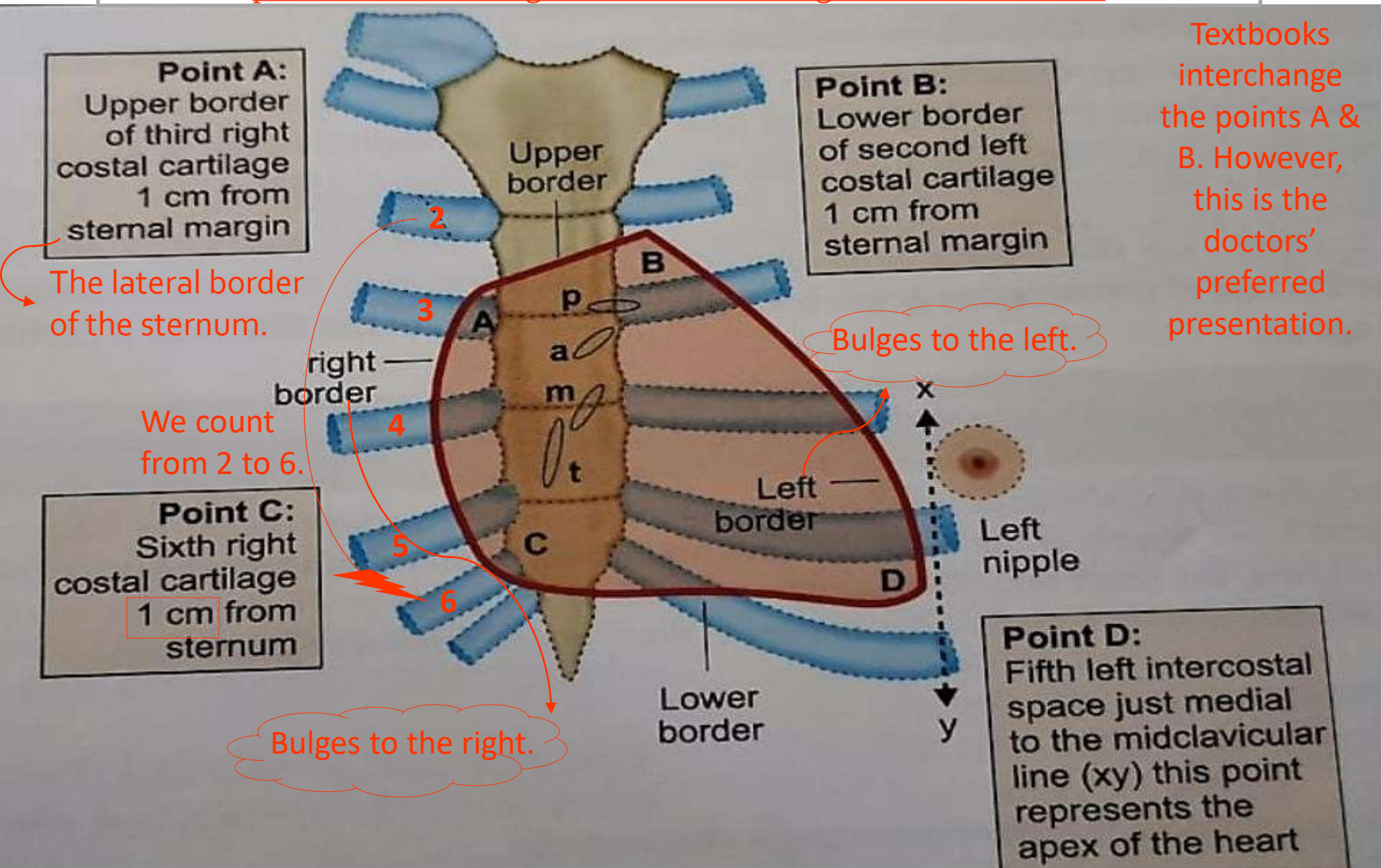
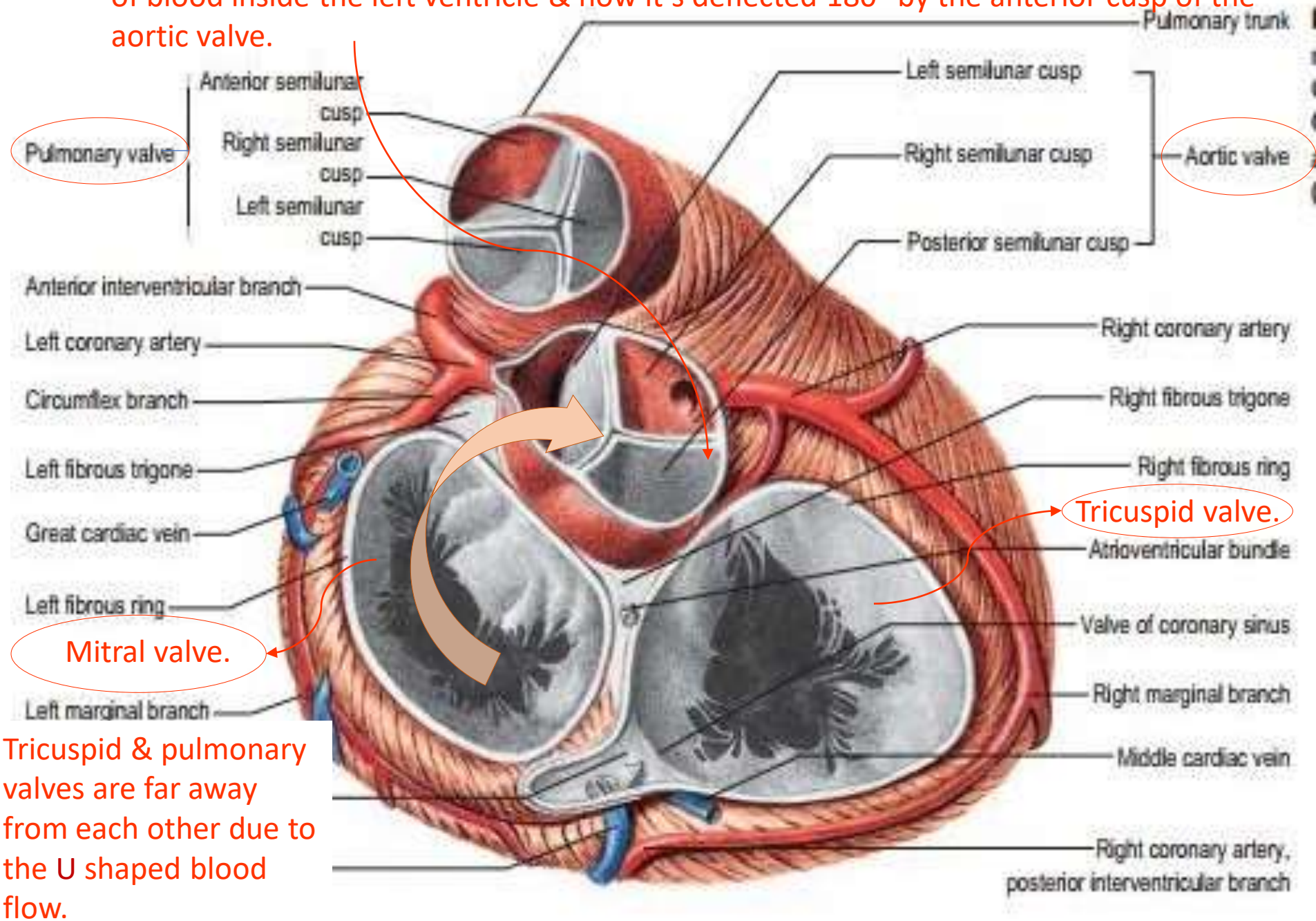
Practical-Xray-CTs-Surface Anatomy Edited.

Done by: Sarah Qudah.

The outline of the heart can be represented on the surface of the body by the irregular quadrangle bounded by the following four points[u identify the points &drow lines to connect them & u'll get the surface presentation]; we need this presentation to recognize abnormal enlargements of the heart.



Remember: the mitral & aortic valves are close to each other due to the flow pattern of blood inside the left ventricle & how it's deflected 180° by the anterior cusp of the aortic valve.



Tricuspid & pulmonary valves are far away from each other due to the U shaped blood flow.

Surface Anatomy of the Heart Valves

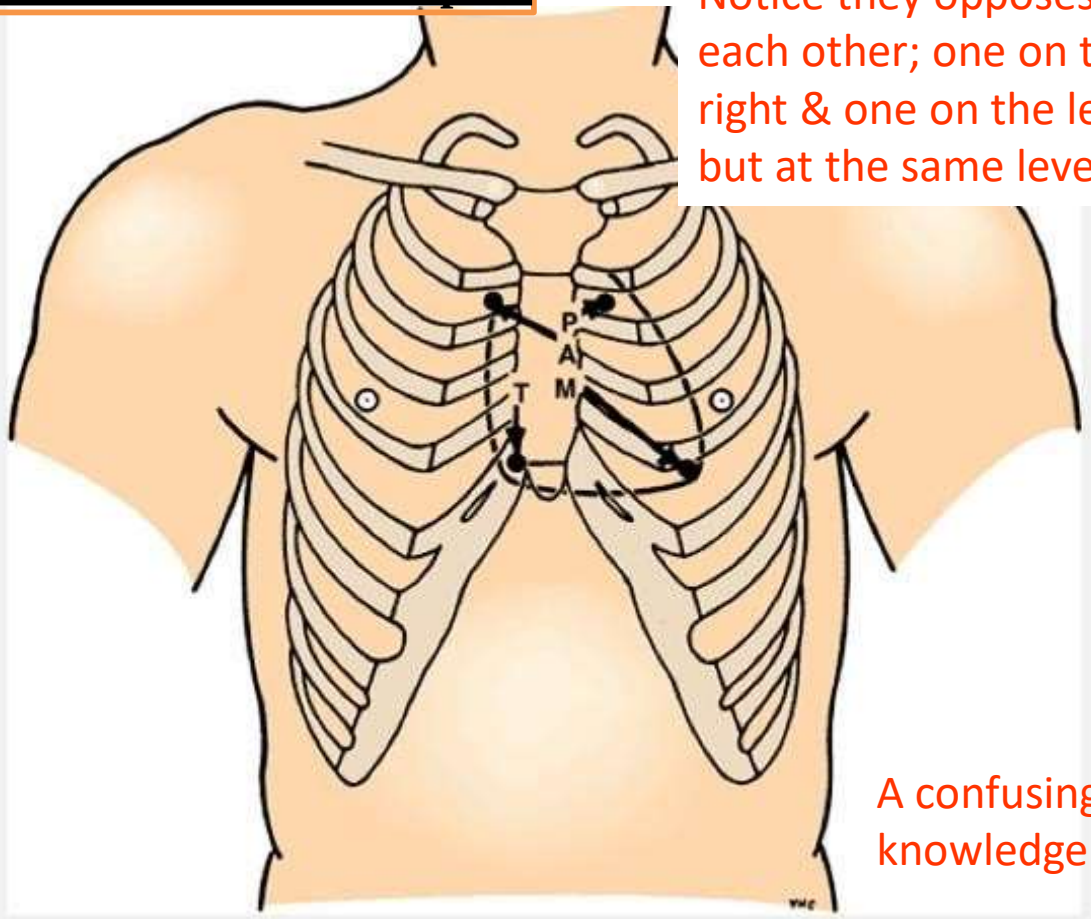
Not for memorization

Not for exam purposes.

THE TRICUSPID VALVE
lies behind
The right half
of the sternum opposite
The fourth intercostal space

THE MITRAL VALVE
lies behind
The left half
of the sternum opposite
The fourth costal cartilage

Notice they opposes each other; one on the right & one on the left but at the same level.

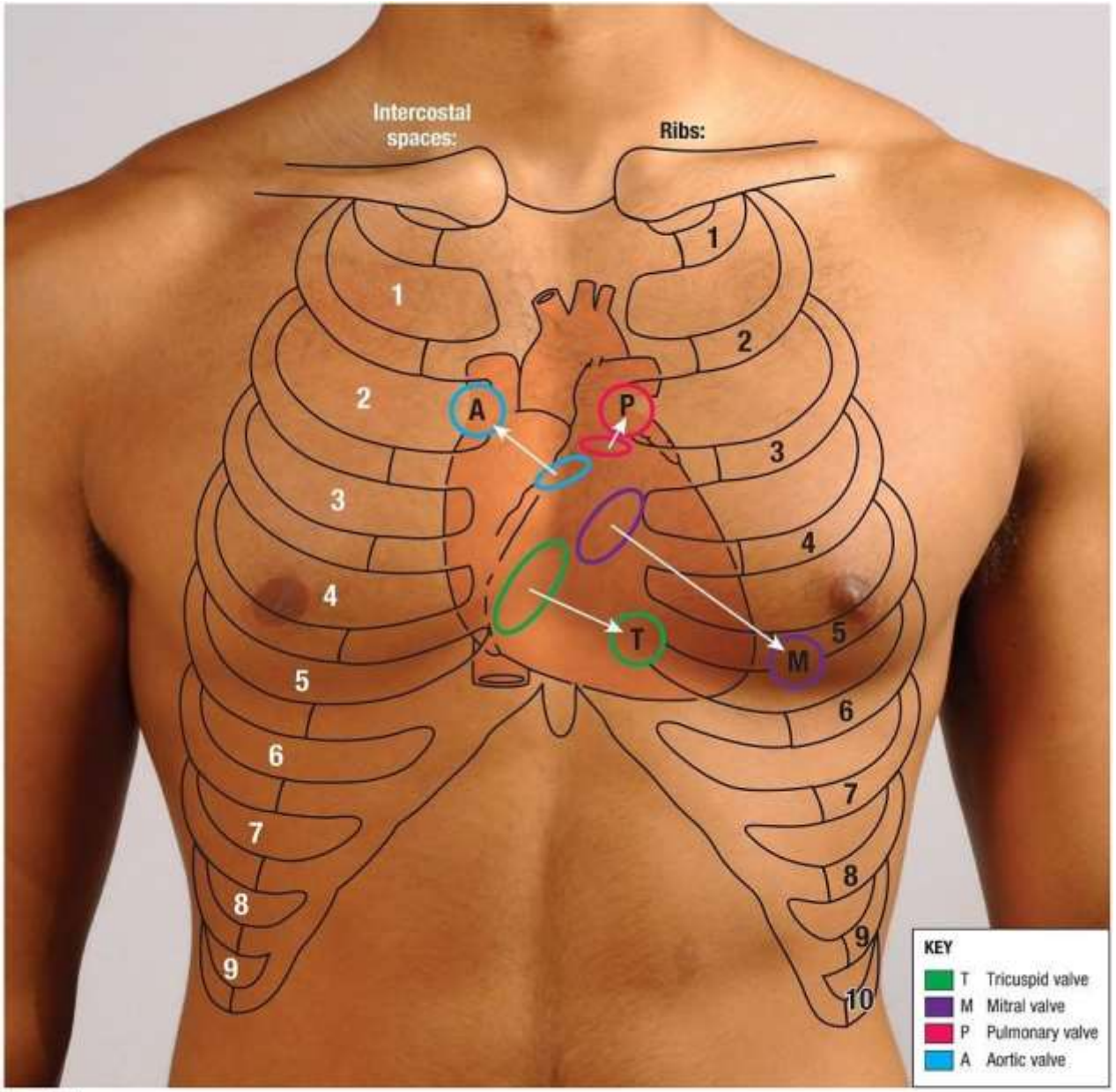


THE PULMONARY VALVE
lies behind the medial end of
the third left costal cartilage
and the adjoining part of the sternum

THE AORTIC VALVE
lies behind the left half of the sternum opposite the third intercostal space

A confusing fast expiring unneeded knowledge.

Figure 3-15 Position of the heart valves. P, pulmonary valve; A, aortic valve; M, mitral valve; T, tricuspid valve. Arrows indicate position where valves may be heard with least interference.



