



ANATOMY LAB 1

Cardiovascular System

Prepared By:

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MD , T.A in AUG

Thoracic Cavity

- **Boundaries:**

demarcated by the rib cage, and separated from the abdominal cavity by the diaphragm

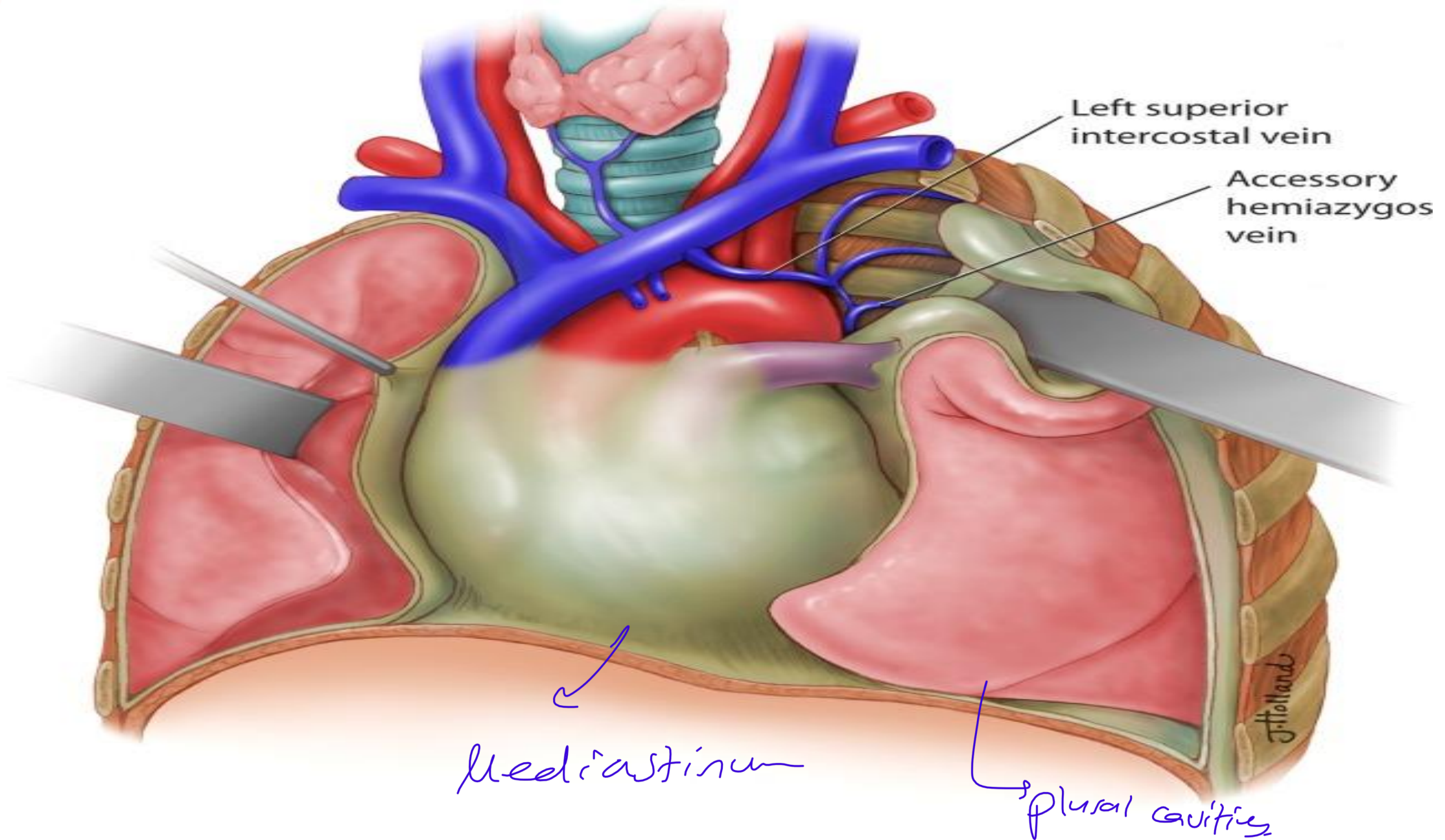
- **Divisions**

- The centrally located mediastinum
- Two laterally located pleural cavities

- **Contents**

- Organs: heart, lungs, esophagus, thymus
- Nerves: sympathetic trunk, *vagus nerve, recurrent laryngeal nerve*
→ SVC
- Vessels (e.g., aorta, thoracic trunk)

