

# COMPUTED TOMOGRAPHY (CT) - CHEST



**Computed tomography (CT) of the chest uses special x-ray equipment to examine abnormalities found in other imaging tests and to help diagnose the cause of unexplained cough, shortness of breath, chest pain, fever and other chest symptoms. CT scanning is fast, painless, noninvasive and accurate. Because it is able to detect very small nodules in the lung, chest CT is especially effective for diagnosing lung cancer at its earliest, most curable stage.**

## WHAT ARE SOME COMMON USES OF THE PROCEDURE?



**Chest CT is used to:**

- **Examine abnormalities found on conventional chest x-rays.**
- **Help diagnose the causes of clinical signs or symptoms of disease of the chest, such as cough, shortness of breath, chest pain, or fever.**
- **Detect and evaluate the extent of tumors that arise in the chest, or tumors that have spread there from other parts of the body.**
- **Assess whether tumors are responding to treatment.**
- **Help plan radiation therapy.**
- **Evaluate injury to the chest, including the heart, blood vessels, lungs, ribs and spine.**
- **Evaluate abnormalities of the chest found on fetal ultrasound examinations.**

## CHEST CT CAN DEMONSTRATE VARIOUS LUNG DISORDERS, SUCH AS:



- **Benign and malignant tumors.**
- **Pneumonia.**
- **Tuberculosis.**
- **Bronchiectasis, *cystic fibrosis*.**
- **Inflammation or other diseases of the pleura (the covering of the lungs).**
- **Interstitial and chronic lung disease.**
- **Congenital abnormalities.**

# CONTRAINDICATIONS

## ○ *Absolute contraindication* :

1. Hypersensitivity to iodinated contrast agent
2. Pregnancy

## • *Relative contraindication*

- ❖ Irregular rhythm
- ❖ Renal insufficiency (sr. creatinine > 1.5 mg/ml)
- ❖ Hyperthyroidism
- ❖ Inability to hold breath for 10 sec
- ❖ History of allergy to other medication
- ❖ Metallic interference (e.g: pacemaker, defibrillator wires)

## HOW IS THE PROCEDURE PERFORMED?



- **The technologist begins by positioning you on the CT exam table, usually lying flat on your back. Straps and pillows may be used to help you maintain the correct position and remain still during the exam.**
- **Many scanners are fast enough that children can be scanned without sedation. In special cases, sedation may be needed for children who cannot hold still. Motion will cause blurring of the images and degrade the quality of the examination the same way that it affects photographs.**
- **If a contrast material is used, it will be injected into a vein shortly before scanning begins.**

## CONTINUE



- Next, the table will move quickly through the scanner to determine the correct starting position for the scans. Then, the table will move slowly through the machine as the actual CT scanning is performed. Depending on the type of CT scan, the machine may make several passes.
- You may be asked to hold your breath during the scanning. Any motion, including breathing and body movements, can lead to artifacts on the images. This loss of image quality can resemble the blurring seen on a photograph taken of a moving object.
- When the exam is complete, you will be asked to wait until the technologist verifies that the images are of high enough quality for accurate interpretation.
- The actual CT scanning takes less than 30 seconds and the entire process, including exam preparation, is usually completed within 30 minutes.

## WHAT DOES THE EQUIPMENT LOOK LIKE?



- **The CT scanner is typically a large, donut-shaped machine with a short tunnel in the center. You will lie on a narrow examination table that slides in and out of this short tunnel. Rotating around you, the x-ray tube and electronic x-ray detectors are located opposite each other in a ring, called a gantry. The computer workstation that processes the imaging information is located in a separate control room. This is where the technologist operates the scanner and monitors your exam in direct visual contact. The technologist will be able to hear and talk to you using a speaker and microphone.**



# BENEFITS



- **CT is fast, which is important for patients who have trouble holding their breath.**
- **CT is widely available.**
- **CT scanning is painless, noninvasive and accurate.**
- **A major advantage of CT is its ability to image bone, soft tissue and blood vessels all at the same time.**
- **Unlike conventional x-rays, CT scanning provides very detailed images of many types of tissue as well as the lungs, bones, and blood vessels.**
- **CT examinations are fast and simple; in emergency cases, they can reveal internal injuries and bleeding quickly enough to help save lives.**
- **CT has been shown to be a cost-effective imaging tool for a wide range of clinical problems.**