Anterior View

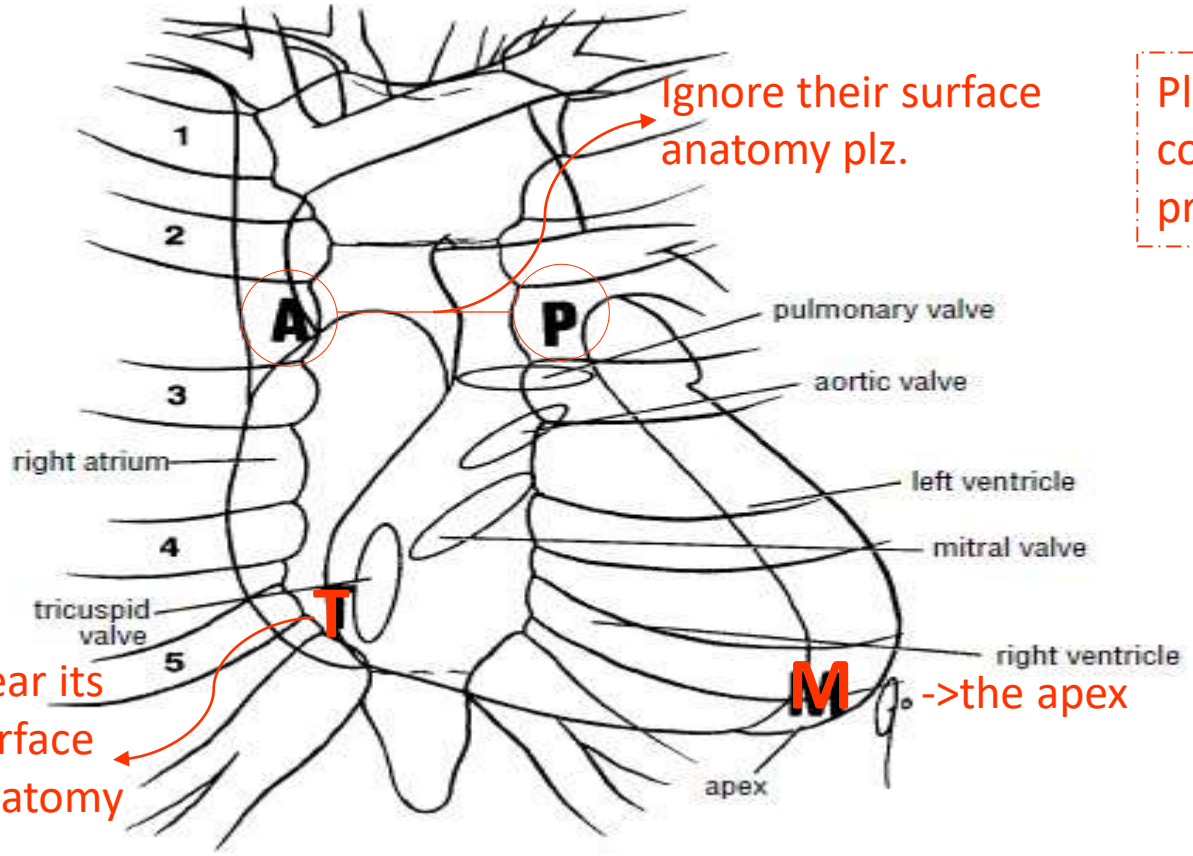
What matters is the places where we set our stethoscope to hear the valves sound; which actually doesn't match the anatomical positions of the valves due to the hemodynamics of the heart.

Auscultation of the Heart Valves

The tricuspid valve is best heard over the **right half of the lower end of the body of the sternum**
The mitral valve is best heard over **the apex** beat (at the level of the fifth left intercostal space, 3.5 in. (9 cm) from the midline)

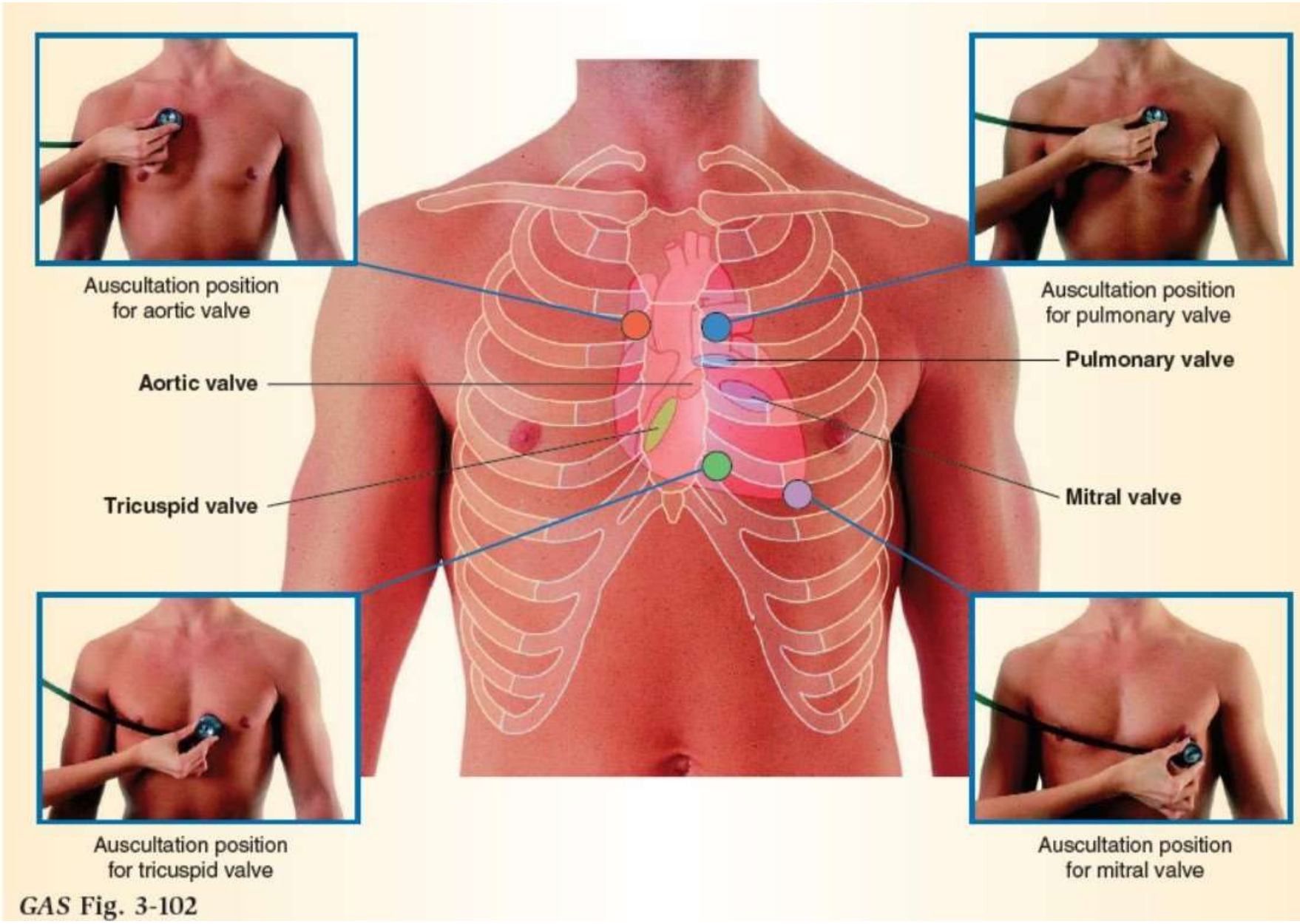
The pulmonary valve is heard over ***the medial end of the second left [far away from the anatomical surface] intercostal space***

The aortic valve is best heard over ***the medial end of the second right intercostal space.***



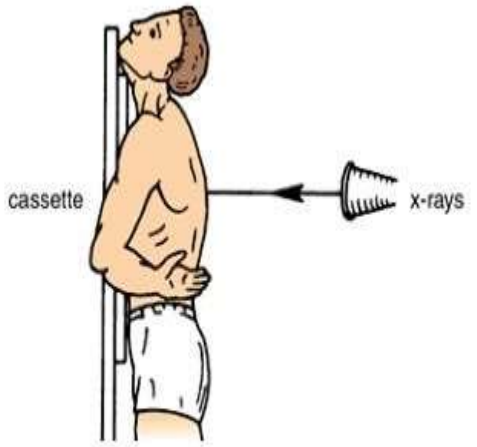
Please make sure to comprehend this well before proceeding.

CD Figure 4-2 Surface anatomy of the heart and great blood vessels. Note the position of the heart valves relative to the chest wall. The bold letters indicate positions where valves may be heard with least interference. A = aortic valve, M = mitral valve, P = pulmonary valve, T = tricuspid valve.

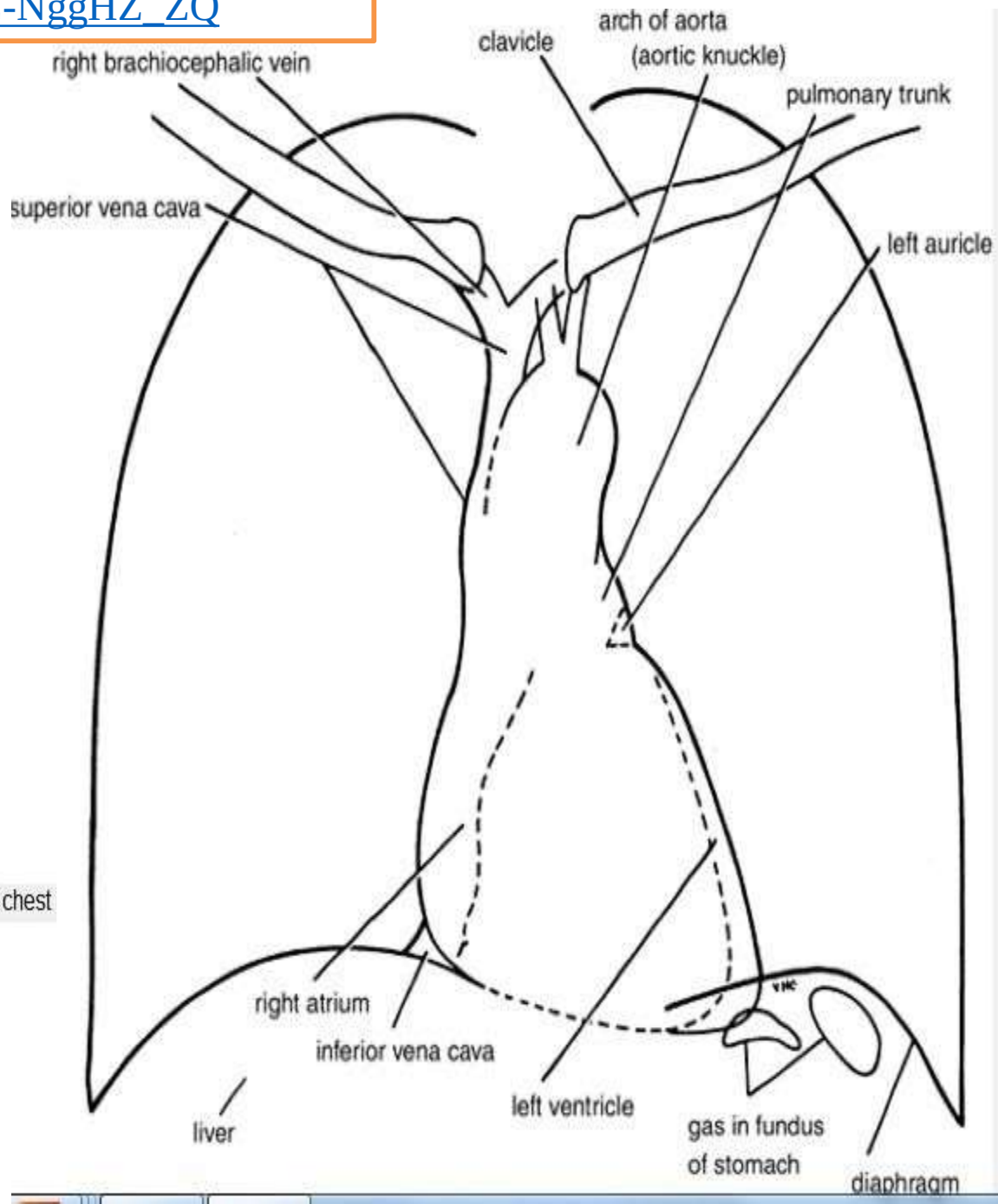

Auscultation position for aortic valve
Auscultation position for pulmonary valve
Pulmonary valve
Aortic valve
Tricuspid valve
Mitral valve
Auscultation position for tricuspid valve
Auscultation position for mitral valve

GAS Fig. 3-102

https://www.youtube.com/watch?v=SC-NggHZ_ZQ



Main features observable in the posteroanterior radiograph of the chest



THE RIGHT CONTOUR[border] OF THE CARDIAC X-RAY

The upper half of the right contour is formed by the superior vena cava (SVC)

is straight

The angle between these two contours represents the superior aspect of the right atrium

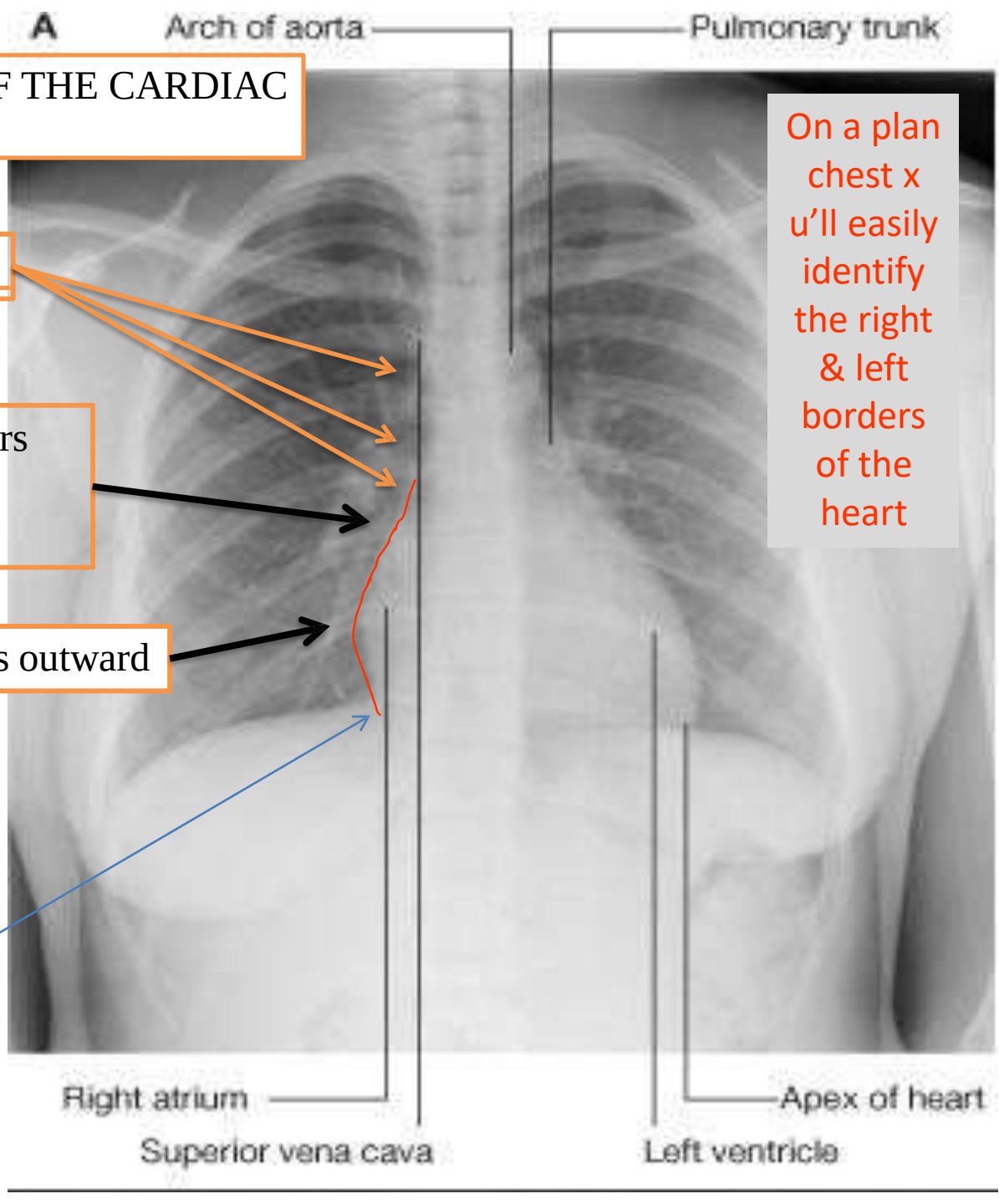
the lower half by the lateral wall of the right atrium

