

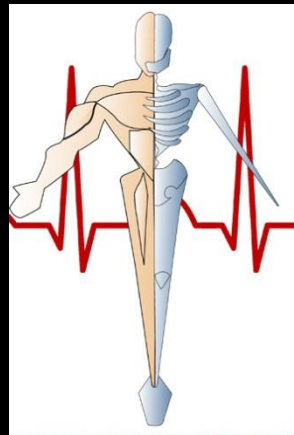
Three Phase CEUs Presents:

*Topics in CT Volume I ©*

“Mastery Test”

by

John Fleming, M.Ed., RT(R)(MR)(CT)



Please scroll down to proceed.

# Forward:

The premise behind the creation of this tutorial is to provide imaging professionals with access to high quality yet affordable continuing education.

Our courses qualify as Category A (technical) points for the following: all ARRT recognized imaging modalities, ARRT-CQR, FDOH-Bureau of Radiation Control, NMTCB, and RCIS.

**According to the ARRT, a current license as a general radiographer with the FDOH is required to qualify to complete this course.**  
*This rule does not apply to either the NMTCB or RCIS credentials.*

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# Mastery Test Instructions:

Please place an “X” over the correct response on your answer sheet. Feel free to write your answer down on a blank piece of paper if you do not have access to a printer. That is just as good.

After you complete your answer sheet, just snap a picture of it with your cell phone and text it to John Fleming at (727) 744-7946. The picture does not need to be perfect, only legible.

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Thanks for your support and be sure to reach out via text message if you encounter any snags.

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# Question #1:

All of the following would be an example of a sign (as opposed to a symptom) except:

- a. skin rash.
- b. edema.
- c. headache.
- d. cyanosis.

# Question #1: Review

- The study of the origin and development of a disease.
- Pathogenesis will lead to observable changes that are known as manifestations.

## Sign

- This is a manifestation that is observable by the health care worker.
- Examples would be edema, cyanosis, or a skin rash.

## Symptom

- This pertains to the patient's perception of what is wrong and is subjective.
- An example would be a headache.

# Question #2:

What is the primary function of the CT gantry?

- a. image storage
- b. patient positioning only
- c. housing rotating imaging components
- d. image reconstruction

# Question #2: Review

- The Gantry

The gantry is the large, circular structure that houses the primary mechanical and imaging components of the CT system.

It is typically mounted vertically and contains the rotating parts necessary for image acquisition.

The gantry opening, or bore, allows the patient to pass through on the CT table during scanning.

# Question #3:

The body is upright with the arms at the side and the palms of the hands facing forward. This describes which of the following?

- a. anatomical position
- b. recumbent
- c. decubitus
- d. oblique

# Question #3: Review

- Position is a term is used to describe the how the patient's body has been physically placed.
- The following is a list of terms that are examples of a position.

## Anatomical Position

- The body is upright with the arms at the side and the hands facing forward.

## Recumbent

- This term is used to describe the body anytime it is lying down.

## Lateral

- When the body has been turned on its side.

## Decubitus

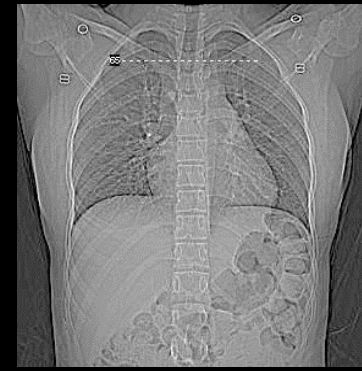
- Refers to when the patient is recumbent and a horizontal x-ray tube is employed.

# Question #4:

The arrow is pointing to the:

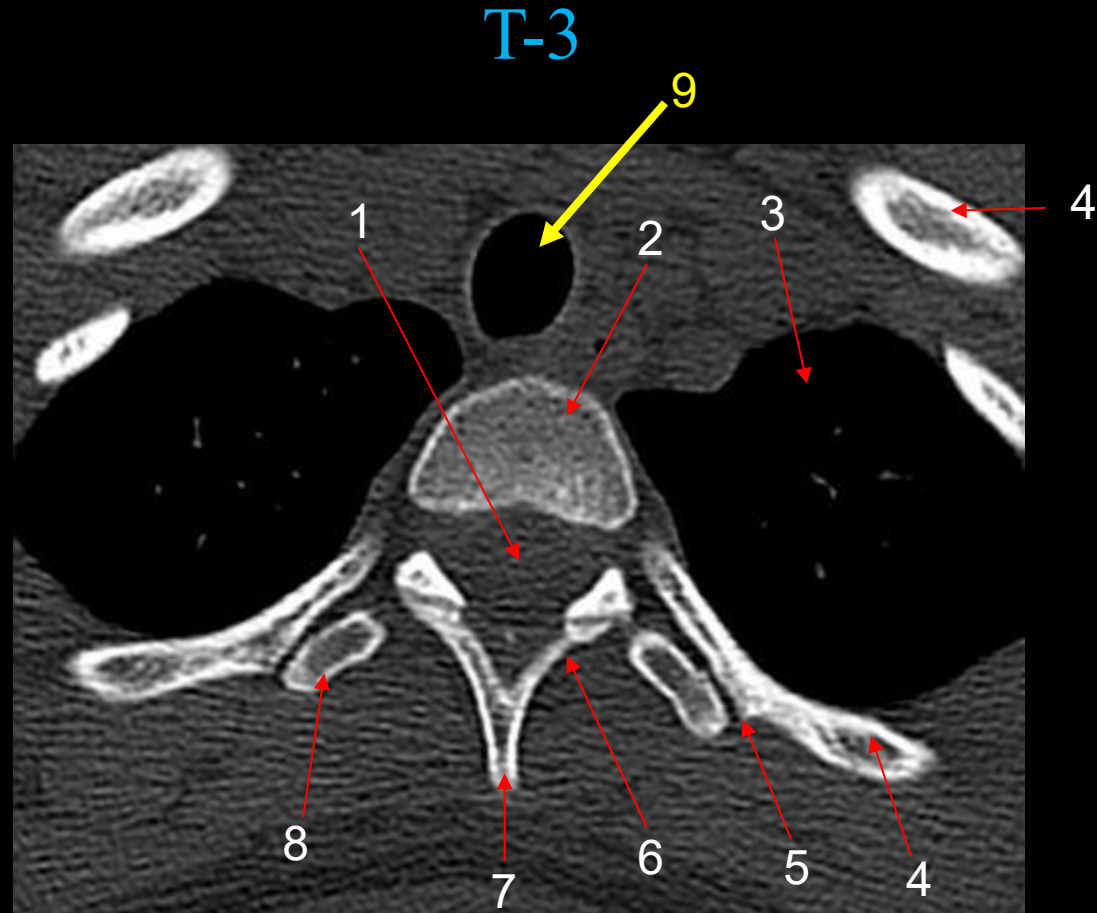
- a. trachea.
- b. aortic arch.
- c. superior vena cava.
- d. esophagus.

T-3



# Question #4: Review

1. Spinal Cord
2. Vertebral Body
3. Left Lung
4. Rib
5. Costovertebral Joint
6. Lamina
7. Spinous Process
8. Transverse Process
9. Trachea



Axial Thoracic Vertebra (T3)

# Question #5:

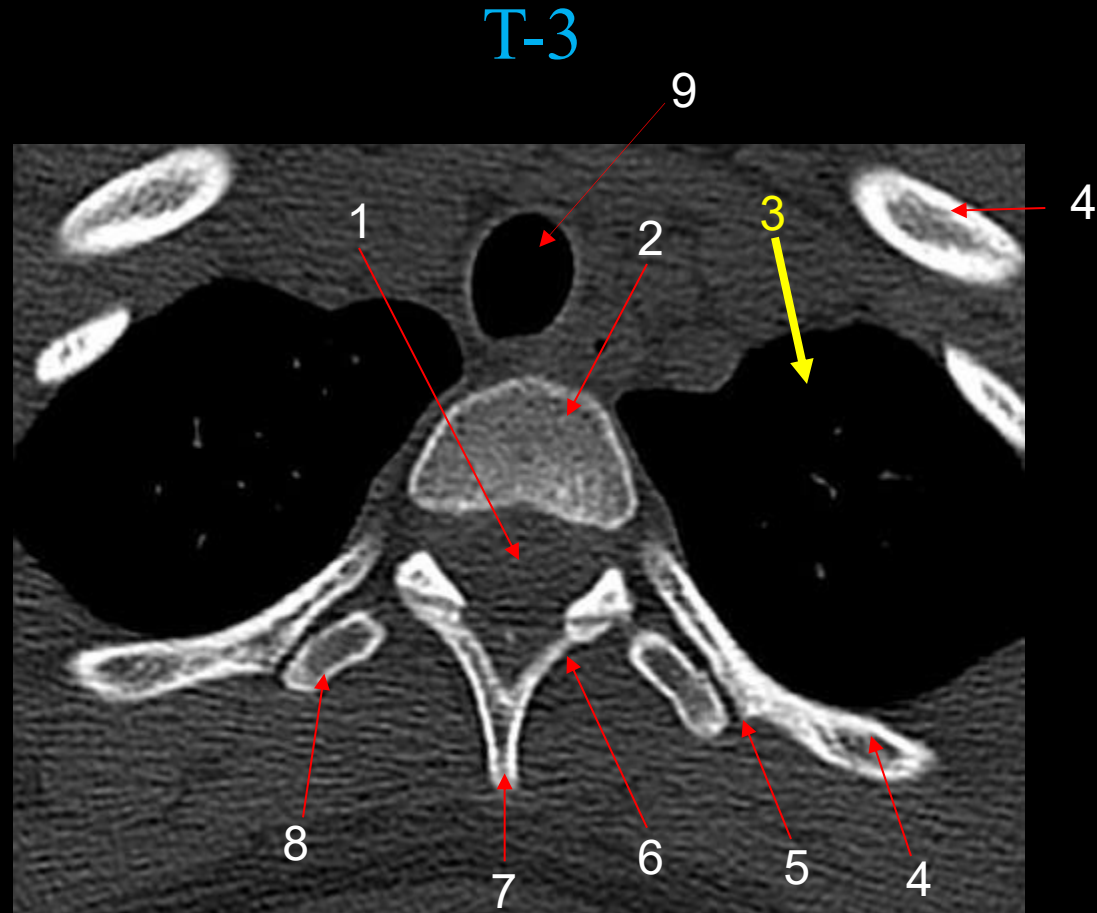
The arrow is pointing to the:

- a. fundus of the stomach.
- b. left lung.
- c. liver.
- d. trachea.



# Question #5: Review

1. Spinal Cord
2. Vertebral Body
3. Left Lung
4. Rib
5. Costovertebral Joint
6. Lamina
7. Spinous Process
8. Transverse Process
9. Trachea



## Axial Thoracic Vertebra (T3)

# Question #6:

The array processor is responsible for:

- a. patient positioning.
- b. image reconstruction.
- c. data storage.
- d. network communication.

# Question #6: Review

- The Array Processor

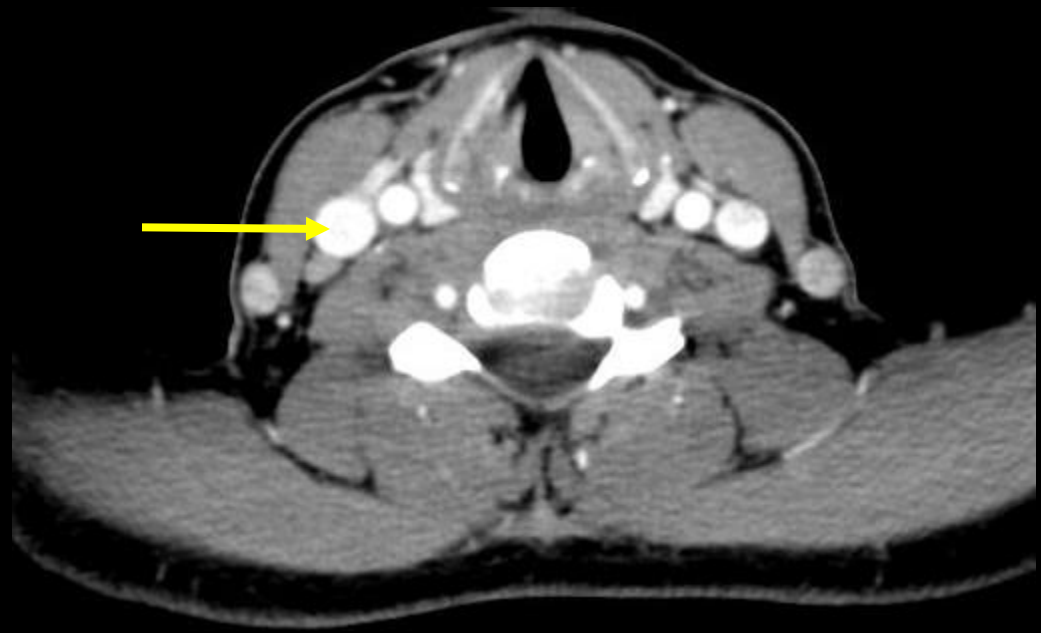
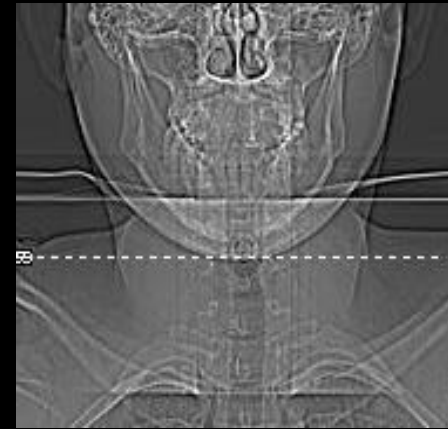
The array processor is a specialized high-speed computational unit dedicated to image reconstruction.

Its primary function is to process the vast amount of raw data collected during a CT scan and transform it into meaningful image data.

# Question #7:

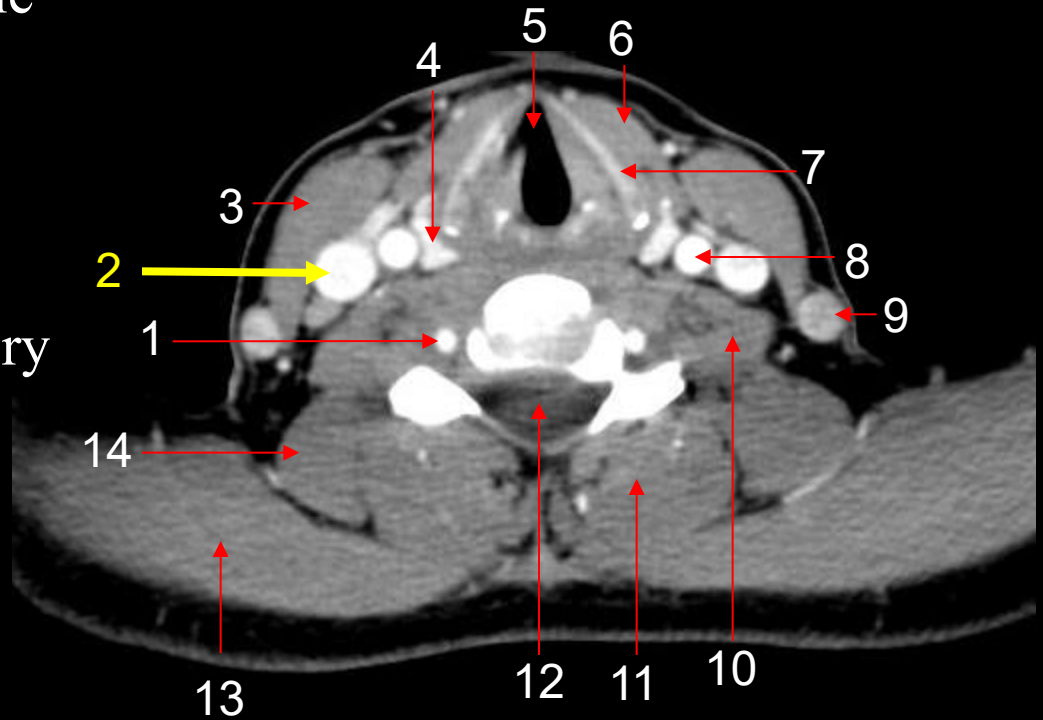
The arrow is pointing to the:

- a. common carotid artery.
- b. external jugular vein.
- c. internal jugular vein.
- d. vertebral artery.



# Question #7: Review

1. Right Vertebral Artery
2. **Right Internal Jugular Vein**
3. Sternocleidomastoid Muscle
4. Thyroid Gland
5. Glottis
6. Infrahyoid Muscle
7. Thyroid Cartilage
8. Left Common Carotid Artery
9. Left External Jugular Vein
10. Scalenus Muscle
11. Erector Spinae Muscle
12. Spinal Canal
13. Trapezius Muscle
14. Levator Scapulae Muscle

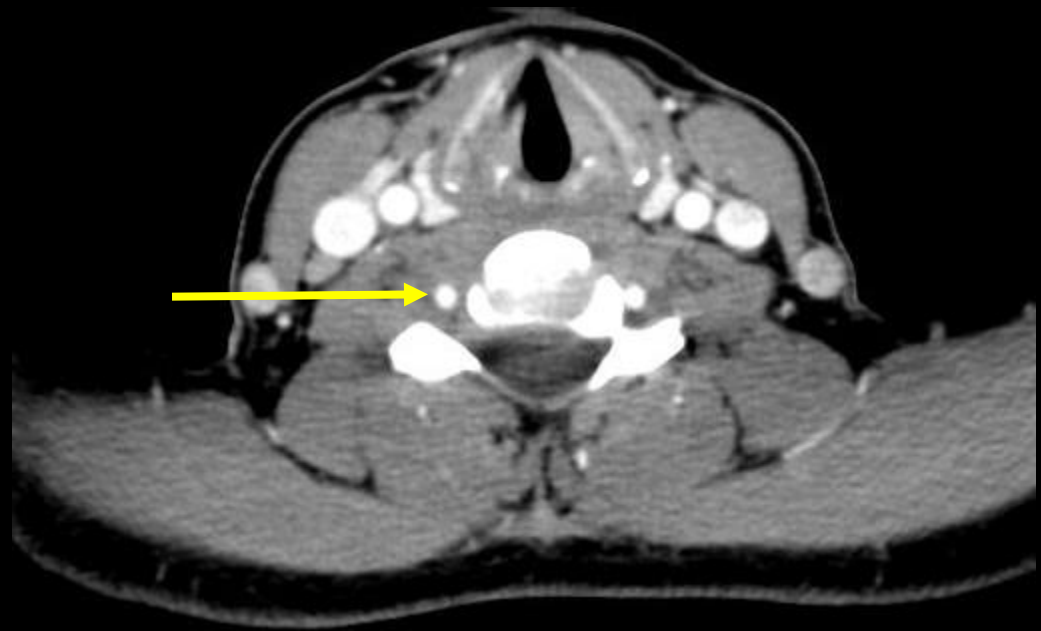
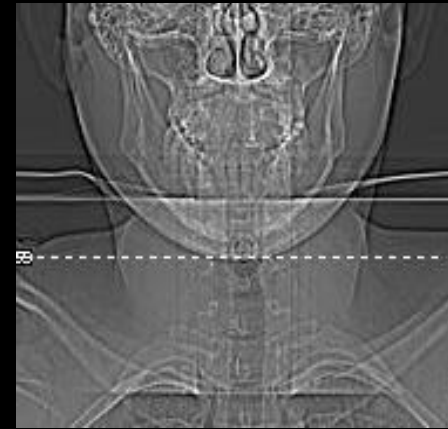


## Axial Neck

# Question #8:

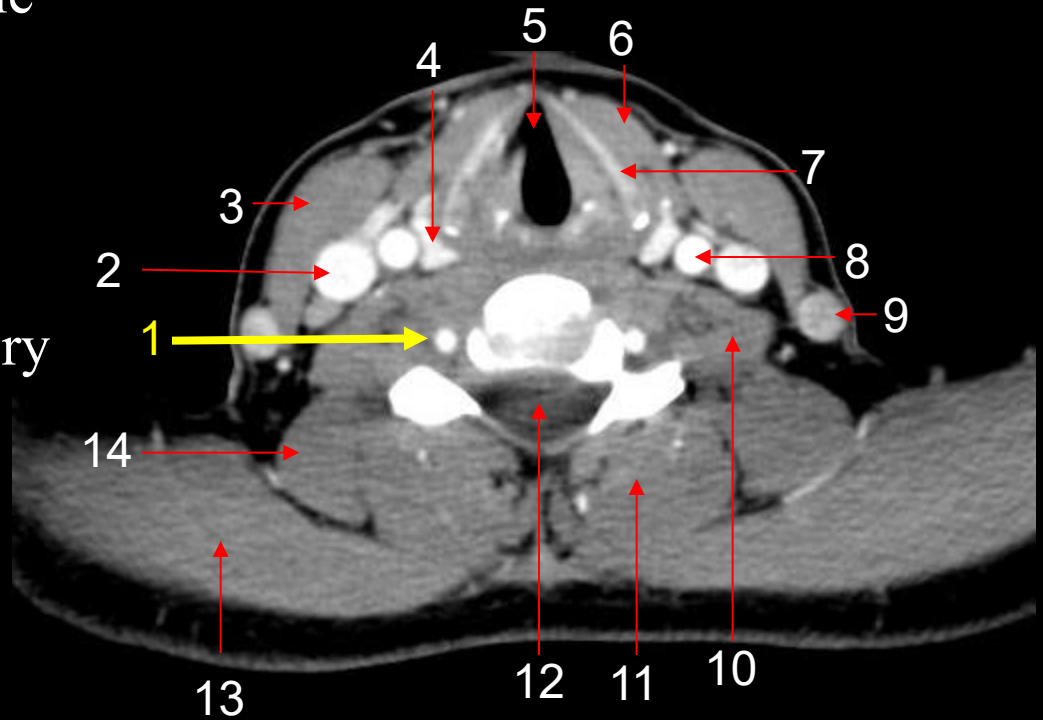
The arrow is pointing to the:

- a. external jugular vein.
- b. internal jugular vein.
- c. vertebral artery.
- d. common carotid artery.



# Question #8: Review

1. Right Vertebral Artery
2. Right Internal Jugular Vein
3. Sternocleidomastoid Muscle
4. Thyroid Gland
5. Glottis
6. Infrahyoid Muscle
7. Thyroid Cartilage
8. Left Common Carotid Artery
9. Left External Jugular Vein
10. Scalenus Muscle
11. Erector Spinae Muscle
12. Spinal Canal
13. Trapezius Muscle
14. Levator Scapulae Muscle



## Axial Neck

# Question #9:

For Single-Slice CT, a pitch value less than 1.0 generally implies:

- a. gaps in data acquisition.
- b. increased table speed.
- c. overlapping data acquisition.
- d. reduced spatial resolution.

# Question #9: Review

- Introduction to Pitch

Pitch is often misunderstood or oversimplified, yet it plays a critical role in balancing competing clinical demands: high image quality, low radiation dose, and fast acquisition times.

As CT technology has advanced, the meaning and practical implications of pitch have expanded, particularly in multi-detector systems.

- **Single-Slice CT**

In single-slice helical CT, pitch is defined as:

$$\text{Pitch} = \text{Table travel per gantry rotation} / \text{Nominal slice thickness}$$

A pitch of 1.0 indicates contiguous data acquisition with no overlap or gaps.

Values less than 1.0 imply overlapping data, while values greater than 1.0 indicate gaps between sampled data.

# Question #10:

In traditional CT imaging, the x–y plane most directly corresponds to which type of image?

- a. sagittal
- b. coronal
- c. axial
- d. oblique

# Question #10: Review

- The Cartesian Coordinate System in CT

In CT imaging, the patient is positioned within a gantry, and spatial locations within the body are described using a Cartesian coordinate system:

- X-axis: Typically represents the left–right direction of the patient.
- Y-axis: Represents the anterior–posterior direction.
- Z-axis: Represents the head–foot (longitudinal) direction.

Together, these axes define the x, y, and z planes, which form the basis for all voxel-based image representation.

- Role of the X and Y Planes: In-Plane Imaging

The x and y planes define the in-plane dimensions of a CT slice.

Traditional CT images are acquired and reconstructed as axial slices, which lie in the x–y plane.

# Question #11:

Helical data acquisition is characterized by:

- a. stationary table motion during scanning.
- b. slice-by-slice data acquisition.
- c. continuous gantry rotation with table motion.
- d. reconstruction without interpolation.

# Question #11: Review

- Definition of Helical Data Acquisition

Helical data acquisition refers to a CT scanning mode in which x-ray data are acquired continuously as the patient table moves through the gantry during continuous tube rotation.

The resulting source trajectory forms a helical path around the patient.

Unlike sequential (axial) acquisition, there are no discrete stops between slices; instead, volumetric data are collected along the z-axis and later reconstructed into images at arbitrary slice locations.

- Pitch

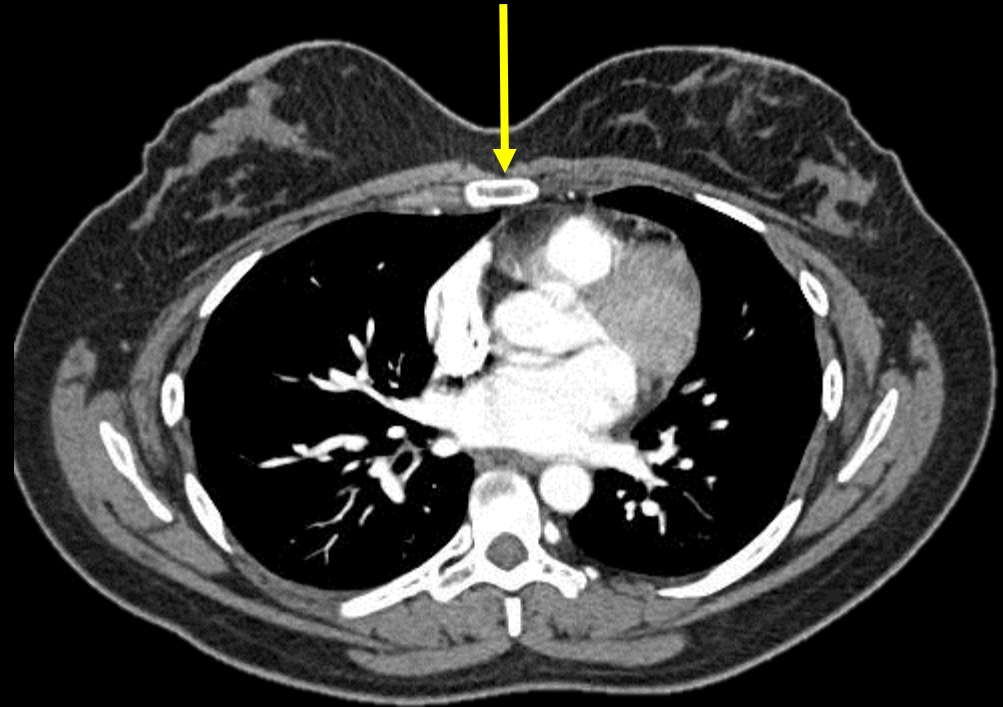
A defining parameter of helical scanning is pitch, typically defined as the table travel per gantry rotation divided by the total nominal beam width.

Pitch directly influences sampling density, scan speed, image noise, and radiation dose.