# CONTINUE



- **CT is less sensitive to patient movement than MRI.**
- **CT can be performed if you have an implanted medical device of any kind, unlike MRI.**
- **CT imaging provides real-time imaging, making it a good tool for guiding minimally invasive procedures such as needle biopsies and needle aspirations of many areas of the body, particularly the lungs, abdomen, pelvis and bones.**
- **A diagnosis determined by CT scanning may eliminate the need for exploratory surgery and surgical biopsy.**
- **No radiation remains in a patient's body after a CT examination.**
- **X-rays used in CT scans should have no immediate side effects.**
- **Low-dose CT scans of the chest use a lower dose of radiation than conventional chest CT.**

# ROUTINE THORAX



- **Indications-** Screening, Infection/ inflammation, Trauma, Mass of Lung, Pleura and Mediastinum, Staging Lymphoma, Lesions of Chest wall and Esophagus, Follow ups.
- **Patient Positioning-** Head First, Spine with Arms elevated above the level of Head.
- **Topogram Position / Landmark-** Anteroposterior; 1 inch below the level of the Chin to Umbilicus.
- **Mode of Scanning-** Helical with Single Breath hold.
- **Scan Orientation-** Caudocranial.
- **Start Location-** The imaginary line joining the two costophrenic angles.
- **End Location-** 1cm above the Apex of the Lung.

# CONTINUE



- **Gantry Tilt- Nil.**
- **Field Of View- Just fitting to the Thoracic Cavity including the soft tissues of the Chest Wall.**
- **Contrast Administration- Intravenous, Oral Air/ Positive Contrast For Esophageal Evaluation.**
- **Volume of Contrast- 60-80 ml.**
- **Rate of Injection of Contrast- 2-2.5 mL/sec.**
- **Scan Delay- 30-35 sec.**
- **Slice Thickness in Reconstruction- 3-5 mm.**
- **Slice Interval- 1.5-2.5 mm.**
- **3D Reconstructions- MRP,MIP VRT if needed.**

# TOPOGRAM IN THE CASE OF CHEST



## NORMAL CHEST-LUNG WINDOW



# HIGH-RESOLUTION COMPUTED TOMOGRAPHY



**High-resolution computed tomography (HRCT) is a type of computed tomography (CT) with specific techniques to enhance image resolution. It is used in the diagnosis of various health problems, though most commonly for lung disease, by assessing the lung parenchyma.**

# HIGH RESOLUTION EXAMINATION



- **Indications-** Diffuse interstitial Lung Disease, Emphysema, Chronic Obstruction Airway Disease, Bronchiectasis.
- **Patient Positioning-** Head first, Spine with Arms elevated above the level of head.
- **Topogram Position/ Landmark-** Anteroposterior; 1 inch below the level of Chin to Umbilicus.
- **Mode of Scanning-** Sequential with Breath-hold Technique in Mid Inspiration with every scan.
- **Scan Orientation-** Craniocaudal.
- **Starting Location-** 1 cm above the Apex of the Lung.



# CONTINUE



- **End Location-** The imaginary line joining the two Costophrenic angles.
- **Gantry angle-** Nil
- **FOV-** Just fitting to the Lung fields.
- **Slice Thickness-** Thinnest available (0.5-1.5mm).
- **Scan Time-** 0.5-1 sec.
- **Slice Interval-** 10mm.
- **Contrast Administration-** Nil.
- **Scan Delay-** None.