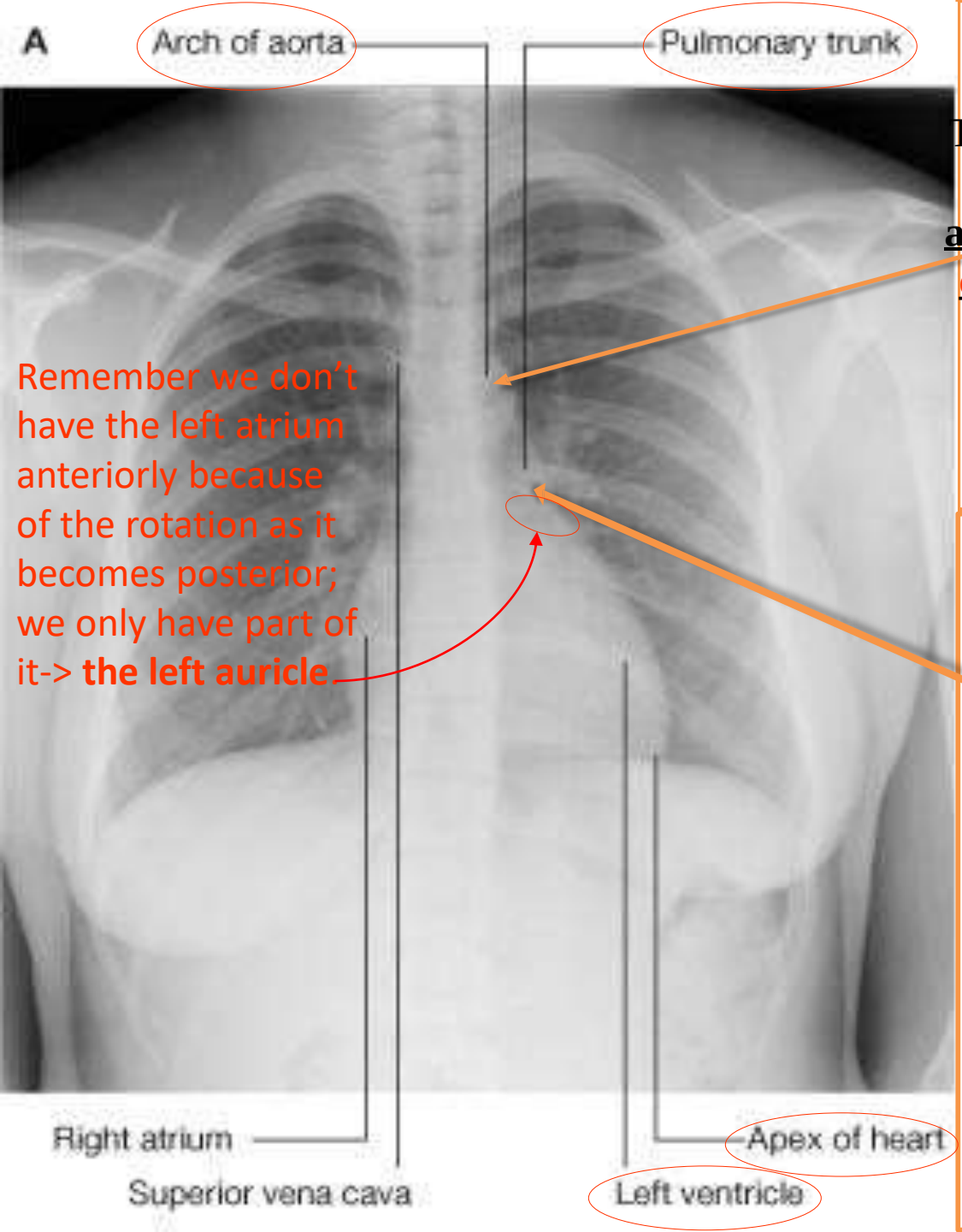
bulges outward

Remember: after rotation, the right ventricle became anterior.

If the patient takes a deep inspiration, an indentation on the right border of the heart can be seen just above the diaphragm, identifying the junction of the inferior vena cava (IVC) [short segment of it] and right atrium

On a plan chest x u'll easily identify the right & left borders of the heart

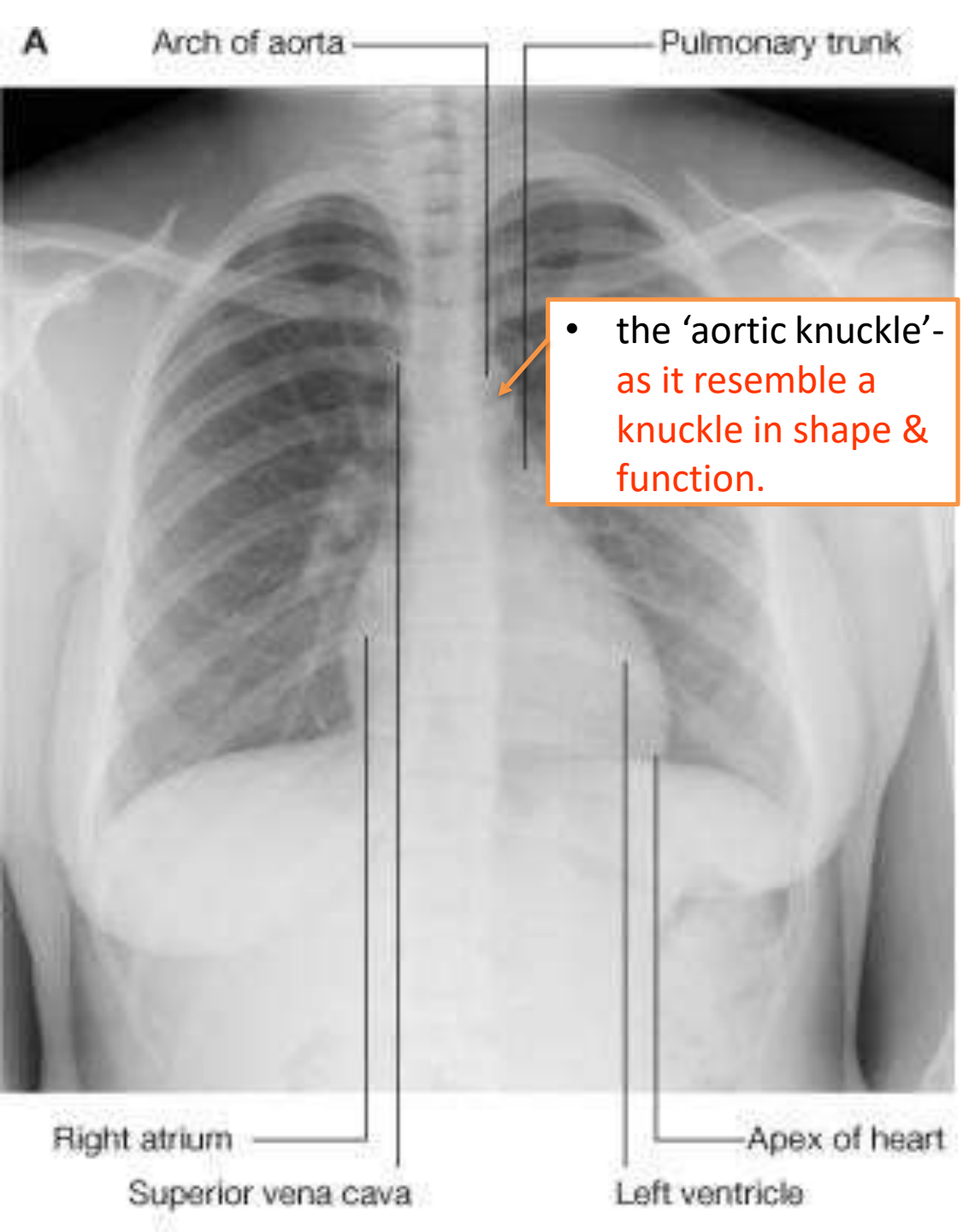




Remember we don't have the left atrium anteriorly because of the rotation as it becomes posterior; we only have part of it-> **the left auricle**.

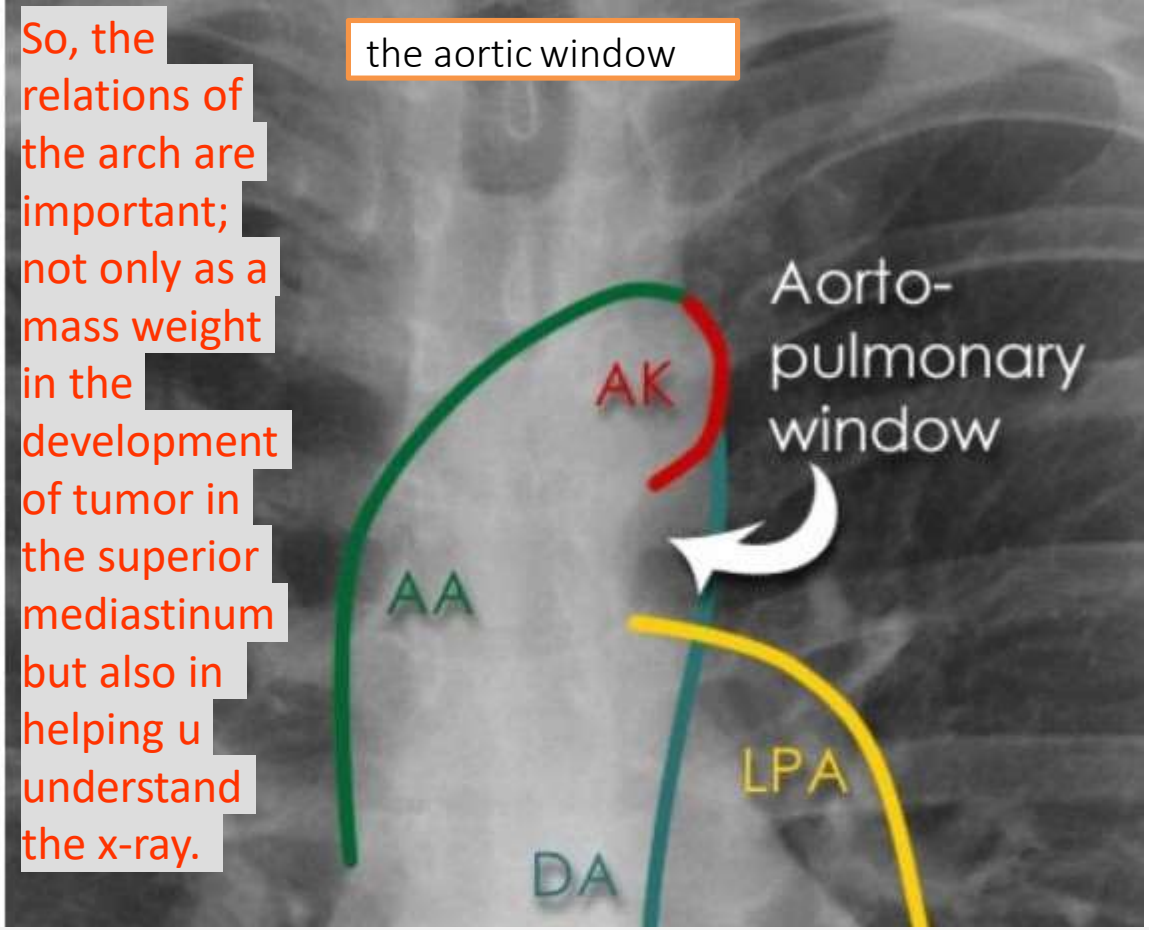
<u>On the left side</u>,
The uppermost part of the cardiovascular is formed by **<u>the distal arch of the aorta</u>**[<u>most superior part of the left border of the heart</u>] as it curves posteriorly and inferiorly to become the descending thoracic aorta.
This is seen as a localized bulge extending from the left side of the mediastinum above he right tracheobronchial angle.

Immediately below the aortic bulge, **<u>the main pulmonary trunk and left main pulmonary artery</u>** are border forming.
A small segment of the left cardiac silhouette below the pulmonary artery is formed by the left atrial appendage.
This segment normally is flat or slightly convex and is continuous with the curve of the left ventricle, which forms the largest part of the left border of the cardiac contour.



- the 'aortic knuckle'- as it resemble a knuckle in shape & function.

- The shadow of the arch is easily identified in anteroposterior radiographs and its left profile is sometimes called
- the 'aortic knuckle' is the most important shadow in a plain chest x ray that targets the vascular system; its importance comes from the fact that it helps u to identify the aortic window.



So, the relations of the arch are important; not only as a mass weight in the development of tumor in the superior mediastinum but also in helping u understand the x-ray.

- The arch may also be visible in left anterior oblique views enclosing a pale space, **'the aortic window'**, in which shadows of the pulmonary trunk and its left branch may be discerned

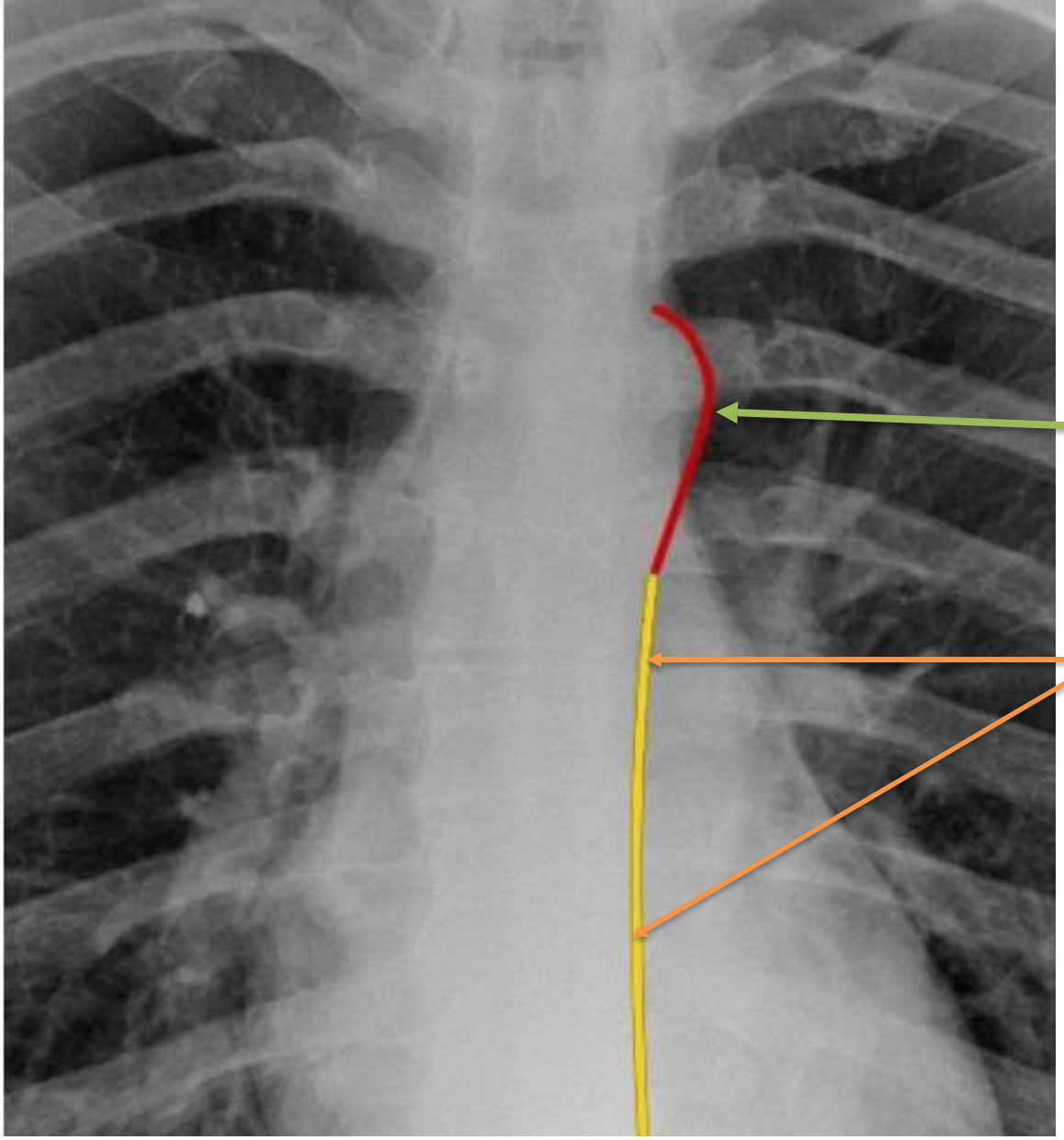
The aorto-pulmonary window lies between the arch of the aorta[below it]and the pulmonary arteries[the pulmonary trunk & its left main branch].

