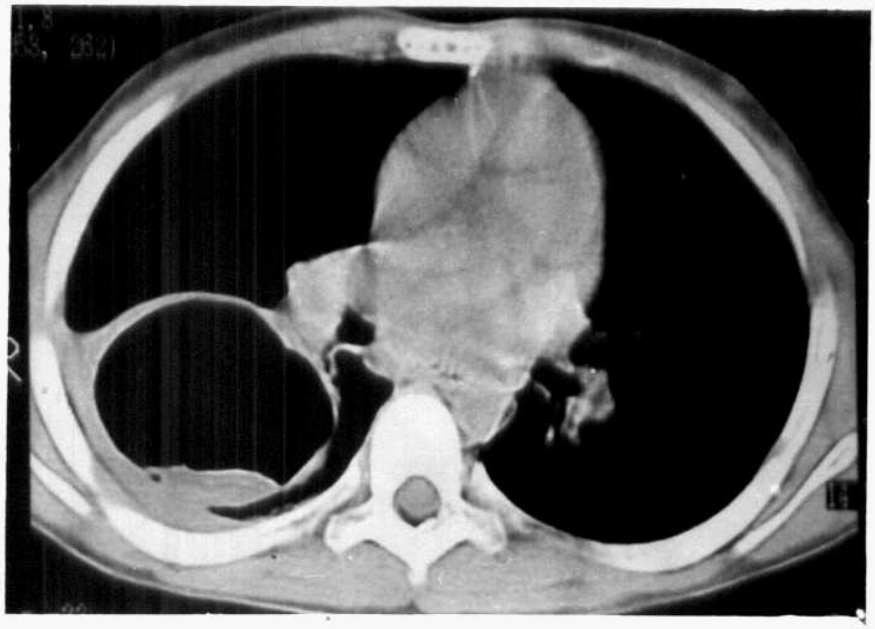


Fig 2 a

CASE 4

Female patient 60 years old complaining of productive cough, hemoptysis ,fever and deterioration of health.

X-ray findings. Fig 1: a

A large irregular homogenous rather ill-defined mass is seen in the upper left lung zone with enlarged hilar region

CT findings.Fig 2: a

A large (50x32x31mm) irregular homogeneous rather ill-defined speculated soft tissue mass lesion is seen in the apico-posterior segment of left upper lobe. Associated hilar lymphadenopathy .so this is a case of bronchogenic carcinoma

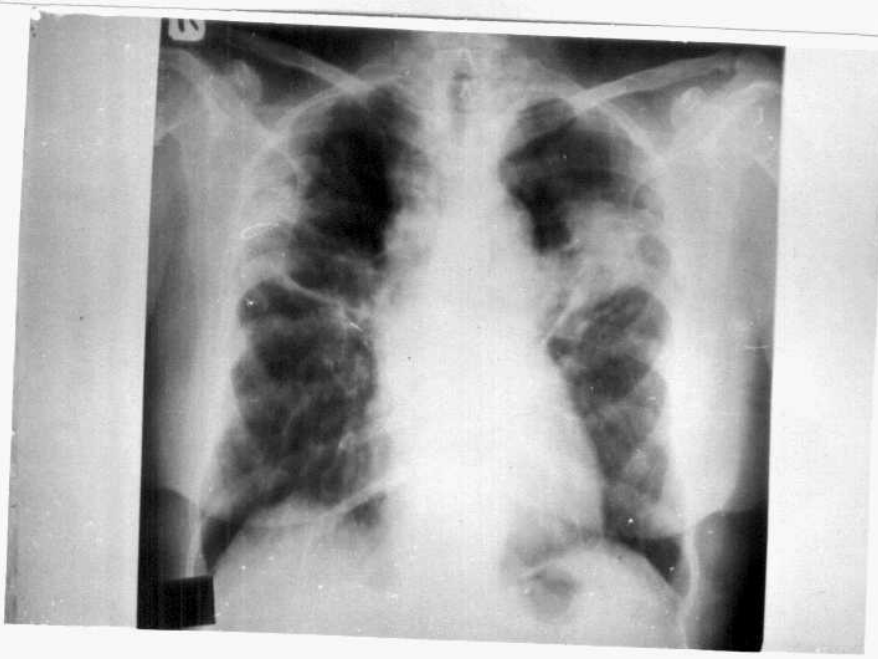


Fig 1 a

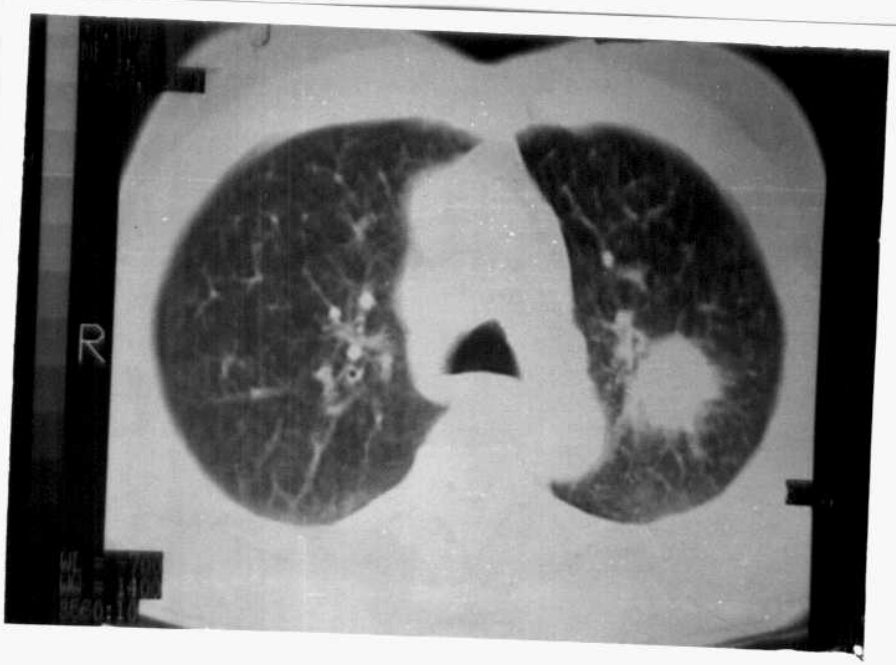


Fig 2 a

CASE 5

Male patient 39 years old complaining of productive cough , night sweating , and fever.

X-ray findings. Fig 1: a

There is fibronodular infiltrations found in the supra and infra clavicular region of the left lung

CT findings. Fig. 2: a, b

There is left apical fibrostrandy opacities are seen involving primarily the apicoposterior segment of the left upper lobe small dense calcific foci are noted among . few small gas lucencies are noted subpleuraly likely representing emphysematous blebs. A case of pulmonary TB

Fig 1 a

Fig 2 a

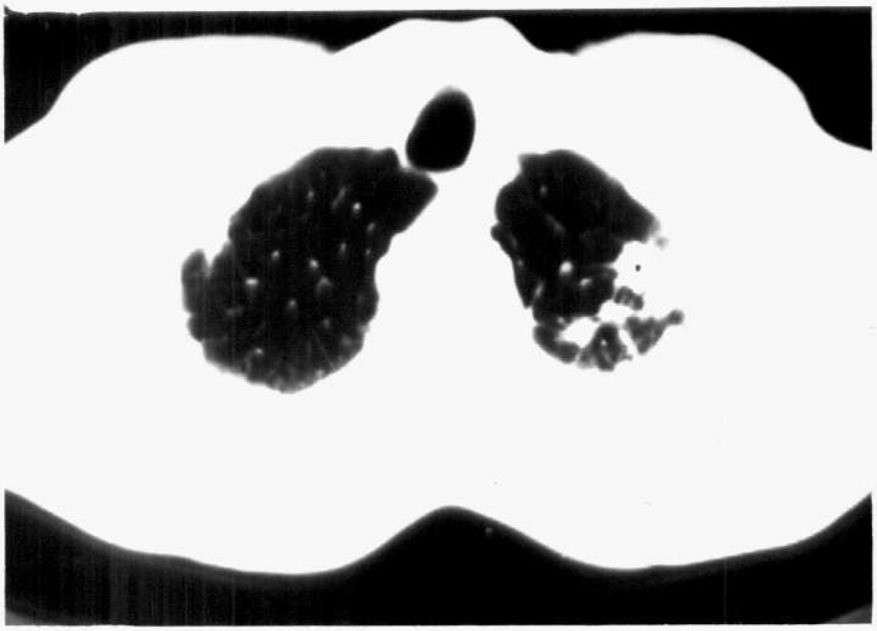


Fig 2 b

CASE 6

Male patient 30 years old with no symptoms only chest pain

X-ray findings. Fig 1: a

No lesions were found

CT findings: Fig 2: a

well defined small rounded opacity found in the left upper lobe for differential diagnosis: a granuloma, bronchial adenoma, metastases