# Question #12:

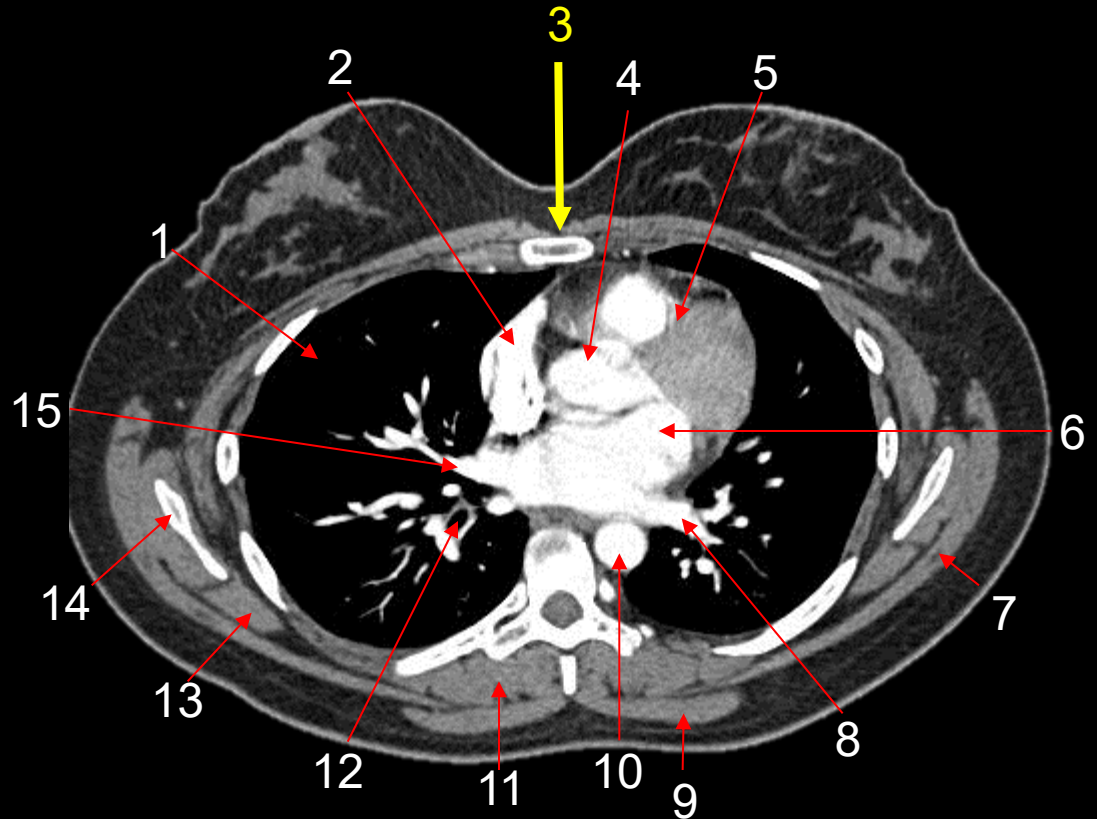
The arrow is pointing to the:

- a. sternum.
- b. rib.
- c. spinous process.
- d. transverse process.



# Question #12: Review

1. Right Lung
2. Right Atrium
3. Sternum
4. Ascending Aorta
5. Right Ventricle
6. Left Atrium
7. Latissimus Dorsi Muscle
8. Left Inferior Pulmonary vein
9. Trapezius
10. Descending Aorta
11. Erector Spinae Muscle
12. Right Bronchus
13. Rhomboid Muscle
14. Scapula
15. Right Inferior Pulmonary Vein

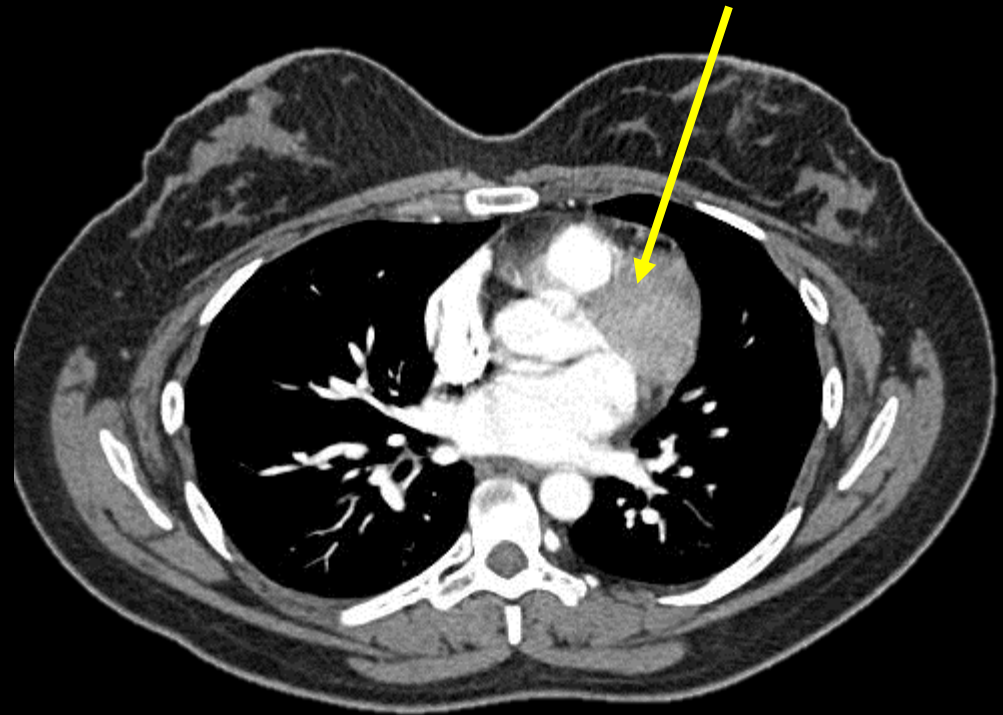


## Axial Chest

# Question #13:

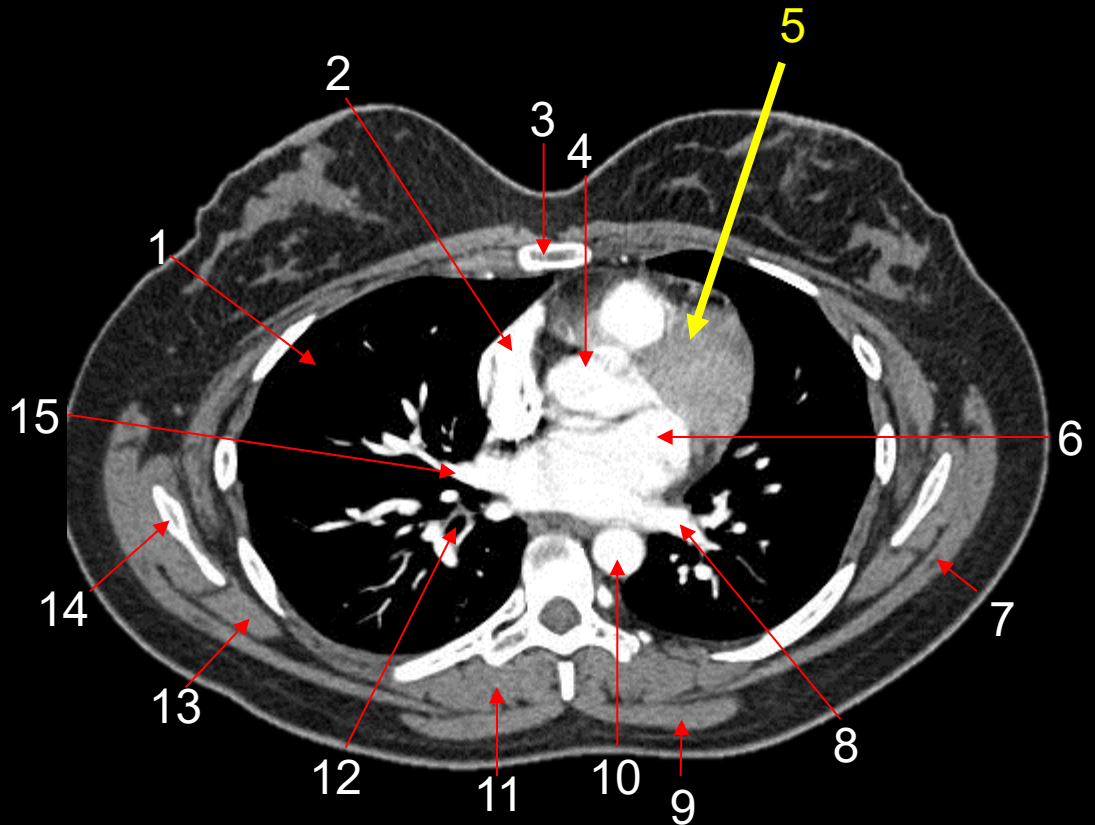
The arrow is pointing to the:

- a. left atrium.
- b. ascending aorta.
- c. right ventricle.
- d. right lung.



# Question #13: Review

1. Right Lung
2. Right Atrium
3. Sternum
4. Ascending Aorta
5. Right Ventricle
6. Left Atrium
7. Latissimus Dorsi Muscle
8. Left Inferior Pulmonary vein
9. Trapezius
10. Descending Aorta
11. Erector Spinae Muscle
12. Right Bronchus
13. Rhomboid Muscle
14. Scapula
15. Right Inferior Pulmonary Vein



## Axial Chest

# Question #14:

What is the name of the plane that divides the body into equal right and left portions?

- a. transverse
- b. axial
- c. midcoronal
- d. midsagittal

# Question #14: Review

- Sagittal Plane
  - Divides the body into right and left portions.
- Midsagittal Plane or Midline
  - Divides the body into equal right and left portions.
- Coronal Plane
  - Divides the body into front and back portions.
- Midcoronal Plane
  - Divides the body into equal front and back portions.
- Axial or Transverse Plane
  - Divides the body into top and bottom portions.

# Question #15:

Which component generates X-rays in a CT system?

- a. detector array
- b. x-ray tube
- c. DAS
- d. array processor

# Question #15: Review

- X-ray Tube

At the heart of the gantry is the X-ray tube, which generates the x-ray beam used for imaging.

CT x-ray tubes are designed to withstand high heat loads due to rapid, continuous exposures.

They often feature rotating anodes, high heat storage capacity, and efficient cooling systems.

The tube rotates around the patient at high speeds—commonly completing a full rotation in less than one second in modern scanners.

# Question #16:

Volumetric acquisition reduces which artifact compared to helical CT?

- a. ring artifacts
- b. z-axis interpolation artifacts and stair-step artifacts
- c. beam hardening
- d. partial volume artifacts in axial slices

# Question #16: Review

- **Volumetric Data Acquisition Impact on Image Quality**

Volumetric data acquisition enhances image quality in multiple ways.

First, it eliminates z-axis interpolation, producing uniform voxel dimensions and isotropic resolution across the entire volume. Second, by capturing a complete dataset in a single rotation, volumetric CT reduces stair-step artifacts and misregistration between slices.

Moreover, volumetric acquisition supports ultra-thin slice reconstruction, enabling high-quality multiplanar reformations (MPRs), curved planar reformations, and three-dimensional visualizations.

These capabilities are critical in complex vascular imaging, oncology, and surgical planning.

# Question #17:

A pixel in CT represents:

- a. a volume of tissue.
- b. a two-dimensional picture element.
- c. a detector element.
- d. raw projection data.

# Question #17: Review

- Defining a Pixel:

A pixel (picture element) is the smallest two-dimensional unit of a digital image.

In CT, each pixel represents a square area within a reconstructed image slice and is assigned a single numerical value corresponding to the average x-ray attenuation within that area.

Pixel values are displayed as shades of gray according to window width and window level settings.

- Defining a Voxel:

A voxel (volume element) extends this concept into three dimensions.

A voxel represents a discrete volume of tissue, defined by pixel dimensions in the x- and y-directions and slice thickness (or reconstruction interval) in the z-direction.

Each voxel contains a single attenuation value, typically expressed in Hounsfield units (HU).

# Question #18:

The CT image matrix primarily defines:

- a. the arrangement of rows and columns of pixels in an image.
- b. radiation dose.
- c. slice thickness.
- d. detector configuration.

# Question #18: Review

- Definition of the CT Image Matrix

The matrix refers to the two-dimensional grid used to display a CT image slice.

The matrix describes the arrangement of pixels in a CT image by specifying the number of rows and columns of pixels the image will possess.

It consists of rows and columns of pixels, most commonly arranged in a  $512 \times 512$  format in clinical CT imaging.

Each pixel within the matrix represents a discrete portion of the reconstructed image and contains a numerical value corresponding to x-ray attenuation, typically expressed in Hounsfield units (HU).

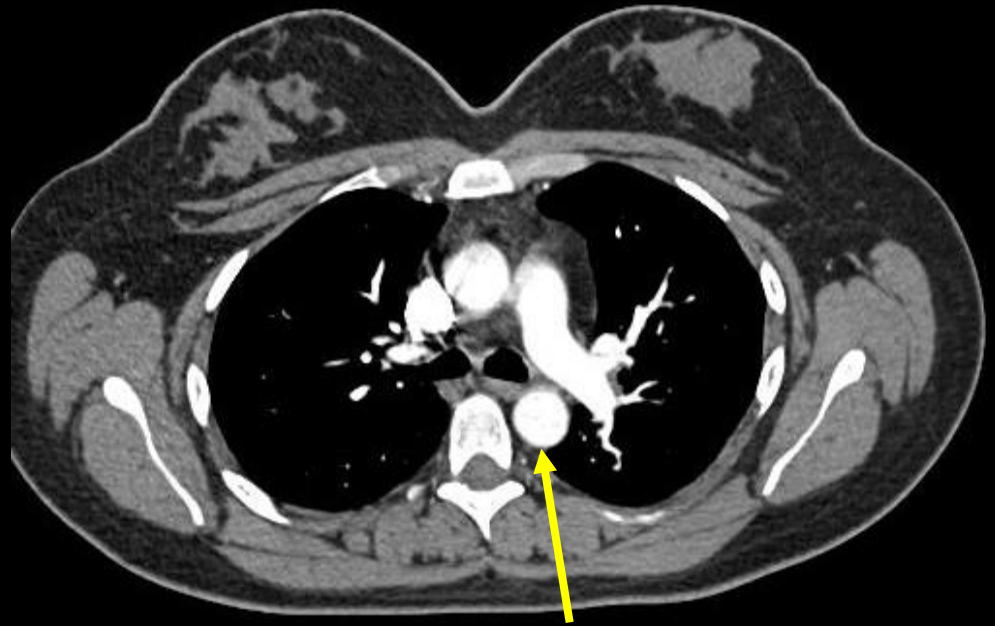
The matrix does not define the physical size of anatomy directly. Instead, physical dimensions are determined by combining the matrix size with the display field of view (DFOV).

Together, these parameters define pixel size, which plays a key role in spatial resolution and image sharpness.

# Question #19:

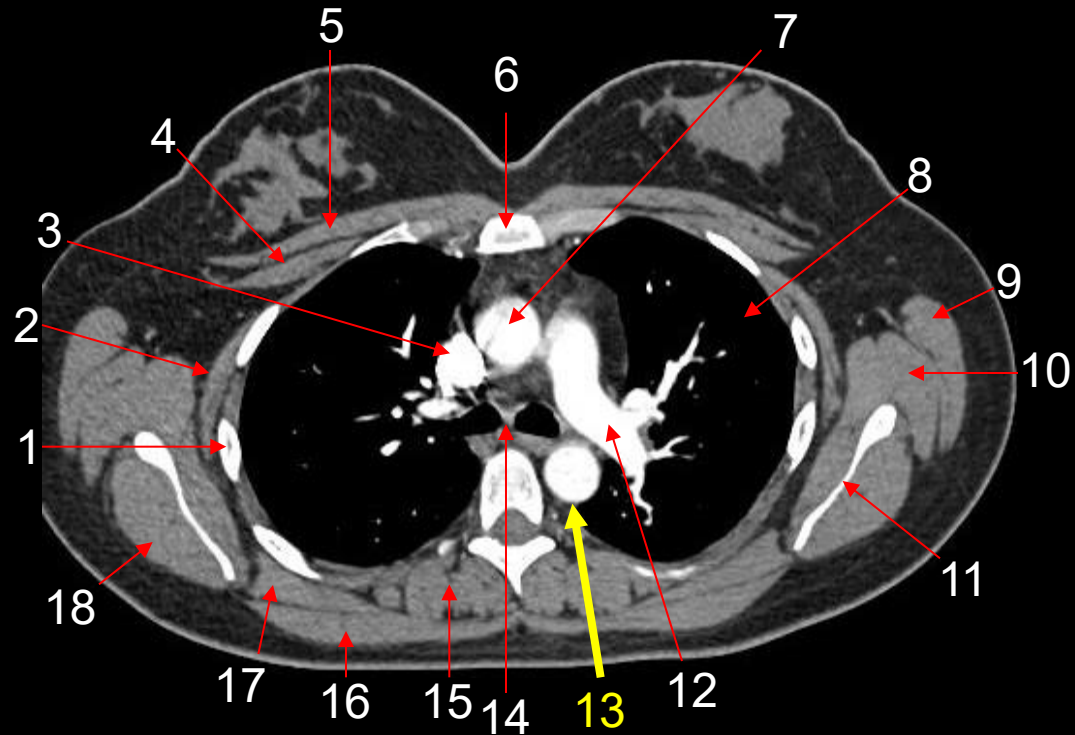
The arrow is pointing to the:

- a. ascending aorta.
- b. descending aorta.
- c. trachea.
- d. esophagus.



# #19: Review

1. Rib
2. Serratus Anterior Muscle
3. Superior Vena Cava
4. Pectoralis Minor Muscle
5. Pectoralis Major Muscle
6. Sternum
7. Ascending Aorta
8. Left Lung
9. Latissimus Dorsi Muscle
10. Teres Major Muscle
11. Scapula
12. Left Pulmonary Artery
13. Descending Aorta
14. Carina (Trachea)
15. Erector Spinae Muscle
16. Trapezius Muscle
17. Rhomboid Muscle
18. Infrapinatus Muscle

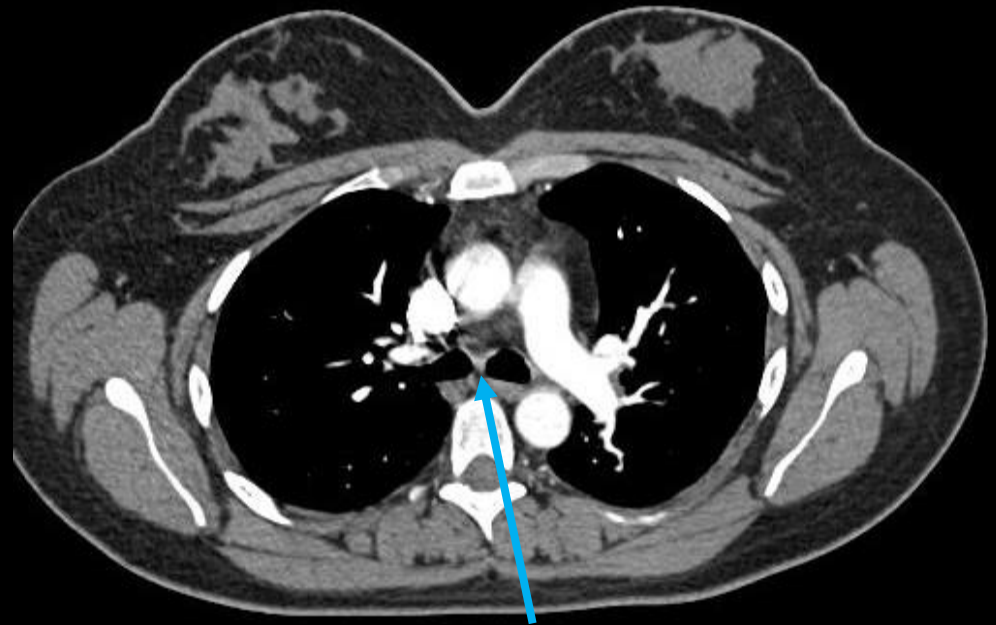


## Axial Chest

# Question #20:

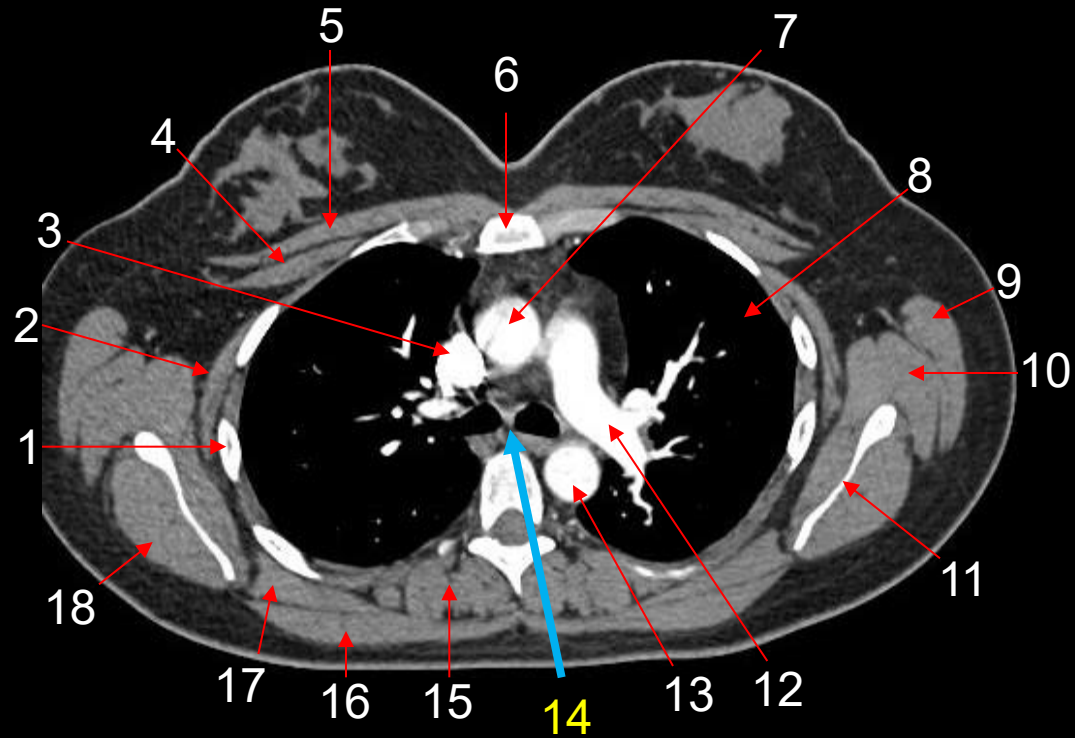
The arrow is pointing to the:

- a. carina.
- b. esophagus.
- c. superior vena cava.
- d. ascending aorta.



# #20: Review

1. Rib
2. Serratus Anterior Muscle
3. Superior Vena Cava
4. Pectoralis Minor Muscle
5. Pectoralis Major Muscle
6. Sternum
7. Ascending Aorta
8. Left Lung
9. Latissimus Dorsi Muscle
10. Teres Major Muscle
11. Scapula
12. Left Pulmonary Artery
13. Descending Aorta
14. Carina (Trachea)
15. Erector Spinae Muscle
16. Trapezius Muscle
17. Rhomboid Muscle
18. Infrapinatus Muscle



## Axial Chest

# Question #21:

Slip ring technology allows for:

- a. reduced patient dose.
- b. continuous gantry rotation.
- c. improved detector efficiency.
- d. faster image display.

# Question #21: Review

- Slip Ring Technology

Modern CT systems employ slip ring technology, which allows continuous rotation of the gantry without cable entanglement.

Electrical power and data are transmitted through conductive rings and brushes, enabling helical (spiral) scanning and faster image acquisition.

# Question #22:

Which of the following terms would be used to describe the CR when it is used to skim the surface of the patient?

- a. anteroposterior
- b. tangential
- c. posteroanterior
- d. axial

# Question #22: Review

- Projection is a term that is used to describe the path of the primary x-ray beam or central ray.
- The following is a list of terms that are examples of a projection.

## Anteroposterior (AP)

- The CR will pass through the anterior aspect of the patient and exit the posterior aspect.

## Posteroanterior (PA)

- The CR will pass through the posterior aspect of the patient and exit the anterior aspect.

## Tangential

- The CR will skim the surface of the patient.

## Axial

- Refers to a tube angle that directed along the long axis of a body part.

# Question #23:

What artifact is most commonly associated with anatomy extending beyond the scan field of view (SFOV)?

- a. truncation artifacts
- b. motion artifacts
- c. ring artifacts
- d. beam hardening

# Question #23: Review

- Truncation and Edge Artifacts

One of the most clinically significant consequences of improper scan field of view (SFOV) selection is data truncation.

When patient anatomy extends beyond the selected SFOV, x-ray attenuation data are incomplete.

This results in characteristic artifacts such as shading, streaking, and inaccurate CT numbers near the periphery of the image.

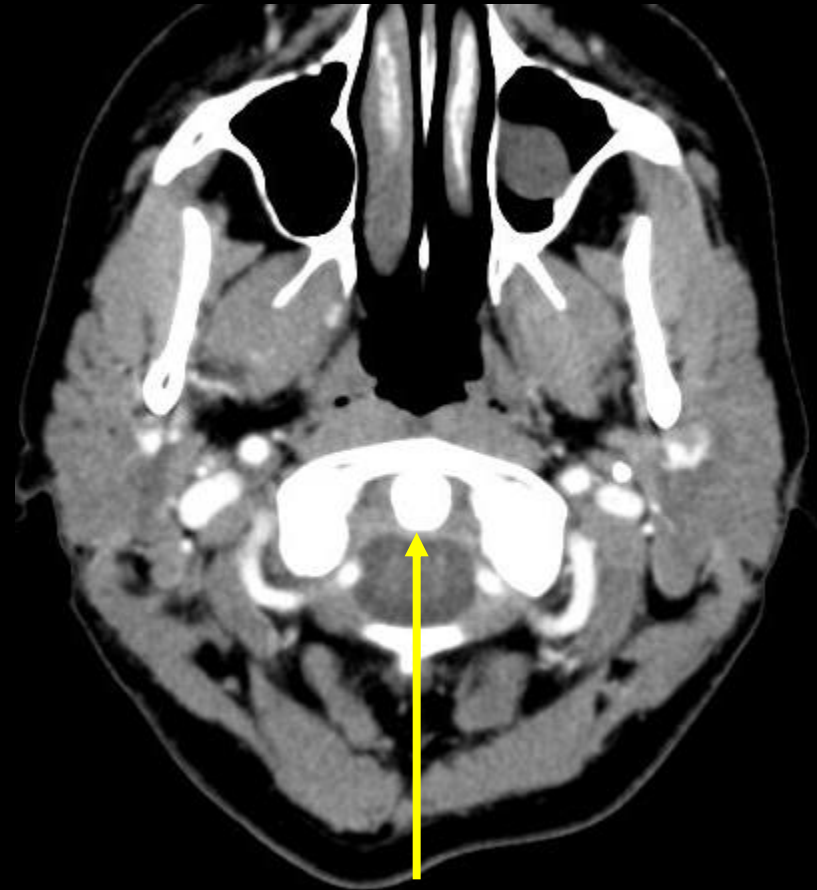
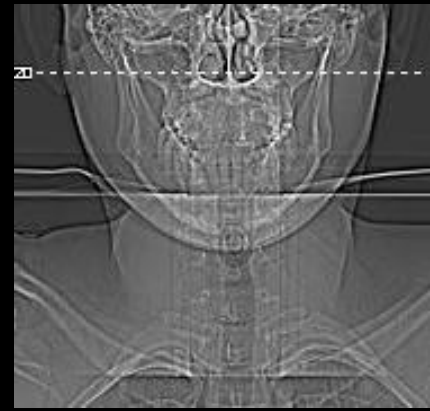
Truncation can compromise quantitative applications such as attenuation-based diagnosis, perfusion imaging, and radiation therapy planning.

Although modern reconstruction algorithms can partially mitigate truncation artifacts, they cannot fully replace missing data, underscoring the importance of correct SFOV selection.

