CT Chest

Indications:

- To assess equivocal plain x-ray findings
- Staging of lung neoplasm
- Merastatic workup of extra thoraces malignancies
- Diagnosis of diffuse lung diseases with HRCT
- Assessment of bronchietasis
- Assessment of suspected posttraumatic complications
- Diagnosis of mediastinal and chest wall lesions
- Diagnosis of suspected pulmmary embolism

Verification of an opacity seen on the straight chest X ray

- Patient preparation: Fasting 4-6 hours before examination [most of the patients are usually injected with contrast material for adequate delineation of the intrathoracic vascular structures]
  Water soluble contrast material (urographin,..) is injected IV
  before start the examination [1-2 ML /kgm body weight]
  NB: Contrast is not usually needed in these conditions:
  - Evaluation of bronchiectasis
  - Evaluation of diffuse pulmonary parenchymal disease
  - Searching for pul. parenchymal deposits
  - Some cases of trauma

- Patient's position: Supine

- Scanogram: Frontal [should include the lower neck and upper abdomen]

- Sections: 1cm sections from the lung apex to the level of the suprarenal glands in the upper abdomen.
  Mediastinal window and lung window for all images
  Bone window for sections showing lesions affecting bones
  [ribs, spine,..]

- **Scanning parameters**
  - Standard routine CT chest
  - High resolution CT [HRCT] using special scanning parameters and filters to get more detailed images of the lung paranchyma.. usually needed for assessment of diffuse paranchymal lung diseases and bronchiectasis