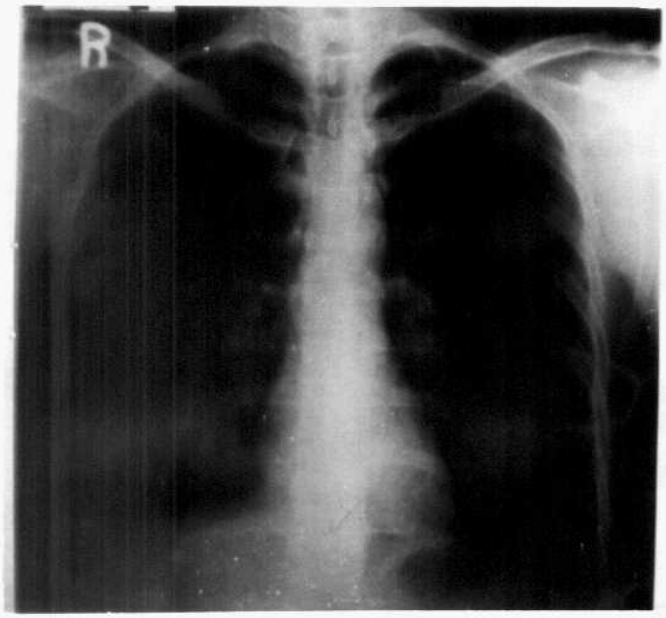


Fig 1 a

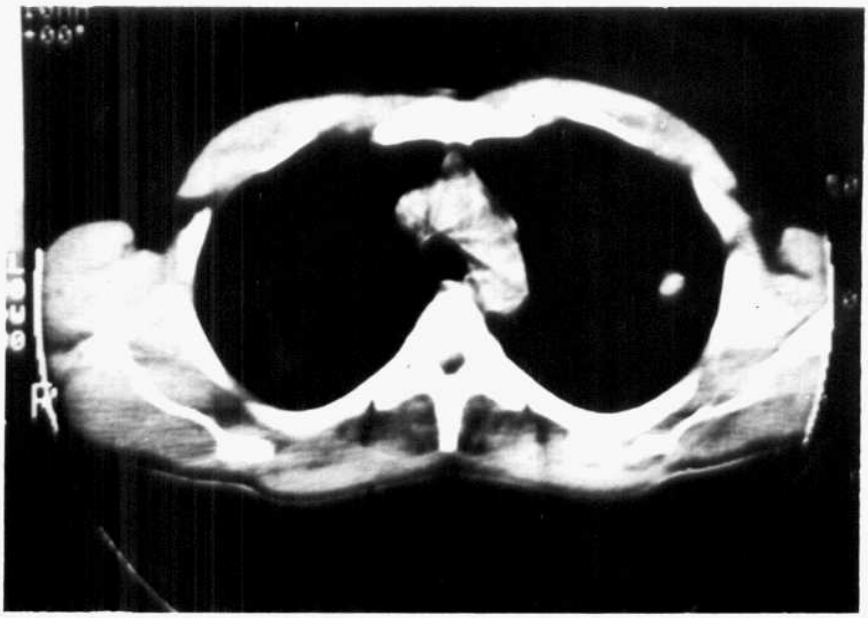


Fig 2 a

CASE 7

Male patient 65 years old complaining of cough ,hemoptysis ,dyspnea and chest pain.

X-ray findings. Fig 1: a

A rather large homogenous apical mass lesion is found in the left lung.

CT findings. Fig 2: a

A large fairly homogeneous mass in the left upper lung zone . It is extending up to reach and fill the apex of the lung . The mass is causing erosion of the head and neck of the left first rib together with the adjacent D1 transverse process The left pedicel and the left side of the vertebral body is also likely eroded exposing the left side of the neural canal. a case of pancoast tumour

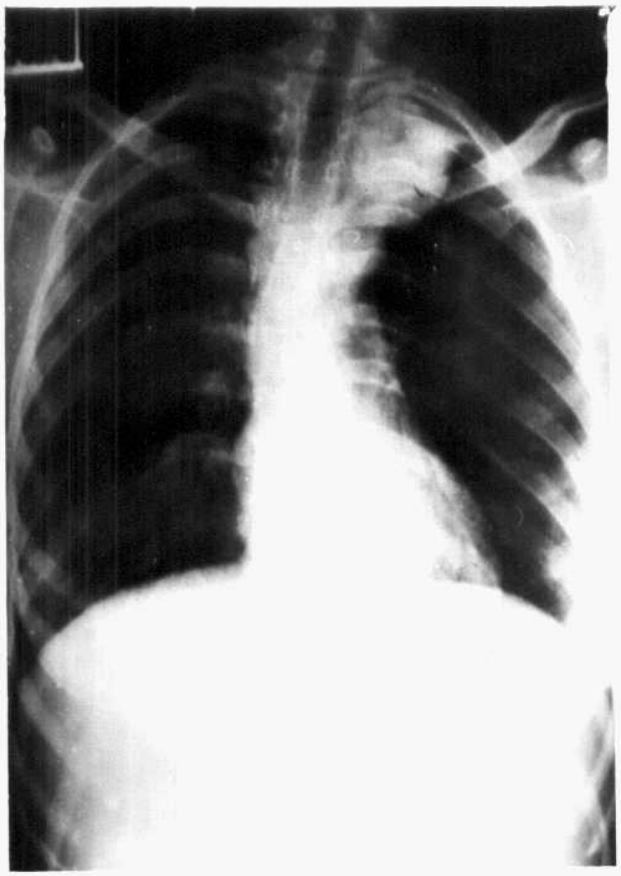


Fig 1 a

Fig 2 a

CASE 8

Female patient complaining of cough, tachycardia, dyspnea and fever

X-ray findings. Fig 1: a

X-ray showing an area of consolidation occupying the right lower lung zone

CT findings. Fig 1: a

CT showing a rather homogenous area of consolidation which is adherent to the pleura with prominent air bronchogram