This is a potential space in the mediastinum where abnormal enlargement of mediastinal lymph nodes can be seen on a chest X-ray.

So, a patient come to u complaining from compression syndrome symptoms or hoarseness of his voice u suspect a tumor pressurizing structures of the superior mediastinum, u ask for a plain chest x-ray→identify the arch→identify the aortic window→find the pulmonary trunk→& u may find some enlarged lymph nodes in the area.

https://www.radiologymasterclass.co.uk/tutorials/chest/chest_home_anatomy/chest_anatomy_page10 Dr.Shatarat

Aortic Knuckle **AK**
Left Pulmonary Artery (**LPA**(
Ascending Aorta=AA
DA atroA gnidnecseD =

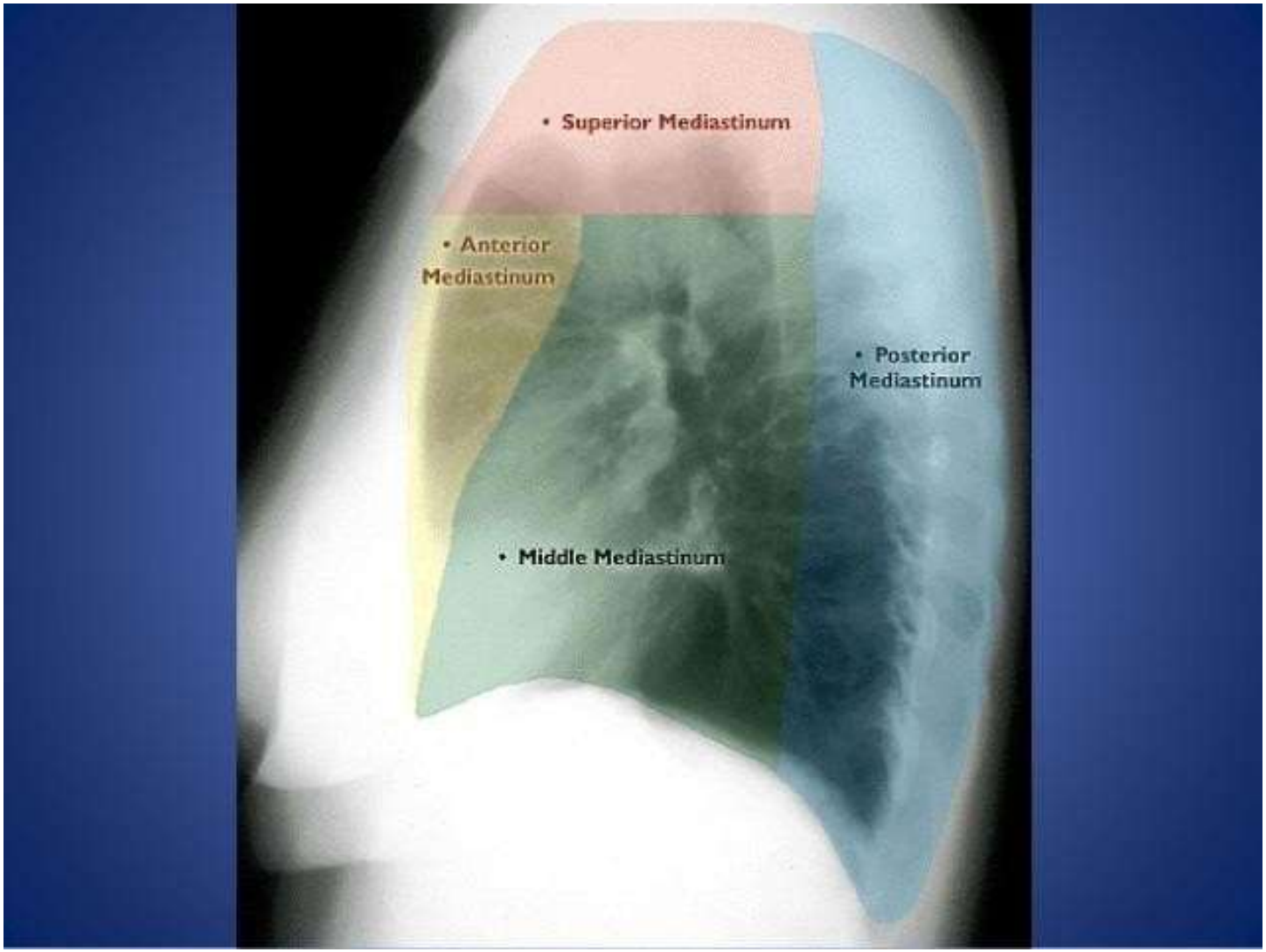


The aortic knuckle (**red line**)

- the ‘aortic knuckle’

The contour of the descending thoracic aorta (**yellow line**)

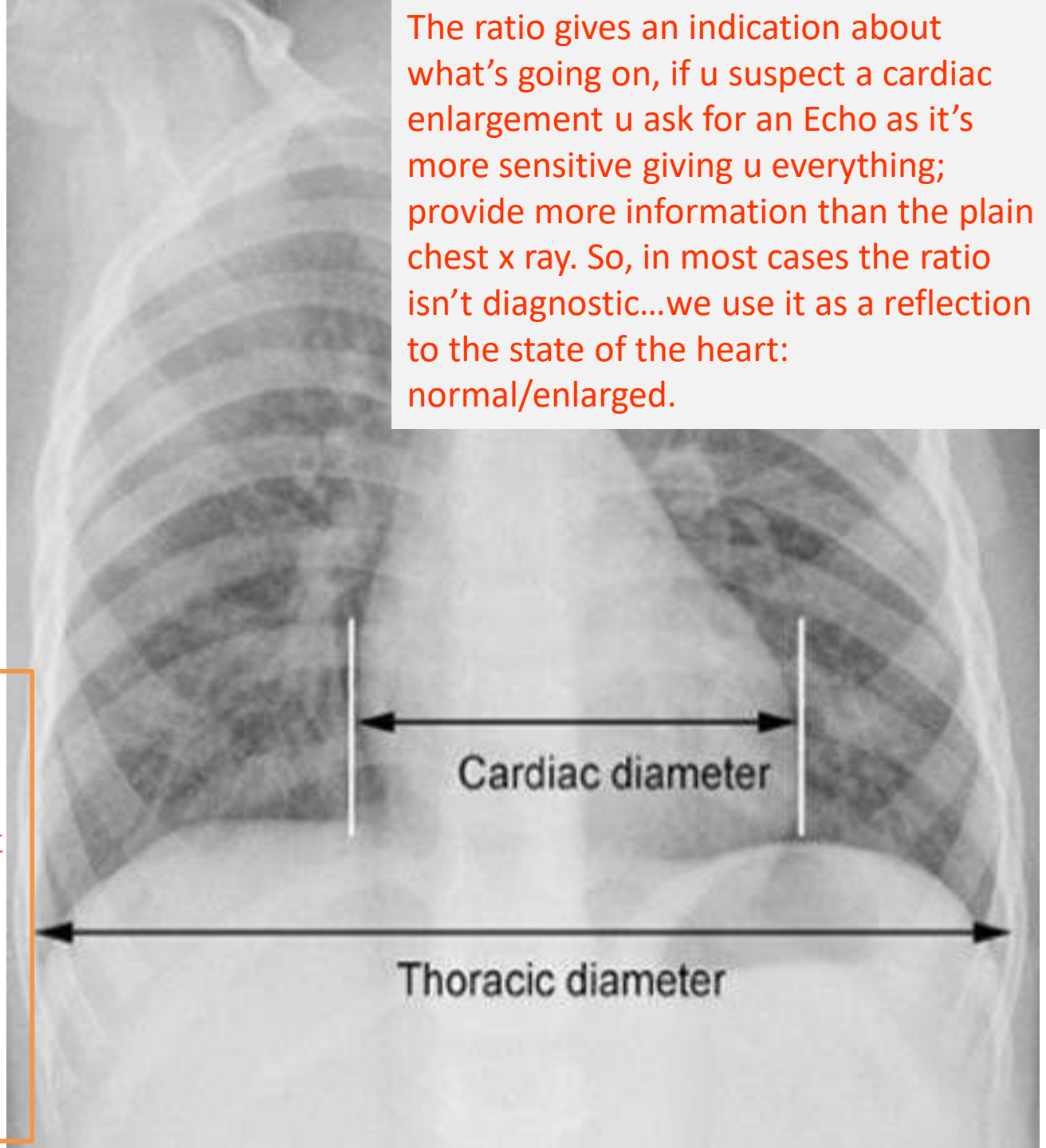
Lateral view of the thoracic cavity.



One of the most important measurements to appreciate the normal size of the heart: The cardiothoracic ratio (CTR) aids in the detection of enlargment of the heart which is most commonly from cardiomagaly but can be due to other processes such as **Pericardial effusion**

It is the ratio of maximal horizontal cardiac diameter[between the tow points that represent the largest cardiac diameter]to maximal horizontal thoracic diameter (inner edge of ribs / edge of pleura)[from the inside]. A normal measurement should be <0.5.

The ratio gives an indication about what's going on, if u suspect a cardiac enlargement u ask for an Echo as it's more sensitive giving u everything; provide more information than the plain chest x ray. So, in most cases the ratio isn't diagnostic…we use it as a reflection to the state of the heart: normal/enlarged.

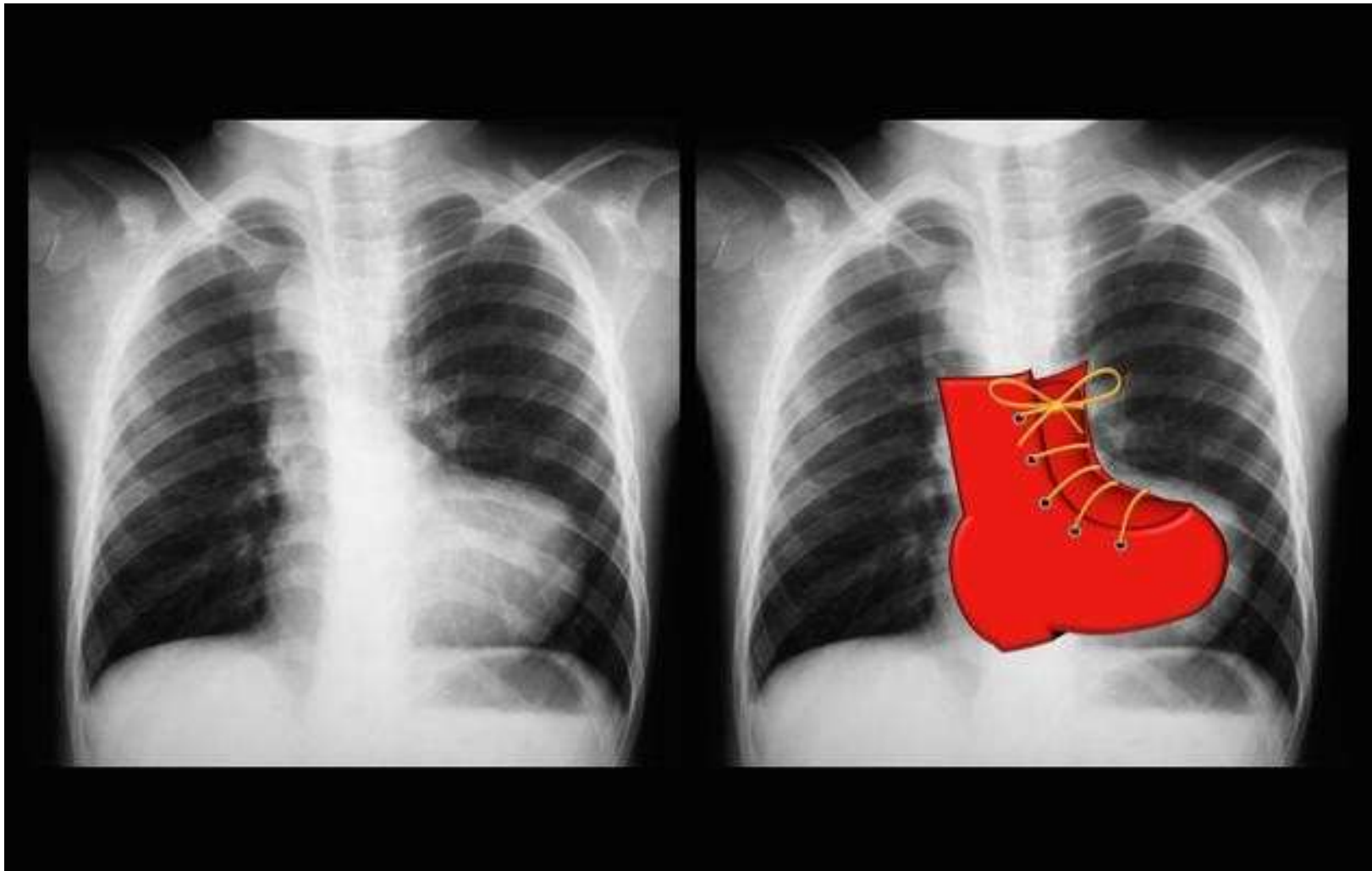


A 'boot-shaped' heart

It is the appearance of the heart on plain film in some cases of Tetralogy of Fallot.

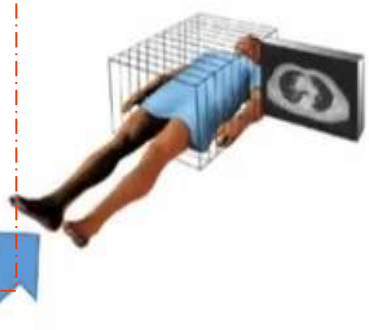
It describes the appearances of an upturned cardiac apex [it should be down]due to right ventricular hypertrophy and a concave pulmonary arterial Segment.

As the doctor said: كندرةlike heart.