6



The Mediastinum

- **Definition:**

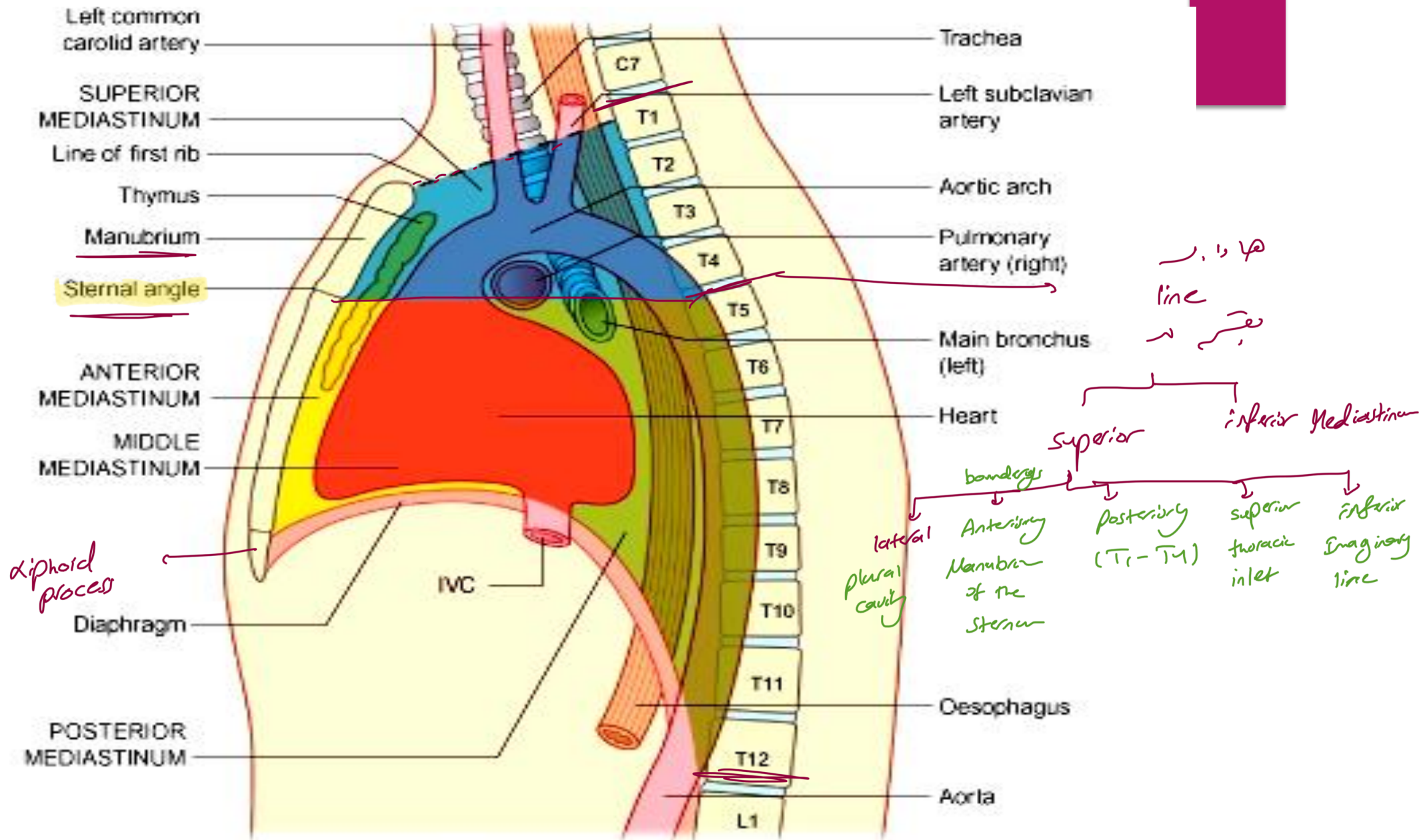
The mediastinum is the central space of the thoracic cavity located behind the sternum and between the two lungs and their respective pleura.