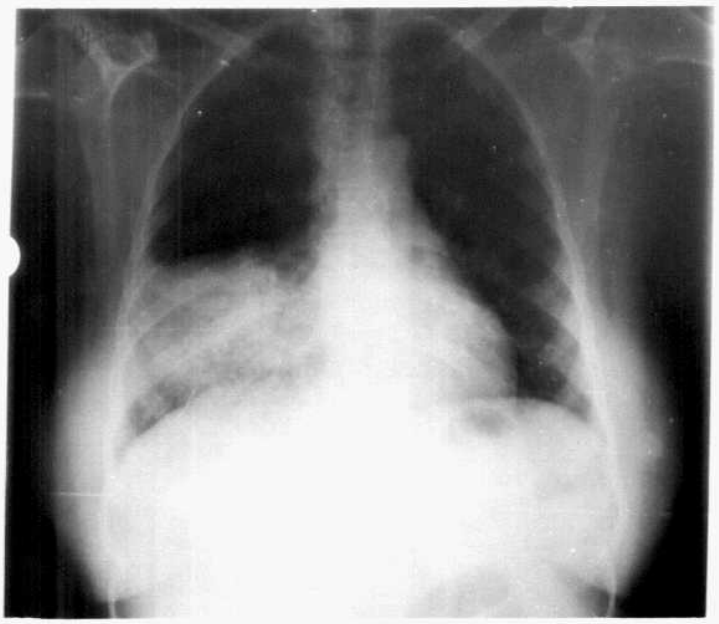


Fig 1 a

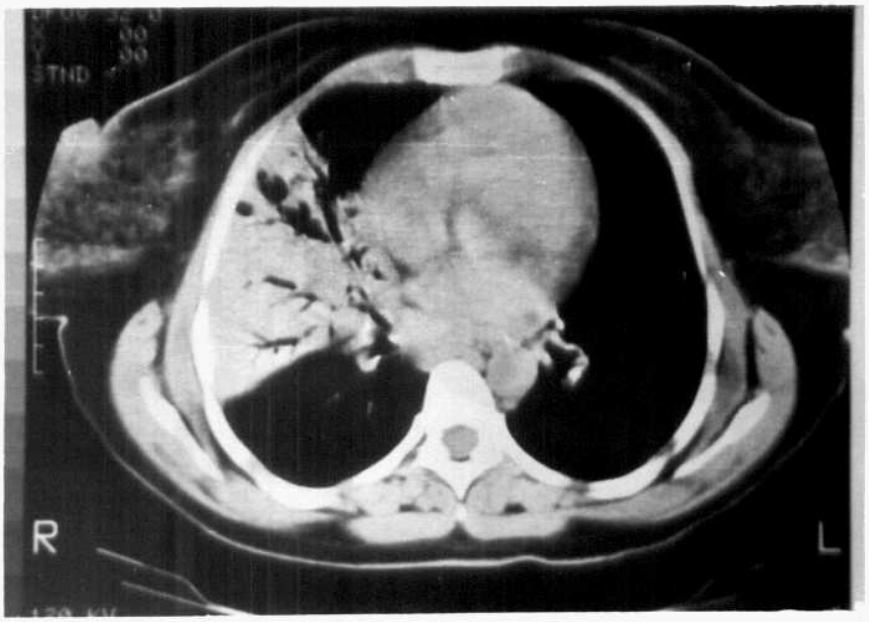


Fig 2 a

CASE 9

Male patient 36 years old complaining of chest pain, cough and bulging of the chest wall.

X-ray findings. Fig 1:a

There is a well-defined Rounded homogenous lung opacity in the upper lung zone

CT findings. Fig 1: a,

There is an homogenous rounded well defined mass which is in the anterior segment of the right lung lobe this mass is adherent to the pleura and chest wall with a focal bulge in the chest wall contour with destruction of the adjacent ribs. Most probably a chest wall tumour

Biopsy ?

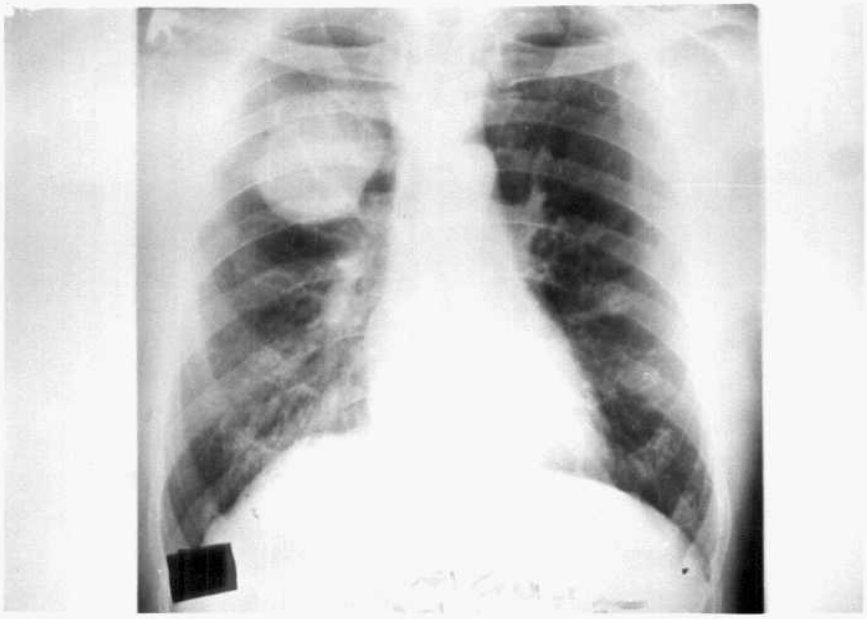


Fig 1 a

Fig 2 a

CASE 10

Male patient 35y complaining of fever and cough

X-ray findings. Fig 1: a

X-ray shows a well-defined homogenous oval lesion in the right middle lung zone

CT findings. Fig 2: a

CT shows a well-defined hypodens lesion of non-measurable wall, the content is of high fluid density. The lesion proved to be hydatid cyst following the operation

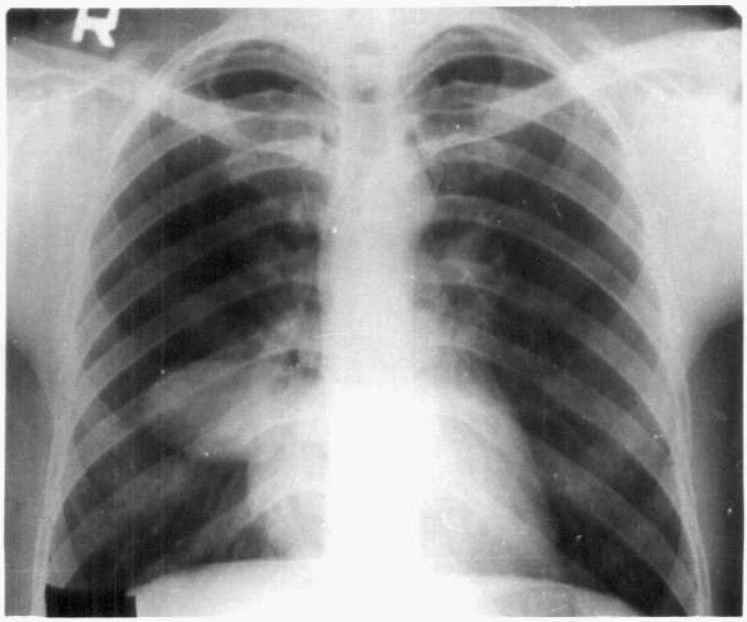


Fig 1 a

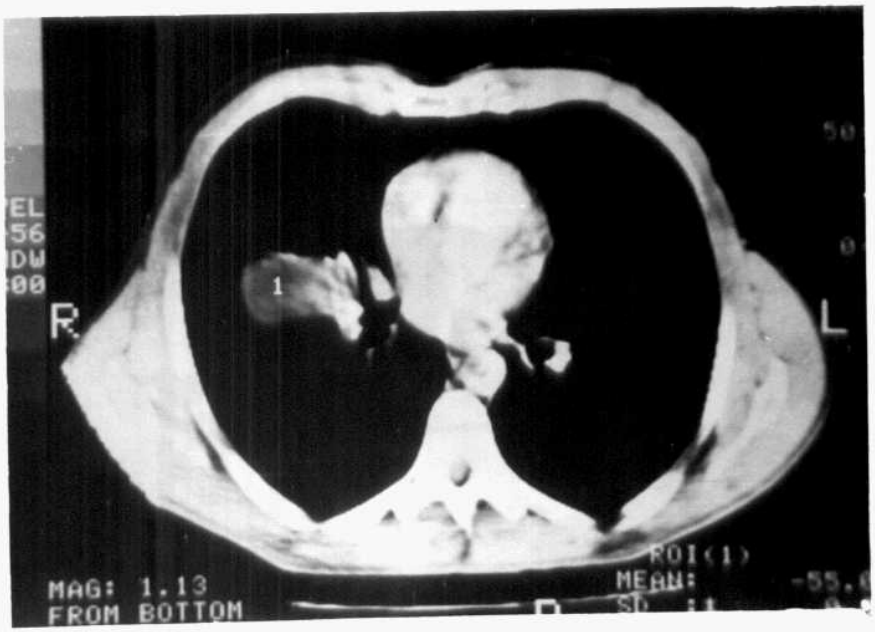


Fig 2 a

CASE 11

Male patient 35 y complaining of fever and cough

X-ray findings. Fig 1: a

X-ray shows a rather large right apical homogenous opacity of a well-defined out line and another opacity is found below it with obliteration of the costophrenic angle