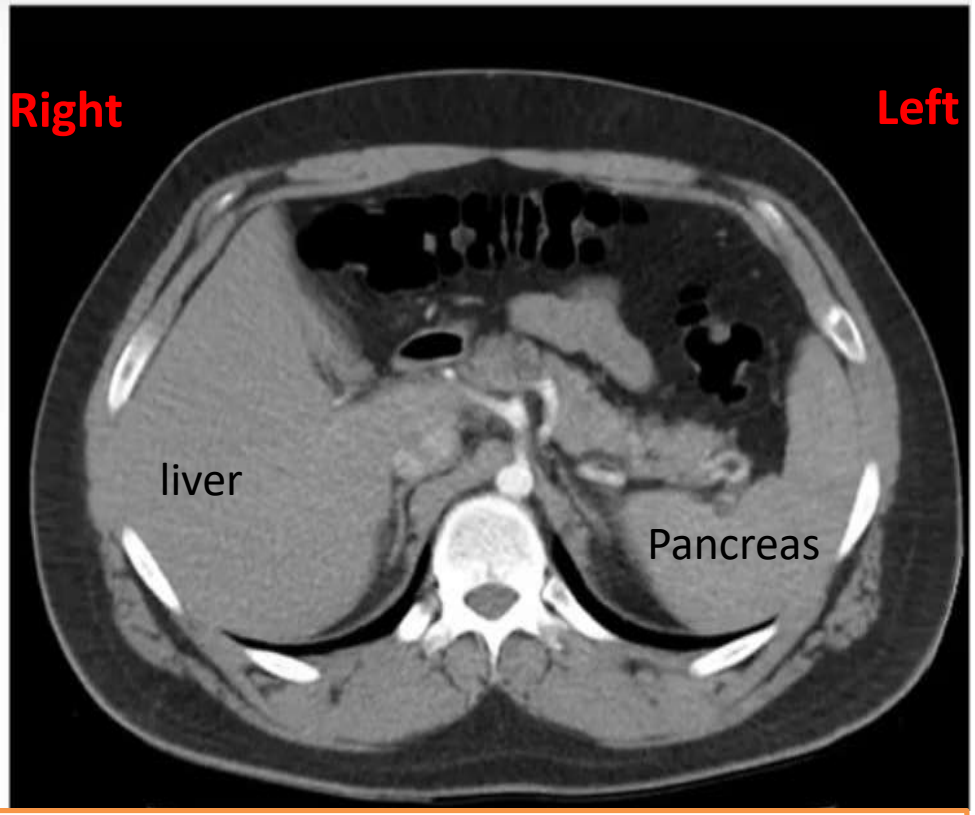


Okay; focus now plz…if u didn't understand this u won't get the rest of the lecture.

CT scans are reflections of ur solid anatomical knowledge.

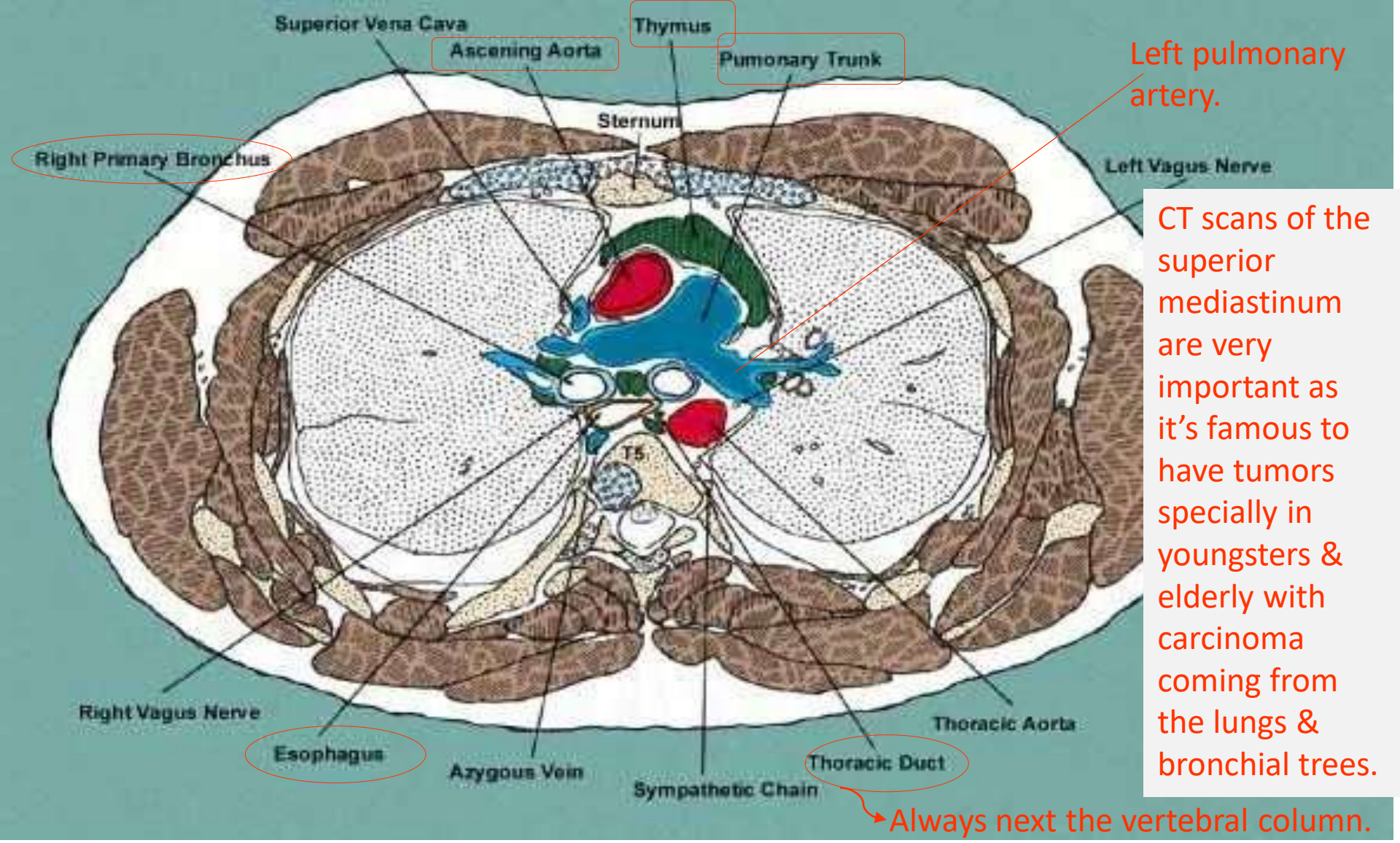


We look & study CT scans as we're sitting near the patients' feet.



ON the CT scans

You should appreciate the fact that we are evaluating the inferior part of the section (not the superior)[so we look at the patient from down→up], therefore, it should be noted right side will be actually on the left side on the scan and vice versa.



CT scans of the superior mediastinum are very important as it's famous to have tumors specially in youngsters & elderly with carcinoma coming from the lungs & bronchial trees.

Cross section through the thorax at vertebra T5. This section cuts through the anterior, middle and posterior mediastina [we aren't in the superior mediastinum] . You now see the ascending and descending aortae as well as the pulmonary trunk; we can't see the trachea as it ends at the level of T4-T5 plane…we only see the main bronchi.

Read this paper

Sex-Specific Parameters of Ascending Aorta, Descending Aorta and Pulmonary Trunk by Computed Tomographic Angiography with Impact of Age, Hypertension, Smoking and Diabetes

Amjad S. Shatarat[a]; Maher T. AL-Hadidi[a]; Darwish H. Badran[a]; Faraj F. Bustami[a]; Azmy M. AL-Hadidy[b]; Emad S. Tarawneh[b]; Nathir M. Obeidat[c] & Sherin W. Abd El Malek

SVC: superior vena cava.
PA: pulmonary artery.

*Remember the CT scan is done with dye that's why we specifically see the vascular structures very well.

DA→ next to the vertebral column.

AA→ close to the sternum.

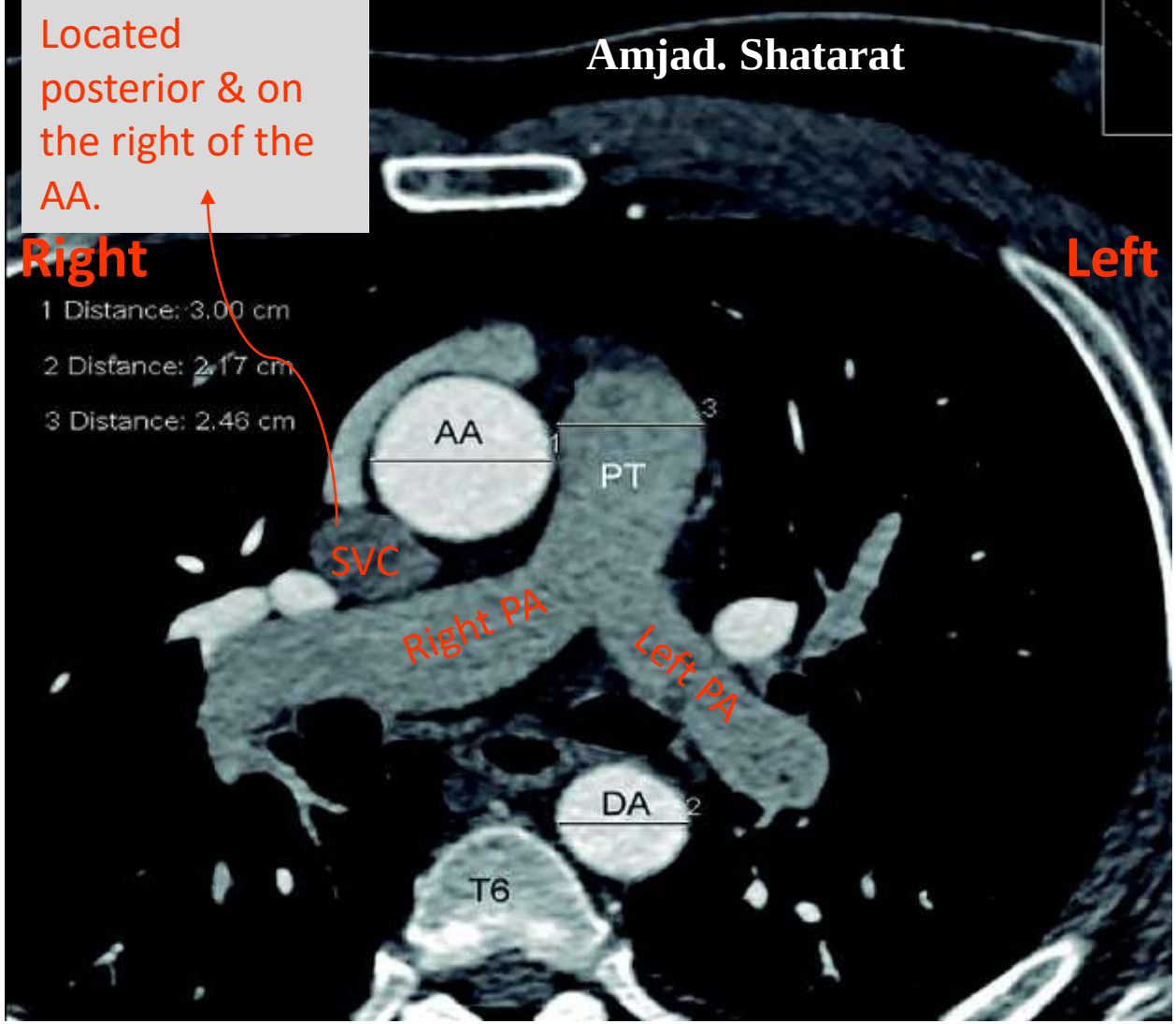
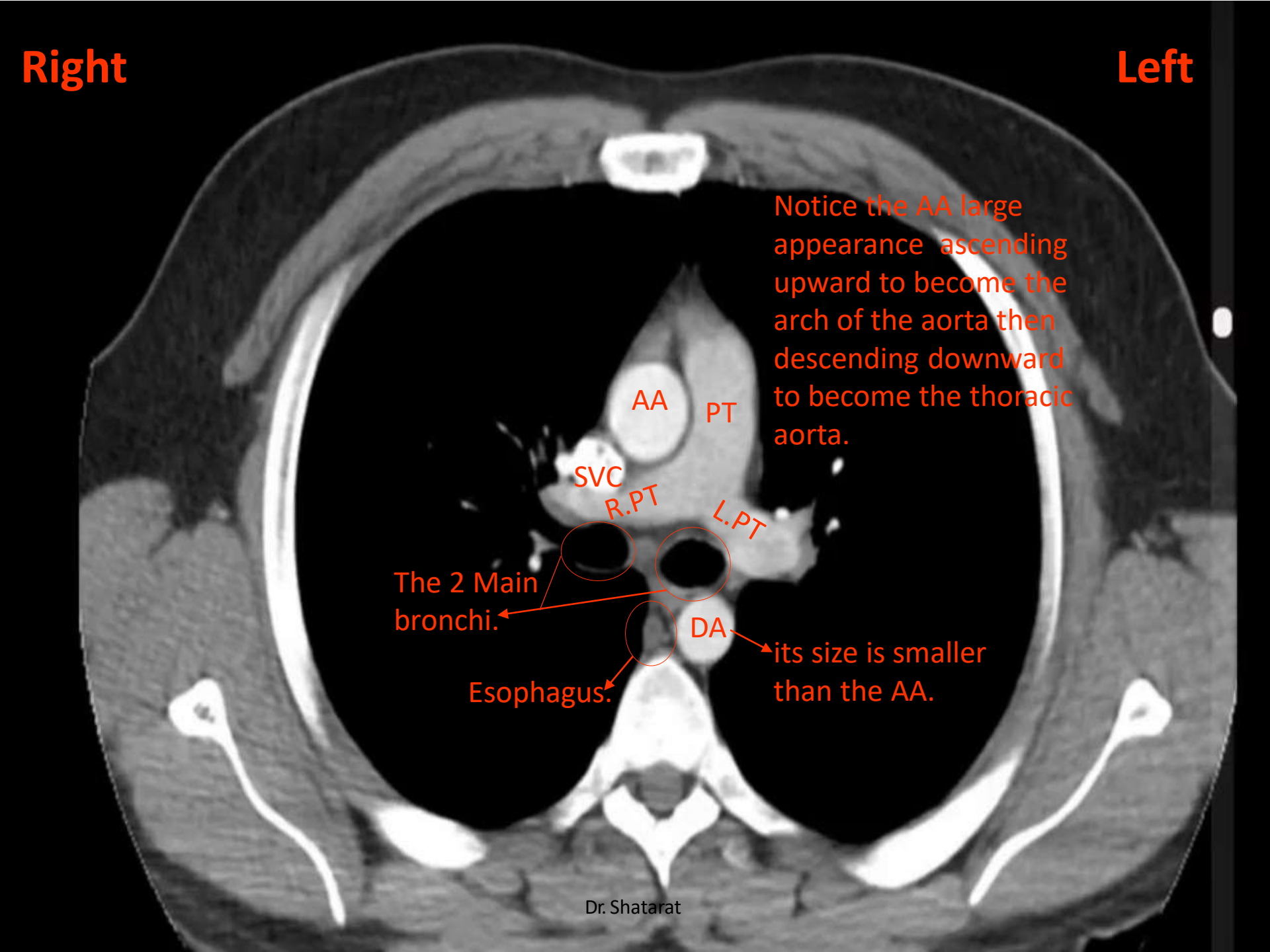
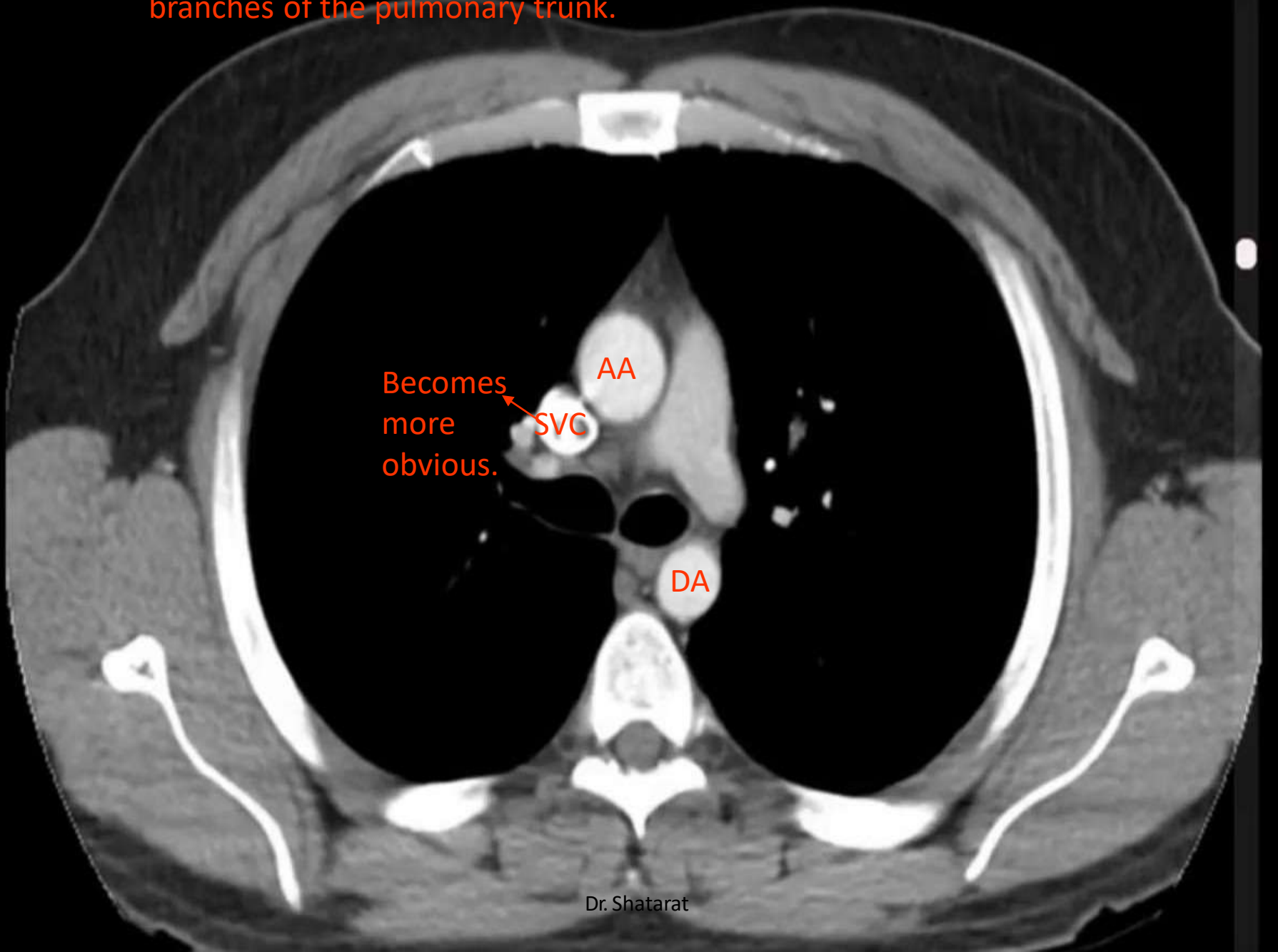
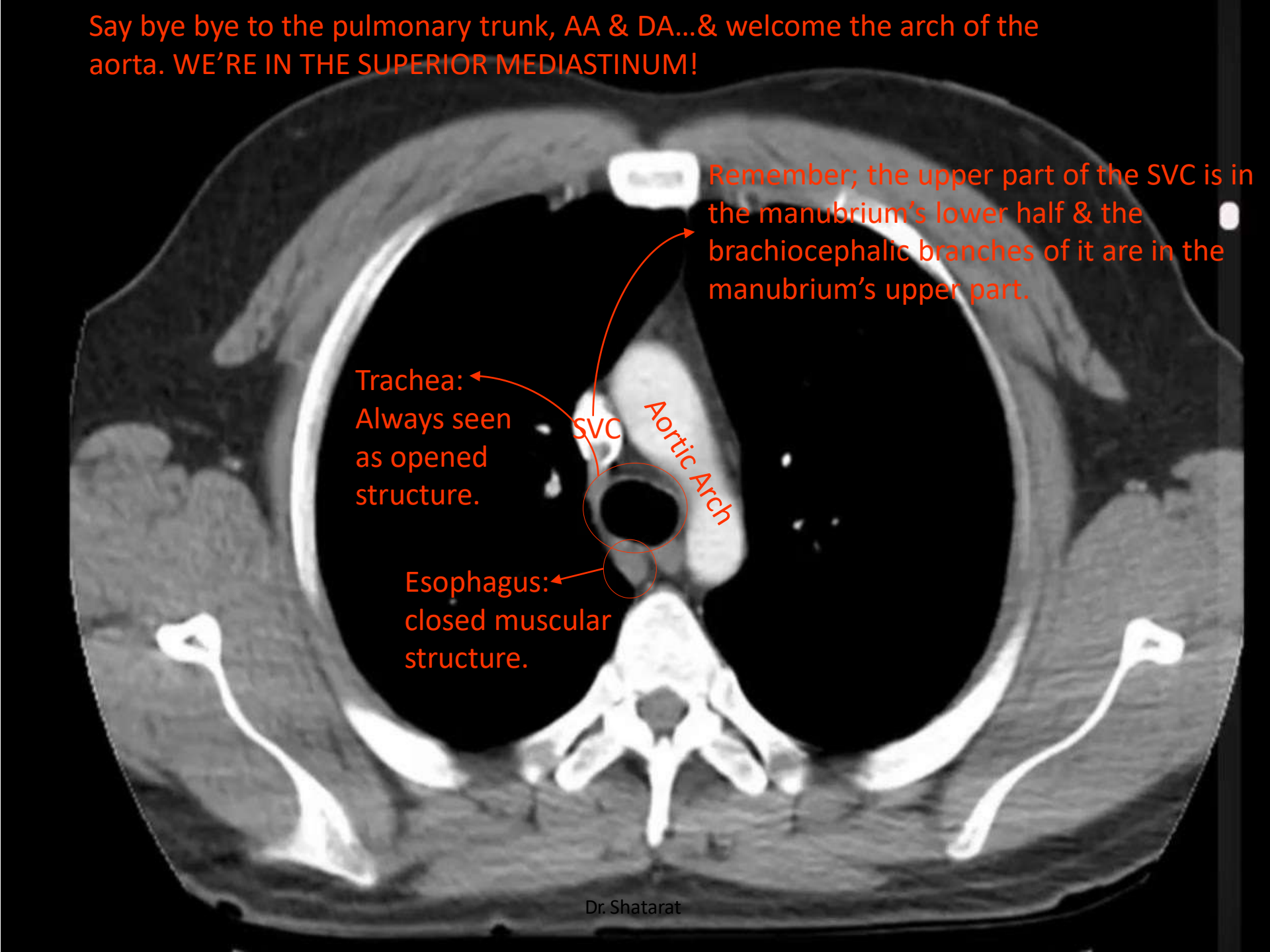