  - Helical CT= spiral CT = volumetric CT
    Allows scanning of the whole thorax in a single breath hold
    Advantages:
    - Rapid examination technique suitable for children and uncooperative patients
    - Ensures adequate vascular opacification with relatively smaller volume of contrast material injected
    - Avoid respiratory misregestration [missing small lesions because of respiratory movements]
  - **Mulridetector CT**
    Recently introduced scanners with multiple detectors instead of one detector in old scanners . These machines allow multiple sections per tube rotation . The number of slices increases with the increase in the number of detectors. The available machines now include from 2–640 detectors.
    Advantages:
    - o Very rapid scanning time
    - o Image reformation in different planes as
      Coronal, sagittal , 3D carded reformatted images as well as coloured images.
    - o Non invasive vascular imaging by injecting contrast material intravenously and imaging any of the arterial or venous circulation
    - o Reduction of the contrast material used
    - o Triphasic and function studies
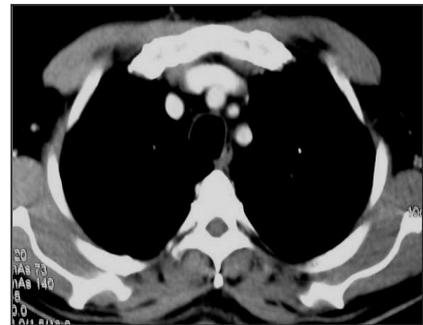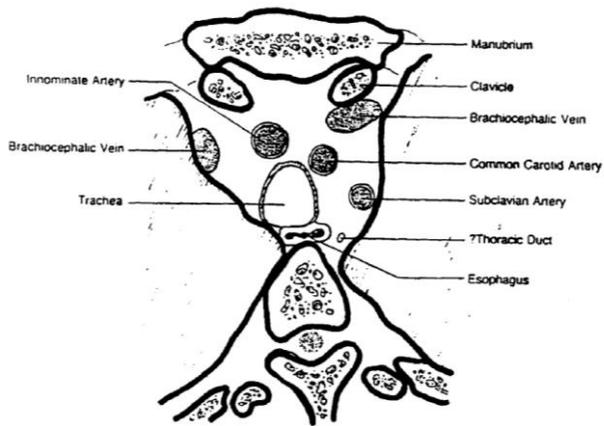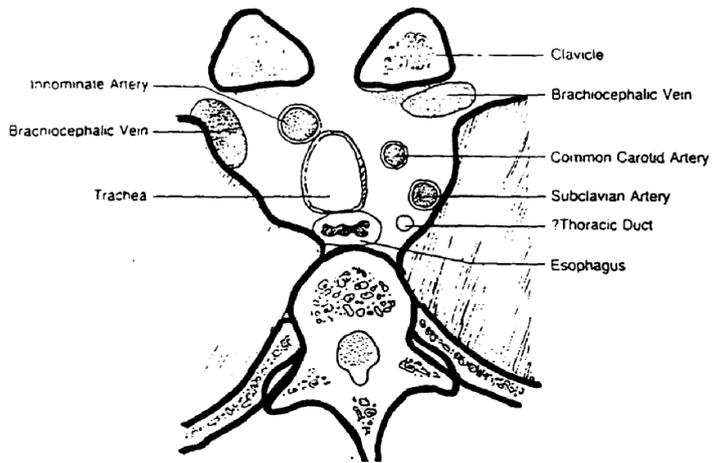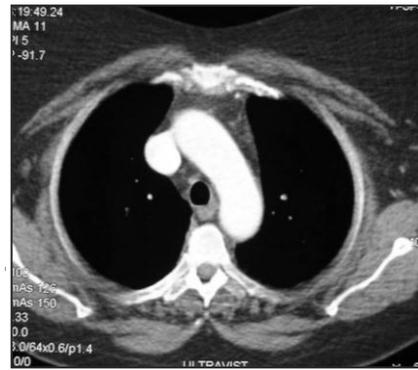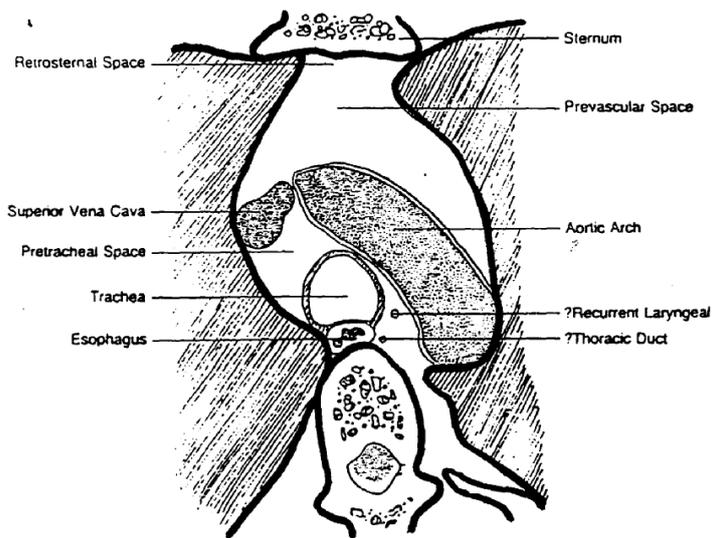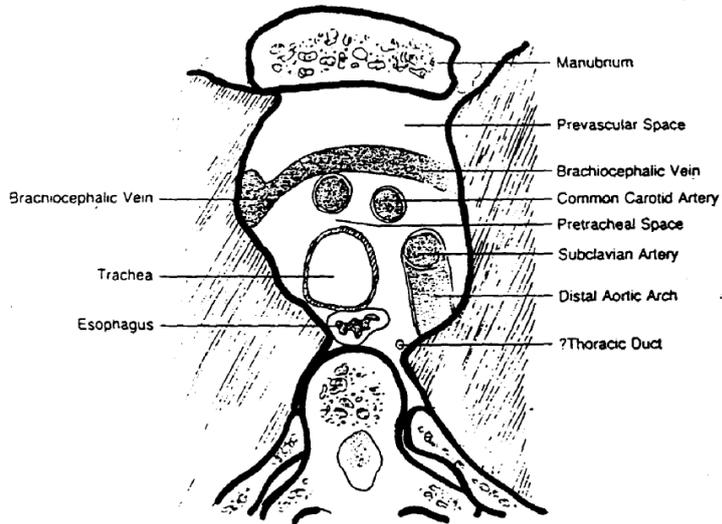   - o The best modality for diagnosis of pul . embolism