CT findings. Fig 2: a

CT shows the lesion to be of cystic nature with fluid content and a thick enhanced wall indicating a case of empyema

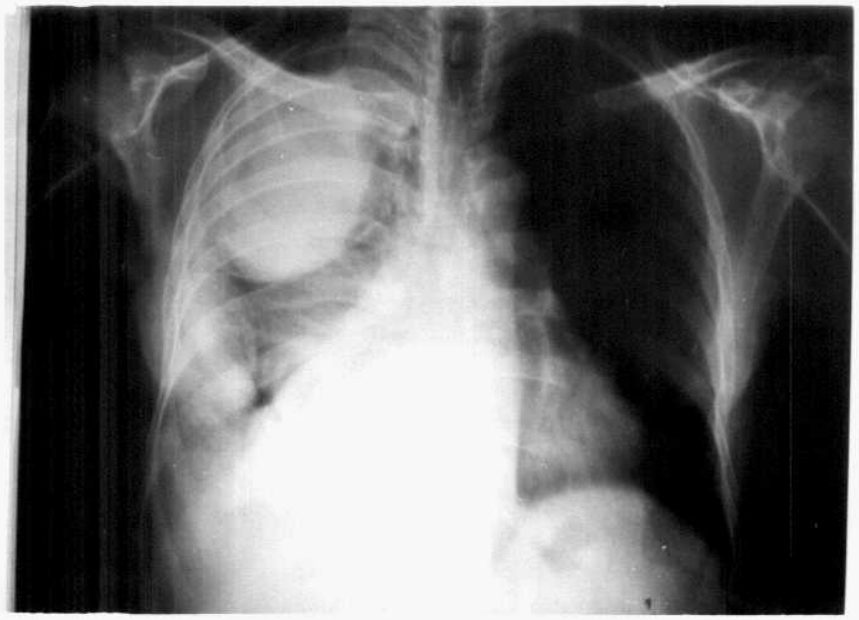


Fig 1 a

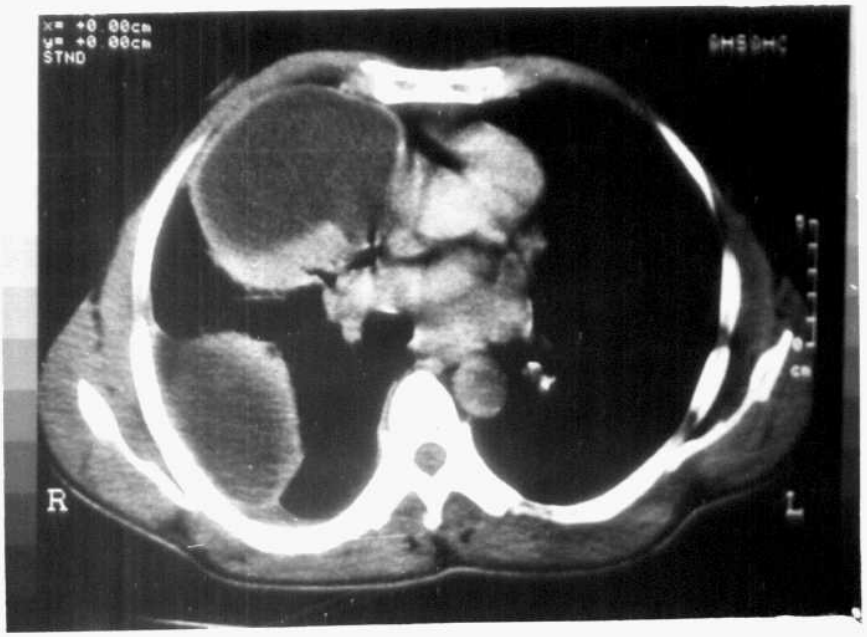


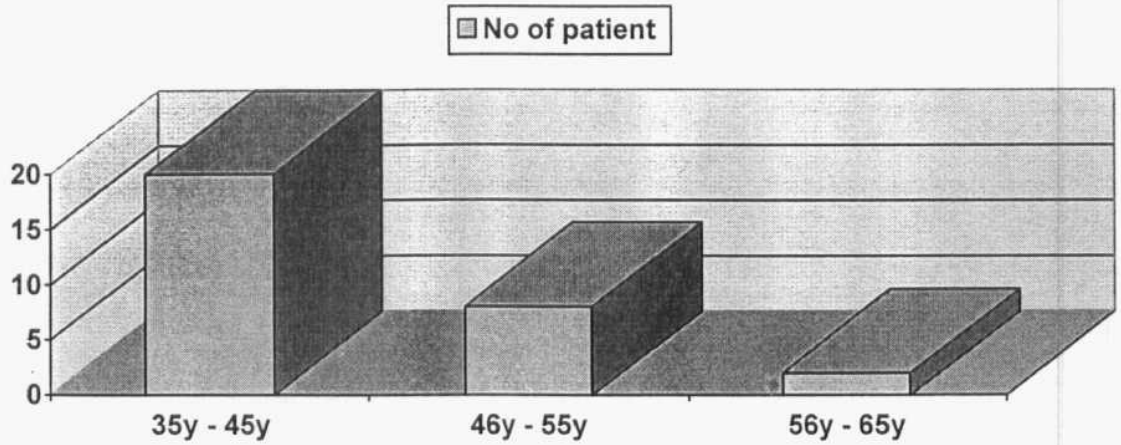
Fig 2 a

CT is considered a non invasive procedure which plays an important role in diagnosing the nature of the lesion , stage the extent of some diseases and localize accurately the position of the lesion from all that we find that CT is of great importance but still X- ray radiography remains the initial imaging study, In our study all cases of metastases where diagnosed by both X –ray and CT but CT showed us more nodules than X-ray .

in case of bronchogenic carcinoma 3 cases where diagnosed by both X-ray and CT the other 2 were benign versus malignant and were diagnosed after needle biopsy , In one case, which is most likely a chest wall tumour CT showed us a focal bulge in the chest wall contour with destruction of the adjacent ribs this was not clearly found by X-ray film , in case of hydatid cyst one case was diagnosed by both X-ray and CT and another case was only diagnosed following surgery as CT did not give us a sure diagnosis , in case of abscess all cases were diagnosed by both X-ray and CT but CT gave us a clear idea about the cavity and the thickness of it's wall and is it smooth or irregular, in case of pancoast tumor two cases were diagnosed by CT as it was better than X-ray in showing us the nature of the opacity and the destructive effect of the tumor in the form of rib destruction . In case of empyema CT give us an idea about the cystic nature and the exact position of the opacity and in case of TB all cases were diagnosed by

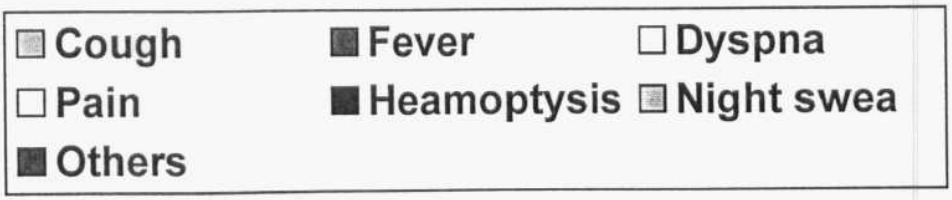
both X-ray and CT but CT gave us more idea about the fibronodular infiltration and its distribution