# Question #24:

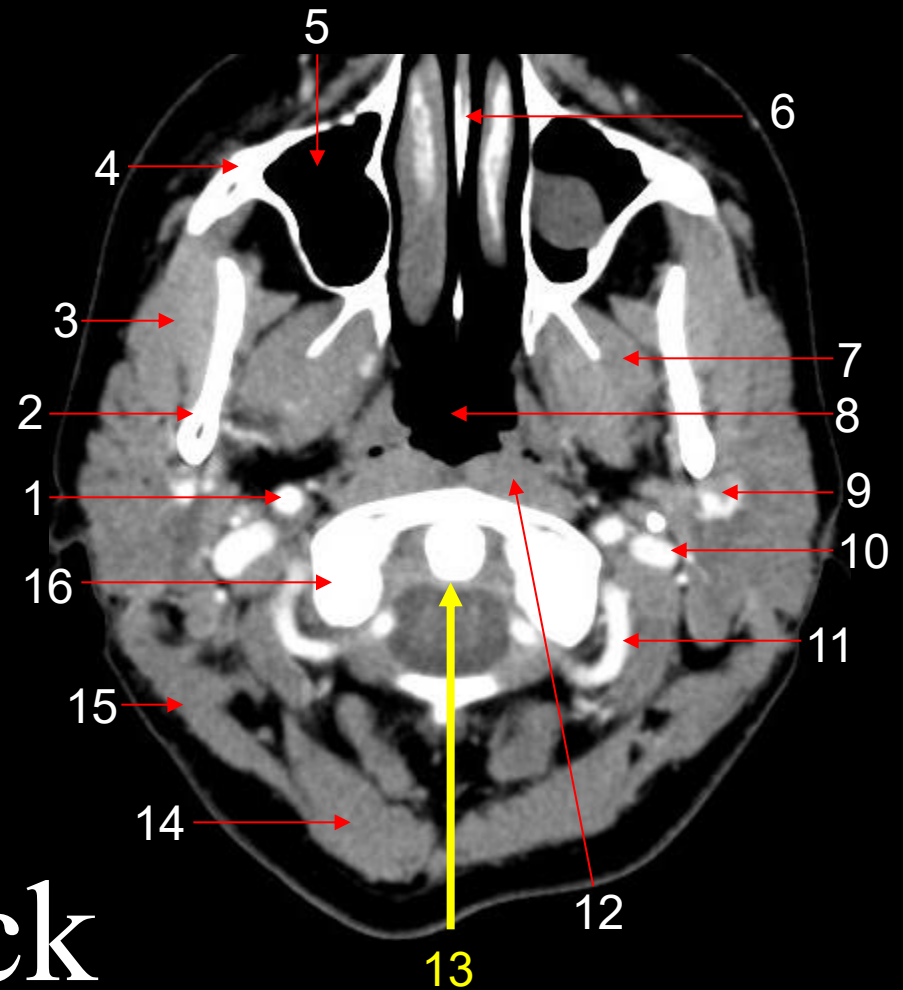
The arrow is pointing to the:

- a. odontoid.
- b. lateral mass.
- c. anterior arch.
- d. posterior arch.



# Question #24: Review

1. Right Internal Carotid Artery
2. Mandible
3. Masseter Muscle
4. Maxilla
5. Maxillary Sinus
6. Perpendicular Plate
7. Pterygoid Muscle
8. Nasopharynx
9. Left Retromandibular Vein
10. Left Internal Jugular Vein
11. Left Vertebral Artery
12. Longus Colli Muscle
13. Odontoid Process, C-2
14. Semispinalis Capitis Muscle
15. Splenius Capitis Muscle
16. Lateral Mass, C-1

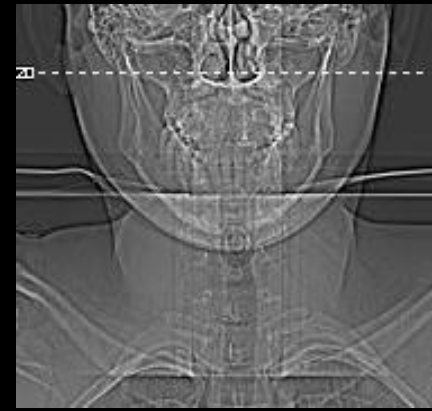


## Axial Neck

# Question #25:

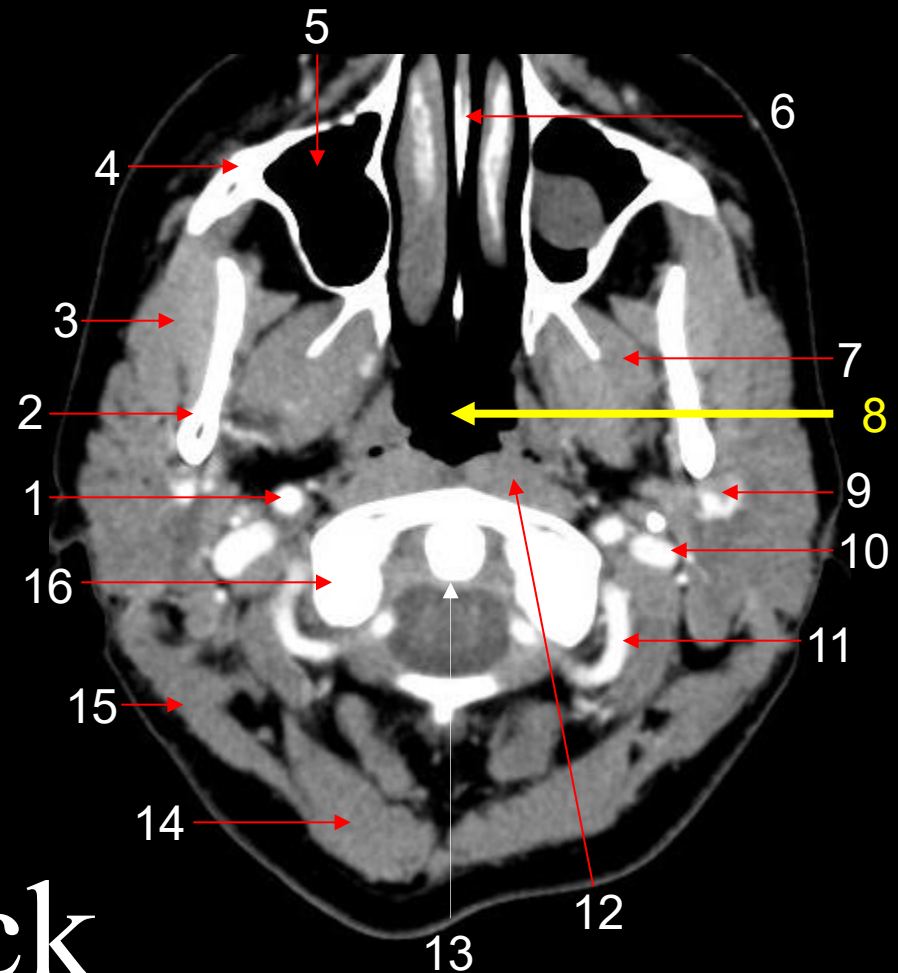
The arrow is pointing to the:

- a. maxillary sinus.
- b. ethmoid sinus.
- c. sphenoid sinus.
- d. nasopharynx.



# #25: Review

1. Right Internal Carotid Artery
2. Mandible
3. Masseter Muscle
4. Maxilla
5. Maxillary Sinus
6. Perpendicular Plate
7. Pterygoid Muscle
8. **Nasopharynx**
9. Left Retromandibular Vein
10. Left Internal Jugular Vein
11. Left Vertebral Artery
12. Longus Colli Muscle
13. Odontoid Process, C-2
14. Semispinalis Capitis Muscle
15. Splenius Capitis Muscle
16. Lateral Mass, C-1



## Axial Neck

# Question #26:

A primary trade-off of increasing matrix size is:

- a. increased image noise.
- b. reduced spatial resolution.
- c. lower radiation dose.
- d. loss of HU accuracy.

# Question #26: Review

- Matrix and Image Noise

While increasing matrix size reduces pixel size, it also increases image noise.

Smaller pixels contain fewer x-ray photons, resulting in increased statistical noise per pixel.

As a result, increasing the matrix size without adjusting acquisition parameters can degrade image quality.

This trade-off is a critical consideration in CT protocol design. Radiologists and technologists must balance spatial resolution against noise, particularly in low-dose imaging applications. Iterative reconstruction techniques have helped mitigate noise issues, allowing finer matrices to be used more effectively.

# Question #27:

What is the main role of the detector array?

- a. emit x-rays
- b. control scan parameters
- c. measure transmitted x-rays
- d. store reconstructed images

# Question #27: Review

- **Detector Array**

Opposite the X-ray tube is the detector array, which measures the intensity of transmitted X-rays after they pass through the patient. Modern CT scanners use solid-state detectors, typically made of scintillated crystals coupled with photodiodes.

These detectors convert X-ray photons into visible light and then into electrical signals.

In multidetector CT (MDCT), detectors are arranged in multiple rows, allowing simultaneous acquisition of multiple slices and significantly reducing scan time.

# Question #28:

HIPAA primarily governs:

- a. image reconstruction.
- b. radiation safety.
- c. scanner design.
- d. patient data privacy and security.

# Question #28: Review

- Regulatory Frameworks Governing CT Data

CT exam security and confidentiality are governed by regulations such as:

- HIPAA (US) protects patient health information

- HITECH Act

- State privacy laws

Noncompliance can result in severe penalties and reputational damage.

# Question #29:

Which of the following terms would be used to describe when one structure is located further from the midline in relation to another structure?

- a. lateral
- b. distal
- c. proximal
- d. medial

# Question #29: Review

- Medial  
Refers to a structure that is closer to the midline.
- Lateral  
Refers to a structure that is further from the midline.
- Proximal  
Refers to a structure that is closer to a source.
- Distal  
Refers to a structure that is further from a source.
- Cephalic or Cephalad  
In a direction towards the head.
- Caudal or Caudad  
In a direction towards the feet.

# Question #30:

Pre-patient collimation is primarily responsible for:

- a. detector calibration.
- b. beam shaping before patient entry.
- c. reconstruction kernel selection.
- d. image display settings.

# Question #30: Review

- Definition of CT Collimation

In CT, collimation refers to the restriction and shaping of the x-ray beam using high-attenuation materials, typically tungsten.

The primary objectives of collimation are to:

- Define slice thickness or beam width
- Limit unnecessary patient exposure
- Reduce scatter radiation reaching the detectors

**Modern CT scanners employ two principal forms of collimation:**

- **Pre-patient collimation is located near the x-ray tube, shapes the beam, and limits patient exposure**
- Post-patient collimation is located just before the detector array and reduces scatter radiation reaching the detectors

Both forms are essential for optimizing image quality and radiation efficiency.

# Question #31:

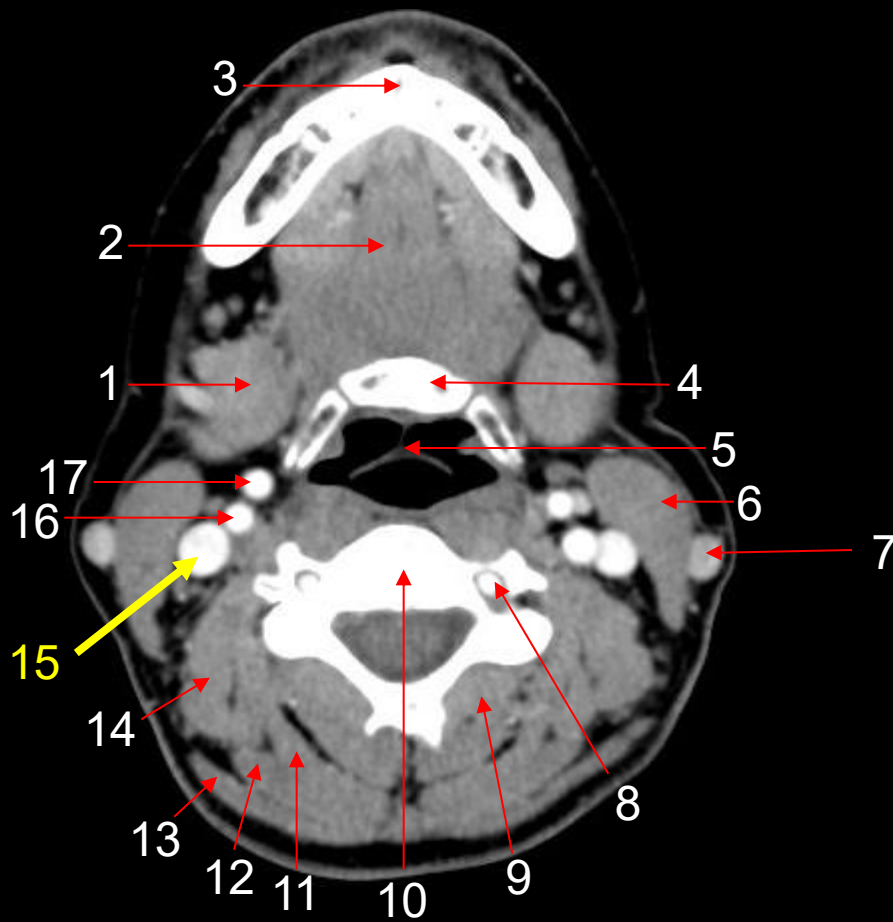
The arrow is pointing to the:

- a. submandibular gland.
- b. internal jugular vein.
- c. vertebral artery.
- d. external carotid artery.



# #31: Review

1. Submandibular Gland
2. Tongue
3. Mandible
4. Hyoid
5. Epiglottis
6. Sternocleidomastoid Muscle
7. Left External Jugular Vein
8. Left Vertebral Artery
9. Multifidus Muscle
10. Cervical Spine
11. Semispinalis Capitis Muscle
12. Splenius Capitis Muscle
13. Trapezius Muscle
14. Levator Scapulae Muscle
- 15. Right Internal Jugular Vein**
16. Right Internal Carotid Artery
17. Right External Carotid Artery

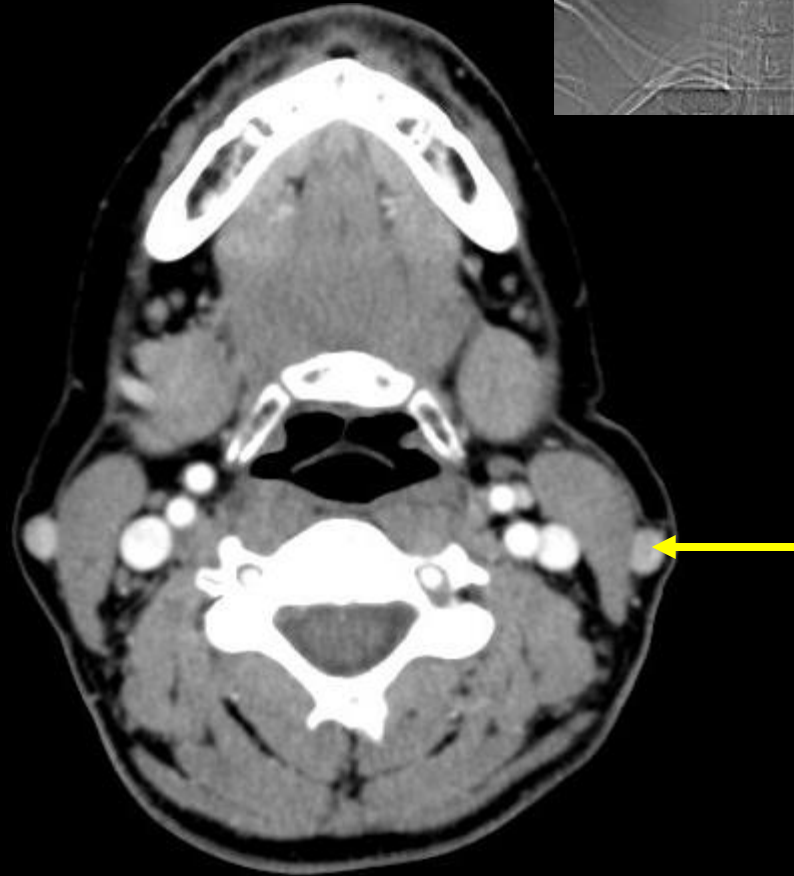


## Axial Neck

# Question #32:

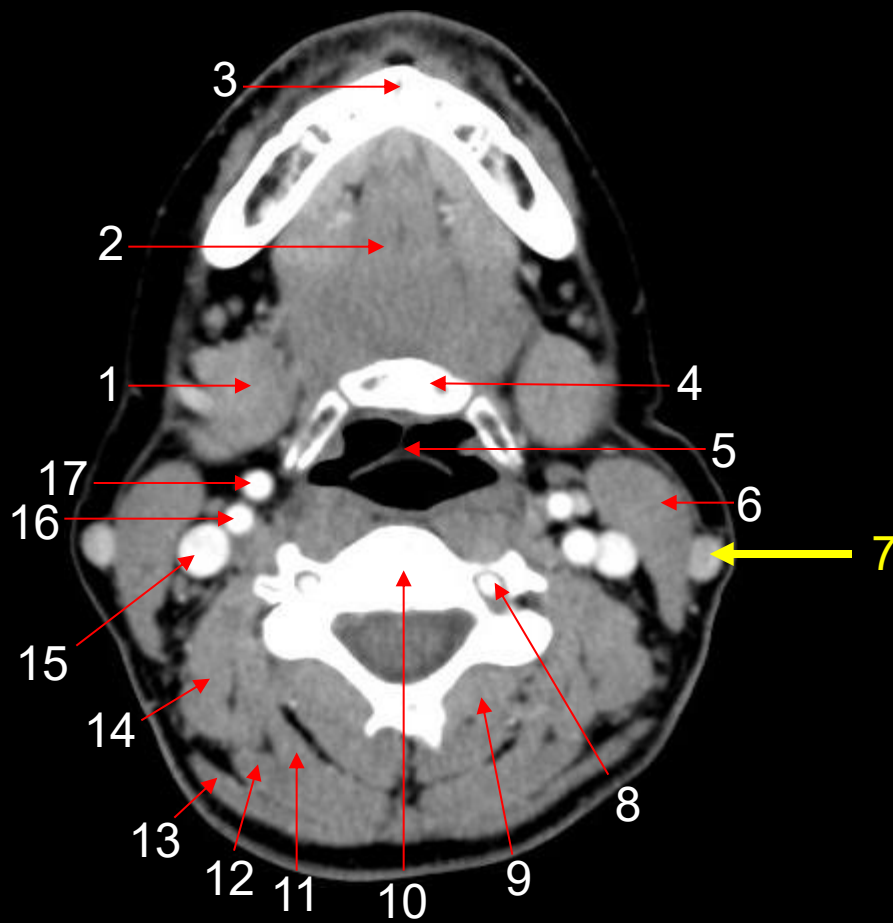
The arrow is pointing to the:

- a. sternocleidomastoid muscle.
- b. internal carotid artery.
- c. external jugular vein.
- d. submandibular gland.



# #32: Review

1. Submandibular Gland
2. Tongue
3. Mandible
4. Hyoid
5. Epiglottis
6. Sternocleidomastoid Muscle
7. Left External Jugular Vein
8. Left Vertebral Artery
9. Multifidus Muscle
10. Cervical Spine
11. Semispinalis Capitis Muscle
12. Splenius Capitis Muscle
13. Trapezius Muscle
14. Levator Scapulae Muscle
15. Right Internal Jugular Vein
16. Right Internal Carotid Artery
17. Right External Carotid Artery



## Axial Neck

# Question #33:

Which reconstruction approach best supports sub-millimeter slice imaging at low dose?

- a. iterative reconstruction (IR)
- b. filtered back projection (FBP)
- c. image smoothing only
- d. no reconstruction algorithm

# Question #33: Review

- Iterative Reconstruction (IR) and Slice Thickness

IR fundamentally changes the relationship between slice thickness and noise.

By modeling noise and system physics, IR reduces noise more effectively than filtered back projection (FBP), allowing thinner slices to be reconstructed at clinically acceptable noise levels.

This capability has enabled routine reconstruction of sub-millimeter slices, which are essential for high-resolution applications such as lung imaging, vascular studies, and multiplanar reformations.

IR allows slice thickness to be selected based on diagnostic needs rather than noise limitations alone.

# Question #34:

The Data Acquisition System primarily:

- a. displays images
- b. converts analog signals to digital signals
- c. controls table motion
- d. performs image reconstruction.

# Question #34: Review

- Data Acquisition System (DAS)

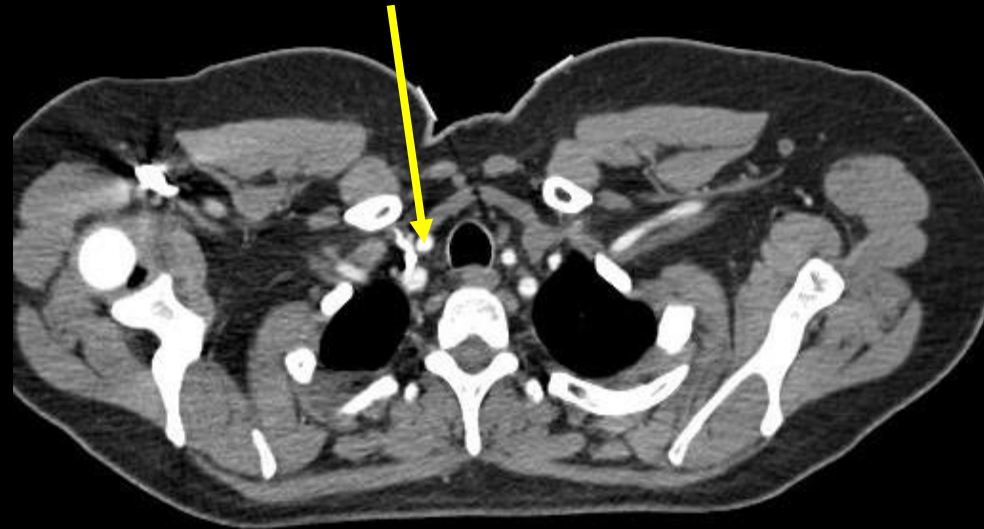
Although not always emphasized as a standalone component, the Data Acquisition System (DAS) plays a critical intermediary role. The DAS receives analog electrical signals from the detectors and converts them into digital data through analog-to-digital converters (ADCs).

These digital signals represent the attenuation values of tissues and form the raw data used for image reconstruction.

# Question #35:

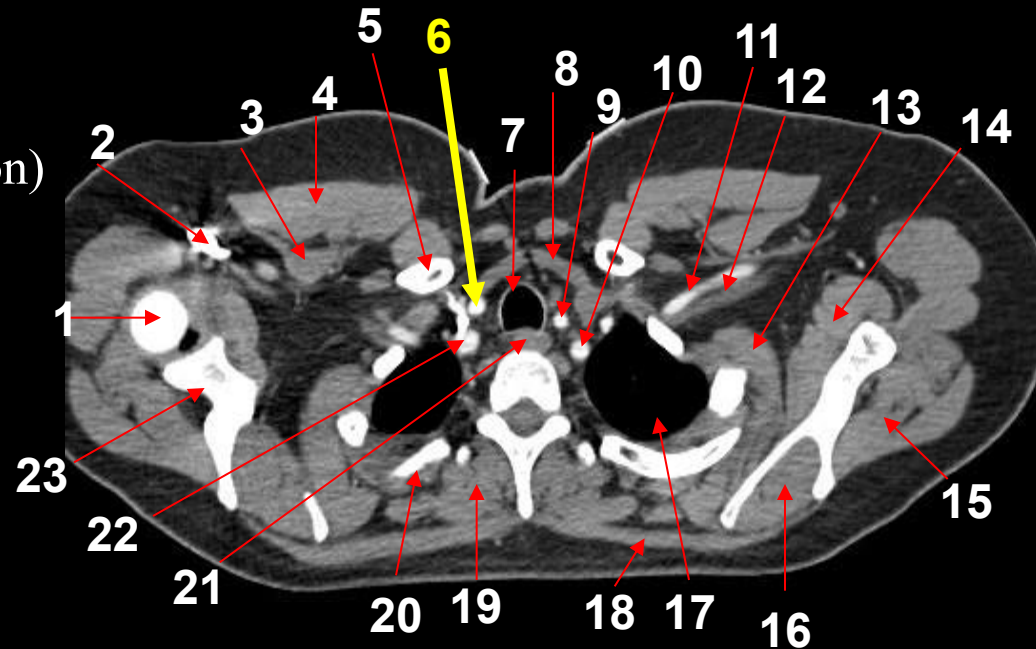
The arrow is pointing to the:

- a. jugular vein.
- b. subclavian artery.
- c. subclavian vein.
- d. common carotid artery.



# #35: Review

1. Head of Humerus
2. Right Subclavian Vein
3. Pectoralis Minor Muscle
4. Pectoralis Major Muscle
5. Clavicle
- 6. Right Common Carotid Artery**
7. Trachea
8. Thyroid
9. Left Common Carotid Artery
10. Left Subclavian Artery
11. Left Subclavian Artery (Lateral Portion)
12. Left Subclavian Vein
13. Serratus Anterior Muscle
14. Subscapularis Muscle
15. Infraspinatus Muscle
16. Supraspinatus Muscle
17. Left Lung
18. Trapezius Muscle
19. Erector Spinae Muscle
20. Rib
21. Esophagus
22. Right Subclavian Artery
23. Scapula



## Axial Chest

# Question #36:

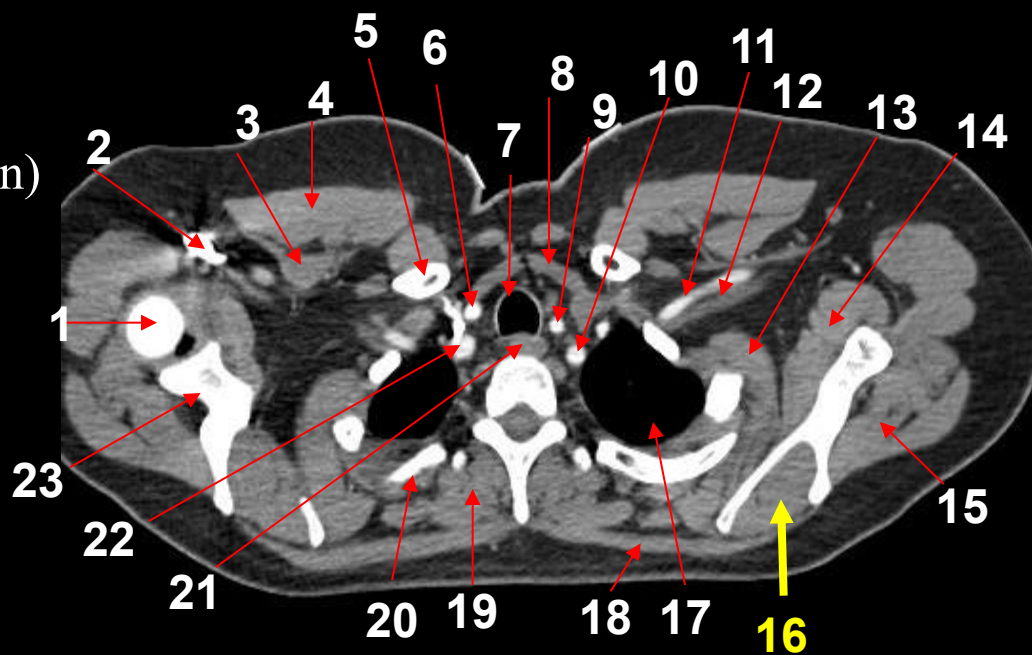
The arrow is pointing to the \_\_\_\_\_ muscle.

- a. supraspinatus
- b. infraspinatus
- c. serratus anterior
- d. erector spinae



# #36: Review

1. Head of Humerus
2. Right Subclavian Vein
3. Pectoralis Minor Muscle
4. Pectoralis Major Muscle
5. Clavicle
6. Right Common Carotid Artery
7. Trachea
8. Thyroid
9. Left Common Carotid Artery
10. Left Subclavian Artery
11. Left Subclavian Artery (Lateral Portion)
12. Left Subclavian Vein
13. Serratus Anterior Muscle
14. Subscapularis Muscle
15. Infraspinatus Muscle
16. **Supraspinatus Muscle**
17. Left Lung
18. Trapezius Muscle
19. Erector Spinae Muscle
20. Rib
21. Esophagus
22. Right Subclavian Artery
23. Scapula



## Axial Chest

# Question #37:

What best defines Scan Field of View (SFOV) in CT?