**High-resolution computed tomography (HRCT) chest showing progressive replacement of lung parenchyma with multiple cysts, and proliferation of abnormal smooth-muscle cells**



## NORMAL HRCT



# CT CHEST- LOW DOSE PROTOCOL



## **Indications:**

- **Pulmonary nodule**
- **ILD (interstitial lung disease) follow Up**
- **Screening of lung cancer in high risk patients**

# PROTOCOL



- **Patient Positioning:** Head first or feet first-Supine with both arms elevated above the head.
- **Topogram Direction:** Craniocaudal
- **Scan Type:** Helical
- **Position/Landmark:** Sternal Notch
- **Start Location:** 1cm superior to lung apices

## CONTINUE..



- **End Location:** Costophrenic angles
- **Gantry tilt:** Nil
- **Breath hold:** Inspiration
- **DFOV:** 38 cm
- **Scan field of view:** 40 cm
- **Contrast:** Nil
- **Algorithm:** Standard, Soft tissue, Lung

## CONTINUE..



- **Recons and Reformations:** MPR, MIP
- **Slice Thickness:** 1-3 mm
- **Tube Voltage (Kv):** 120
- **Tube Current (mAs):** 40-80
- **Rotation Time (s):** 0.5
- **Image Format:** DICOM



# CT AIRWAY/TRACHEA PROTOCOL



## **Indications:**

- **Congenital airway abnormality**
- **Suspected airway obstruction of the trachea**
- **Tracheobronchial filling defects**

# PROTOCOL



- **Patient Positioning:** Head first or feet first-Supine with both arms elevated above the head.
- **Topogram Direction:** Craniocaudal
- **Scan Type:** Helical
- **Position/Landmark:** Sternal Notch
- **Start Location:** 1cm superior to lung apices

## CONTINUE..



- **End Location:** Below adrenal glands
- **Gantry tilt:** Nil
- **Breathe hold:** Inspiration and Expiration
- **DFOV:** 38 cm
- **Scan field of view:** 40 cm
- **Contrast:** Nil
- **Algorithm:** Standard, Soft tissue, Lung

## CONTINUE..



- **Recons and Reformations:** MPR, MIP
- **Slice Thickness:** 3-5 mm
- **Tube Voltage (Kv):** 120
- **Tube Current (mAs):** 80-450
- **Rotation Time (s):** 0.5
- **Image Format:** DICOM

## Coronal Ct chest showing trachea and its bifurcation



# CT CHEST AORTIC ANGIOGRAPHY PROTOCOL



## **Indications:**

- **Congenital aortic anomalies**
- **Aortic aneurysm**
- **Aortic dissection**
- **Traumatic aortic injury**
- **Takayasu's arteritis**
- **Postoperative aorta**

# CONTRAINDICATIONS



- **Pregnancy**
- **Allergic to contrast media**
- **Previous severe reactions to iodinated contrast**
- **Raised urea and creatinine**
- **Uncooperative patient**



# PROTOCOL



- **Patient Positioning:** Head first or feet first-Supine with both arms elevated above the head.
- **Topogram Direction:** Caudocranial
- **Scan Type:** Helical
- **Position/Landmark:** Sternal Notch
- **Start Location:** 1cm superior to lung apices

## CONTINUE..



- **End Location:** Mid kidney (L2 vertebral level)
- **Gantry tilt:** Nil
- **Breath hold:** Inspiration
- **DFOV:** 38 cm
- **Scan field of view:** 40 cm
- **Contrast:** Nonionic low osmolar Iodinated Contrast media (350 mg of iodine/ml)
- **Contrast Administration:** Intravenous (IV) with 20-22 G intravenous catheter

## CONTINUE..



- **Volume:** 100-120 ml
- **Rate of Injection:** 3-4 ml /s
- **Saline flush-** 40ml
- **Bolus tracking is done and monitoring slice (region of interest) is at descending aorta and threshold of contrast is 100HU.**
- **Time delay:** 4-6sec after bolus trigger time

## CONTINUE..



- **Algorithm:** Standard, Soft tissue, Lung
- **Recons and Reformations:** MPR, MIP, Volume rendering, SSD
- **Slice Thickness:** 1-3 mm
- **Tube Voltage (Kv):** 120-180
- **Tube Current (mAs):** 250-450
- **Rotation Time (s):** 0.5
- **Image Format:** DICOM

## CT THORACIC ANGIOGRAPHY SHOWS THORACIC AORTIC ARCH





**THANK YOU**