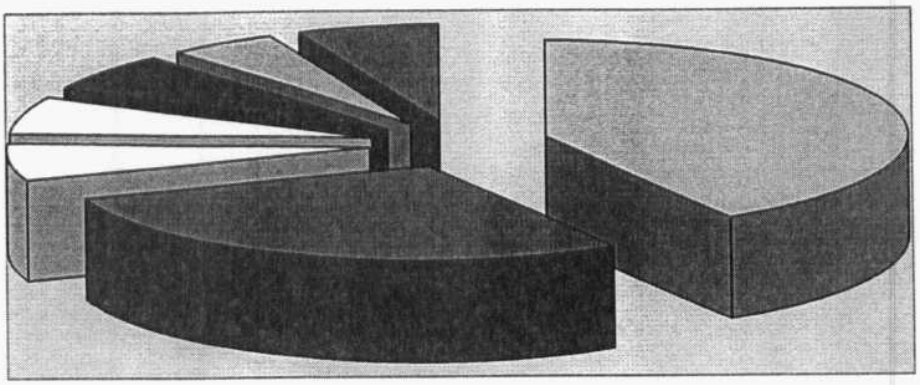
The following are charts for the age group and symptoms and signs of the patients and a chart showing the number of cases diagnosed by CT and X-ray and number of cases diagnosed by CT alone and number of cases required needle biopsy to reach the correct diagnosis this is followed by a table showing the results of X-ray and CT findings.



Age Group	35y – 45y	46y – 55y	56y – 65y
Number of patient	20	8	2

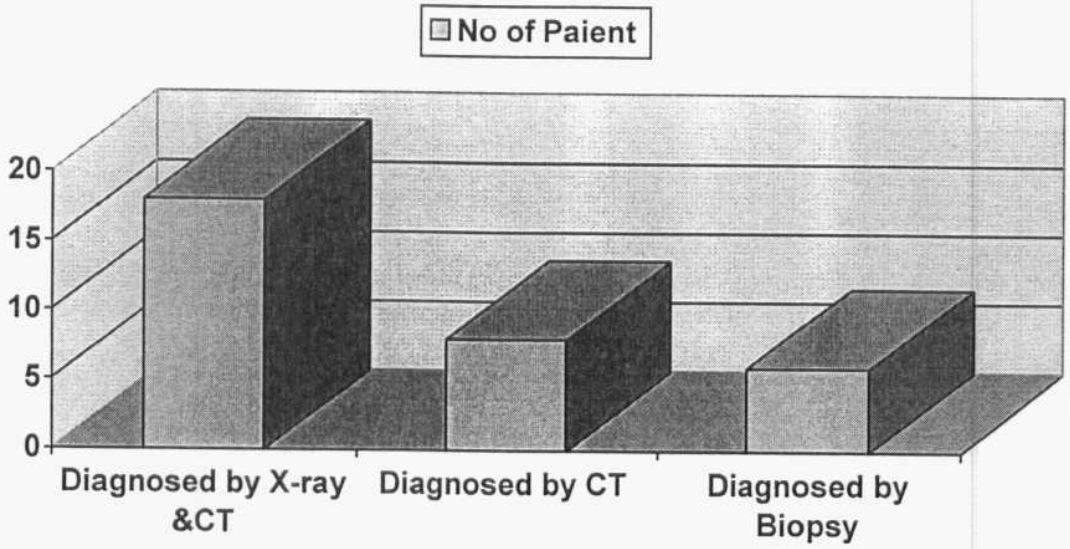
Chart showing the age group of the patients whom X-ray and CT were performed for them





Sympt& signs	Cough	Fever	Dyspnea	Pain	hemoptysis	Night sweat	Others
No of Patient	26	18	4	6	4	3	4

Chart showing the symptoms and signs of the patient



Diagnosis	*Diagnosed by X-ray & CT*	*Diagnosed by CT*	*Diagnosed by Biopsy*
No of Patient	16	8	6

Chart showing the diagnosis made by both X-ray & CT and Diagnosis made only by CT and Diagnosis made only after Biopsy

	X-ray Findings	CT Findings
1	There is a well-defined coin shadow seen in the middle lung zone.	A well defined rounded homogenous shadow is seen in the posterior segment of the right upper lobe
2	There is nodular, fibrotic infiltration mainly in the middle and lower right lung zone with a cavity seen in the peripheral part of right middle lung zone	The right lung is the seat of extensive fibrotic, nodular infiltrations .A 25x20mm cavity seen in the apical basal segment of the right lung showing smooth regular interior and thick wall. bands of infeltrations are seen connecting between the cavity and the right hilum .
3	A large rounded well defined cyst is seen in right middle lung zone	Atypical finding of hydatid cyst is seen in the apical segment of the right lower lobe measuring (74x70x68mm) with ruptured pattern and detached endocyst and consequent shallow undulating fluid level (water-lily sign).

4	A large irregular homogenous rather ill-defined mass is seen in the upper left lung zone with enlarged hilar region	A large (50x32x31mm) irregular homogeneous rather ill-defined speculated soft tissue mass lesion is seen in the apico-posterior segment of left upper lobe. Associated with hilar lymphadenopathy .
5	There is fibronodular infiltrations found in the supra and infra clavicular region of the left lung	There is left apical fibrostrandy opacities are seen involving primarily the apicoposterior segment of the left upper lobe small dense calcific foci are noted among . few small gas lucencies are noted subpleuraly likely representing emphysematous blebs.
6	No lesions were found	well defined small rounded opacity found in the left upper lobe for differential diagnosis: a granuloma, hamartoma, bronchial adenoma, metastases.
7	A rather large homogenous apical mass lesion is found in the left	A large fairly homogeneous mass in the left upper lung zone . It is extending up to reach and fill the

	lung.	apex of the lung . The mass is causing erosion of the head and neck of the left first rib together with the adjacent D1 transverse process The left pedicel and the left side of the vertebral body is also likely eroded exposing the left side of the neural canal.
8	X-ray showing an area of consolidation occupying the right lower lung zone	CT showing a rather homogenous area of consolidation which is adherent to the pleura with prominent air bronchogram
9	There is a well-defined Rounded homogenous lung opacity in the upper lung zone	There is an homogenous rounded well defined mass which is in the anterior segment of the right lung lobe this mass is adherent to the pleura and chest wall with a focal bulge in the chest wall contour with destruction of the adjacent ribs.

10	X-ray shows a well-defined homogenous oval lesion in the right middle lung zone	CT shows a well-defined hypodens lesion of non-measurable wall, the content is of high fluid density.
11	X-ray shows a rather large right apical homogenous opacity of a well-defined out line and another opacity is found below it with obliteration of the costophrenic angle	CT shows the lesion to be of cystic nature with fluid content and a thick enhanced wall .
12	there is right upper zonal lung opacity with no bone destruction , normal cardiac shadow and normal costophrenic angles.	There is a rounded homogenous well defined opacity in the right upper zone of the lung which is adherent to the pleura in some areas.
13	x-ray shows an area of consolidation in the middle lung zone	CT shows a rather homogenous opacity with an air bornchogram in the middle lung zone
14	X- ray shows multiple small rounded nodules	CT shows multiple small rounded nodules found scattered all over the lung, and the majority are at the

		peripheral lung region
15	There is a left apical lung opacity with destruction of the 2nd rib normal cardiac shadow and normal costophrenic angle	There is an apical soft tissue mass occupying the apical area of the left lung with displacement of the trachea and the oesophagous with destruction of the vertebral bodies and the upper 2 and 3 ribs
16	A large lobulated rather heterogenous opacity is seen in the right mid and lower lung Zones marging with the right mediastinal contour Rt. mild pleural effusion is seen with underlying partial collapse of the Rt. lung few nodular opacities are seen scattered in the left mid lung zones and right lower lung zones. suggesting pulmonary metastatic deposits Enlarged golublar cardiac shadow suggesting	A large (10.5x9cm) lobulated heterogeneous mass lesion is seen in the mid and lower lung zones and seen in continuity with a similar lesion encircling the major vessels and cardiac chambers. Pericardial effusion with irregular pericardial wall thickening are seen. No significant contrast enhancement. Multiple nodular infilterations of both lungs are seen suggesting pulmonary deposits. right pleural effusion and interlobar effusion are seen and marked widening of the carina is seen.

	pericardial effusion.	
17	X-ray shows multiple small areas of opacity mainly in the right lung	CT shows multiple small nodules all over the lung with slight hilar lymphnode enlargment
18	X-ray shows a rather rounded cavity found in the left upper lung zone	CT shows a cavity in the anterior segment of the left upper lobe with a thick and smooth wall
19	There is a rounded opacity in the left lower lung zone	CT shows a rather rounded opacity with calcification in the posterior segment of the left lower lobe most probably a bengin lesion
20	X-ray shows an area of consolidation in the left lower lung zone with small abscess found within the lesion	CT shows an homogenous area of consolidation and a small thick walled cavity which is rather smooth and found within the lesion
21	X-ray shows a spherical shadow in the apical area of the left lung with air fluid level	CT shows a cavity found in the apical area of the left lung with a rather smooth wall with air fluid level .