- a. The physical region from which CT projection data are acquired
- b. The area displayed on the monitor
- c. The reconstructed image zoom level
- d. The slice thickness

# Question #37: Review

- Definition of Scan Field of View (SFOV)

Scan Field of View refers to the diameter of the circular region from which CT projection data are acquired and reconstructed.

It is determined primarily by scanner hardware, including detector geometry, gantry aperture, and data acquisition electronics.

SFOV differs from Display Field of View (DFOV), which defines the portion of the reconstructed image displayed to the viewer and can be adjusted retrospectively.

In contrast, SFOV is selected prior to scanning and constrains what anatomical data are actually measured.

Objects outside the SFOV are either partially sampled or excluded entirely, leading to potential truncation artifacts and loss of diagnostic information.

# Question #38:

Post-patient collimation mainly serves to:

- a. increase beam intensity.
- b. improve tube cooling.
- c. control table motion.
- d. reduce scatter reaching the detectors.

# Question #38: Review

- Definition of CT Collimation

In CT, collimation refers to the restriction and shaping of the x-ray beam using high-attenuation materials, typically tungsten.

The primary objectives of collimation are to:

- Define slice thickness or beam width
- Limit unnecessary patient exposure
- Reduce scatter radiation reaching the detectors

**Modern CT scanners employ two principal forms of collimation:**

- Pre-patient collimation is located near the x-ray tube, shapes the beam, and limits patient exposure
- **Post-patient collimation is located just before the detector array and reduces scatter radiation reaching the detectors**

Both forms are essential for optimizing image quality and radiation efficiency.

# Question #39:

Which of the following is used to describe the path that the x-ray beam travels?

- a. projection
- b. position
- c. medial
- d. coronal

# Question #39: Review

- Projection is a term that is used to describe the path of the primary x-ray beam or central ray.
- The following is a list of terms that are examples of a projection.

## Anteroposterior (AP)

- The CR will pass through the anterior aspect of the patient and exit the posterior aspect.

## Posteroanterior (PA)

- The CR will pass through the posterior aspect of the patient and exit the anterior aspect.

## Tangential

- The CR will skim the surface of the patient.

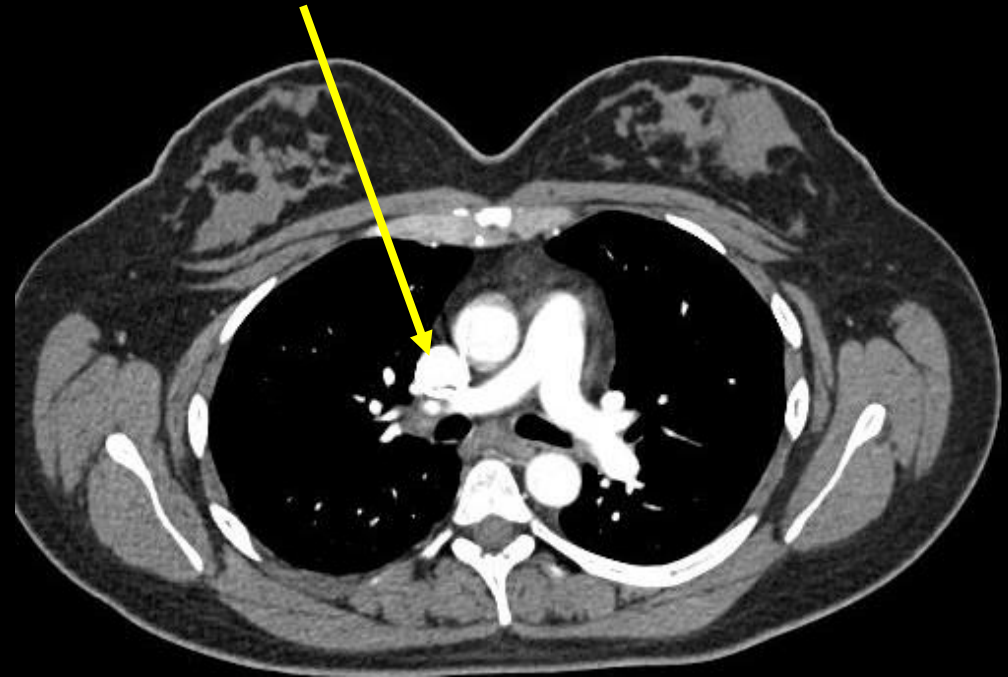
## Axial

- Refers to a tube angle that directed along the long axis of a body part.

# Question #40:

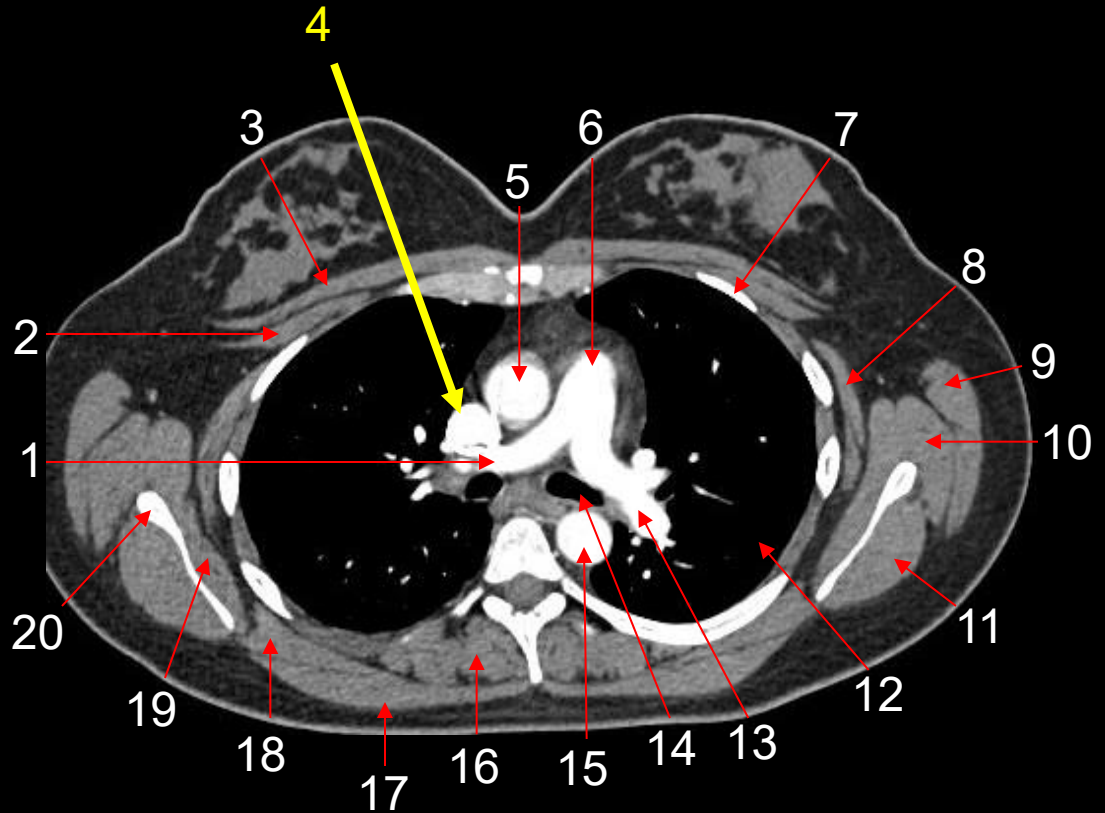
The arrow is pointing to the:

- a. ascending aorta.
- b. pulmonary trunk.
- c. superior vena cava.
- d. left pulmonary artery.



# Question #40: Review

1. Right Pulmonary Artery
2. Pectoralis Minor Muscle
3. Pectoralis Major Muscle
4. Superior Vena Cava
5. Ascending Aorta
6. Pulmonary Trunk
7. Rib
8. Serratus Anterior Muscle
9. Latissimus Dorsi Muscle
10. Teres Major Muscle
11. Infraspinatus Muscle
12. Left Lung
13. Left Pulmonary Artery
14. Left Mainstem Bronchus
15. Descending Aorta
16. Erector Spinae Muscle
17. Trapezius Muscle
18. Rhomboid Muscle
19. Subscapularis Muscle
20. Scapula

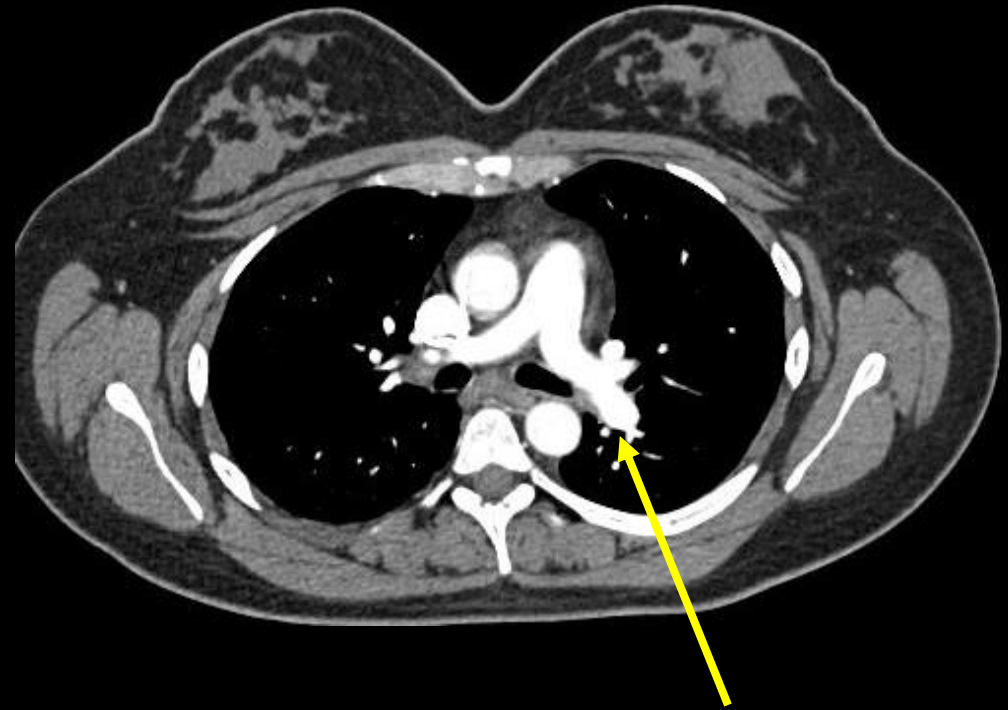
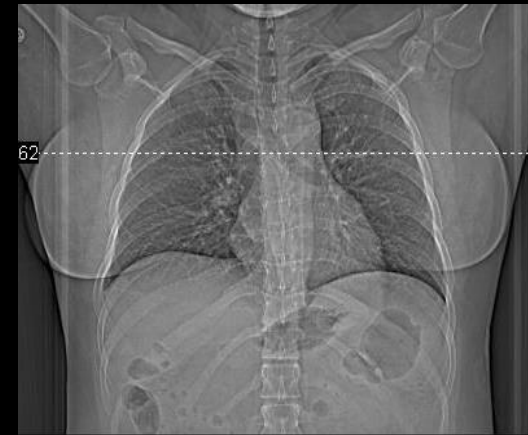


## Axial Chest

# Question #41:

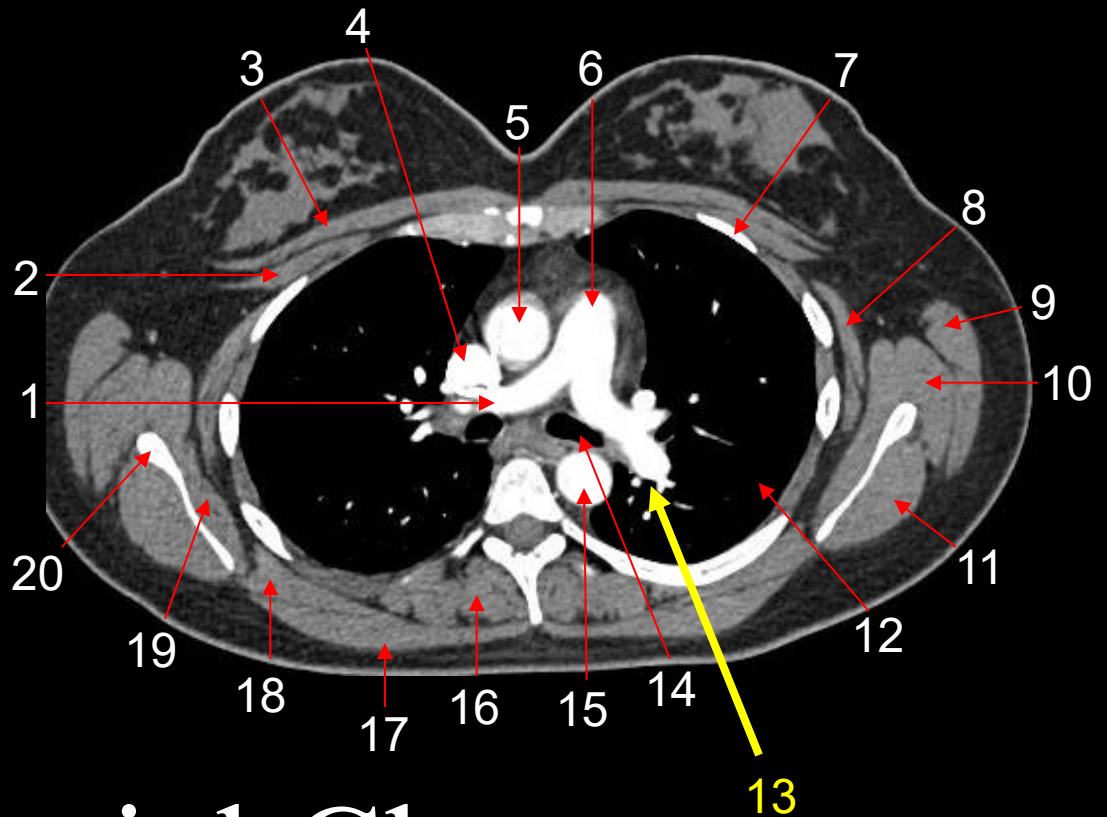
The arrow is pointing to the:

- a. ascending aorta.
- b. pulmonary trunk.
- c. superior vena cava.
- d. left pulmonary artery.



# Question #41: Review

1. Right Pulmonary Artery
2. Pectoralis Minor Muscle
3. Pectoralis Major Muscle
4. Superior Vena Cava
5. Ascending Aorta
6. Pulmonary Trunk
7. Rib
8. Serratus Anterior Muscle
9. Latissimus Dorsi Muscle
10. Teres Major Muscle
11. Infraspinatus Muscle
12. Left Lung
13. Left Pulmonary Artery
14. Left Mainstem Bronchus
15. Descending Aorta
16. Erector Spinae Muscle
17. Trapezius Muscle
18. Rhomboid Muscle
19. Subscapularis Muscle
20. Scapula



## Axial Chest

# Question #42:

Which reconstruction method is traditionally used in CT:

- a. Fourier transform only.
- b. filtered back projection.
- c. ultrasound beam forming.
- d. magnetic resonance encoding.

# Question #42: Review

- Image Reconstruction

The array processor performs complex mathematical operations by using a traditional method such as a filtered back projection algorithm.

This method calculates the linear attenuation coefficients for each voxel in the scanned volume.

Because CT imaging generates enormous datasets in a very short time, the array processor must operate extremely quickly to deliver images promptly.

# Question #43:

Thicker slices are commonly used because they:

- a. increase spatial resolution
- b. reduce image noise
- c. increase radiation dose
- d. improve temporal resolution

# Question #43: Review

- **Slice Thickness: Definition and Importance**

Slice thickness refers to the thickness of the reconstructed image section along the patient's longitudinal axis.

It is distinct from detector collimation and is determined during reconstruction rather than acquisition.

Slice thickness affects:

- Spatial resolution in the z-direction
- Image noise
- Partial volume averaging
- Visibility of small structures

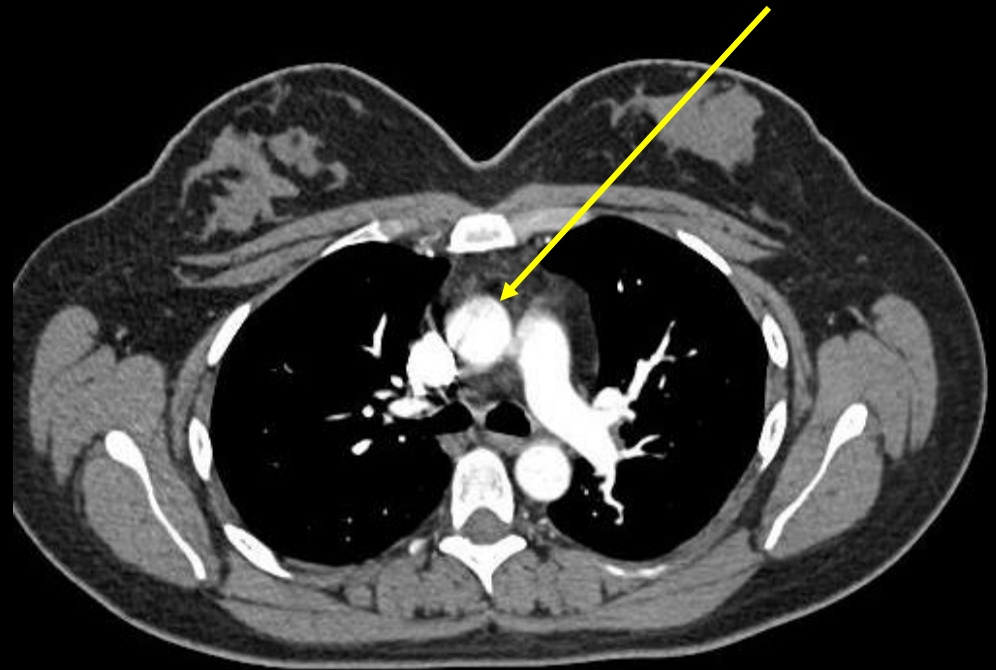
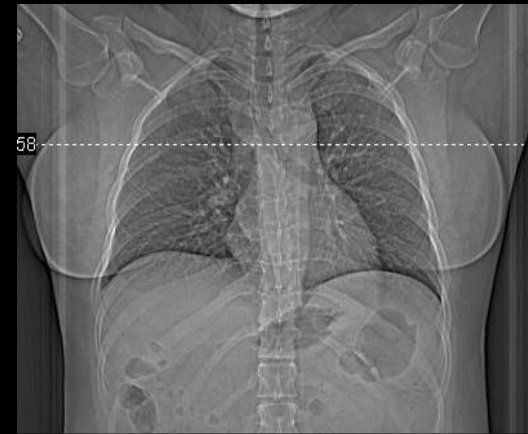
Thinner slices reduce partial volume effects and improve visualization of small or low-contrast structures.

**Thicker slices reduce noise by averaging data over a larger volume but may obscure fine anatomical detail.**

# Question #44:

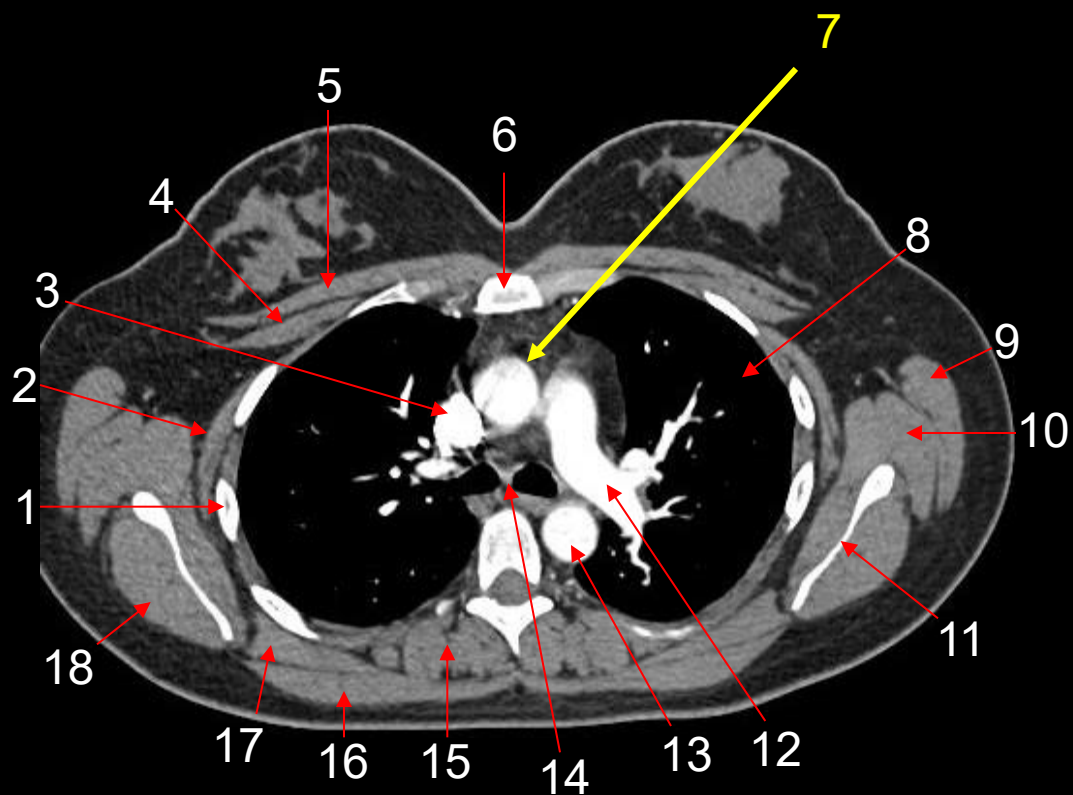
The arrow is pointing to the:

- a. ascending aorta.
- b. superior vena cava.
- c. descending aorta.
- d. left pulmonary artery.



# #44: Review

1. Rib
2. Serratus Anterior Muscle
3. Superior Vena Cava
4. Pectoralis Minor Muscle
5. Pectoralis Major Muscle
6. Sternum
7. Ascending Aorta
8. Left Lung
9. Latissimus Dorsi Muscle
10. Teres Major Muscle
11. Scapula
12. Left Pulmonary Artery
13. Descending Aorta
14. Carina (Trachea)
15. Erector Spinae Muscle
16. Trapezius Muscle
17. Rhomboid Muscle
18. Infraspinatus Muscle

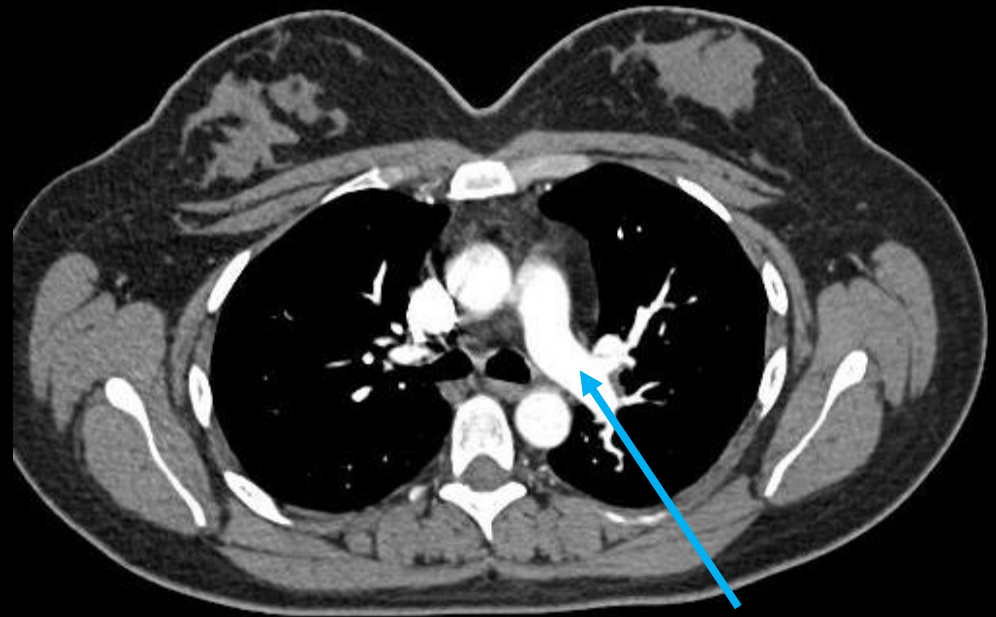
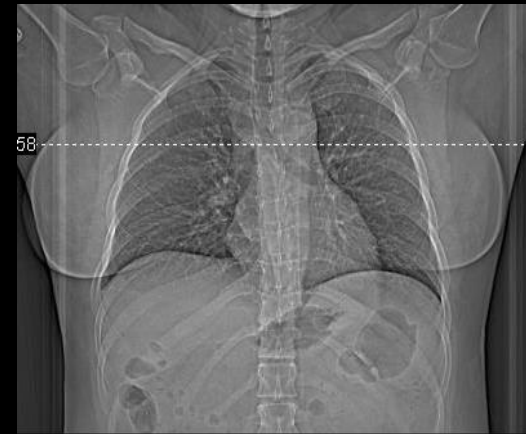


## Axial Chest

# Question #45:

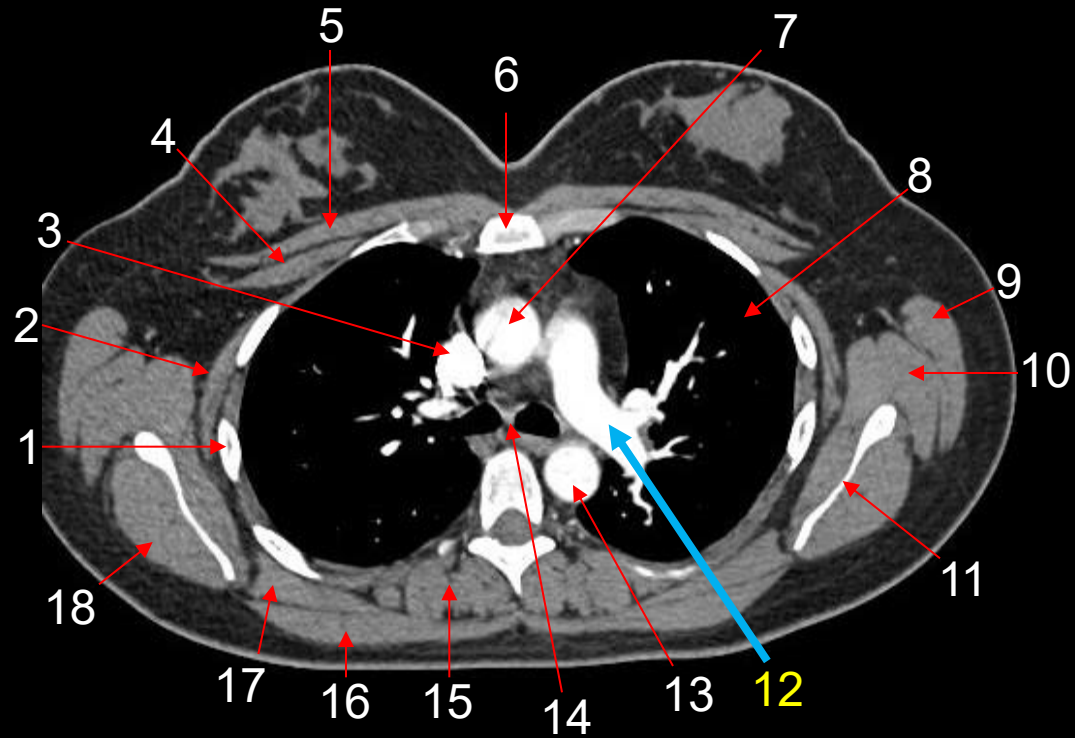
The arrow is pointing to the:

- a. descending aorta.
- b. pulmonary artery.
- c. superior vena cava.
- d. ascending aorta.