- **Boundaries**

- Anterior: sternum and transversus thoracis muscles
- Posterior: vertebral column (thoracic vertebra (T₁ - T₁₂))
- Superior: thoracic inlet
- Inferior: diaphragm
- Lateral: pleura of the lung

الحدود الجانبية لل Mediastinum — lateral boundary

↓
↓
↓
pleural cavity



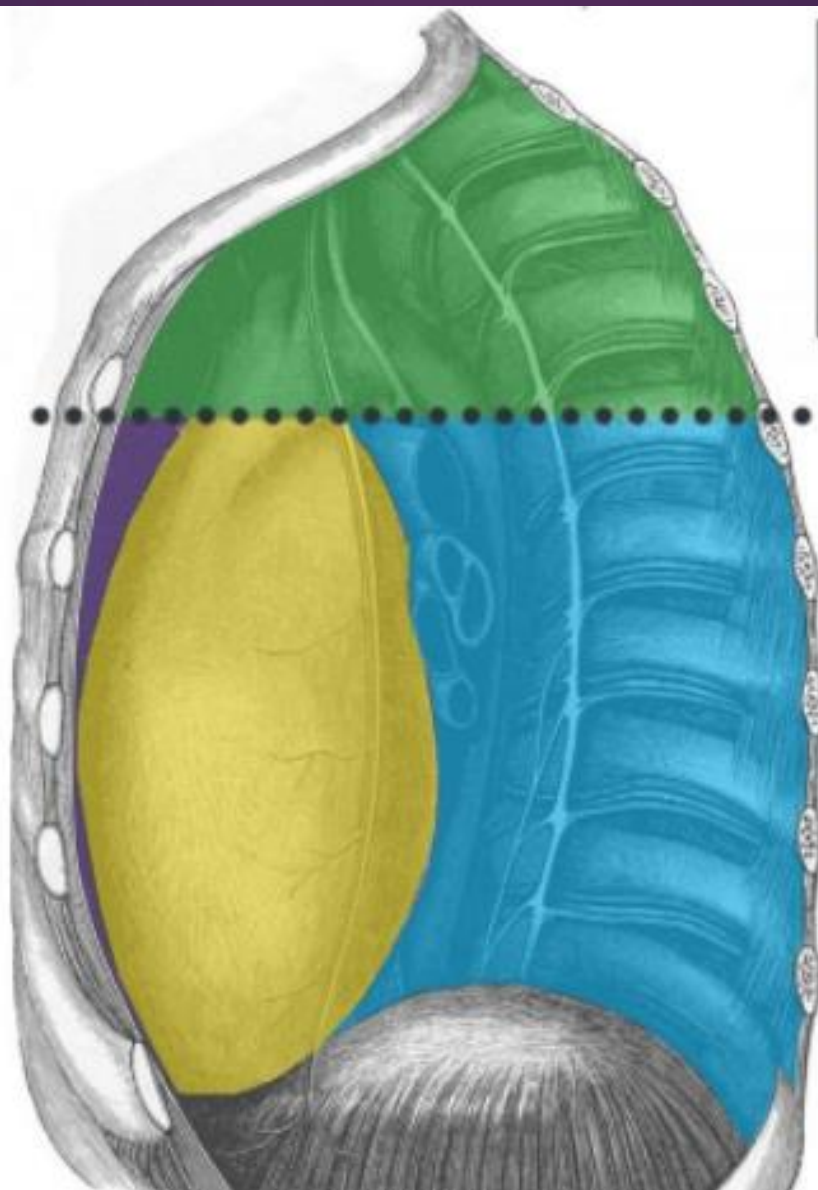
Mediastinum

Anatomically, the mediastinum is divided into two parts by an imaginary line that runs from the **sternal angle** anteriorly, intervertebral disc between T4 and T5 vertebrae posteriorly.

- **Superior mediastinum** – extends upwards, terminating at the superior thoracic aperture.
- **Inferior mediastinum** – extends downwards, terminating at the diaphragm.
- It is further subdivided into
 - Anterior mediastinum.
 - Middle mediastinum.
 - Posterior mediastinum.

It contains most of the thoracic organs, and acts as a conduit for structures traversing the thorax on their way into the abdomen.