22	X-ray shows a cavity in the lower lung zone with an irregular and thick wall	CT shows a cavity with a thick irregular wall and slight enlargement of the hilar lymphnode
23	a large rounded opacity is seen in the apical segment of the right upper lobe .	A (80x74x54mm) large rounded rather well defined homogenous sub-pleural mass lesion is seen in the apical segment of the right upper lobe and extending downward and medially to just above the level of tracheal bifurcation with whiskery outercontour and peripheral corona radiata. No detected adjacent bony rib erosive changes . No associated hilar or mediastinal lymphadenopathy.
24	X-ray shows an area of homogenous opacity in the right lower lung zone with minimal pleural	CT shows the opacity to be cystic in nature with fluid content indicating a case of empyma

	effusion	
25	A large rounded well defined homogenous mass is seen in the right lower lobe	A (62x61x55mm) large rounded well defined rather homogenous isodense mass is seen in the apical segment of the right lower lobe with large irregular area of eccentric cavitation . No associated hilar or mediastinal lymphadenopathy.
26	There is multiple small areas of consolidation with fibronodular infiltration in the upper lung zone	There is multiple small areas of fibronodular infiltration mainly in the right upper lung zone with multiple small areas of consolidation with slight hilar lymph node enlargement
27	X-ray shows wide spread ill defined consolidation mainly in the left lower lung zone	CT shows multiple areas of consolidation in the left lower lung lobe
28	A rounded homogenous shadow is found in the right lower lung zone	There is a well defined rounded shadow with no calcification found in the posterior segment of thr right lower lobe, there is no other

		abnormalities in the lung.
29	There is fibronodular infiltration in the apical lung zone with normal cardiac shadow and normal costophrenic angles	There is multiple fibronodular infiltration in both lung fields and at the peripheral areas of the lung. With minimal pleural effusion.
30	There is right upper zonal lung opacity with no bone destruction , normal cardiac shadow and normal costophrenic angles.	There is a rounded homogenous well defined opacity in anterior segment of the upper lung lobe which is adherent to the pleura in some areas

Although the chest radiography remains the initial imaging study in patients with intrathoracic pathology computed tomography has become useful in the early detection and evaluation of all lung aspects.(Indira Mootosmy., 1993)

CT is a non invasive procedure that has high contrast resolution it provides valuable diagnostic information in a number of disease and clinical situation
(Philippe Gremiea, et al., 1993)

In our study we compared x-ray films with CT films in various types of peripheral lung shadows .

In conventional chest radiology a false-negative rate for detection of pulmonary nodules as high as 18-32% has been reported in part this may be due to obscuration by overlying bone and soft tissue structure (Frederick Kelcz. et al., 1994) This could be shown in case 6 in the plain chest x-ray no lesion could be shown but on CT a small well defined opacity in the left upper lung lobe was detected.

Peripheral lung cancer was detected in 15 of 3.457 examination (0.3) of normal people among the 15 cases the results of chest radiography were negative in 11(73%) . (Masahira Kaneko, et al., 1996)

Differentiation of benign from malignant solitary pulmonary nodule is an important task for a radiologist. (Arfa Khan, et al., 1991) A nodule is assumed to be benign if it shows no changes in size and appearance on serial chest x-ray over 2 years in the absence of previous chest x-ray the presence of a benign pattern of calcification in the nodule is valuable . (Indire Mootoosamy, Rodney H Reznek, 1993) CT has been shown to be an effective means of detecting calcification and fat in peripheral lung nodules . (Keiko Kuriyama, et al., 1991) In our study serial chest x-ray over 2 years were not obtained but case 19 X-ray showed a rounded opacity in the left lower lung zone ,but CT showed calcification in the opacity , so it is assumed to be bengin

from this we find that CT is of great value in detecting calcification and confirming that the calcification is with in the lesion not just projecting over it , uniform calcification is difficult to recognize on plain chest radiography . with CT however uniform calcification can be diagnosed and in such cases carcinoma of the lung can be excluded from differential diagnosis. (Peter armstrong, Martin L wastie, 1992)

Computed tomography scanning provides a much clearer idea of the position , shape and size of any mass than it is possible from the plain

chest radiograph ,(Peter armstrong, Martin L wastie, 1992) and it is also superior to conventional radiographic techniques for the demonstration of direct extention of the primary neoplasm in to the mediastinum or chest wall (Mc cloud et al., 1979)

In case 7 a pancoast tumor is shown, in this case the CT shows us the invasion of the tumor to the adjacent ribs and vertebral bodies which were not clearly found on the plain x-ray

Pulmonary malignancies often appear irregular and spiculated on CT, and this appearance strongly suggests malignancies .(Kuriyama K, et al., 1987) and this could be shown in our study in case 4 in which x-ray showed A large irregular homogenous rather ill-defined mass . CT showed A large irregular homogenous rather ill-defined speculated soft tissue mass lesion is seen in the apico-posterior segment of left upper lobe with. hilar lymphadenopathy. we could see that CT gave us more information about the lesion but we could not ignore that this tumor could be diagnosed through the x-ray film. In our study three cases of bronchogenic carcinoma where diagnosed by both X-ray and CT , the other two were bengin versus malignant and were diagnosed after needle biopsy.

Bronchogenic carcinoma has a variety of radiological manifestation ranging from a solid , cavitating nodule or mass, peripheral or central in location.(Ella A. Kazerooni, et al., 1994), notch (lobulation) and spiculation were seen in 83% of small peripheral lung cancer. (Keiko Kuriyama, et al., 1987) Ella A. Kazerooni found that fifty- three percent of all the tumors were peripheral masses , four of the 29 tumors seen on imaging had undergone cavitation(Ella A. Kazerooni, et al., 1994)

In our study all tumors selected were peripheral in location and 1 of them showed cavitation this is in case 25 the cavity had a thick irregular wall
In case 3 a large rounded cavity with a rather smooth and thin wall is shown this a typical finding of hydatid cyst in this case CT did not add any more information except for the water lily sign
In case 2 A cavity is seen in the peripheral part of right middle zone showing smooth regular interior and thick wall with extensive fibronodular infiltration indicating extensive right pulmonary TB with middle zone cavity , in this case CT showed us the fibronodular infiltration more clearly.