Fig. 1. Axial CTA image of the thorax, demonstrates ascending aorta, descending aorta and pulmonary trunk at the ***upper border of the sixth thoracic vertebra***. AA=ascending aorta, DA= descending aorta, PT= pulmonary trunk

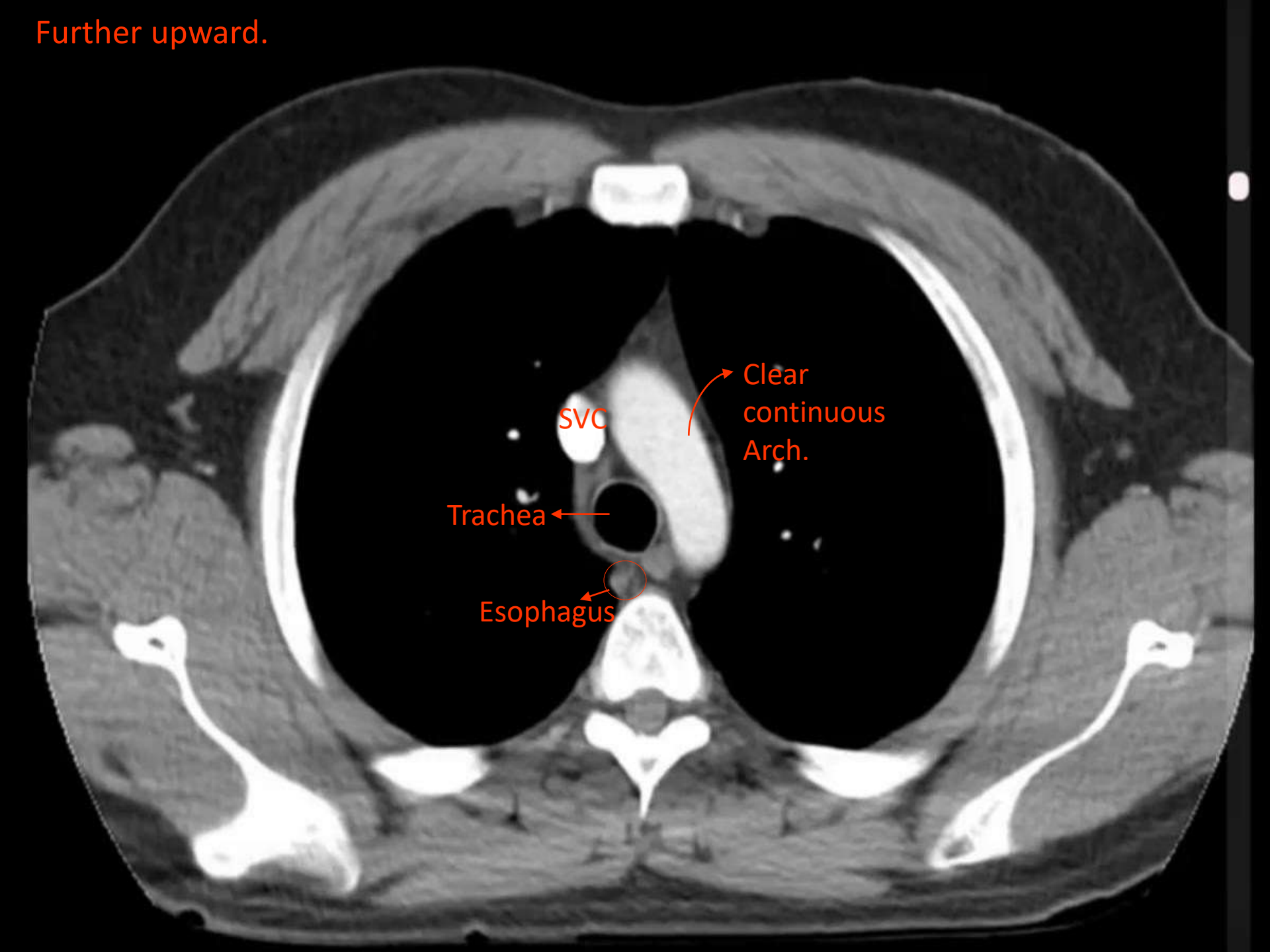

Right
Left
Notice the AA large appearance ascending upward to become the arch of the aorta then descending downward to become the thoracic aorta.
AA
PT
SVC
R.PT
L.PT
The 2 Main bronchi.
DA
its size is smaller than the AA.
Esophagus.
Dr. Shatarat

BY GOING UP toward the superior mediastinum we loos the view of the branches of the pulmonary trunk.



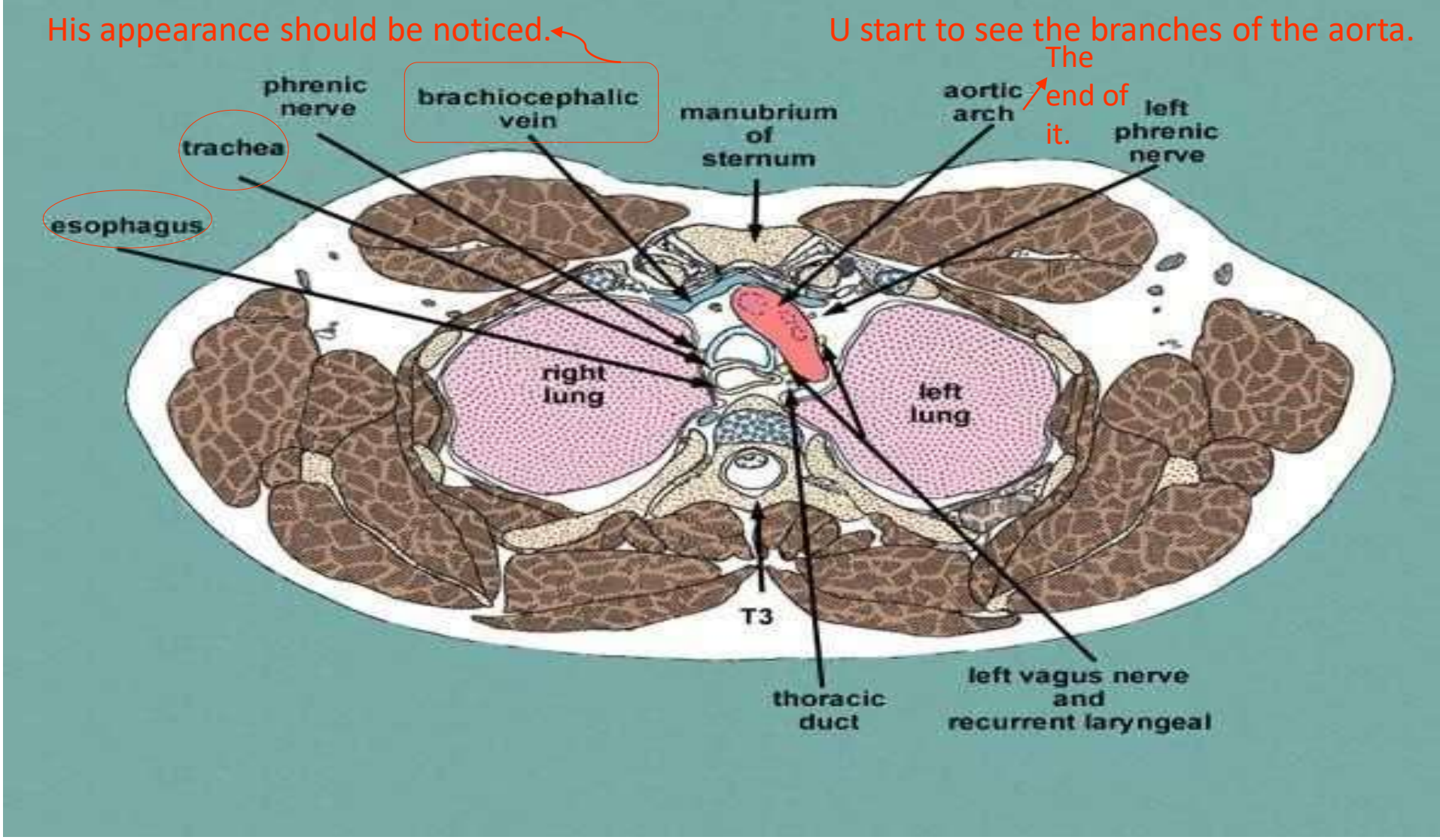

Say bye bye to the pulmonary trunk, AA & DA…& welcome the arch of the aorta. WE'RE IN THE SUPERIOR MEDIASTINUM!
Remember; the upper part of the SVC is in the manubrium's lower half & the brachiocephalic branches of it are in the manubrium's upper part.
Trachea: Always seen as opened structure.
SVC
Aortic Arch
Esophagus: closed muscular structure.
Dr. Shatarat

Further upward.