# #45: Review

1. Rib
2. Serratus Anterior Muscle
3. Superior Vena Cava
4. Pectoralis Minor Muscle
5. Pectoralis Major Muscle
6. Sternum
7. Ascending Aorta
8. Left Lung
9. Latissimus Dorsi Muscle
10. Teres Major Muscle
11. Scapula
- 12. Left Pulmonary Artery**
13. Descending Aorta
14. Carina (Trachea)
15. Erector Spinae Muscle
16. Trapezius Muscle
17. Rhomboid Muscle
18. Infrapinatus Muscle



## Axial Chest

# Question #46:

Iterative reconstruction (IR) allows thin slices to be reconstructed by:

- a. reducing noise through statistical modeling.
- b. increasing tube voltage.
- c. averaging image data only.
- d. eliminating reconstruction filters.

# Question #46: Review

- **Iterative Reconstruction (IR) and Slice Thickness**

Iterative reconstruction fundamentally changes the relationship between slice thickness and noise.

By modeling noise and system physics, IR reduces noise more effectively than filtered back projection (FBP), allowing thinner slices to be reconstructed at clinically acceptable noise levels.

This capability has enabled routine reconstruction of sub-millimeter slices, which are essential for high-resolution applications such as lung imaging, vascular studies, and multiplanar reformations.

IR allows slice thickness to be selected based on diagnostic needs rather than noise limitations alone.

# Question #47:

Thinner slices generally result in:

- a. lower image noise.
- b. increased partial volume effects.
- c. reduced spatial resolution.
- d. improved z-axis resolution.

# Question #47: Review

- Longitudinal Resolution

Slice thickness directly determines resolution along the z-axis.

Thinner slices improve the ability to resolve small structures and separate closely spaced anatomy, particularly in high-contrast regions such as the lungs and osseous structures.

- Isotropic Voxels

Thin slice thickness enables near-isotropic voxels, where resolution is similar in all three spatial dimensions.

Isotropic imaging is essential for accurate 3D reconstructions, curved planar reformations, and quantitative measurements.

- Influence of Slice Thickness

Thicker slices increase the likelihood of partial volume averaging.

Thinner slices reduce this effect by limiting the amount of anatomy included in each voxel, improving lesion detectability and edge definition.

# Question #48:

Which of the following terms would be used to describe when a patient is lying on their back and in an AP projection?

- a. supine
- b. prone
- c. decubitus
- d. lateral

# Question #48: Review

- Position is a term used to describe the how the patient's body has been physically placed.
- The following is a list of terms that are examples of a position.

## Anatomical Position

- The body is upright with the arms at the side and the hands facing forward.

## Recumbent

- This term is used to describe the body anytime it is lying down.

## Supine

- The body is recumbent and in an AP projection.

## Prone

- The body is recumbent and in a PA projection.

# Question #49:

Multidetector CT improves imaging by:

- a. increasing tube voltage.
- b. acquiring multiple slices simultaneously.
- c. eliminating reconstruction algorithms.
- d. reducing gantry size.

# Question #49: Review

- **Detector Array**

Opposite the X-ray tube is the detector array, which measures the intensity of transmitted X-rays after they pass through the patient. Modern CT scanners use solid-state detectors, typically made of scintillated crystals coupled with photodiodes.

These detectors convert X-ray photons into visible light and then into electrical signals.

**In multidetector CT (MDCT), detectors are arranged in multiple rows, allowing simultaneous acquisition of multiple slices and significantly reducing scan time.**

# Question #50:

Volumetric data acquisition is characterized by:

- a. slice-by-slice scanning with table motion between slices.
- b. continuous helical scanning along the z-axis.
- c. acquisition of a large z-axis volume in a single gantry rotation.
- d. limited to sequential imaging only.

# Question #50: Review

- Definition of Volumetric Data Acquisition

Volumetric data acquisition is characterized by the simultaneous capture of a large z-axis volume of data during a single rotation of the gantry.

Unlike sequential (axial) or helical acquisition, which acquire data slice by slice or continuously along a helical trajectory, volumetric CT uses wide-area detectors to encompass entire organs or regions in one pass.

The acquisition produces a fully sampled three-dimensional dataset, eliminating the need for table motion during the scan.

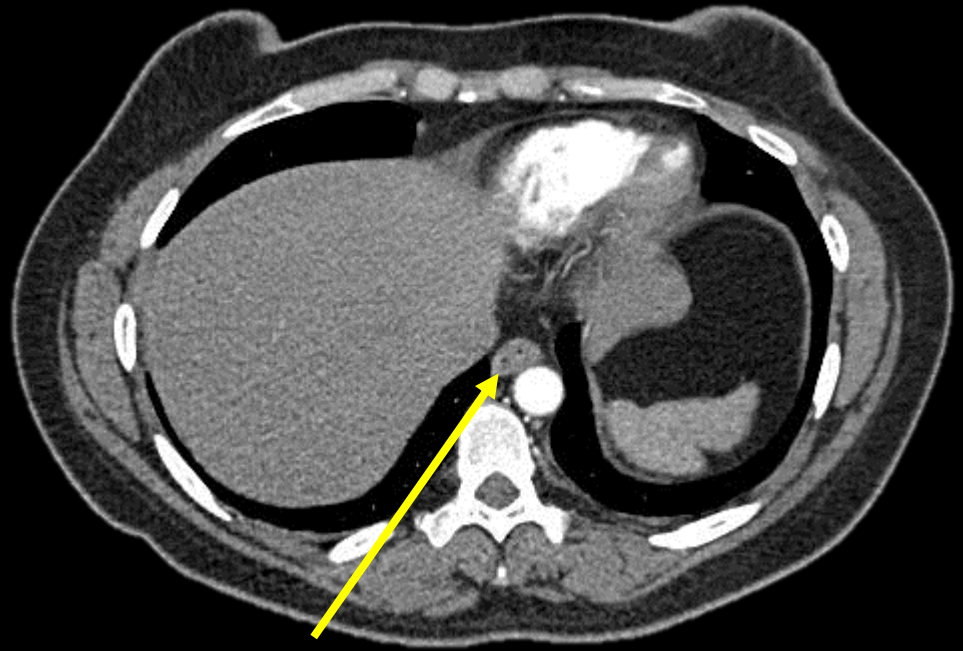
The key determinant of volumetric acquisition is detector coverage along the z-axis, which typically ranges from 16 cm to over 160 mm in modern scanners.

Wider detector arrays allow entire organs, such as the heart or liver, to be imaged in a single rotation, reducing artifacts and improving temporal resolution.

# Question #51:

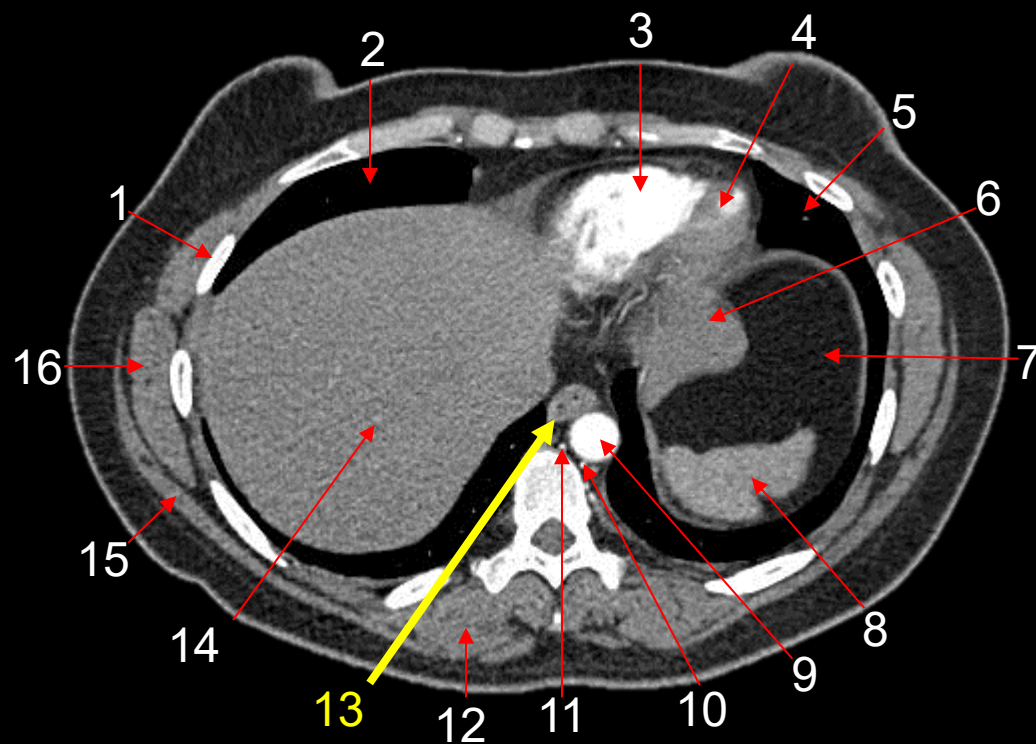
The arrow is pointing to the:

- a. aorta.
- b. trachea.
- c. esophagus.
- d. hemiazygos vein.



# #51: Review

1. Rib
2. Right Lung
3. Right Ventricle
4. Left Ventricle
5. Left Lung
6. Stomach
7. Fat
8. Spleen
9. Descending Aorta
10. Hemiazygos Vein
11. Azygos Vein
12. Erector Spinae Muscles
- 13. Esophagus**
14. Liver
15. Latissimus Dorsi Muscle
16. Serratus Anterior Muscle

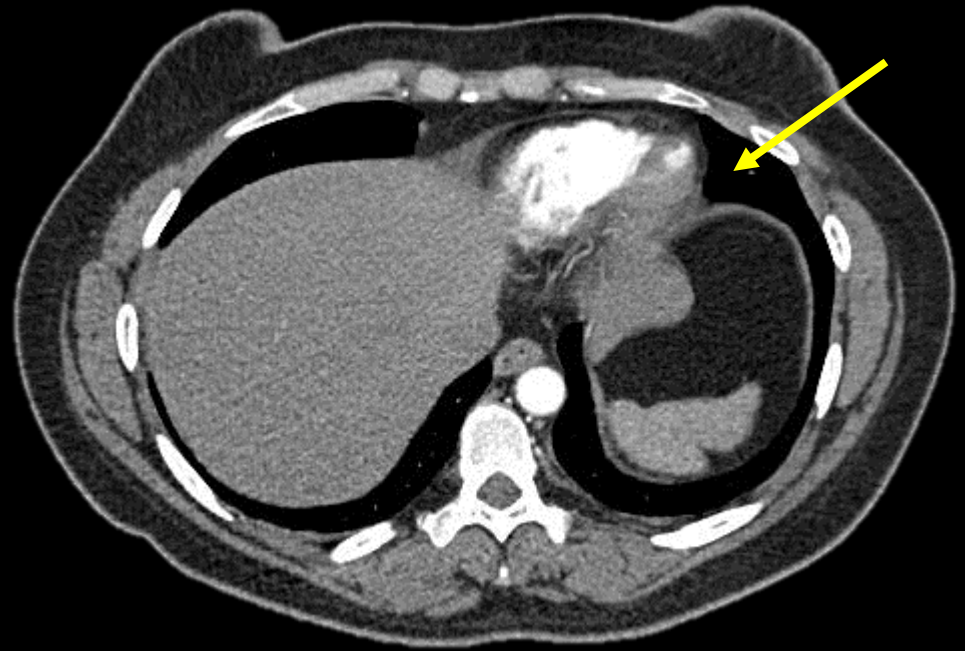


## Axial Chest

# Question #52:

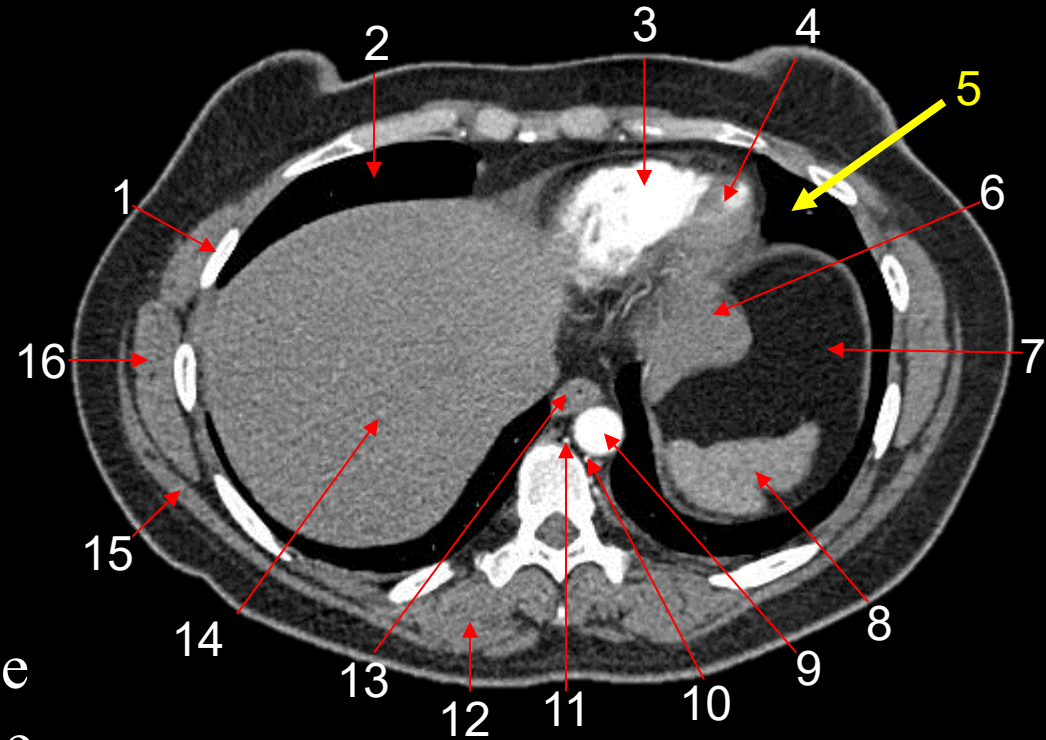
The arrow is pointing to the:

- a. spleen.
- b. fundus of the stomach.
- c. left lung.
- d. diaphragm.



# #52: Review

1. Rib
2. Right Lung
3. Right Ventricle
4. Left Ventricle
5. Left Lung
6. Stomach
7. Fat
8. Spleen
9. Descending Aorta
10. Hemiazygos Vein
11. Azygos Vein
12. Erector Spinae Muscles
13. Esophagus
14. Liver
15. Latissimus Dorsi Muscle
16. Serratus Anterior Muscle



## Axial Chest

# Question #53:

Atrophy refers to a decrease in size of cells within an organ or structure. Which of the following would **not** be an underlying cause of atrophy?

- a. nerve damage
- b. increase in physical activity
- c. poor nourishment
- d. poor circulation

# Question #53: Review

- Atrophy is the decrease in size of the cells within an organ or structure.
- The following is a list of some of the common causes of atrophy:
  - Lack of Physical Activity
  - Poor Nourishment
  - Nerve Damage
  - Poor Circulation

# Question #54:

The term caudad refers to which of the following?

- a. In a direction towards the feet.
- b. Refers to a structure that is further from a source.
- c. Refers to a structure that is closer to the midline.
- d. In a direction towards the head.

# Question #54: Review

- Medial  
Refers to a structure that is closer to the midline.
- Lateral  
Refers to a structure that is further from the midline.
- Proximal  
Refers to a structure that is closer to a source.
- Distal  
Refers to a structure that is further from a source.
- Cephalic or Cephalad  
In a direction towards the head.
- Caudal or Caudad  
In a direction towards the feet.

# Question #55:

DICOM standards are used for:

- a. radiation shielding.
- b. image reconstruction.
- c. medical image communication.
- d. x-ray generation.

# Question #55: Review

- **Communication and Networking**

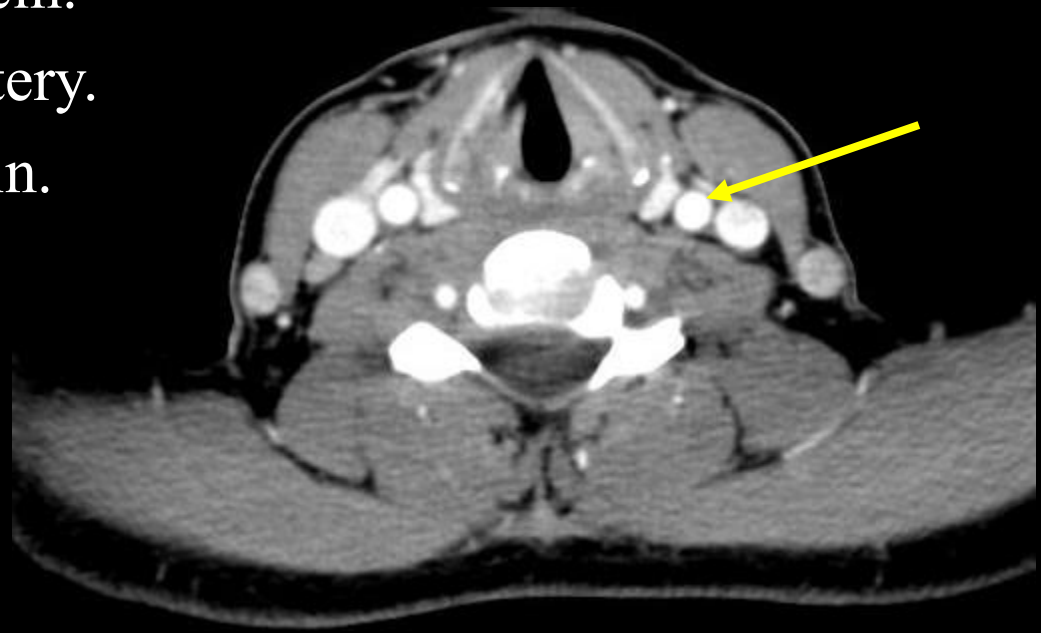
The host computer manages data transfer to external systems, including Picture Archiving and Communication Systems (PACS) and Radiology Information Systems (RIS).

It also ensures compliance with **DICOM standards**, enabling interoperability with other imaging devices and healthcare information systems.

# Question #56:

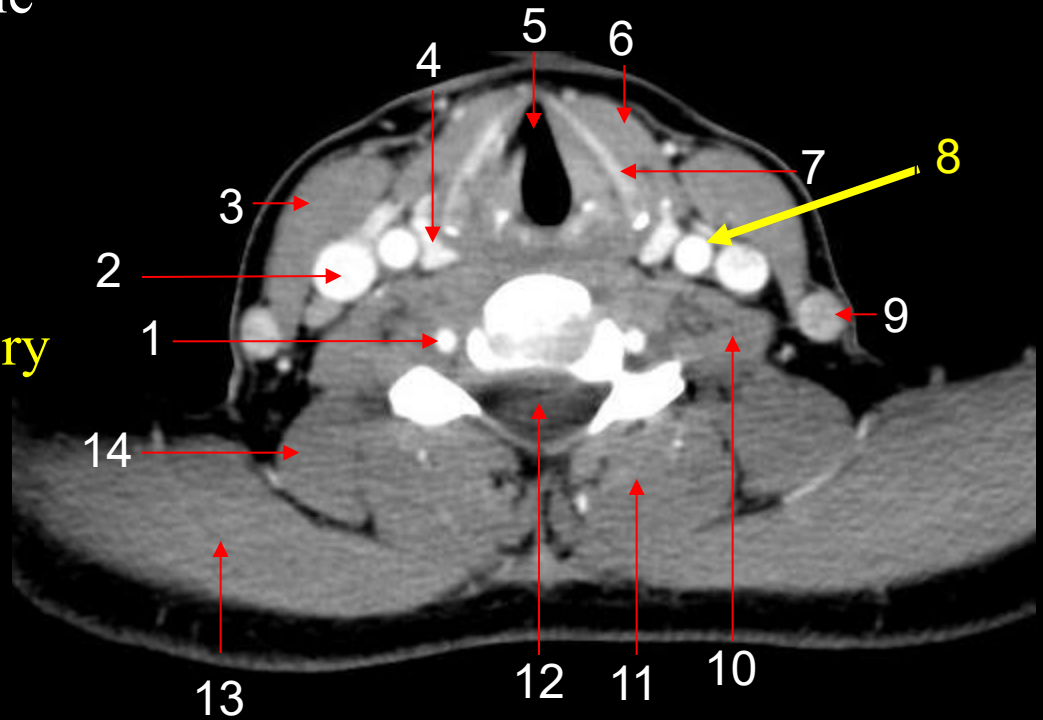
The arrow is pointing to the:

- a. right vertebral artery.
- b. right internal jugular vein.
- c. left common carotid artery.
- d. left external jugular vein.



# Question #56: Review

1. Right Vertebral Artery
2. Right Internal Jugular Vein
3. Sternocleidomastoid Muscle
4. Thyroid Gland
5. Glottis
6. Infrahyoid Muscle
7. Thyroid Cartilage
8. Left Common Carotid Artery
9. Left External Jugular Vein
10. Scalenus Muscle
11. Erector Spinae Muscle
12. Spinal Canal
13. Trapezius Muscle
14. Levator Scapulae Muscle



## Axial Neck

# Question #57:

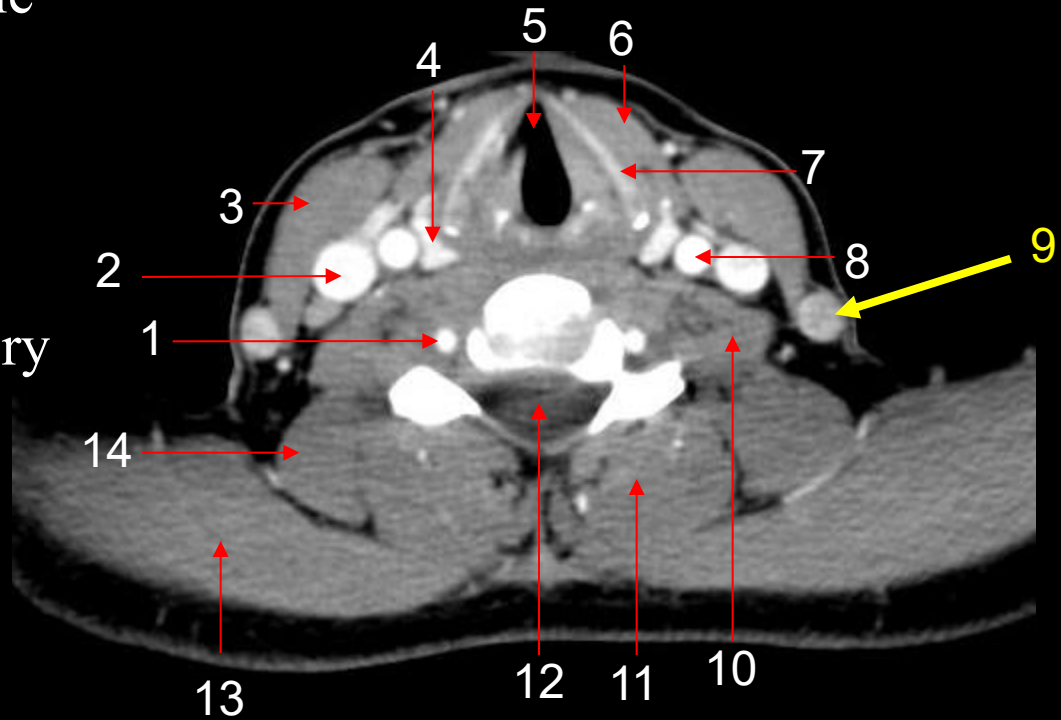
The arrow is pointing to the:

- a. right vertebral artery.
- b. right internal jugular vein.
- c. left common carotid artery.
- d. left external jugular vein.



# Question #57: Review

1. Right Vertebral Artery
2. Right Internal Jugular Vein
3. Sternocleidomastoid Muscle
4. Thyroid Gland
5. Glottis
6. Infrahyoid Muscle
7. Thyroid Cartilage
8. Left Common Carotid Artery
9. Left External Jugular Vein
10. Scalenus Muscle
11. Erector Spinae Muscle
12. Spinal Canal
13. Trapezius Muscle
14. Levator Scapulae Muscle



## Axial Neck

# Question #58:

What is the primary role of the high voltage generator in a CT scanner?

- a. capture detector signals
- b. rotate the gantry
- c. position the patient
- d. supply stable kV and mA for x-ray production

# #58: Review

- Purpose and Requirements for the High-Voltage Generator

The generator supplies and regulates the high voltage (kV) and current (mA) required by the X-ray tube.

It must provide a stable, nearly constant potential to ensure consistent X-ray production during rapid CT rotations and pulsed exposures.

Generators also control exposure timing, waveform shape, and safety functions.

# Question #59:

Over-ranging in helical CT refers to:

- a. excessive tube current.
- b. radiation beyond the planned scan range.
- c. motion between slices.
- d. detector saturation.

# #59: Review

- Radiation Dose Implications for Helical Scanning

Helical scanning has complex dose implications. Continuous acquisition enables efficient use of x-ray output and supports advanced dose modulation techniques, such as angular and longitudinal tube current modulation.

These features allow dose to be tailored dynamically to patient size and anatomy.

However, helical scanning introduces over-ranging, in which additional radiation is delivered beyond the planned scan range to ensure adequate data for interpolation at the scan edges.

While the relative impact of over-ranging decreases with longer scan lengths, it is an important consideration in short scans and pediatric imaging.

Modern scanners mitigate over-ranging through adaptive collimation and improved reconstruction methods.

# Question #60:

Which of the following terms would be used to describe a structure that is closer to a source?

- a. proximal
- b. medial
- c. caudal
- d. distal

# #60: Review

- Medial
  - Refers to a structure that is closer to the midline.
- Lateral
  - Refers to a structure that is further from the midline.
- Proximal
  - Refers to a structure that is closer to a source.
- Distal
  - Refers to a structure that is further from a source.
- Cephalic or Cephalad
  - In a direction towards the head.
- Caudal or Caudad
  - In a direction towards the feet.

# Question #61:

Isotropic voxels are important because they:

- a. reduce radiation dose.
- b. increase scan time.
- c. eliminate noise.
- d. improve reformatted image quality equally in all planes.

# Question #61: Review

- Voxel Geometry and Its Clinical Significance

Voxels incorporate slice thickness or reconstruction interval, making them essential for understanding volumetric resolution.

Voxel dimensions directly affect partial volume averaging, spatial resolution, and post-processing accuracy.

Voxels may be:

- Anisotropic: Unequal dimensions in x, y, and z directions (common with thicker slices)

- Isotropic: Equal dimensions in all three directions (achieved with thin slices & overlapping reconstruction)

**Isotropic voxels are a hallmark of modern CT imaging.**

**They allow images to be reformatted into any plane with equivalent resolution, enabling high-quality multiplanar reformations (MPRs) and 3D visualizations without loss of detail.**

# Question #62:

CT slice thickness primarily affects which type of resolution?

- a. temporal resolution
- b. contrast resolution
- c. longitudinal (z-axis) resolution
- d. spectral resolution

# Question #62: Review

- Role of CT Slice Thickness in CT Image Production

Computed tomography produces cross-sectional images by reconstructing volumetric data acquired during gantry rotation and table motion.

One of the most critical parameters defining the appearance and diagnostic value of these images is slice thickness, which determines the extent of anatomy represented in each reconstructed image along the longitudinal (z) axis.

In early CT systems, slice thickness was fixed by mechanical collimation.

In modern CT, however, thin detector elements, multi-row arrays, and advanced reconstruction techniques allow slice thickness to be selected retrospectively, making it a powerful tool for optimizing image quality for diverse clinical applications.

# Question #63:

Which component in the X-ray tube emits electrons?

- a. anode
- b. focusing cup
- c. filament
- d. slip ring

# Question #63: Review

- Cathode Assembly

The cathode comprises a filament and focusing mechanisms:

- The filament, typically tungsten, is heated to high temperatures to emit electrons via *thermionic emission* when energized by the filament circuit.
  - A focusing cup shapes and directs the electron cloud toward the anode's focal spot, ensuring a concentrated beam and stable X-ray production.
- Control over cathode emission is essential for regulating tube current (mA), which directly affects X-ray output and image quality.