Cavitation is very common in chronic pulmonary tuberculosis and is one of the hallmarks of the disease it is usually indicates active disease and a

cavity is frequently the source of tuberculosis bacilli (Graninger and Allison.1992)

Lillington, jamplies 1973 stated that cavitation is a characteristic of pulmonary tuberculosis , resulting from evacuation of necrotic material in to a bronchus , cavities may be single or multiple often of different sizes , the wall of the cavity is usually 2-5mm in thickness and contour may be smooth or irregular . Characteristically, the surrounding lung tissue shows radiological evidence of granulomatous consolidation , fibrosis and areas of calcification (Libington, Jamplies , 1987)

Computed tomography is clearly more sensitive than chest radiography in the detection of pulmonary metastases .They are generally bilateral and peripheral within the subpleural regions and outer third of the lung .(Sheila D. Davis, 1991)

In the radiologic-pathologic study of schoten and kreel 92% of countable metastases were peripheral.(Scholten Et, Kreell 1977) and Crow showed that 82% of metastases were peripheral (Crow j, et al., 1981)

This could be shown in case 14 in which multiple nodules are shown in both lung fields and the majority are at the peripheral lung region

It is well known that CT frequently demonstrates occult abnormalities where chest radiograph is negative or reveals multiple or bilateral nodules when conventional studies suggest only solitary or unilateral lesions

Lesions in the apices or posterior sulci against the heart or mediastinum and in the sub pleural regions are well visualized at CT but they may be obscured in conventional studies ,even when they are relatively large. (Schaner EG, et al., 1978)

Other great sensitivity of CT is attributable mainly to the lack of superimposition of intrathoracic structures and the high contrast resolution between soft tissue attenuation nodules and air containing lung .(Sheila D. Davis 1991)

This could be shown in case 16 , x-ray showed few nodules mainly due to the presence of a huge shadow in the right mid and lower lung zone which made the nodules not well visualized but on CT multiple nodules were clearly seen in both lung fields suggesting pulmonary deposits , this was a case of pericardial neoplasm

The differential diagnosis of various kinds of pulmonary nodules is difficult because of the gross appearance of pulmonary lesions is not specific.(Heritzman ER. 1984) Also differentiation between metastases and benign lesion remains a difficult task. (Sherila D . Davis 1991)

In case 28 we could not confirm if the lesion is benign or malignant

As diagnosis of lesion may still remain obscured after routine clinical and radiographic examination but can only be established when adequate histological examination of tissue section has been carried out. (Paul and Clark, 1987)

In cases of small peripheral lung cancer histopathologic confirmation by transbronchial brushing or percutaneous needle biopsy is often difficult because of the small size poor contrast relation to surrounding normal lung.(Keiko Kuriyama, etal., 1987)

So despite improved techniques to evaluate pulmonary nodules , such as bronchoscopy and percutaneous needle biopsy , there remain a significant number of cases is which surgical resection is necessary before carcinoma can be differentiated from benign lesions.(Keiko Kuriyama, etal., 1987)

CONCLUSION

CT is a non invasive procedure that has high contrast resolution ,it provides valuable diagnostic information in a number of disease and clinical situation , it can accurately localize abnormalities and give the precise shape and position and size of a lesion , it can also differentiate between solid, cystic, vascular or fatty lesion all this will narrow the differential diagnosis, inspite of all these advantages some lesions may still be obscured and the need for percutaneous needle biopsy is essential to give a proper diagnosis although there is a significant number of cases in which surgical resection is necessary before the lesion can be diagnosed especially between benign and malignant lesion, from all that we could say that not one procedure can give alone the correct diagnosis because every procedure has its weakness so they all complete each other in order to reach a correct diagnosis . chest radiography remains the initial imaging study as it is cheap and found in every place But should be carried out under standard conditions as it has many pitfalls, this is followed by CT when recommended. As it is expansive and could not be routinely done for every patient .

1- A.J Harding Rains and H.David Ritchie:
Baily and love's short practice of surgery Nineteenth edition . English language book society H.K.Lewis , 1986.

2- Anderson, J.R.:
Muri's Textbook of pathology, Tenth edition. The English Language
Book Society and Edward Arroid (Publishers) Ltd., London, 1977.

3- Anderson,W.A.D:
pathology. St. louts, C.V. mosby co., 1977.

4- Arfa K.; Peter G. H.; Patrice V.; Paul S.; Kathy A. R.; and Michael G.:
Solitary pulmonary nodules: comparison of classification with standard , thin - section, and reference phantom CT . Radiology, 179:477, 1991.

5- Brash, J.C,:
Cunningham's manual of practical anatomy , Eleventh ed. The English language book society and oxford university press, 1963.

6- Crow, J,; Slavin, G.; and Kreel, L.:
Pulmonary metastasis : A pathologic and radiologic study .
Cancer, 47: 2595-2602 ,1981.

7- Davidsons:
The principles of practice of medicine ,thirteen edition . Livingstone, 1981.

8- Ella, A. Kazerooni, Meenakshibhalla,Jo-Anne O.S.; and Theresac M.:
Adenosquamous carcinoma of the lung : Radiologic appearance.
AJR, 163: 304, 1994.

9- Francis A. B.; and Martti K.:
Differential Diagnosis in Computed Tomography , 1993.

10- Frank, slaby.; and Eugene, R. Jacobs :
Radiographic anatomy.
Notational Medical Series from william and wilkins boltimore, Hong kong , London, Sydney. 1990.

11- Fraser, R.G.; and Pare, J.A.P.:
The diagnosis of diseases of the chest , 2nd edition. sanuders Co. Philadelphia. 1978.

12- Frederick K.; Frank E.Z.; Walterw. Peppler,David G.; Kruger, Davis L.E.; and Charles A. M.:
Conventional chest Radiography vs Dual -energy computed radiography in the detection and characterization of pulmonary nodules. AJR, 162: 271-271, 1994

13- G. A. Bell.; D.B.L. Finlay:
Basic Radiographic Positioning and anatomy . English Language book society, 1986

14- Glazer,Gray M.; Gross, Barry H.; Quint, Lesile E.; Francis, Isaac R.; Boolsterin, Fred L.; and Orringer, mark B.:
Normal Mediastinal lymph nodes : Number and size according to American Thoracic Society Mapping . AJR, 144:261-265,1985.

15- Goralink, Cynthia H.; O'Connell, Debbie M.; El Yousef, Saba.; and Haaga, John R.:
CT – Guided cutting-Needle Biopsies of Selected chest lesions . AJR, 151:903-907,1988.

16- Grainger , R.G.; and D.J.Allison.:
Diagnostic radiology 2nd edition. 1992

17- Godwin, J.:
Computed tomography of the chest . J.B. Lippincott company, 1984.

18- Grech,p.; and Clark, R.A.:
Clin Radiol, 29:113 ,1987.

19- Haaga, John R.; and Alfidi, Ralphy J.:
Computed tomography of the whole body, 2nd edition . The C.V. Mosby Company . st.Louis Washington, D.C ., and Toronto, 1988.

20- Hamdy, R. H.:
Indication of computed tomography of the thorax M.D. thesis, Faculty of medicine -Cairo university , 1983

21- Heitzman ER.
Pulmonary Neoplasm : Radiologic -Pathologic correlation of lung-tumor interface in the lung .
Radiologic -pathologic correlation . st.louis: Mosby, 353-384.1984

22- Indira, M.; and Rodney, H.R.:
Computed tomography scanning of the thorax. Brithish Journal of hospital medicine . vol 50.No 2/3, 1993.

23- Keiko K.; Ryuhei T.; Samau Doi,Ken K.; Masayuki T.; Minoru M.; Takashi M.; Yoshifumi N.; and Makoto F.:
CT-Pathological correlation in small peripheral lung cancers AJR,149: 1143,1987.

24- Keiko K.; Ryuhei T.; Samau Doi,Ken K.; Masayuki T.; Minoru M.; Takashi M.; Yoshifumi N.; and Makoto F.:
Prevalence of air bronchogram in small peripheral carcinomas of the lung on thin-section CT: comparison with benign tumor. AJR, 156:921-924, may 1991.

25- Kissane, Jhonm:
Anderson's Pathology, Ninth edition. The C.V. Mosby company . St. louis, Batimore, and philadelphia, 1990.

26- Kormana, M.; and Dean, P.B.:
Extra vascular contrast media : The major component of contrast enhancement. Radiology , 121: 379-382,1976.

27- Kuriyamak,and Tateishi R. Doi :
CT- pathologic correlation in small peripheral lung cancers . Radiology, 163:57-510 ,1987.

28- Last , R.:
Anatomy of regional and applied . 6th edition, churchil livingstone , Edingurgh, 1987.