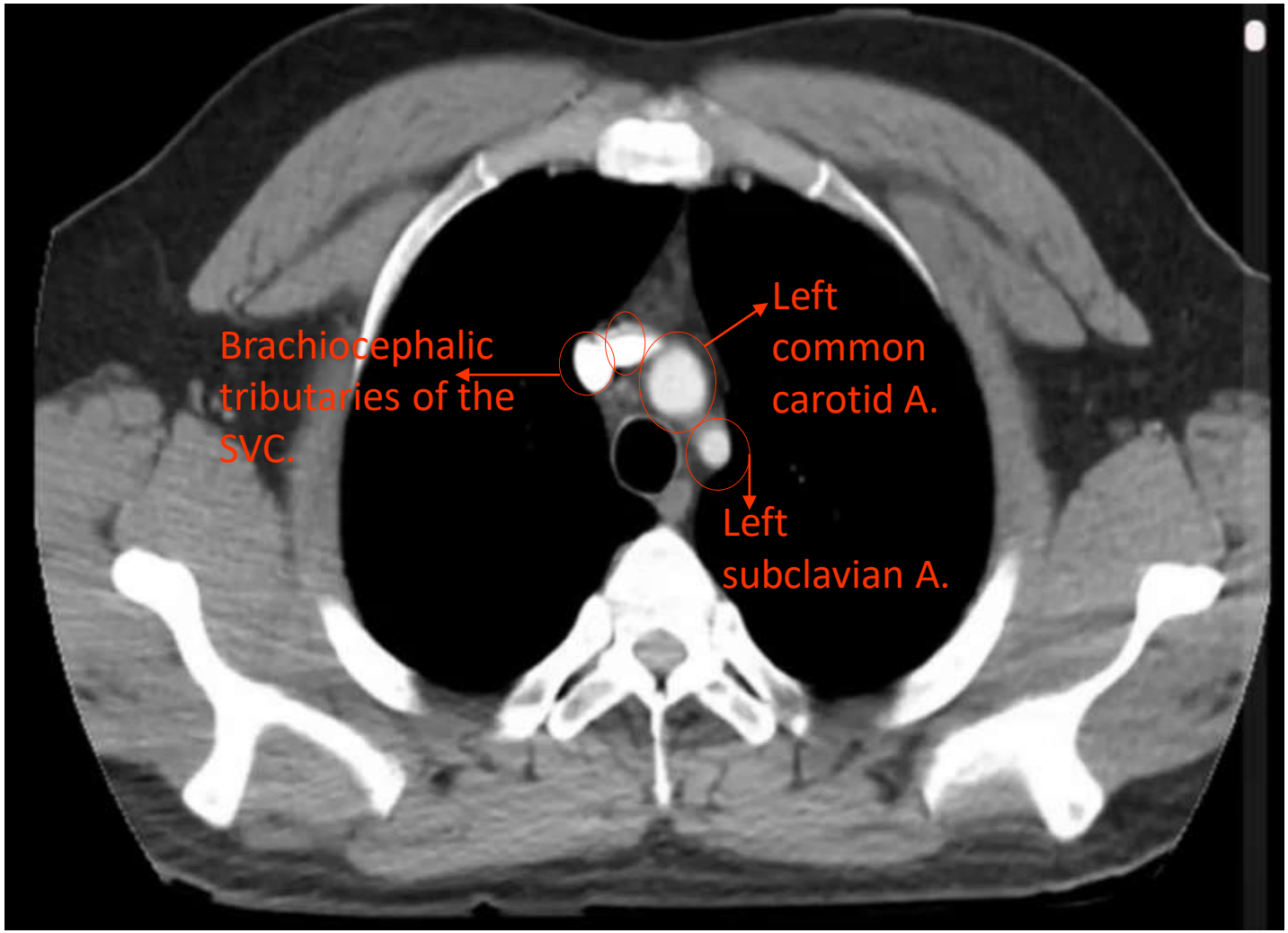
His appearance should be noticed.

U start to see the branches of the aorta.

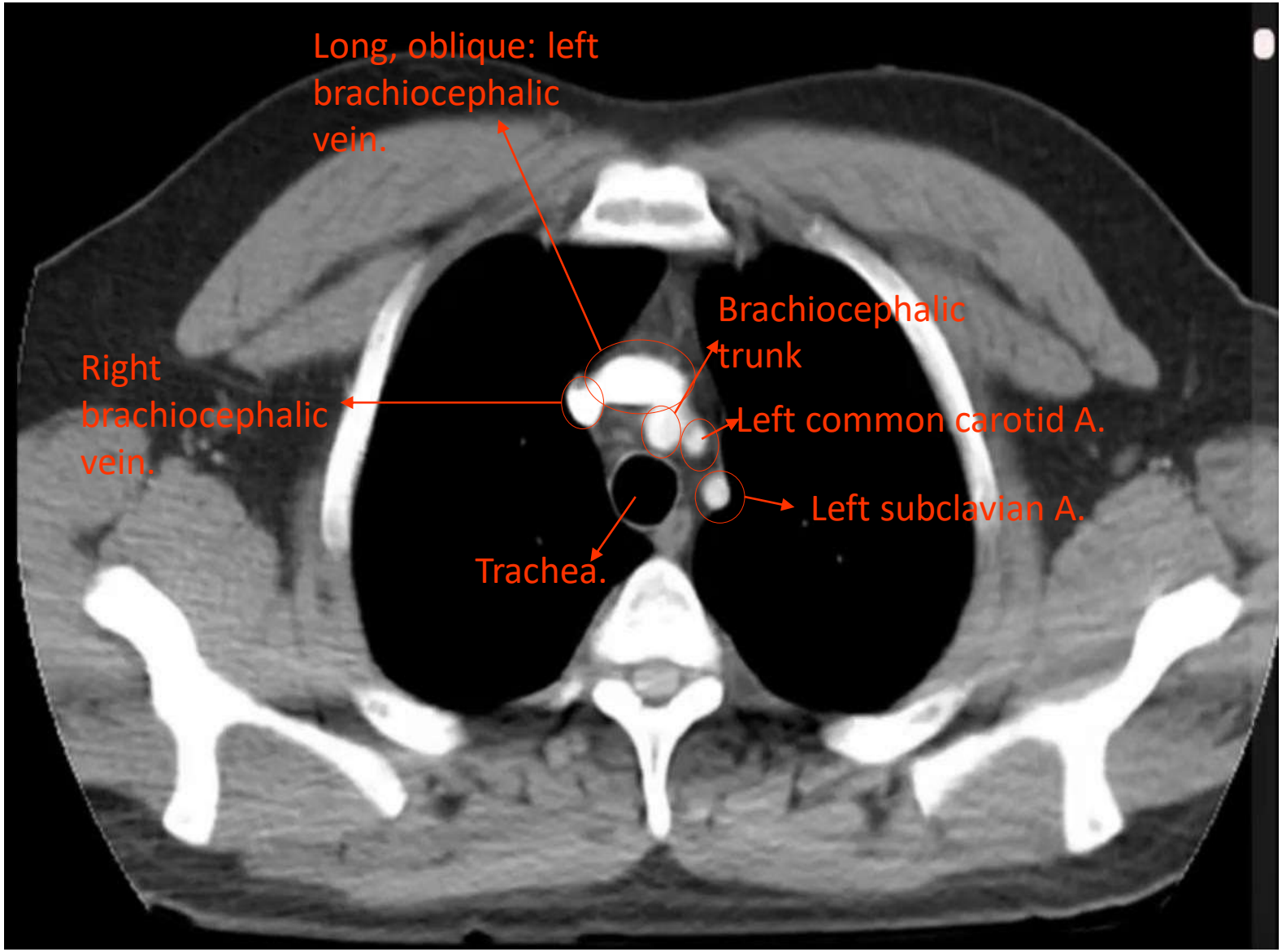


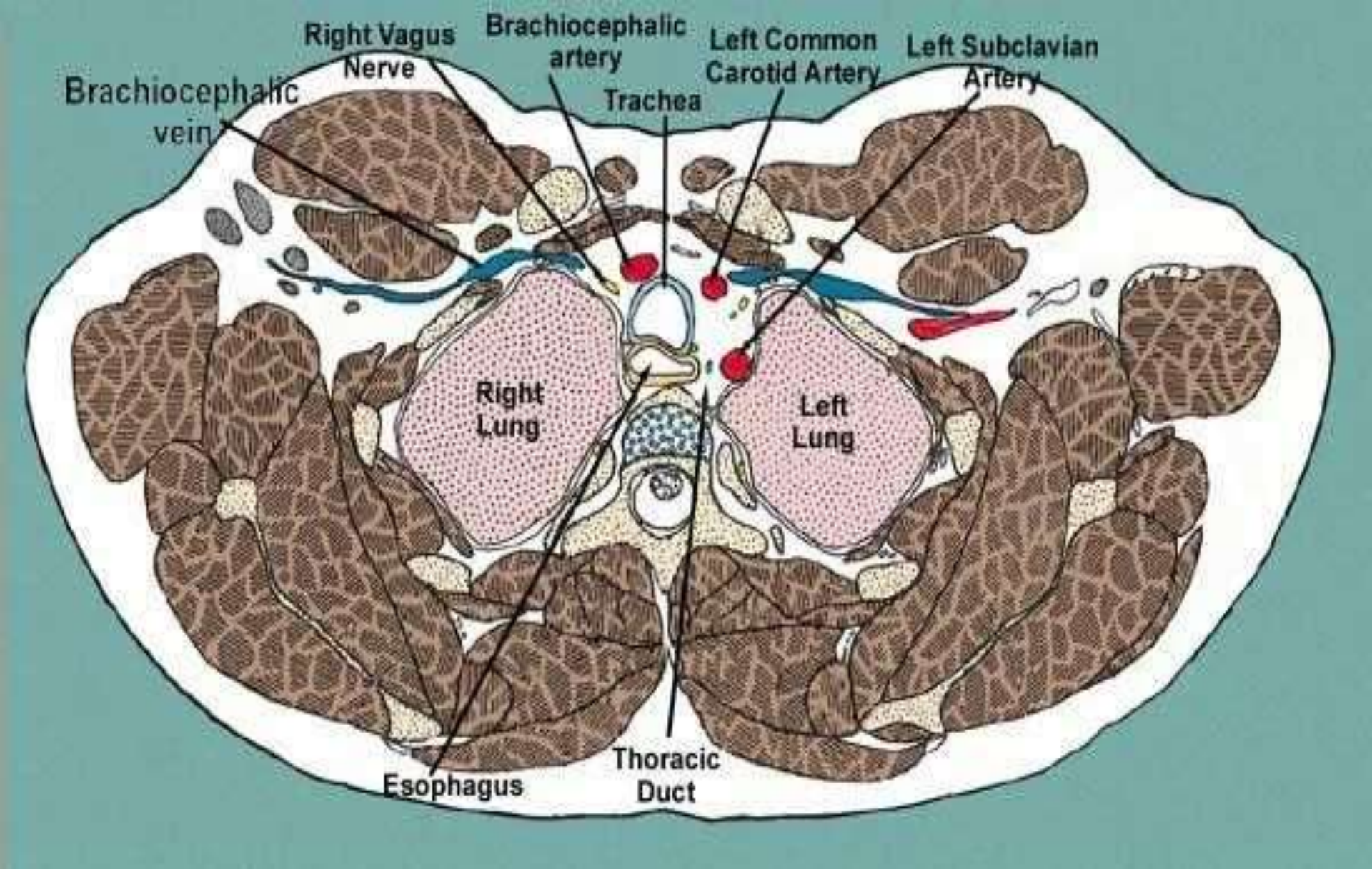
Cross section through the thorax at vertebra T3. This section is also through the superior mediastinum but a little lower than the one above. You are looking up and into the aortic arch. Although not labeled, you should be able to make out the openings of the brachiocephalic, left common carotid and left subclavian arteries.

More superior.



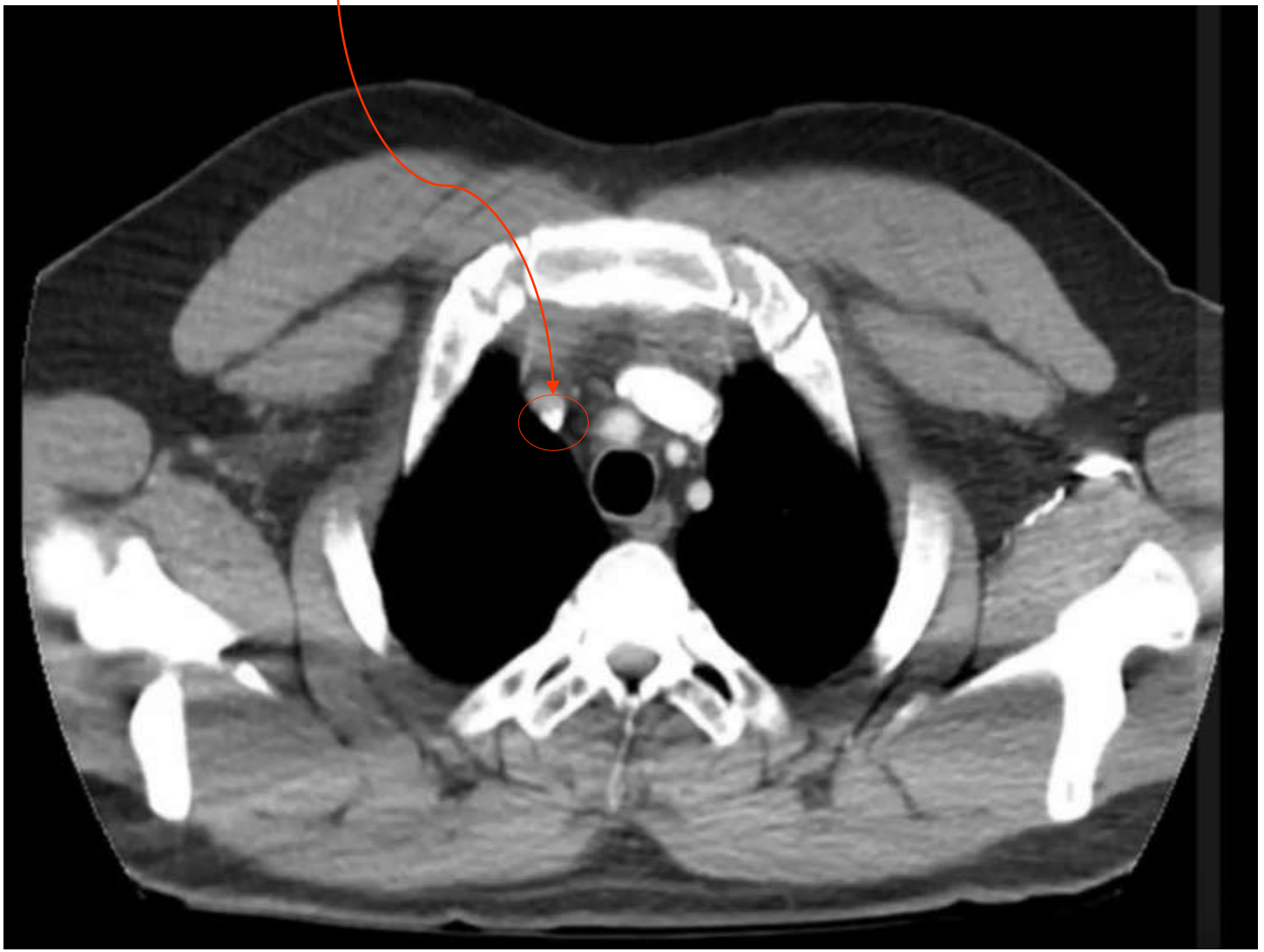
Notice that the brachiocephalic tributaries look a little bit overlapped, so we need another section to identify them clearly.


Long, oblique: left brachiocephalic vein.
Brachiocephalic trunk
Right brachiocephalic vein.
Left common carotid A.
Left subclavian A.
Trachea.