# Question #64:

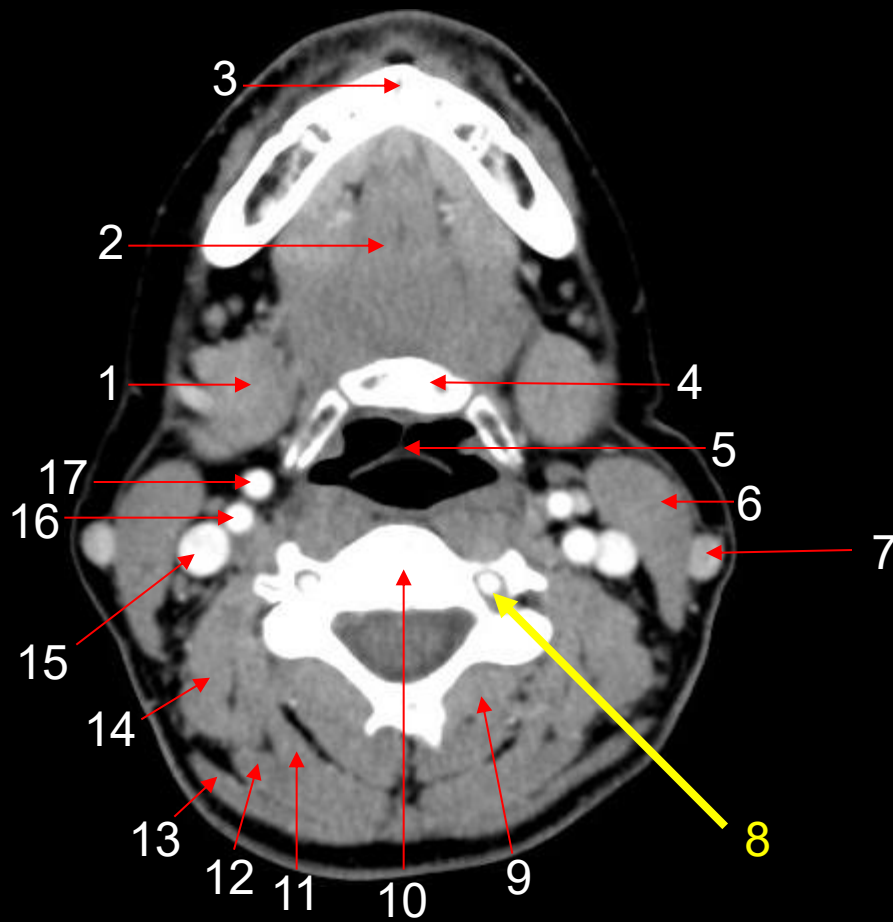
The arrow is pointing to the:

- a. left external jugular vein.
- b. left vertebral artery.
- c. right internal carotid artery.
- d. right external carotid artery.



# #64: Review

1. Submandibular Gland
2. Tongue
3. Mandible
4. Hyoid
5. Epiglottis
6. Sternocleidomastoid Muscle
7. Left External Jugular Vein
8. Left Vertebral Artery
9. Multifidus Muscle
10. Cervical Spine
11. Semispinalis Capitis Muscle
12. Splenius Capitis Muscle
13. Trapezius Muscle
14. Levator Scapulae Muscle
15. Right Internal Jugular Vein
16. Right Internal Carotid Artery
17. Right External Carotid Artery



## Axial Neck

# Question #65:

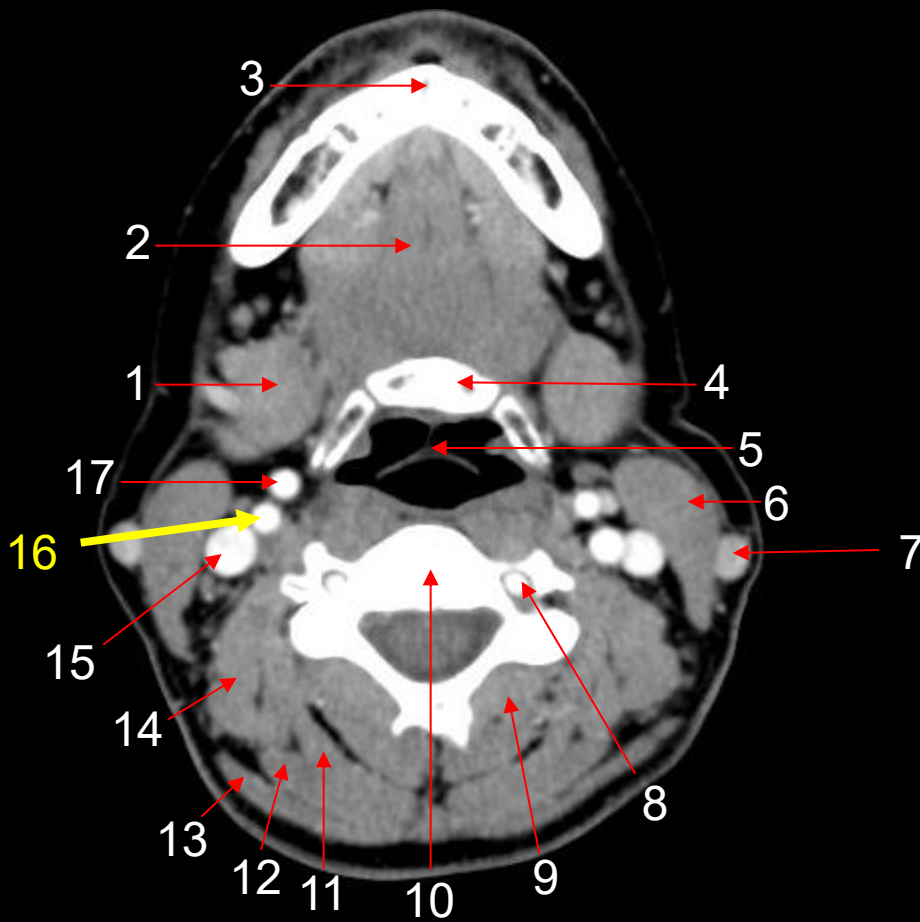
The arrow is pointing to the:

- a. left external jugular vein.
- b. left vertebral artery.
- c. right internal carotid artery.
- d. right external carotid artery.



# #65: Review

1. Submandibular Gland
2. Tongue
3. Mandible
4. Hyoid
5. Epiglottis
6. Sternocleidomastoid Muscle
7. Left External Jugular Vein
8. Left Vertebral Artery
9. Multifidus Muscle
10. Cervical Spine
11. Semispinalis Capitis Muscle
12. Splenius Capitis Muscle
13. Trapezius Muscle
14. Levator Scapulae Muscle
15. Right Internal Jugular Vein
16. Right Internal Carotid Artery
17. Right External Carotid Artery



## Axial Neck

# Question #66:

The understanding that there may be no real underlying cause for a disease is referred to as:

- a. idiopathic.
- b. etiology.
- c. syndrome.
- d. pathology.

# Question #66: Review

- Idiopathic

This refers to the fact that there may be no real cause for the disease.

Examples would be hypertension and a spontaneous pneumothorax.

# Question #67:

Which of the following terms would be used to describe dividing the body into equal front (anterior) and back (posterior) portions.

- a. midsagittal
- b. transverse
- c. midcoronal
- d. tangential

# Question #67: Review

- Sagittal Plane
  - Divides the body into right and left portions.
- Midsagittal Plane or Midline
  - Divides the body into equal right and left portions.
- Coronal Plane
  - Divides the body into front and back portions.
- Midcoronal Plane
  - Divides the body into equal front and back portions.
- Axial or Transverse Plane
  - Divides the body into top and bottom portions.

# Question #68:

A voxel differs from a pixel because it includes:

- a. window width.
- b. display resolution.
- c. matrix size.
- d. slice thickness.

# Question #68: Review

- Defining a Pixel (picture element):

A pixel is the smallest two-dimensional unit of a digital image.

In CT, each pixel represents a square area within a reconstructed image slice and is assigned a single numerical value corresponding to the average x-ray attenuation within that area.

Pixel values are displayed as shades of gray according to window width and window level settings.

- Defining a Voxel (volume element):

**A voxel includes depth or slice thickness (z-dimension), making it a three-dimensional element.**

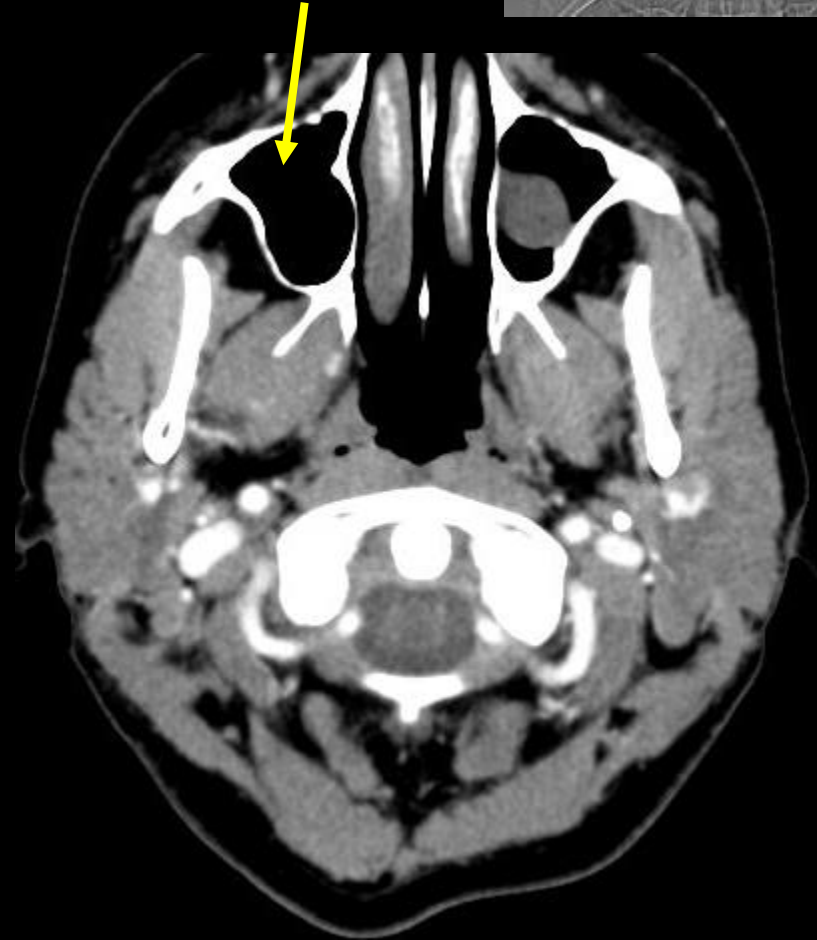
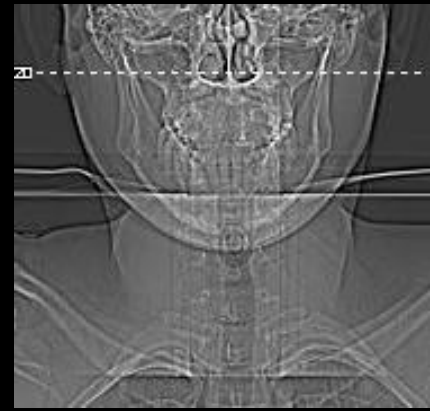
A voxel represents a discrete volume of tissue, defined by pixel dimensions in the x- and y-directions and slice thickness (or reconstruction interval) in the z-direction.

Each voxel contains a single attenuation value, typically expressed in Hounsfield units (HU).

# Question #69:

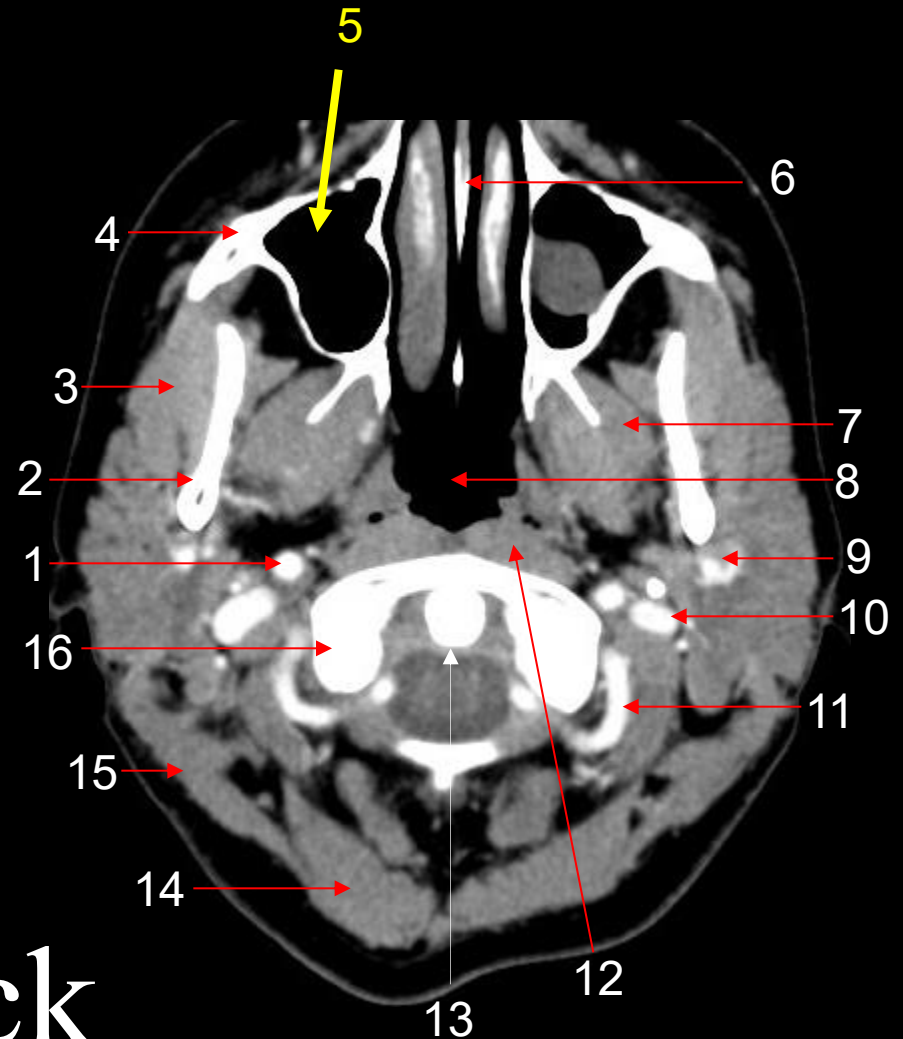
The arrow is pointing to the \_\_\_\_\_ sinus.

- a. sphenoid
- b. ethmoid
- c. maxillary
- d. frontal



# Question #69: Review

1. Right Internal Carotid Artery
2. Mandible
3. Masseter Muscle
4. Maxilla
5. Maxillary Sinus
6. Perpendicular Plate
7. Pterygoid Muscle
8. Nasopharynx
9. Left Retromandibular Vein
10. Left Internal Jugular Vein
11. Left Vertebral Artery
12. Longus Colli Muscle
13. Odontoid Process, C-2
14. Semispinalis Capitis Muscle
15. Splenius Capitis Muscle
16. Lateral Mass, C-1

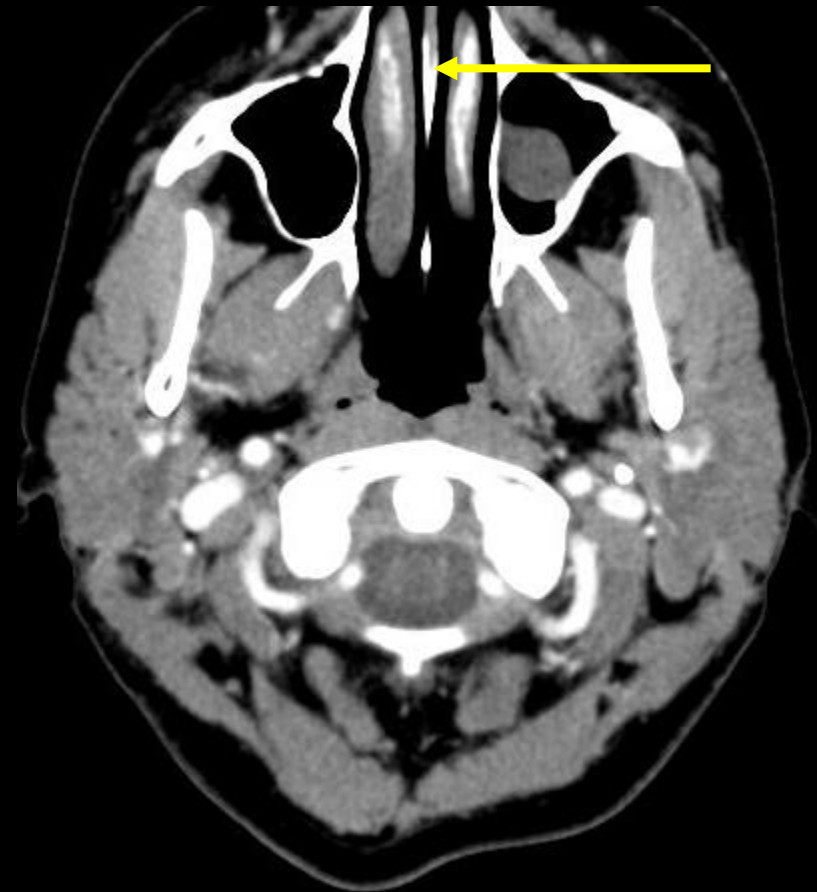
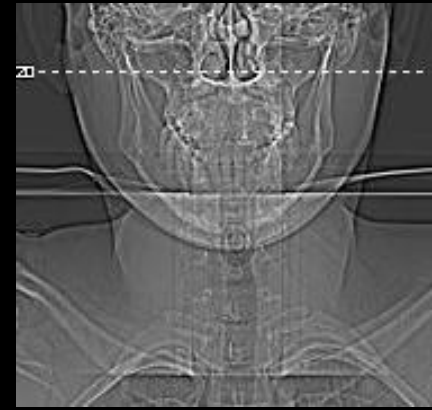


## Axial Neck

# Question #70:

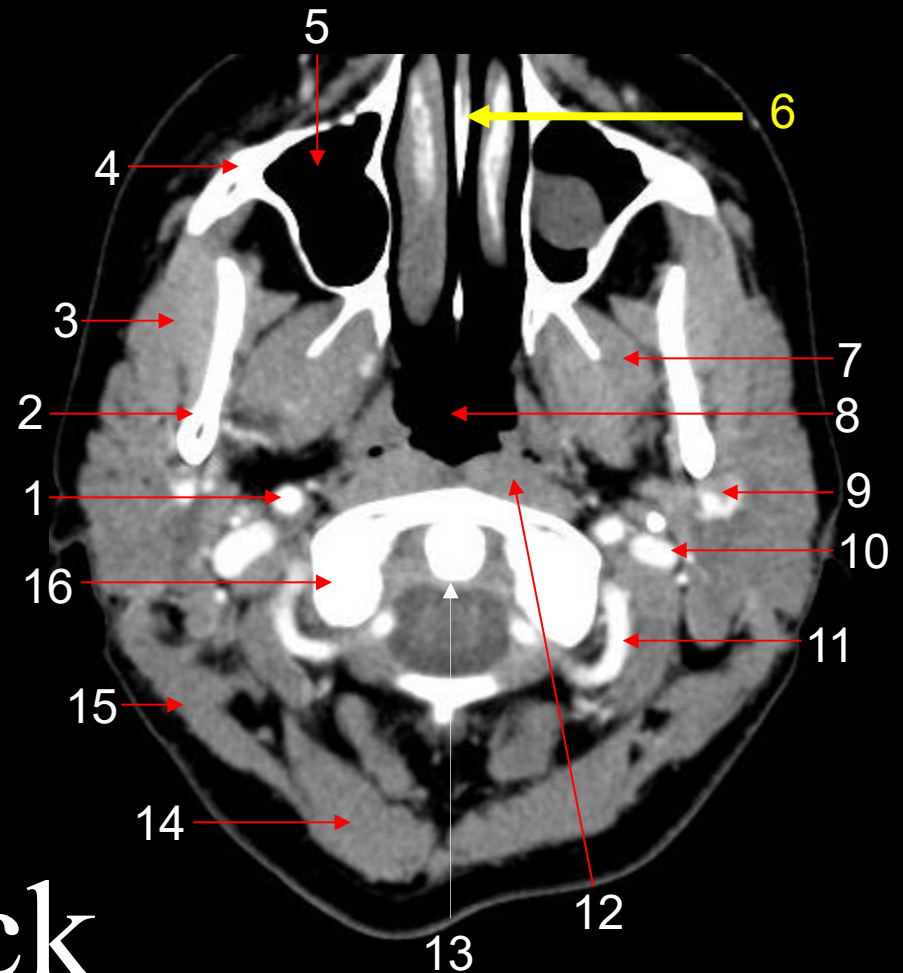
The arrow is pointing to the:

- a. dorsum sellae.
- b. sella turcica.
- c. cribriform plate.
- d. perpendicular plate.



# Question #70: Review

1. Right Internal Carotid Artery
2. Mandible
3. Masseter Muscle
4. Maxilla
5. Maxillary Sinus
6. Perpendicular Plate
7. Pterygoid Muscle
8. Nasopharynx
9. Left Retromandibular Vein
10. Left Internal Jugular Vein
11. Left Vertebral Artery
12. Longus Colli Muscle
13. Odontoid Process, C-2
14. Semispinalis Capitis Muscle
15. Splenius Capitis Muscle
16. Lateral Mass, C-1



## Axial Neck

# Question #71:

An abnormal proliferation of foreign cells that forms a mass of tissue within an organ or structure is called:

- a. edema.
- b. transudate.
- c. cachexia.
- d. neoplasm.

# Question #71: Review

- A neoplasm is the abnormal proliferation of foreign cells that form a mass of tissue within an organ or structure.
- A neoplasm will compete for nutrients from the cells that normally comprise the host organ and it is often referred to as a mass or tumor.
- Oncology is the study of neoplasms.
- A benign neoplasm is one that is self-limited and will not spread or seed to distant sites within the host organism.
- A malignant neoplasm (cancer), on the other hand, does possess the ability to spread to distant sites in the body.

This type of tumor will seed by employing either the lymphatic system (primary method) or by using the circulatory system (hematogenous spread).

# Question #72:

Modern CT generators commonly use which technology to achieve nearly constant potential output?

- a. single phase AC
- b. battery power
- c. high frequency inverter.
- d. transformer only.

# Question #72: Review

- High-Frequency Inverter Circuit

Modern CT systems use high-frequency generators (HF) that convert standard low-frequency (60 Hz) power to high-frequency (>500 Hz to >25 kHz) power.

This allows compact form factors, efficient energy transfer, and near-constant potential output with minimal voltage ripple, which improves image quality and reduces artifacts.

The high-frequency inverter typically includes:

- Input rectifiers to convert AC from the mains to DC.
- Inverter stages boost frequency and voltage.

High-voltage transformers and rectification stages to achieve the desired kV levels.

# Question #73:

Pitch in helical CT is defined as:

- a. slice thickness divided by matrix size.
- b. table travel per rotation divided by beam width.
- c. tube current divided by gantry speed.
- d. detector width divided by DFOV.

# Question #73: Review

- Definition of Helical Data Acquisition

Helical data acquisition refers to a CT scanning mode in which x-ray data are acquired continuously as the patient table moves through the gantry during continuous tube rotation.

The resulting source trajectory forms a helical path around the patient.

Unlike sequential (axial) acquisition, there are no discrete stops between slices; instead, volumetric data are collected along the z-axis and later reconstructed into images at arbitrary slice locations.

- Pitch

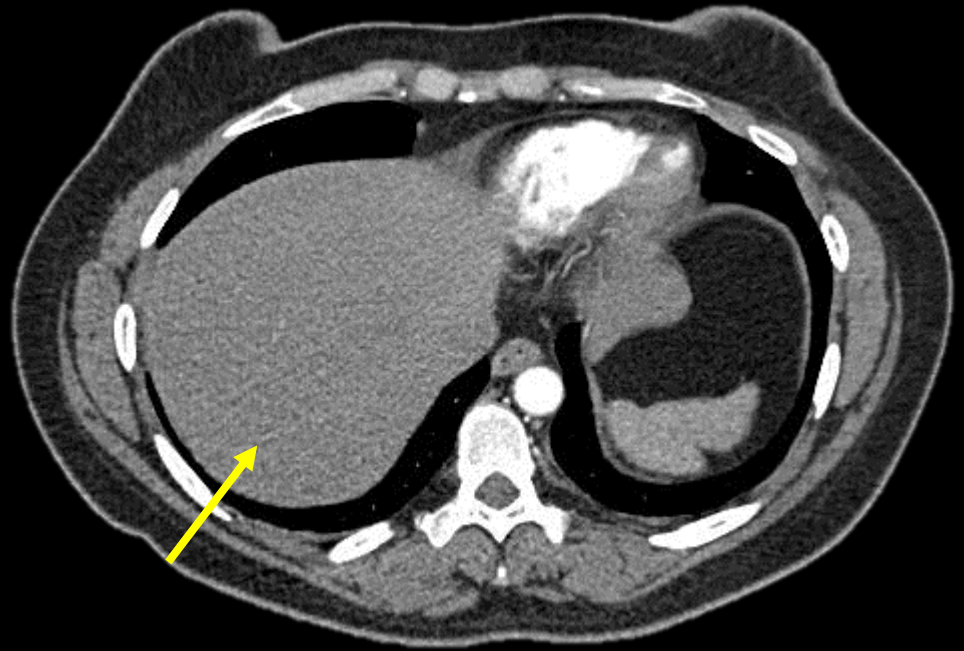
A defining parameter of helical scanning is pitch, typically defined as the table travel per gantry rotation divided by the total nominal beam width.

Pitch directly influences sampling density, scan speed, image noise, and radiation dose.

# Question #74:

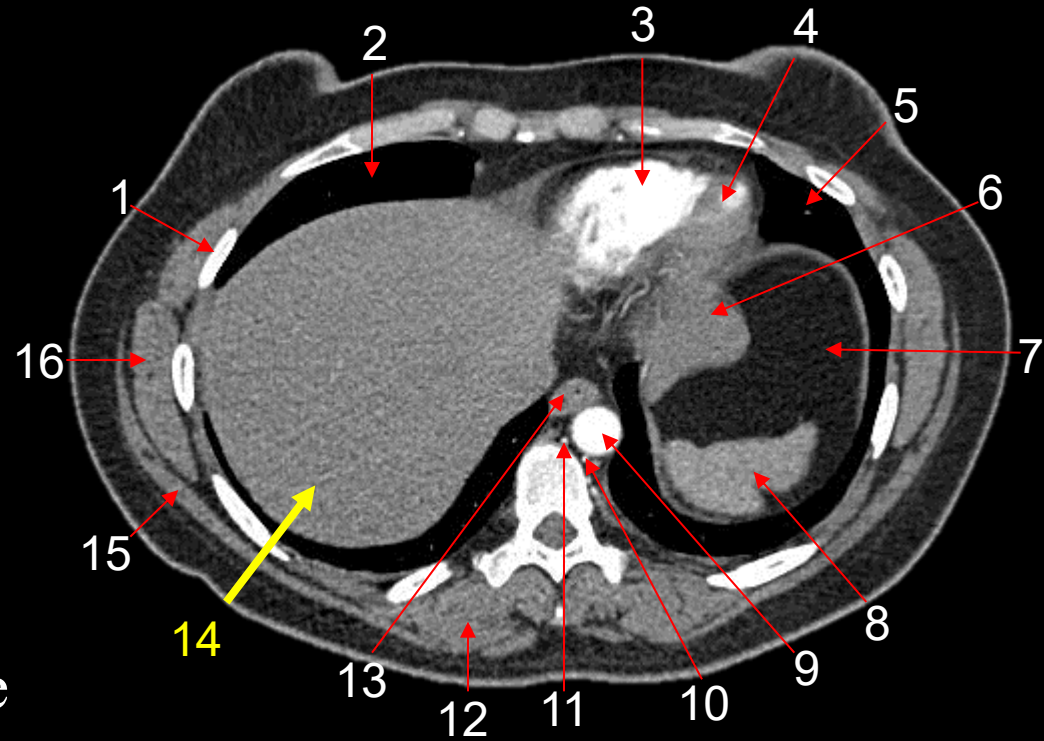
The arrow is pointing to the:

- a. diaphragm.
- b. lung.
- c. liver.
- d. stomach.