29- lillington , GA.; and Jamplies: 1987
Chest eliseal, Oxford, london, 220-239 1965

30- Lillington, G. A.:A Diagnostic approach to chest disease: Differential diagnosis based on Roentgenographic patterns, Third Ed. Wilims and wilkins, Baltimore, Hong Kong. London , and sydney,1987.

31- Masahira K.; Kenji E.; Hironobu O.; Ryutare K.; Tuguo N.; Keiichi S.; and Noriyuki M.:
Peripheral lung cancer: screening and detection with bow-dose spiral CT versus radiography. Radiology, 201:798-799, 1996.

32- Meschan, Isadora:
An atlas of anatomy Basic to Radiology . W.B. Saunders company. Philadelphia , London, and Toronto, 1987.

33- Mccloud, T.C.; Wittenberg J.; and Ferrucci, J.T.:
Computed Tomography of the thorax and standard radiographic evaluation of the chest: A comparative study. Journal of computer Assisted Tomography, 3: 170-180,1979.

34- Moss, Albert A.; Gamsu, G.; and Genant, Harry K.:
Computed Tomography of the body. W.B. Saunders company. Philadelphia, and London, 1983.

35- Nakata, H.; Kimoto, T.; Nakyama ,T.; Kido, M.; Miyazaki, N.; and Harada, S.:
Diffuse peripheral lung disease: evaluation by high resolution computed tomography. Radiology , 157: 181-185, 1985.

36- Naidich, D.P.; Stitik, F. P.; Khouri, N.F.; Terry, P.B.; and Siegelman, S.S.

Computed Tomography of the bronchi. Journal of computer Assisted tomography, 4:754-762, 1980.

37- Naidich, David P.; Zerhouni, Elias A., Siegelman, Stanley S.,: Computed tomography of the thorax. Raven Press. New York, 1984.

38- Pansky, B.:
Review of gross anatomy , 5Th . Ed., Mcmillan publishing company, Newyork, 1984.

39- Peter A; and Martin L.W.:
Diagnostic Imaging , third edition, 1996.

40- Philippe G.; Marie-Pierre C.; and Catherine B.:
Journal of thoracic imaging, 8:21-229 (1993)
Pinstein. Martin L.; Scott, Randall L.; and Salazar, Jorge:
Avoidance of negative percutaneous lung biopsy using contrast-enhanced CT. AJR, 140:265-267, 1983.

41- Ralph J. et al., (1979)
Ralf L.S.; and Lee C.C.:
Atlas of normal and abnormal anatomy, 1980.

42- Sage, M.R.:
Blood brain barrier: Phenomenon of increasing importance to the imaging clinician. American Journal of radiology , 138: 887-898, 1982.

43- Schaner E.G.; Chang A.E.; Doppman L.G.; Conkle D.M.; Flye M.W.; Rosenberg A.S.:
Comparison of computed and conventional whole lung tomography in detecting pulmonary nodules: a prospective radiologic-pathologic study . AJR, 1311:51-54,1978.

44- Scholten ET, Kreell.
Distribution of lung metastases in the axial plane .
Radiol Clin , 46: 248-256 1977.

45- Sheila D. Davis:
CT evaluation for pulmonary Metastases in patients with extrathoracic

malignancy. Radiology , 180: 1-12,1991.

46- Sutton, D.:
Text book of radiological and imaging , 4th ed.
Churchill Livingstone, Edinburgh, London. 1987.

47- Swallow, R.A.; Naylor, E.; Roebuck, E.J.; and Whitley, A.S.:
Clarks positioning in Radiography. Eleventh Edition. William Heinemam Medical Book London, 1986.

48- Ten Broek, J,E,; and Fred, H. L.:
Bilateral pulmonary amebiasis. Am.Rev.Resp.Dis. 1967.

49- Thomas E.A,; Charles C.J.; Fred P.; and Lloyoh H.S.:
Cecil essentials of medicine. 1986. W.B. saunders company page 150., 614-616, 628

50- Warwick, R.; and Williams, P.L.:
Grays Anatomy . 35th Edition . W.B. saunders company, Philiadelphia, 1973.

51- W.Richard, William, E., and Clyde, A.;
Fundamentals of body CT, second edition, (1998)

Arabic Summary

بسم الله الرحمن الرحيم

ملخص عربى

فى هذة الدراسة تم مقارنة الأشعة المقطعيه بالحاسب الألى ضد الأشعة العاديه السينيه فى

تشخيص العتامه الرئويه الطرفيه

واشتملت الرساله على الأبواب الأتيه

الباب الأول: ويشتمل على المقدمه والهدف من الدراسه

الباب الثانى: ويشتمل على الوصف التشريحى والمقطعى للرئتين

الباب الثالث: ويشتمل على طرق فحص الرئتين باستخدام الأشعه المقطعيه والأشعه العاديه السينيه

البلب الرابع: ويشتمل على باثولوجيا بعض الأمراض التى تصيب الرئتين

الباب الخامس: ويشتمل على مظاهر الأشعه العاديه والأشعه المقطعيه للأمراض المختلفه ا التى تصيب الرئتين

الباب السادس: ويشتمل على المرضى وطرق الفحص حيث تمت هذه الدراسه على ٣٠ مريض ٢٢من الذكور و ٨ من الأناث وتتراوح اعمارهم بين ٣٥ و ٦٥ سنه ولقد تم اخذ التاريخ المرضى وعمل فحص اكلينيكى لكل مريض بالأضافة الى عمل الأشعه المقطعيه والأشعه العاديه السينيه

الباب السابع: ويشتمل على حالات توضيحيه مختاره

الباب الثامن: ويشتمل على نتائج البحث

الباب التاسع: ويشتمل على المناقشه والتعقيب

الباب العاشر: ويشتمل على المراجع

الباب الحادى عشر: ويشتمل على الملخص العربى

من هذه الدراسه وجد أن الأشعة المقطعية وسيله غير عدوانيه ذات دقة وضوح عاليه

خالد ٤٠١٤٤٢٧

حيث توفر لنا معلومات تشخيصيه هامه لعدد كبير من الأمراض، حبث تستطيع ان تحدد بدقه شكل وموقع وحجم الضرر وتستطيع ايضا ان تفرق بين الضرر ذو الصفه الصلبه او الصفه الدمويه او الصفه الدهنيه ويؤدى هذا الى تضيق التشخيص بالتفريق. وبالرغم من كل هذه الميزات فان بعض الضرر من الممكن ان يظل مبهما والأحتياج الى اخذ عينه من الضرر يصبح ضروره للوصول الى التشخيص السليم وبالرغم من كل هذا فان عدد من الحالات لا يتم نشخيصها الا بعد اجراء الجراحه وبالتالى نستطيع ان نقول بناء على ماسبق انه لا نوجد وسيله بمفردها تستطيع ان تشخص جميع الحالات بمفردها لان كل وسيله لها نقاط ضعف ونقاط قوه وبالتالى فان جميع الوسائل تكمل بعضها البعض وذلك للوصول الى التشخيص السليم. ومن هذا المنطلق فان الأشعة العاديه السينيه تظل هى الوسيله الاوليه فى التشخيص حيث انه رخيصه ومتوفره فى معظم الأماكن تتبعها الأشعة المقطعية بالحاسب الألى حيث اننا لانستطيع ان نستخدمها فى جميع الحالات بصوره روتينيه نظرا لتكلفتها العاليه .

الأشعة المقطعية بالحاسب الألى ضد الأشعة العاديه السينيه فى تشخيص العتامه الرئويه الطرفيه

بحث
توطئة للحصول على درجة الماجستير
فى الأشعه التشخيصيه

مقدم من

الطبيب/ خالد محمد على المرصفى

تحت اشراف

الدكتور: أحمد مصطفى عوف
أستاذ الأشعه التشخيصيه
كلية الطب
جامعة الأزهر

الدكتور:صلاح محمد كريم
أستاذ مساعد الأشعه التشخيصيه
كلية الطب
جامعة الأزهر