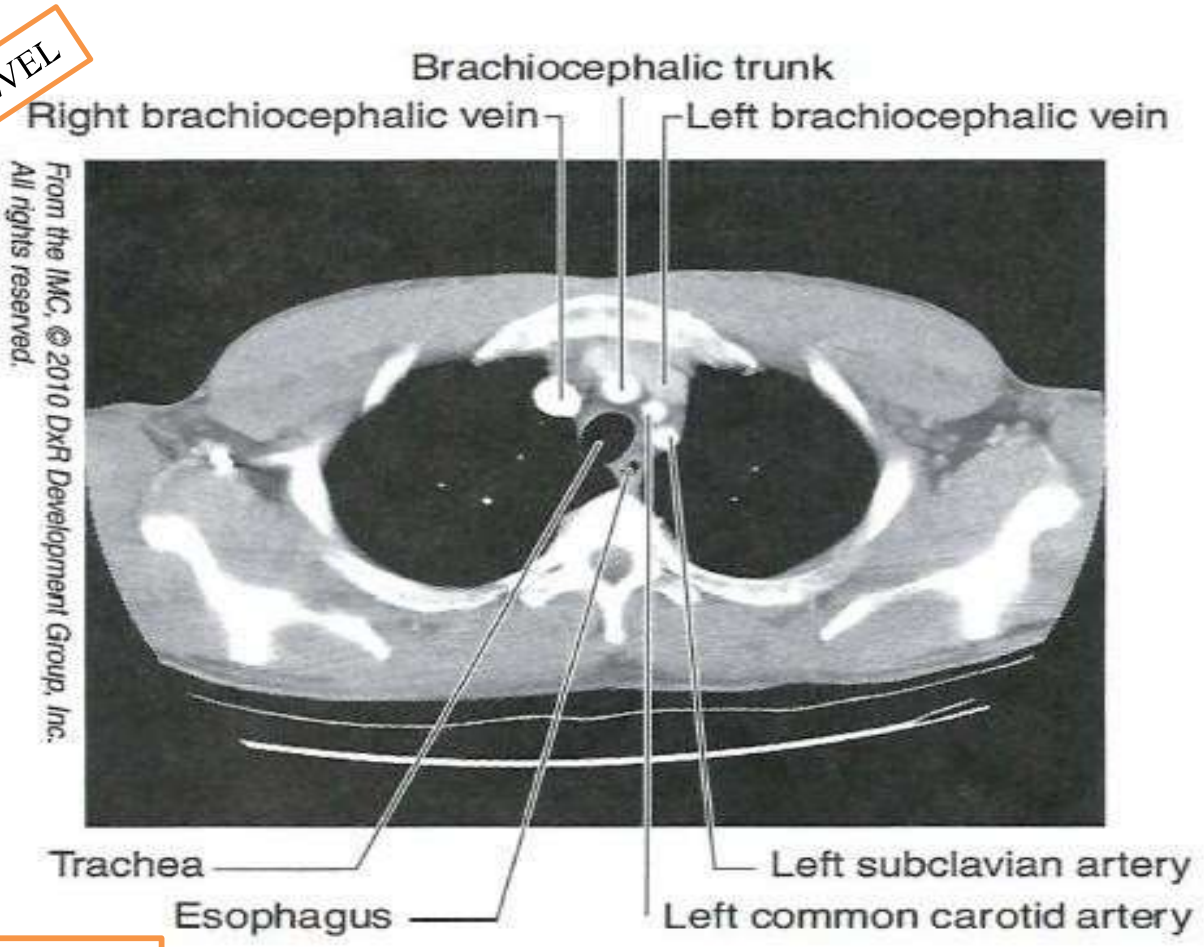
Cross section through the thorax at vertebra **T2** This section cuts through the superior mediastinum above the aortic arch

More up: u'll begin to loos the brachiocephalic tributaries specially the right one; but it's evident still here…



Now we are at the neck [not of our interests]; just to remined about the presence of the THYROID GLAND & that we can see it as well as the shoulders here.

Repetition.

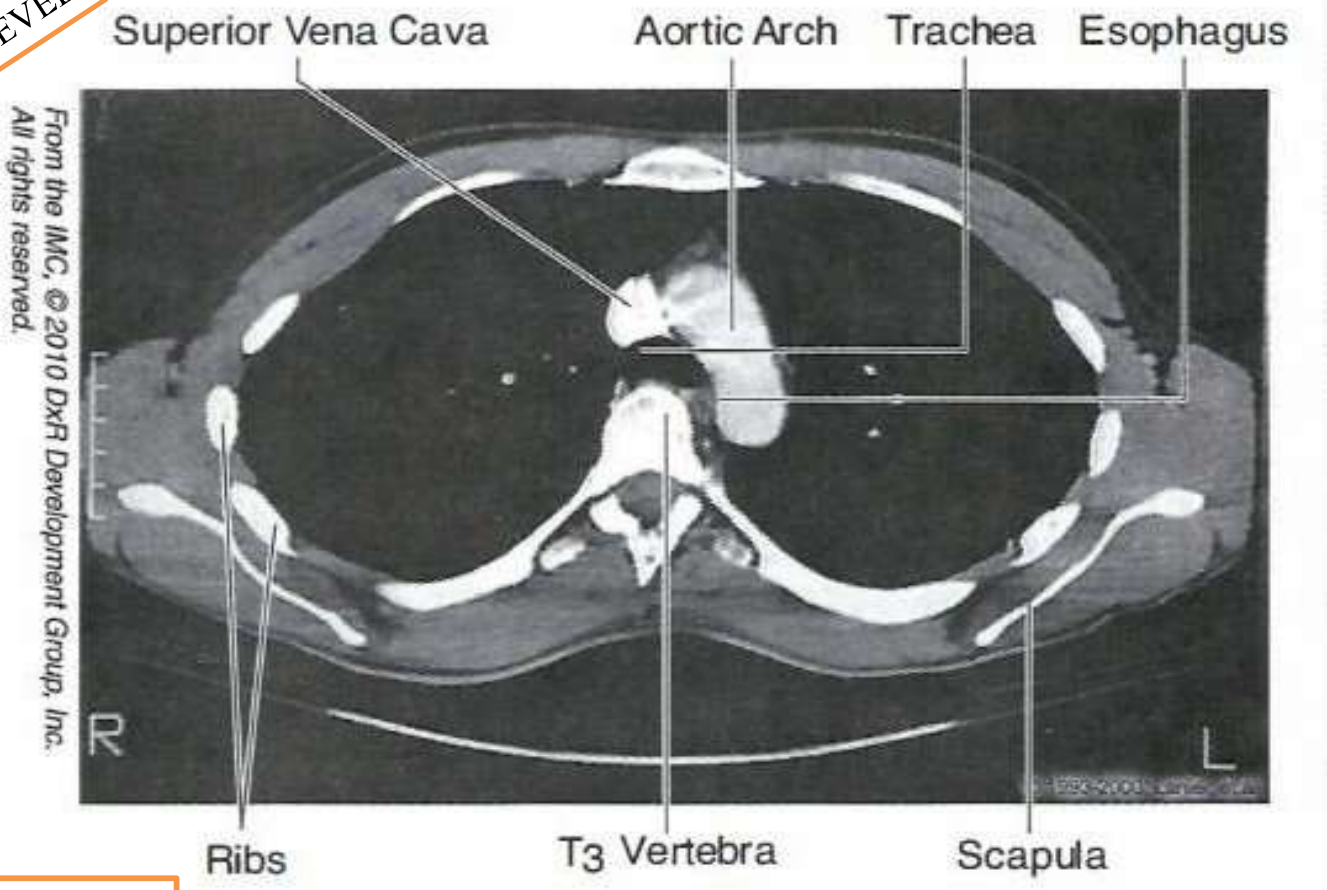


Exam material

Figure III-2-39. Chest: CT, T2

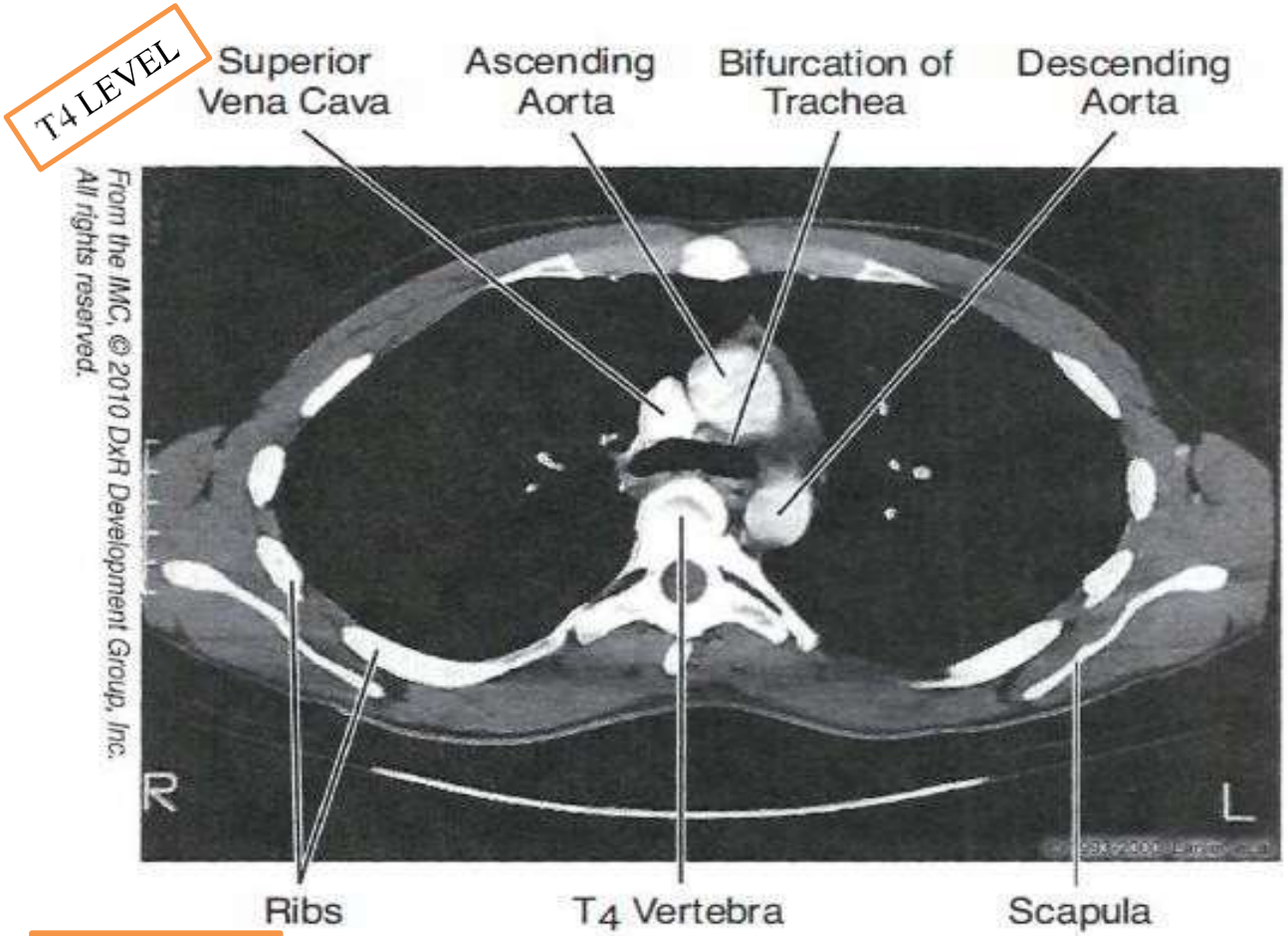
U can read the CT scan the way u want but u always need to appreciate that we look from inferior to superior; knowing anatomy very well is the best way to get engaged with the process.

T3 LEVEL



Exam material

Figure III-2-40. Chest: CT, T3



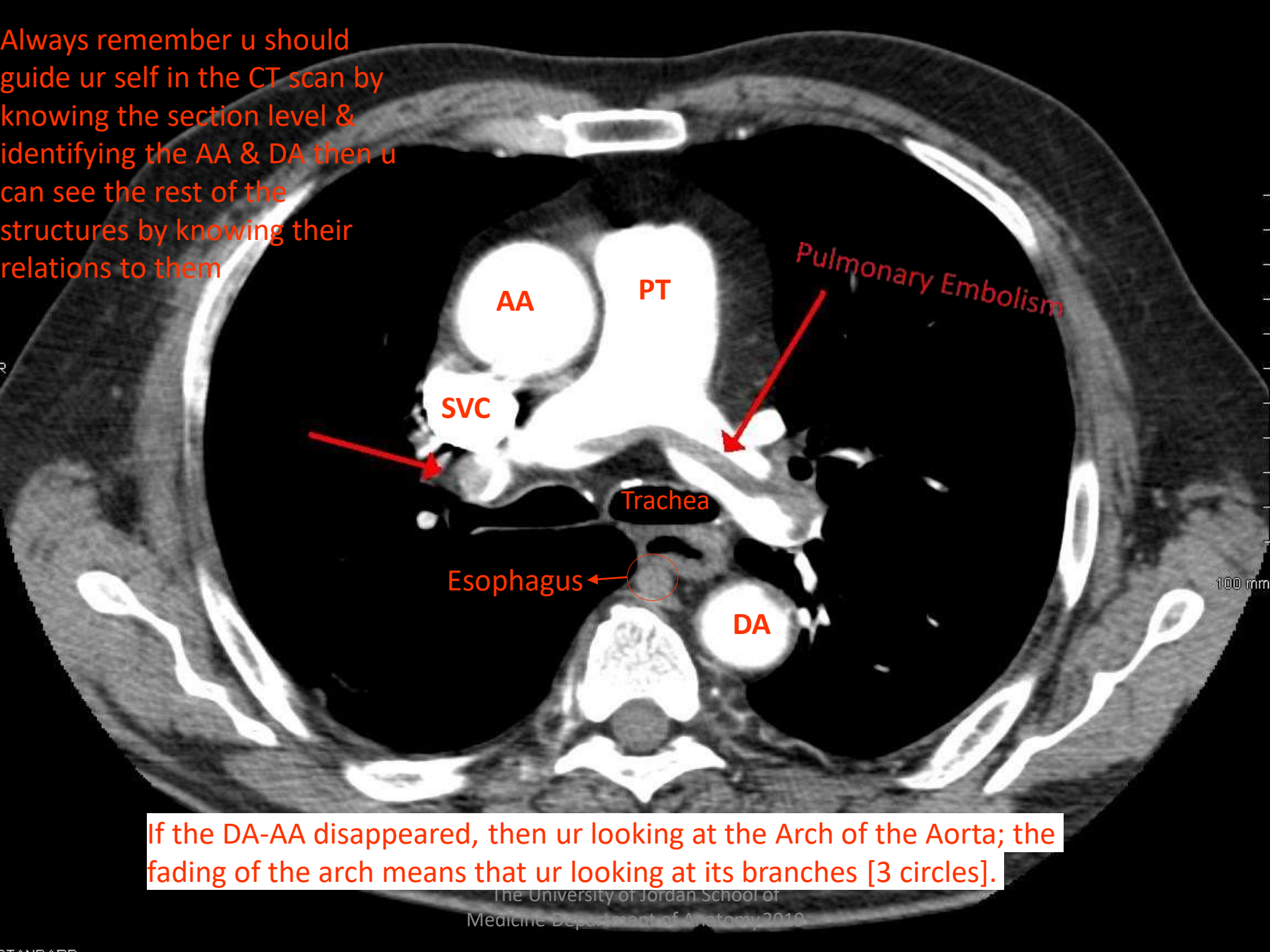
Exam material

Figure III-2-41. Chest: CT, T4

Pulmonary Embolism [commonly from veins specially those of the lower limbs].

- Obstruction of a pulmonary artery by a blood clot (embolus) is a common cause of morbidity (sickness) and mortality (death); knowing the history of the patient is very important as most of the cases represented as an **old** man/woman complaining about pain in their leg after **travelling for long distances**. Long journeys may provide a good condition for the development of embolism thrombus in the venous system that'll eventually bloke the pulmonary trunk or it's branches. Listening to the patient & providing early assessment can prevent thrombus embolism from happening.

An embolus in a pulmonary artery forms when a blood clot, fat globule, or air bubble travels in
the blood to the lungs from a leg vein.
The embolus passes through ***the right side of the heart to a lung*** ***through a pulmonary artery***.
The embolus may block a pulmonary artery—pulmonary embolism—or one of its branches.
The immediate result is partial or complete obstruction of blood flow to the lung.
The obstruction
results in a sector of lung that is ventilated but not perfused with blood.
When a large embolus occludes a pulmonary artery, the person suffers acute respiratory distress because of a major decrease in the oxygenation
of blood owing to blockage of blood flow through the lung. A medium-size embolus may block an artery
supplying a bronchopulmonary segment, producing a pulmonary infarct, an area of necrotic (dead) lung tissue.


Always remember u should guide ur self in the CT scan by knowing the section level & identifying the AA & DA then u can see the rest of the structures by knowing their relations to them
AA
PT
Pulmonary Embolism
SVC
Trachea
Esophagus
DA
100 mm
If the DA-AA disappeared, then ur looking at the Arch of the Aorta; the fading of the arch means that ur looking at its branches [3 circles].
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