# Question #74: Review

1. Rib
2. Right Lung
3. Right Ventricle
4. Left Ventricle
5. Left Lung
6. Stomach
7. Fat
8. Spleen
9. Descending Aorta
10. Hemiazygos Vein
11. Azygos Vein
12. Erector Spinae Muscles
13. Esophagus
14. Liver
15. Latissimus Dorsi Muscle
16. Serratus Anterior Muscle

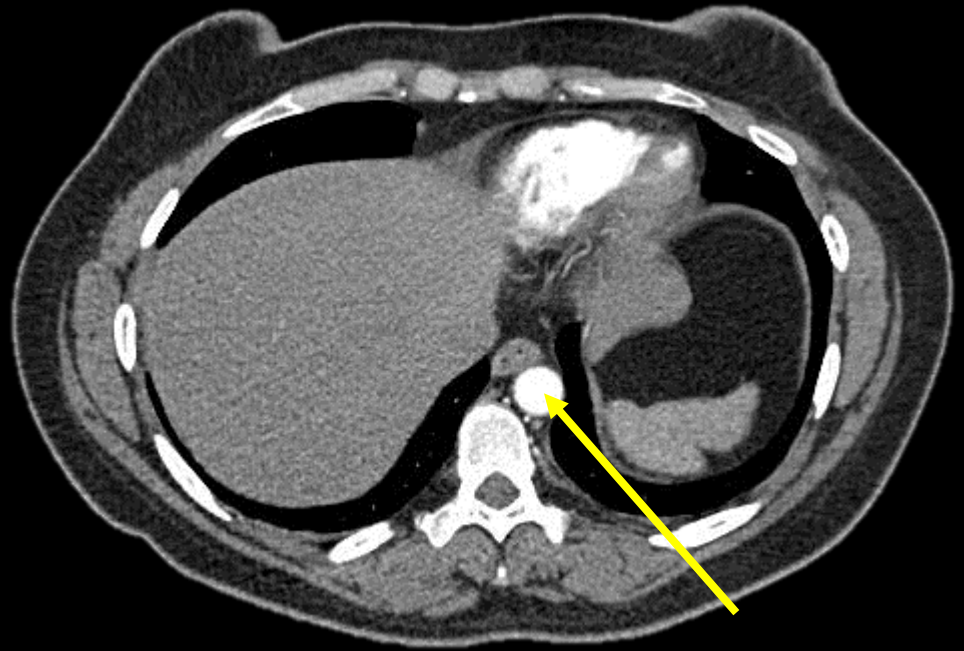


## Axial Chest

# Question #75:

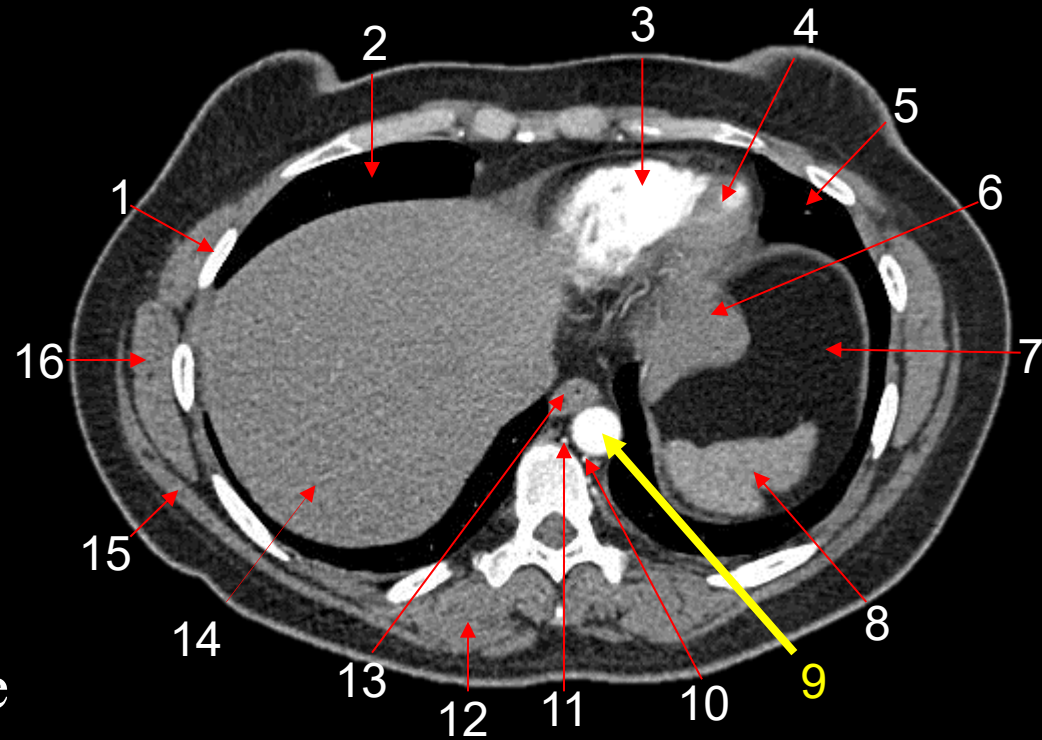
The arrow is pointing to the:

- a. esophagus.
- b. azygos vein.
- c. hemiazygos vein.
- d. descending aorta.



# Question #75: Review

1. Rib
2. Right Lung
3. Right Ventricle
4. Left Ventricle
5. Left Lung
6. Stomach
7. Fat
8. Spleen
9. Descending Aorta
10. Hemiazygos Vein
11. Azygos Vein
12. Erector Spinae Muscles
13. Esophagus
14. Liver
15. Latissimus Dorsi Muscle
16. Serratus Anterior Muscle



# Question #76:

The inability of an organ or structure to form properly is called:

- a. aplasia.
- b. atrophy.
- c. hypertrophy.
- d. ischemia.

# Question #76: Review

- Aplasia is the inability of an organ or structure to form properly.
- The defective development of an organ can result in the partial or complete loss of an organ.

# Question #77:

What is another term that can be used to describe the midsagittal plane?

- a. coronal
- b. axial
- c. midline
- d. transverse

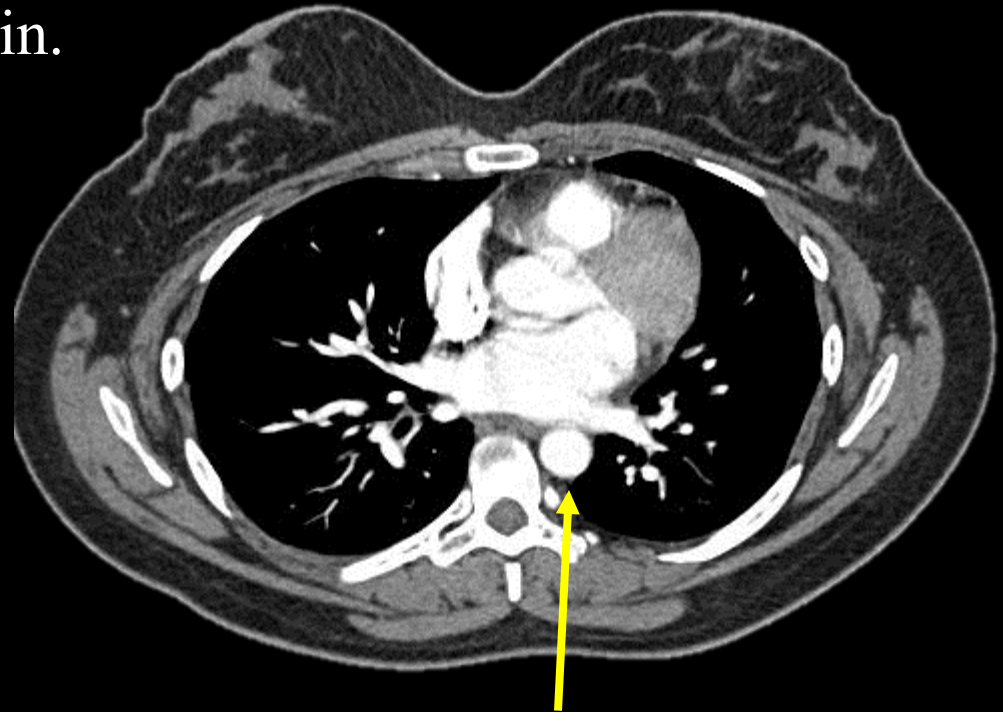
# Question #77: Review

- Sagittal Plane
  - Divides the body into right and left portions.
- Midsagittal Plane or Midline
  - Divides the body into equal right and left portions.
- Coronal Plane
  - Divides the body into front and back portions.
- Midcoronal Plane
  - Divides the body into equal front and back portions.
- Axial or Transverse Plane
  - Divides the body into top and bottom portions.

# Question #78:

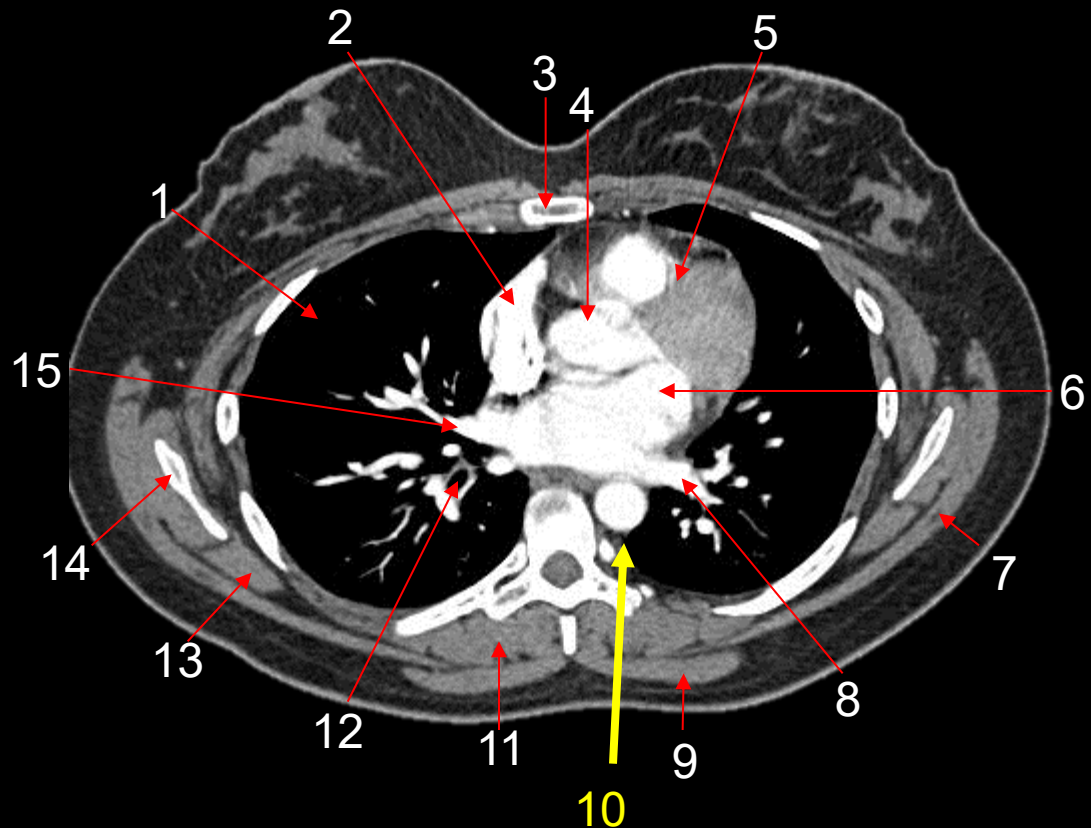
The arrow is pointing to the:

- a. ascending aorta.
- b. descending aorta.
- c. left inferior pulmonary vein.
- d. esophagus.



# Question #78: Review

1. Right Lung
2. Right Atrium
3. Sternum
4. Ascending Aorta
5. Right Ventricle
6. Left Atrium
7. Latissimus Dorsi Muscle
8. Left Inferior Pulmonary vein
9. Trapezius
10. Descending Aorta
11. Erector Spinae Muscle
12. Right Bronchus
13. Rhomboid Muscle
14. Scapula
15. Right Inferior Pulmonary Vein

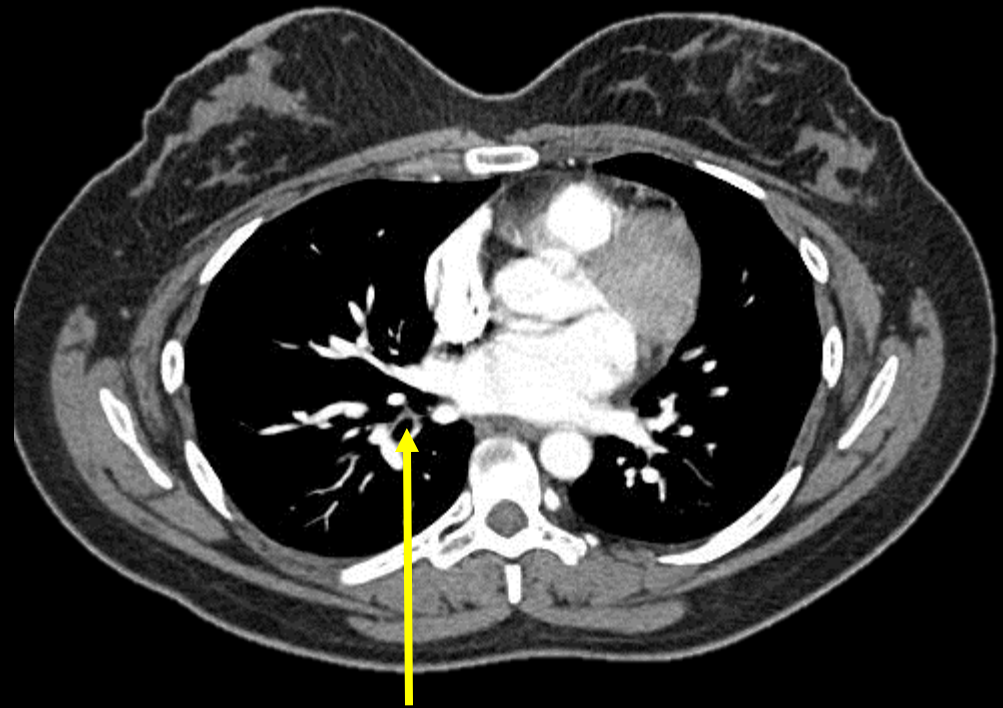


## Axial Chest

# Question #79:

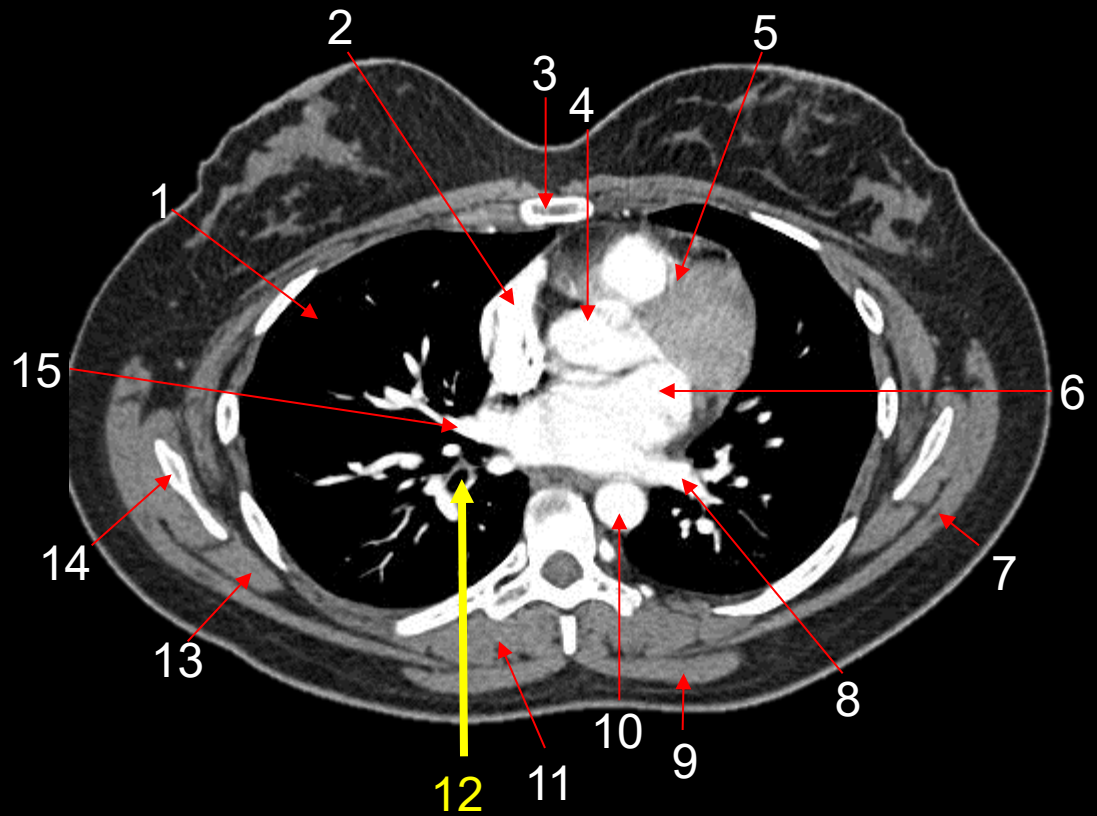
The arrow is pointing to the:

- a. right bronchus.
- b. right inferior pulmonary vein.
- c. trachea.
- d. ascending aorta.



# Question #79: Review

1. Right Lung
2. Right Atrium
3. Sternum
4. Ascending Aorta
5. Right Ventricle
6. Left Atrium
7. Latissimus Dorsi Muscle
8. Left Inferior Pulmonary vein
9. Trapezius
10. Descending Aorta
11. Erector Spinae Muscle
12. Right Bronchus
13. Rhomboid Muscle
14. Scapula
15. Right Inferior Pulmonary Vein



## Axial Chest

# Question #80:

Which artifact is most commonly associated with helical CT?

- a. ring artifact
- b. beam hardening
- c. windmill artifact
- d. partial volume artifact

# Question #80: Review

- Helical Data Acquisition Image Quality and Artifact Considerations

Helical data acquisition influences image quality in several ways. At lower pitch values, sampling density is high, resulting in improved z-axis resolution and reduced noise.

At higher pitch values, scan speed increases, but sampling density decreases, potentially increasing noise and degrading spatial resolution.

**A characteristic artifact associated with helical scanning is the windmill artifact, which can occur when detector configuration, pitch, and reconstruction parameters interact unfavorably.**

Advances in detector design and reconstruction algorithms have substantially reduced these artifacts, but careful protocol optimization remains essential.

# Question #81:

Heat generated in the X-ray tube is commonly dissipated through the:

- a. added filtration
- b. cooling and heat exchangers
- c. air jets inside the tube
- d. filament

# Question #81: Review

- **Thermal Management**

The tube and generator must operate under high thermal loads, often exceeding 50–100 kW of instantaneous power.

**Efficient cooling through external heat exchangers**, oil circulation and fan systems is essential to maintain stable operation and prevent overheating.

# Question #82:

Which of the following terms would be used to describe when the patient's body has been turned on its side so that the midcoronal plane is perpendicular to the IR?

- a. anteroposterior
- b. lateral
- c. prone
- d. posteroanterior

# Question #82: Review

- This term position is used to describe the how the patient's body has been physically placed.
- The following is a list of terms that are examples of a position.

## Anatomical Position

- The body is upright with the arms at the side and the hands facing forward.

## Recumbent

- This term is used to describe the body anytime it is lying down.

## Lateral

- When the body has been turned on its side.

## Decubitus

- Refers to when the patient is recumbent and a horizontal x-ray tube is employed.

# Question #83:

Which reconstruction algorithms operate primarily within the x–y plane for each slice?

- a. Fourier transform only
- b. filtered back projection and iterative reconstruction
- c. maximum intensity projection
- d. surface rendering

# Question #83: Review

- Image Reconstruction

Reconstruction algorithms such as filtered back projection (FBP) and iterative reconstruction operate primarily in the x–y plane for each slice.

Spatial resolution within this plane is influenced by:

- Detector element size
- Reconstruction matrix (e.g.,  $512 \times 512$ )
- Reconstruction kernel

The x–y plane is therefore critical for visualizing fine anatomical detail, such as lung parenchyma, cortical bone, and vascular structures.

# Question #84:

Which of the following is not a cardinal sign of inflammation?

- a. pain
- b. redness
- c. cyanosis
- d. heat

# Question #84: Review

- Inflammation refers to the body's ability to wall-off and sequester an injurious agent.
- The ultimate goal of this process is the safe removal of said injurious agents.
- Hyperemia is the process of dilating capillaries to allow fluids and leucocytes to infiltrate the infected area.
- The leucocytes will act to remove cellular debris through a process known as phagocytosis.
- The cardinal signs of inflammation include heat (results from hyperemia), redness, pain, and often a decrease in function.

# Question #85:

A patient lying on their abdomen and in a PA projection is described as being in which of the following positions?

- a. supine
- b. decubitus
- c. lateral
- d. prone

# Question #85: Review

- The term position is used to describe the how the patient's body has been physically placed.
- The following is a list of terms that are examples of a position.

## Anatomical Position

- The body is upright with the arms at the side and the hands facing forward.

## Recumbent

- This term is used to describe the body anytime it is lying down.

## Supine

- The body is recumbent and in an AP projection.

## Prone

- The body is recumbent and in a PA projection.

# Question #86:

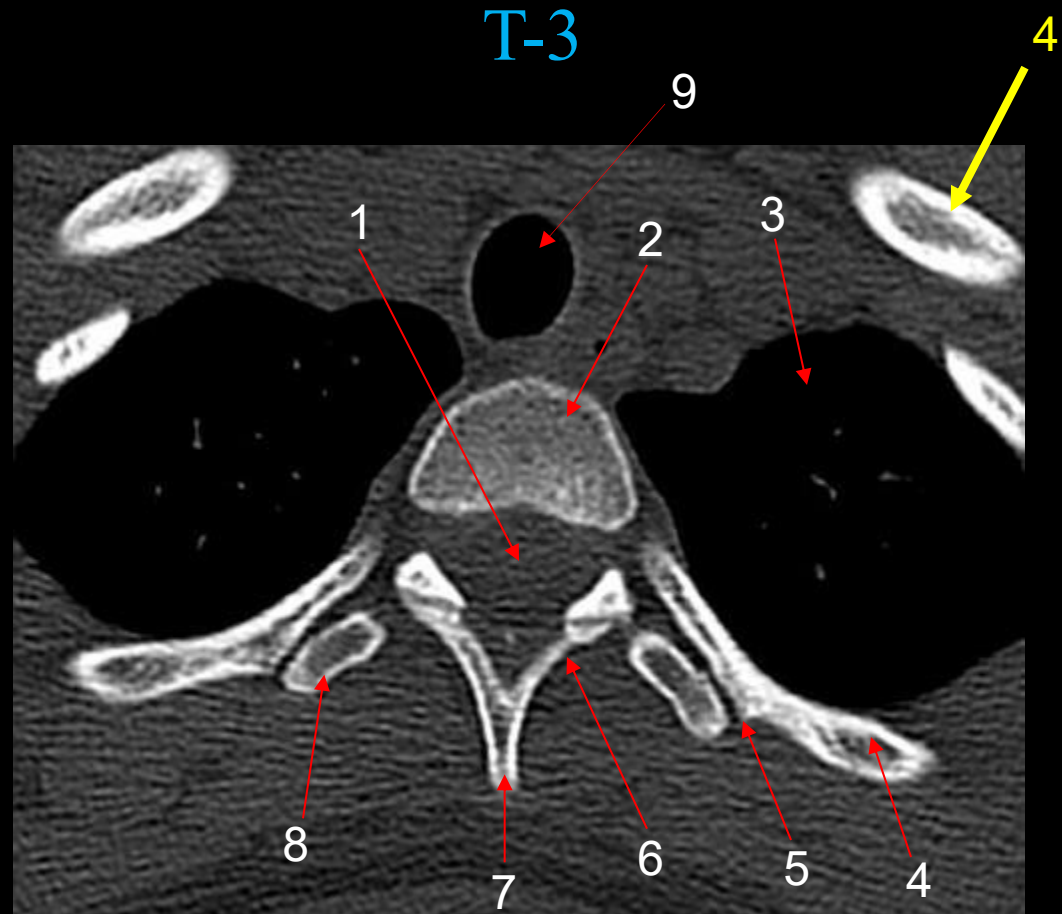
The arrow is pointing to the:

- a. rib.
- b. body of the scapula.
- c. sternum.
- d. humerus.