Anatomy

- The aortic arch is our anatomic landmark . At this level we identify the SVC, trachea and esophagus. The space between the sternum and aortic arch represents the anatomic site of the thymus which is normally seen up to the age of 2 years.
- Sections above the level of the aortic arch show the major aortic branches (left subclavian, left common carotid and innominate arteries) as well as both innominate veins + trachea and esophagus
- Sections below the aortic arch show the ascending and descending aorta with the pulmonary artery in between. The SVC is seen postrolateral to the ascending aorta.
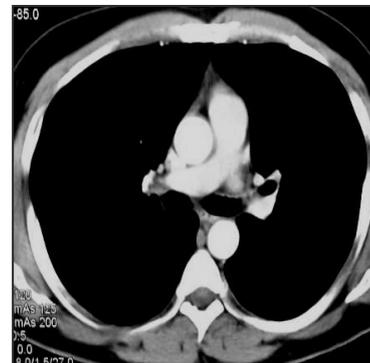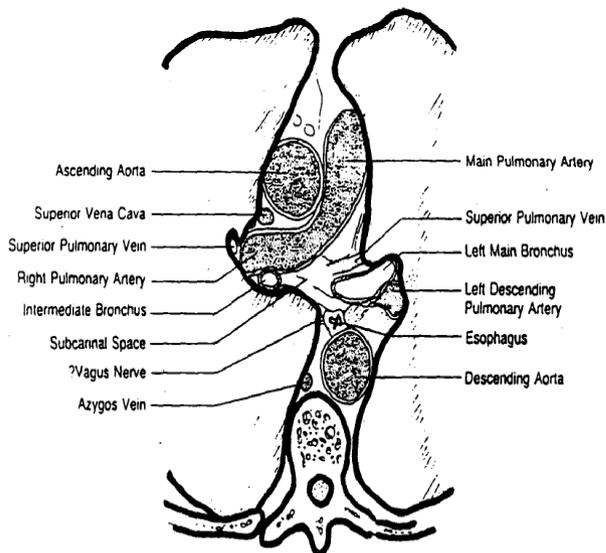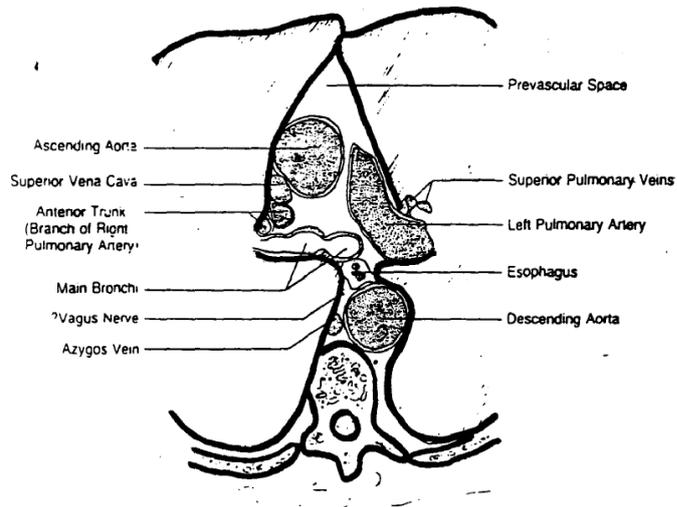- Lower down sections will show different cardiac chambers, descending aorta and esophagus

Anatomic sites of intrathoracic lymph nodes:

NB Normal lymph nodes are not usually seen in CT scan with minor exceptions

- Internal mammary lymph nodes along the postro lateral aspect of the sterum on both sides
- Retrocaval (Rt paratracheal) lymph nodes posterior to the SVC
- Pre vascular (retrosternal) lymph nodes along the antrolateral aspect of the aortic arch
- Aortic window lymph nodes between the ascending and descending aorta above the pulmonary artery
- Carinal lymph nodes around the tracheal bifurcation
- Subcarinal lymph nodes between the mainstem bronchi
- Hilar (broncho -pulmonary) lymph nodes at the left and Rt hilar regions
- Circum cardiac lymph nodes around the pericardium
- Posterior mediastinal (Zygo esophageal) lymph nodes near the lower esophagus

Clavicle

Innominate Artery

Brachiocephalic Vein

Brachiocephalic Vein

Common Carotid Artery

Trachea

Subclavian Artery

?Thoracic Duct

Esophagus

Manubrium

Innominate Artery

Clavicle

Brachiocephalic Vein

Brachiocephalic Vein

Common Carotid Artery

Trachea

Subclavian Artery

?Thoracic Duct

Esophagus

Manubrium
Prevascular Space
Brachiocephalic Vein
Common Carotid Artery
Pretracheal Space
Subclavian Artery
Distal Aortic Arch
?Thoracic Duct