# Question #86: Review

1. Spinal Cord
2. Vertebral Body
3. Left Lung
4. Rib
5. Costovertebral Joint
6. Lamina
7. Spinous Process
8. Transverse Process
9. Trachea

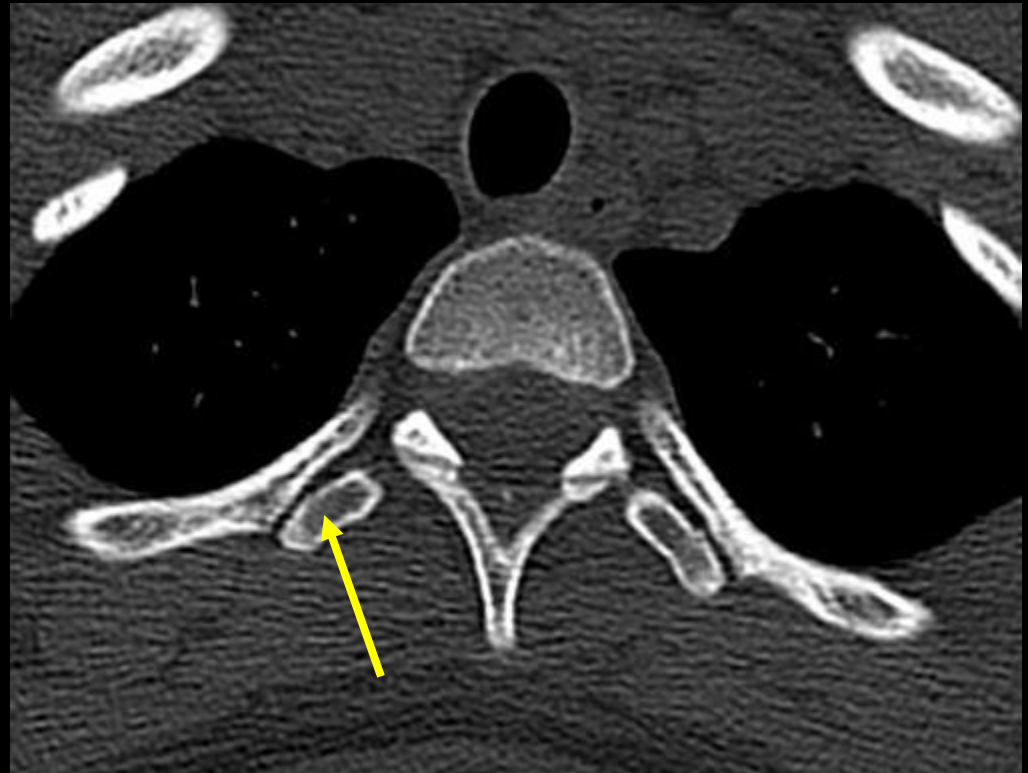
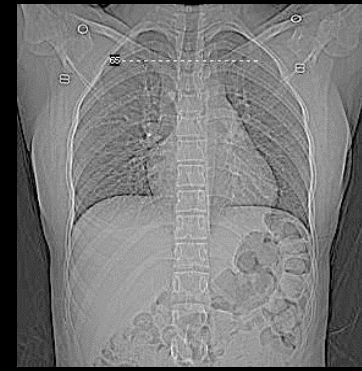


Axial Thoracic Vertebra (T3)

# Question #87:

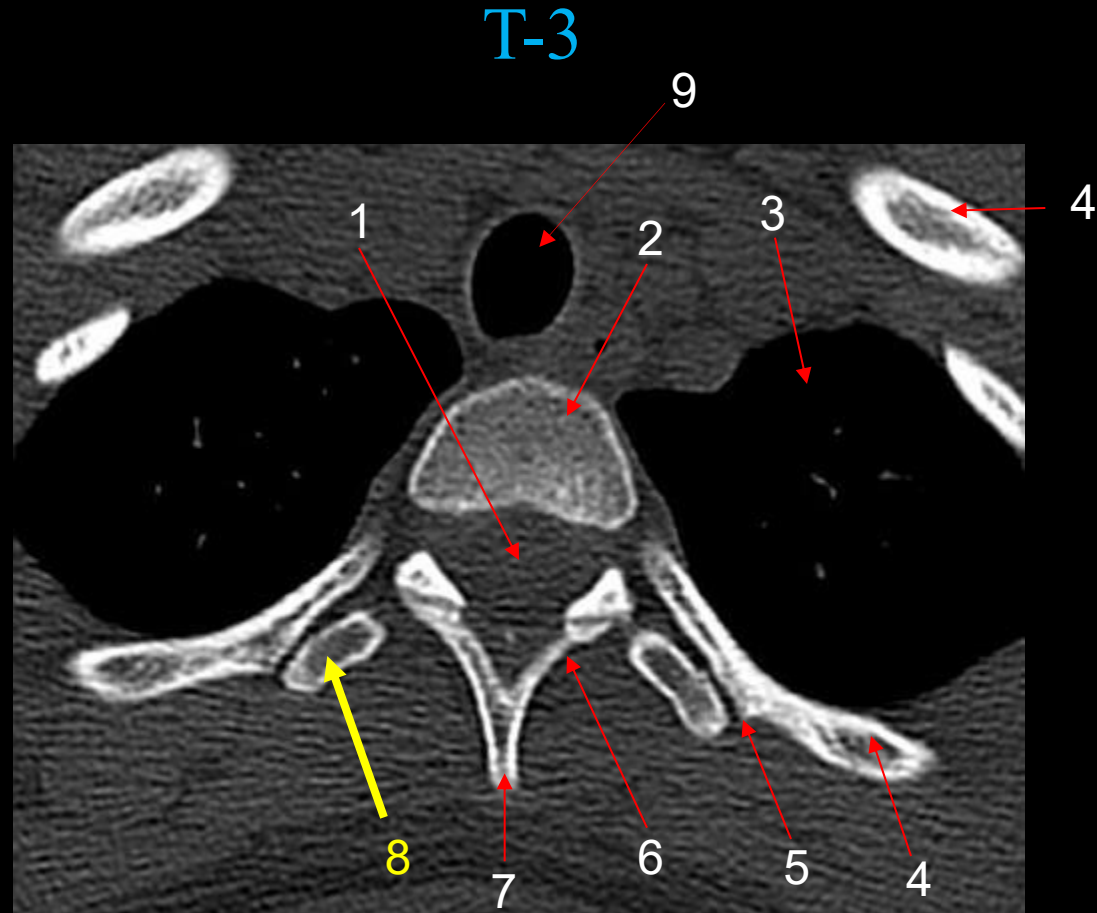
The arrow is pointing to the:

- a. costovertebral joint.
- b. spinous process.
- c. rib.
- d. transverse process.



# Question #87: Review

1. Spinal Cord
2. Vertebral Body
3. Left Lung
4. Rib
5. Costovertebral Joint
6. Lamina
7. Spinous Process
8. Transverse Process
9. Trachea



## Axial Thoracic Vertebra (T3)

# Question #88:

Which of the following terms would be used to describe when the x-ray tube has been angled towards the head of the patient?

- a. caudal
- b. lateral
- c. distal
- d. cephalic

# Question #88: Review

- Medial  
Refers to a structure that is closer to the midline.
- Lateral  
Refers to a structure that is further from the midline.
- Proximal  
Refers to a structure that is closer to a source.
- Distal  
Refers to a structure that is further from a source.
- Cephalic or Cephalad  
In a direction towards the head.
- Caudal or Caudad  
In a direction towards the feet.

# Question #89:

In Multi-Detector CT (MDCT), pitch is defined as:

- a. slice thickness divided by gantry rotation time.
- b. table movement per rotation / by total collimated beam width.
- c. detector width divided by table speed.
- d. tube current divided by rotation time.

# Question #89: Review

- Multi-Detector CT (MDCT)

In modern MDCT systems, pitch is defined as:

$$\text{Pitch} = \text{Table travel per rotation} / \text{Total collimated beam width}$$

Total collimated beam width equals the number of active detector rows multiplied by the individual detector width.

This revised definition reflects the volumetric nature of MDCT data acquisition.

# Question #90:

Which term below is used to describe a structure that is located furthest from the source?

- a. distal
- b. proximal
- c. medial
- d. lateral

# Question #90: Review

- Medial
  - Refers to a structure that is closer to the midline.
- Lateral
  - Refers to a structure that is further from the midline.
- Proximal
  - Refers to a structure that is closer to a source.
- Distal
  - Refers to a structure that is further from a source.
- Cephalic or Cephalad
  - In a direction towards the head.
- Caudal or Caudad
  - In a direction towards the feet.

# Question #91:

Which axis typically represents the head-to-foot (longitudinal) direction of the patient?

- a. X
- b. Y
- c. Z
- d. Theta

# Question #91: Review

- **The Cartesian Coordinate System in CT**

In CT imaging, the patient is positioned within a gantry, and spatial locations within the body are described using a Cartesian coordinate system:

- **X-axis:** Typically represents the left–right direction of the patient.
- **Y-axis:** Represents the anterior–posterior direction.
- **Z-axis:** Represents the head–foot (longitudinal) direction.

Together, these axes define the x, y, and z planes, which form the basis for all voxel-based image representation.

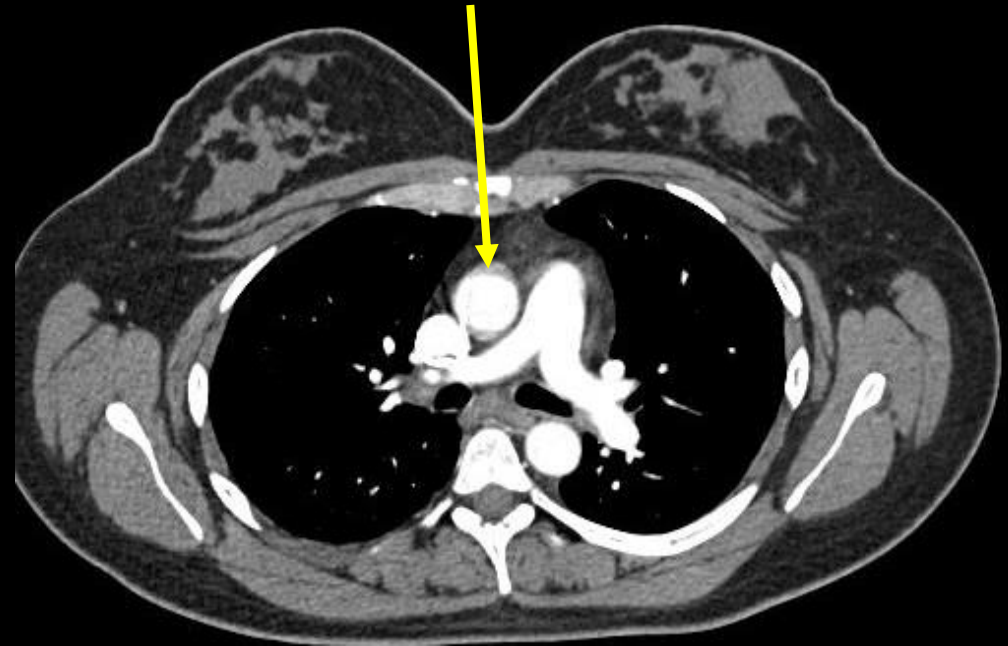
- **Role of the X and Y Planes: In-Plane Imaging**

The x and y planes define the in-plane dimensions of a CT slice. Traditional CT images are acquired and reconstructed as axial slices, which lie in the x–y plane.

# Question #92:

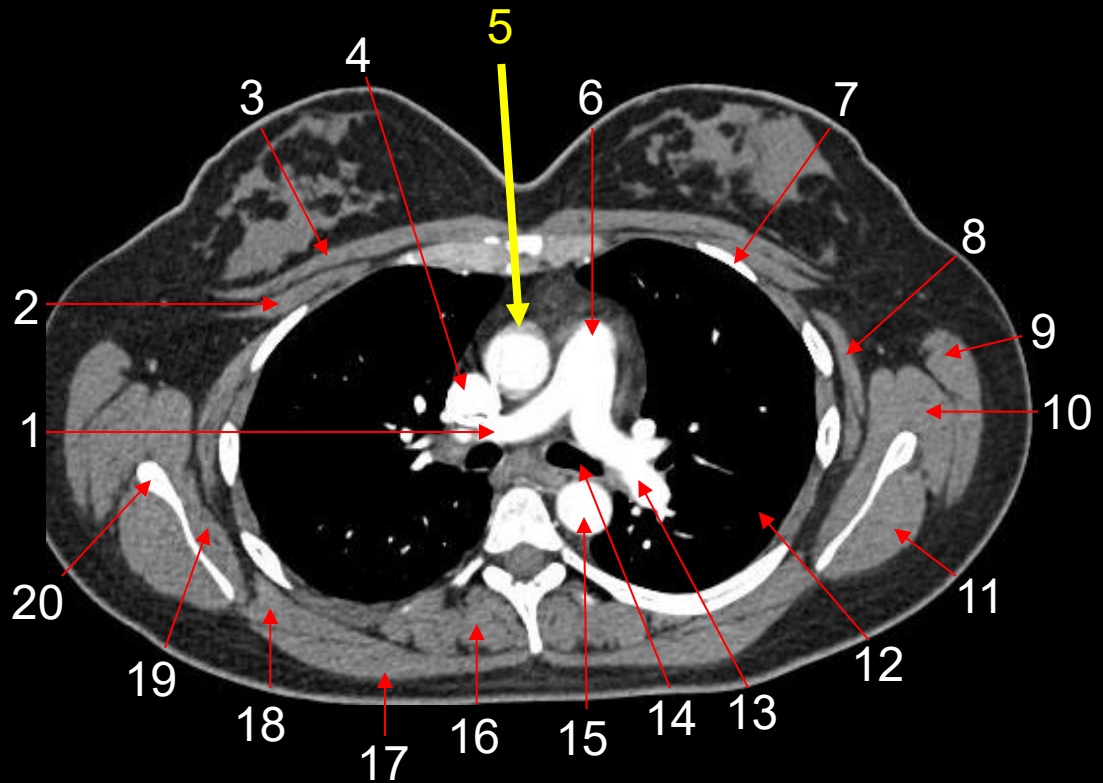
The arrow is pointing to the:

- a. ascending aorta.
- b. pulmonary trunk.
- c. superior vena cava.
- d. left pulmonary artery.



# Question #92: Review

1. Right Pulmonary Artery
2. Pectoralis Minor Muscle
3. Pectoralis Major Muscle
4. Superior Vena Cava
5. Ascending Aorta
6. Pulmonary Trunk
7. Rib
8. Serratus Anterior Muscle
9. Latissimus Dorsi Muscle
10. Teres Major Muscle
11. Infraspinatus Muscle
12. Left Lung
13. Left Pulmonary Artery
14. Left Mainstem Bronchus
15. Descending Aorta
16. Erector Spinae Muscle
17. Trapezius Muscle
18. Rhomboid Muscle
19. Subscapularis Muscle
20. Scapula

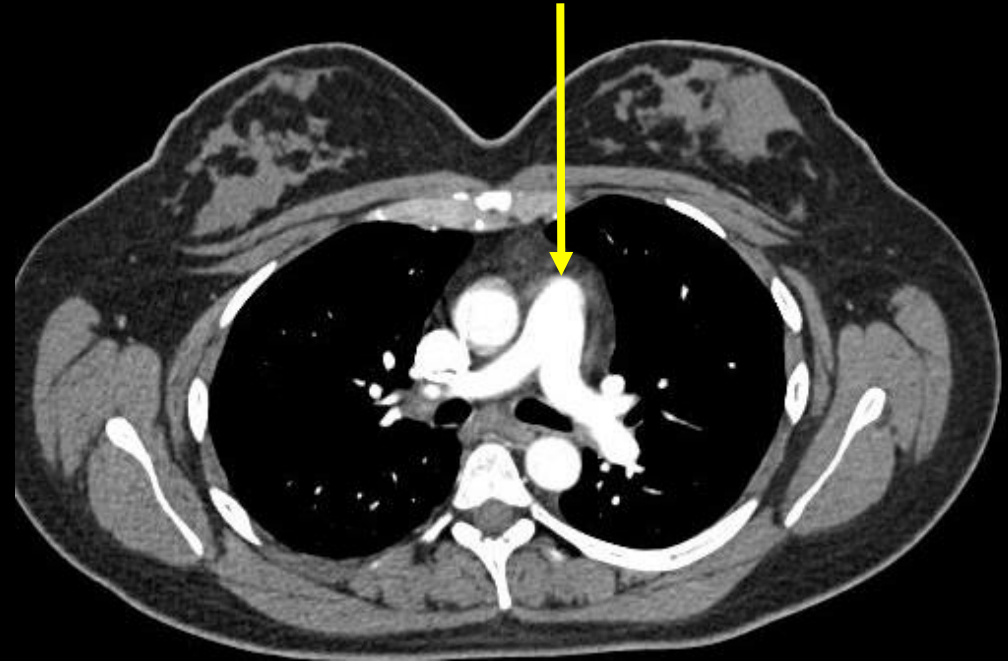
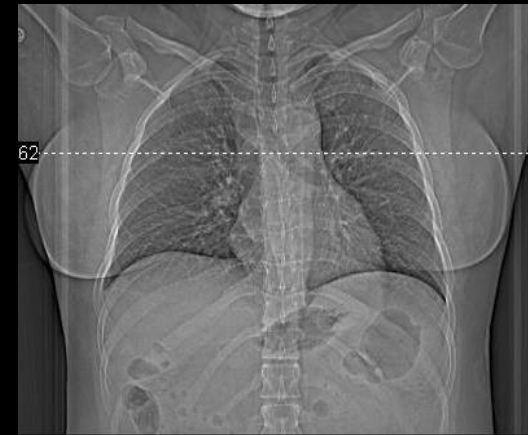


## Axial Chest

# Question #93:

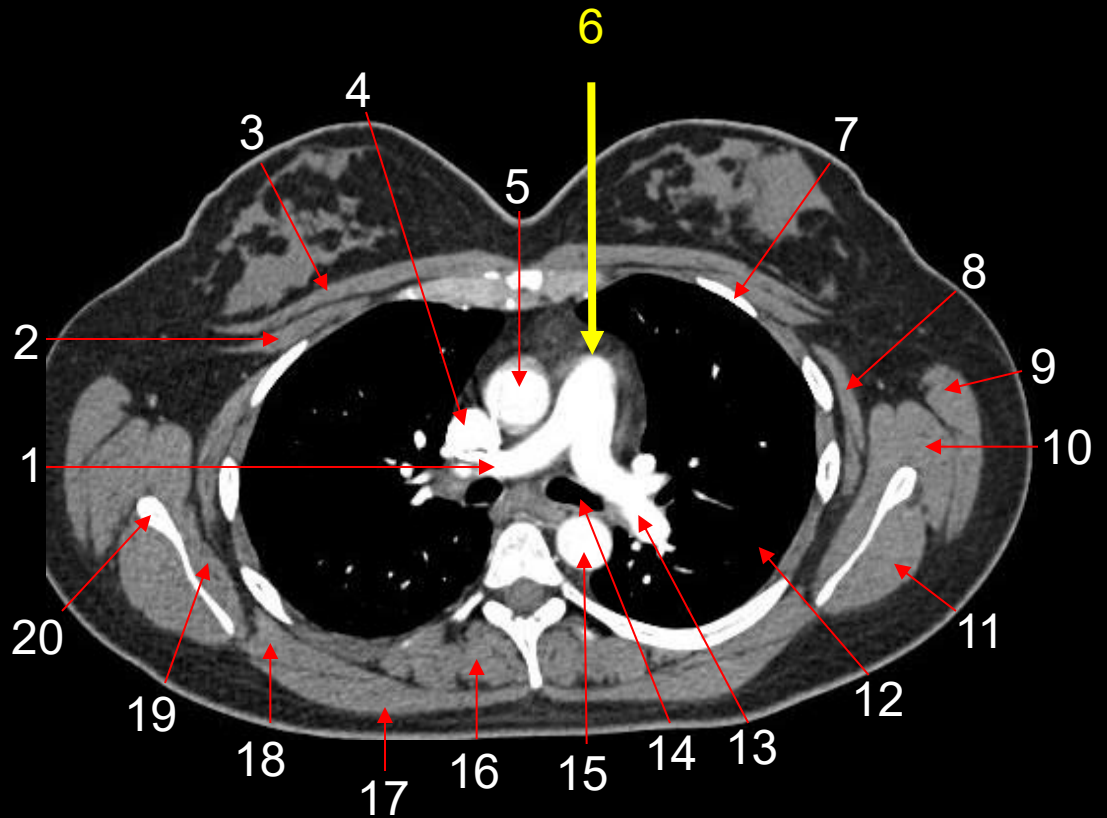
The arrow is pointing to the:

- a. ascending aorta.
- b. pulmonary trunk.
- c. superior vena cava.
- d. left pulmonary artery.



# Question #93: Review

1. Right Pulmonary Artery
2. Pectoralis Minor Muscle
3. Pectoralis Major Muscle
4. Superior Vena Cava
5. Ascending Aorta
6. Pulmonary Trunk
7. Rib
8. Serratus Anterior Muscle
9. Latissimus Dorsi Muscle
10. Teres Major Muscle
11. Infraspinatus Muscle
12. Left Lung
13. Left Pulmonary Artery
14. Left Mainstem Bronchus
15. Descending Aorta
16. Erector Spinae Muscle
17. Trapezius Muscle
18. Rhomboid Muscle
19. Subscapularis Muscle
20. Scapula



## Axial Chest

# Question #94:

Which of the following terms is used to describe the body when it has been divided into top and bottom portions?

- a. axial or transverse
- b. sagittal
- c. coronal
- d. superior

# Question #94: Review

- Sagittal Plane
  - Divides the body into right and left portions.
- Midsagittal Plane or Midline
  - Divides the body into equal right and left portions.
- Coronal Plane
  - Divides the body into front and back portions.
- Midcoronal Plane
  - Divides the body into equal front and back portions.
- Axial or Transverse Plane
  - Divides the body into top and bottom portions.

# Question #95:

Which of the following is not an example of an inflammatory reaction?

- a. abscess
- b. ulcer
- c. cellulitis
- d. ischemia

# Question #95: Review

- Three Types of Inflammatory Reactions:

## Abscess

- This type of inflammatory reaction causes the injurious agent to become a walled-off ball of pus.

## Ulcers

- This is another type of inflammatory reaction that is the result of a healing wound that is located on the skin or a mucous membrane

## Cellulitis

- This is an acute bacterial infection of the skin and is a third example of an inflammatory reaction.
- It can be found anywhere in the body, but it is more often seen in areas where the skin can be damaged and thus allow a portal of entry for bacteria.

# Question #96:

Helical CT primarily affects sampling along which plane or axis?

- a. X
- b. Y
- c. Z.
- d. X-Y only.

# Question #96: Review

- Helical CT and Pitch

In helical (spiral) CT, the patient table moves continuously along the z-axis while the x-ray tube rotates.

The relationship between table movement and beam width—known as pitch—directly affects sampling density in the z plane.

Insufficient z-axis sampling can lead to interpolation artifacts and reduced image quality.

# Question #97:

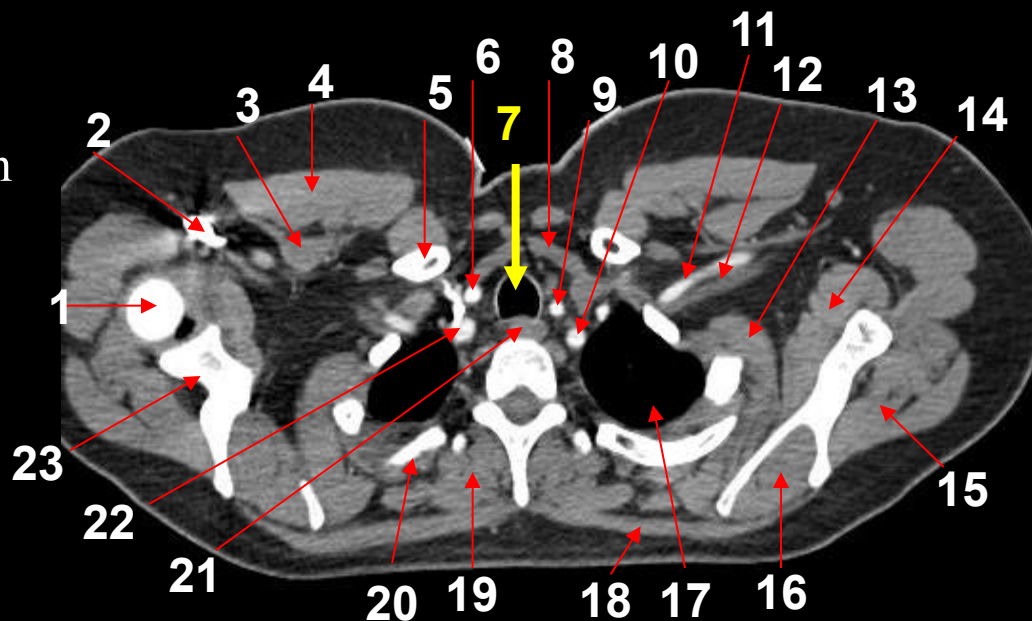
The arrow is pointing to the:

- a. lung.
- b. trachea.
- c. left subclavian artery.
- d. spine of the scapula.



# #97: Review

1. Head of Humerus
2. Right Subclavian Vein
3. Pectoralis Minor Muscle
4. Pectoralis Major Muscle
5. Clavicle
6. Right Common Carotid Artery
7. Trachea
8. Thyroid
9. Left Common Carotid Artery
10. Left Subclavian Artery
11. Left Subclavian Artery-Lateral Portion
12. Left Subclavian Vein
13. Serratus Anterior Muscle
14. Subscapularis Muscle
15. Infraspinatus Muscle
16. Supraspinatus Muscle
17. Left Lung
18. Trapezius Muscle
19. Erector Spinae Muscle
20. Rib
21. Esophagus
22. Right Subclavian Artery
23. Scapula



## Axial Chest

# Question #98:

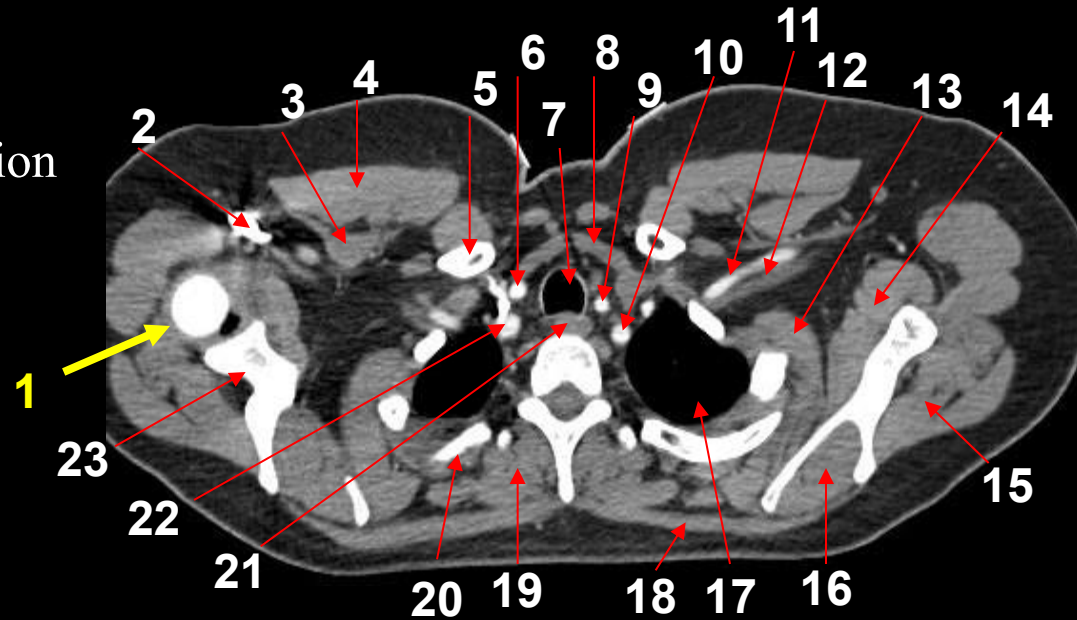
The arrow is pointing to the:

- a. scapula.
- b. clavicle.
- c. subscapularis muscle.
- d. head of the humerus.



# #98: Review

1. Head of Humerus
2. Right Subclavian Vein
3. Pectoralis Minor Muscle
4. Pectoralis Major Muscle
5. Clavicle
6. Right Common Carotid Artery
7. Trachea
8. Thyroid
9. Left Common Carotid Artery
10. Left Subclavian Artery
11. Left Subclavian Artery-Lateral Portion
12. Left Subclavian Vein
13. Serratus Anterior Muscle
14. Subscapularis Muscle
15. Infraspinatus Muscle
16. Supraspinatus Muscle
17. Left Lung
18. Trapezius Muscle
19. Erector Spinae Muscle
20. Rib
21. Esophagus
22. Right Subclavian Artery
23. Scapula



## Axial Chest

# Question #99:

Which of the following terms is used to describe the body anytime that the patient is in a position where they are lying down?

- a. recumbent
- b. anteroposterior
- c. decubitus
- d. posteroanterior

# Question #99: Review

- The term position is used to describe the how the patient's body has been physically placed.
- The following is a list of terms that are examples of a position.

## Anatomical Position

- The body is upright with the arms at the side and the hands facing forward.

## Recumbent

- This term is used to describe the body anytime it is lying down.

## Supine

- The body is recumbent and in an AP projection.

## Prone

- The body is recumbent and in a PA projection.

# Question #100:

Which of the following terms refers to a condition that is marked by an abnormal disturbance in the function and or structure of the human body as the result of some type of injury or trauma?

- a. disease
- b. pathology
- c. pathogenesis
- d. etiology

# Question #100: Review

- Simply put, pathology is the study of disease.
- **Disease** is a term that literally refers to a lack of “ease.”
- It is a condition that is marked by an abnormal disturbance in the function and or structure of the human body as the result of some type of injury or trauma.

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# Congratulations, you have just completed the Mastery Test!!

Now, just snap a picture of your completed answer sheet and text it to John Fleming at (727) 744-7946. If you score a 75% or higher, your certificate of completion will be emailed back to you within one week of us receiving your completed answer sheet and payment. *You will be allowed no more than three attempts to achieve a passing score on the mastery test.*

I hope that you have enjoyed this format for earning your continuing education and thanks for your support.

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# About the Author:

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John Fleming graduated from the St. Petersburg College (SPC) Radiography Program in Pinellas Park, Florida in December of 1985. He has been employed by SPC since May of 1987 and is currently the Radiography Program Director.

John completed a Master of Education Degree from the University of South Florida in December of 1998, and he has passed the American Registry of Radiologic Technology's Computed Tomography and Magnetic Resonance Imaging certification examinations.

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