Brachiocephalic Vein
Trachea
Esophagus

Retrosternal Space
Sternum
Prevascular Space

Superior Vena Cava
Aortic Arch
Pretracheal Space
Trachea
?Recurrent Laryngeal
Esophagus
?Thoracic Duct

Sternum

Prevascular Space

Superior Vena Cava

Pretrachea Space

Lymph Nodes

Trachea

Esophagus

Ascending Aorta

Aortic – Pulmonic Window

Descending Aorta

?Thoracic Duct

Prevascular Space

Ascending Aorta

Superior Vena Cava

Anterior Trunk (Branch of Right Pulmonary Artery)

Main Bronchi

?Vagus Nerve

Azygos Vein

Superior Pulmonary Veins

Left Pulmonary Artery

Esophagus

Descending Aorta

Ascending Aorta

Superior Vena Cava

Superior Pulmonary Vein

Right Pulmonary Artery

Intermediate Bronchus

Subcarinal Space

?Vagus Nerve

Azygos Vein

Main Pulmonary Artery

Superior Pulmonary Vein

Left Main Bronchus

Left Descending Pulmonary Artery

Esophagus

Descending Aorta

Segmental anatomy

The anatomic land mark for labor and segmental lung anatomy is the tracheal bifurcation

- Sections above the level of tracheal bifurcation (upper sections)
- Sections at the tracheal bifurcation (middle sections)
- Sections below the tracheal bifurcation (lower sections)

- **In the upper sections** the trachea appears as rounded air filled structure. The 1ˢᵗ two sections in this group pass through the lung apex [On the Rt side known as the apical segment of the upper lobe while on the left side it is called the apicoposterior segment of the upper lobe]
  Lower down in this group, one can identify 3 segments on the Rt side [anterior, apical and posterior segments] while on the left side the apical and posterior segments form only one segment, so according to the figure, we can identify only 2 segments [anterior and apico posterior]

- **In middle sections** the trachea has divided into two mainstem bronchi. At this level 2 segments are seen on both sides [the anterior segment of the upper lobe and the superior segment of the lower lobe]. No difference between the Rt and left side in this group

- **In the lower sections** the mainstem bronchi are not seen, subsegmental bronchi may be identified and the cardiac shadow is seen
  These sections are divided in an anterior one third which corresponds to the middle lobe on the Rt side and the lingula on the left side
  The posterior two thirds correspond to the lower lobe segments

Differences between Rt and left side:
- The segments of the middle lobe are medial and lateral
- The segments of the lingula are superior and inferior
- Four segments are seen in the Rt lower lobe [anterior, posterior, medial and lateral]
- No medial segment in the left lower lobe because of the heart
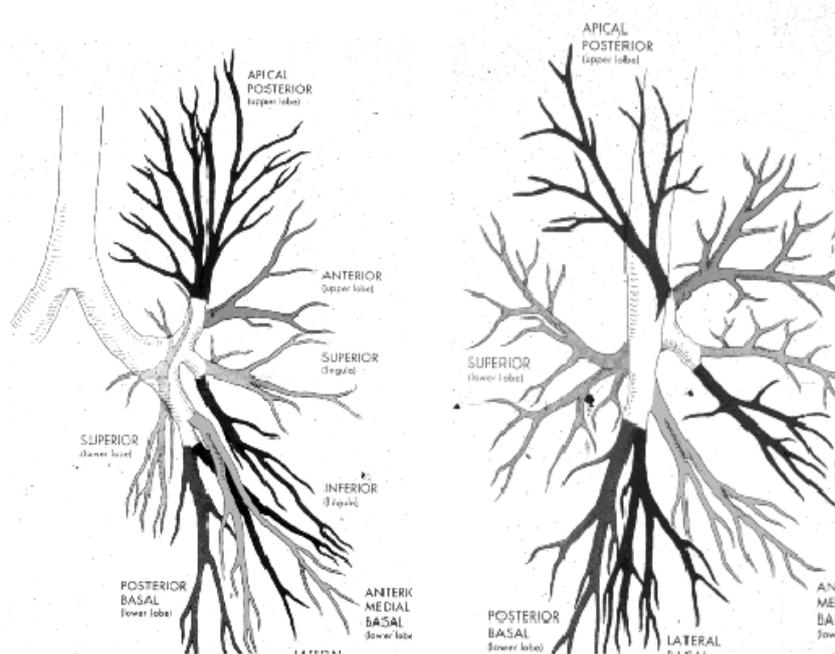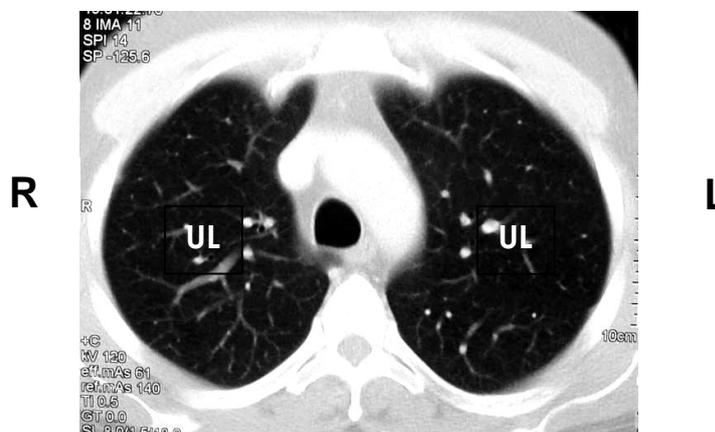
In order to know the lobar anatomy of the lung on CT basis we have to divide the CT images into 3 major groups:
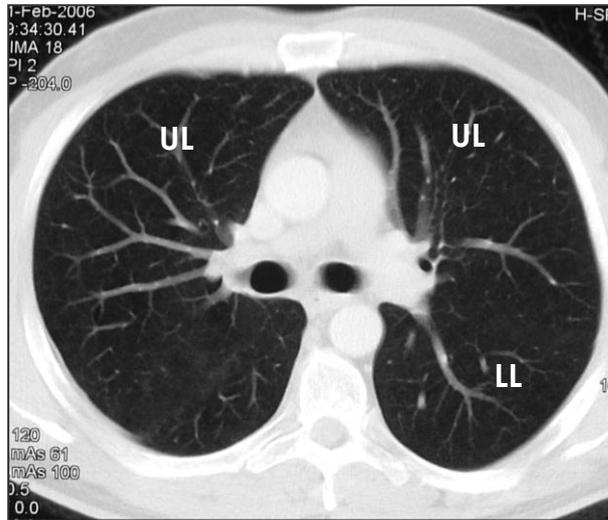
Group I: The images where you can see the trachea
**Group II:**   The level of the tracheal bifurcation
Group III: The images below the tracheal bifurcation

In this image the trachea is seen as an air filled rounded midline structure. Wherever you see the trachea, you are cutting in the upper lobe (UL)

In this image you can see the tracheal bifurcation. Whenever the trachea is divided into 2 main stem bronchi, the section is also divided into two halves, the anterior half belongs to the upper lobe (UL) and the posterior half belongs to the lower lobe (LL)
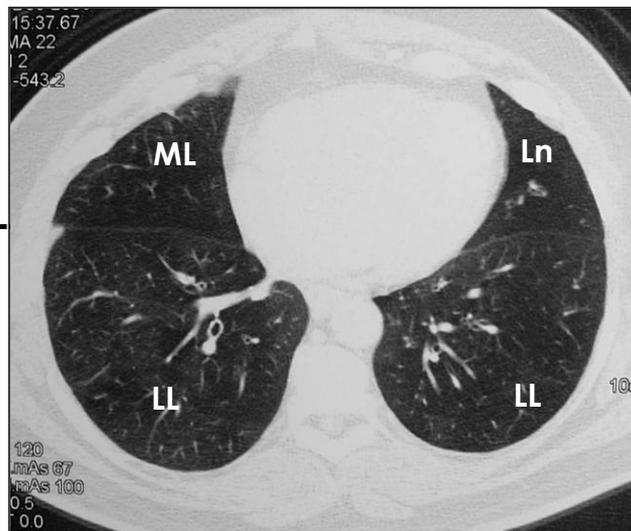
In this image you can see the cardiac shadow, no trachea, no main stem bronchi. This section is divided into an anterior 1/3 and posterior 2/3. The anterior 1/3 on the left side belongs to the lingua (Ln) while the anterior 1/3 on the right side belongs to the middle lobe (ML). The posterior 2/3 on both sides belong to the lower lobe (LL)