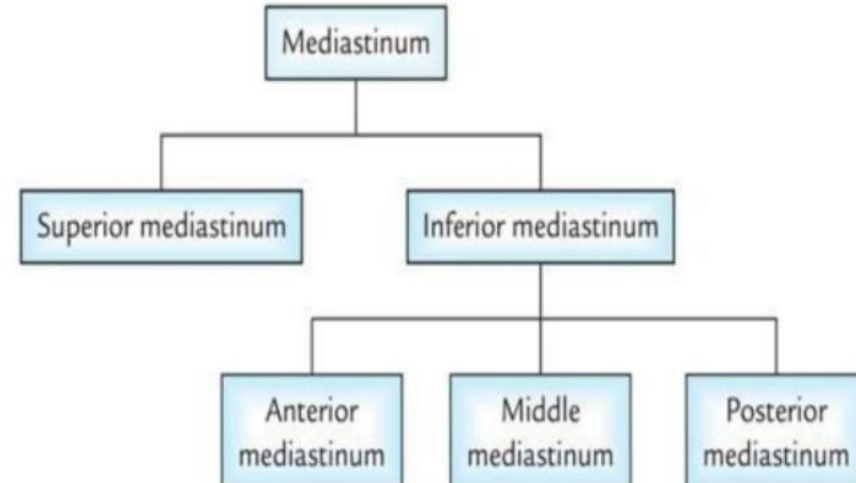
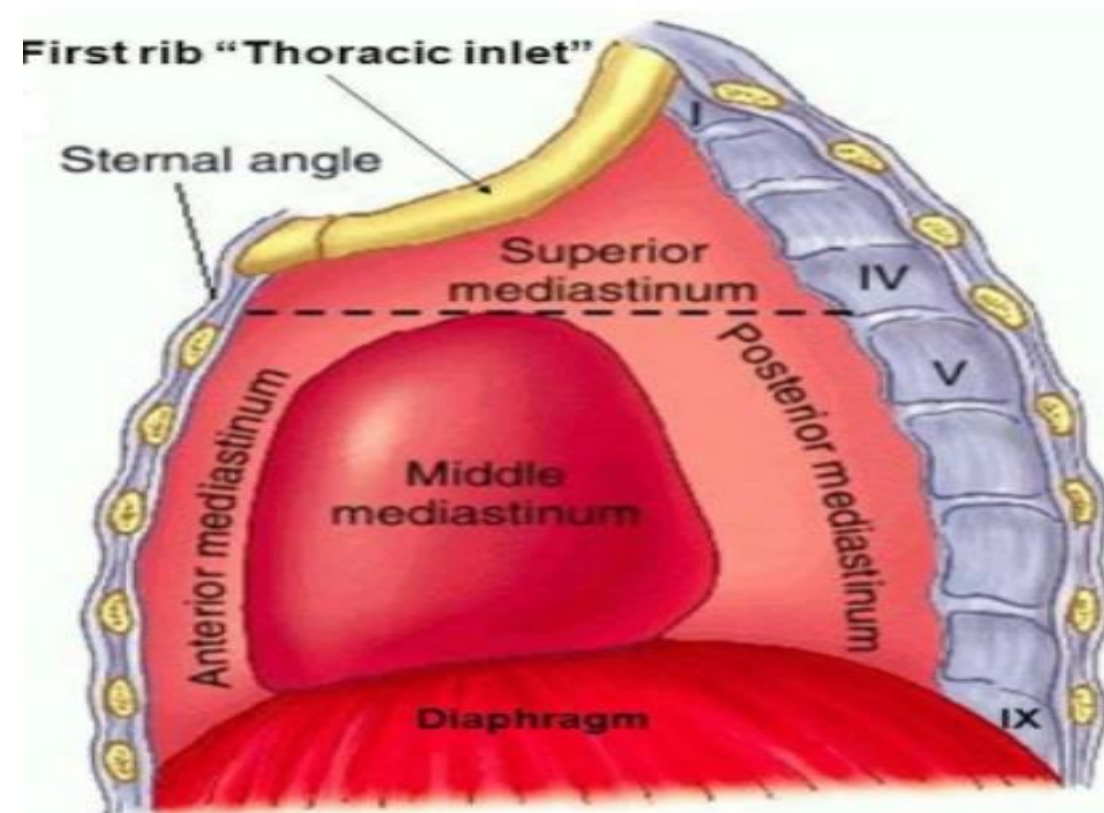
Sternal
angle

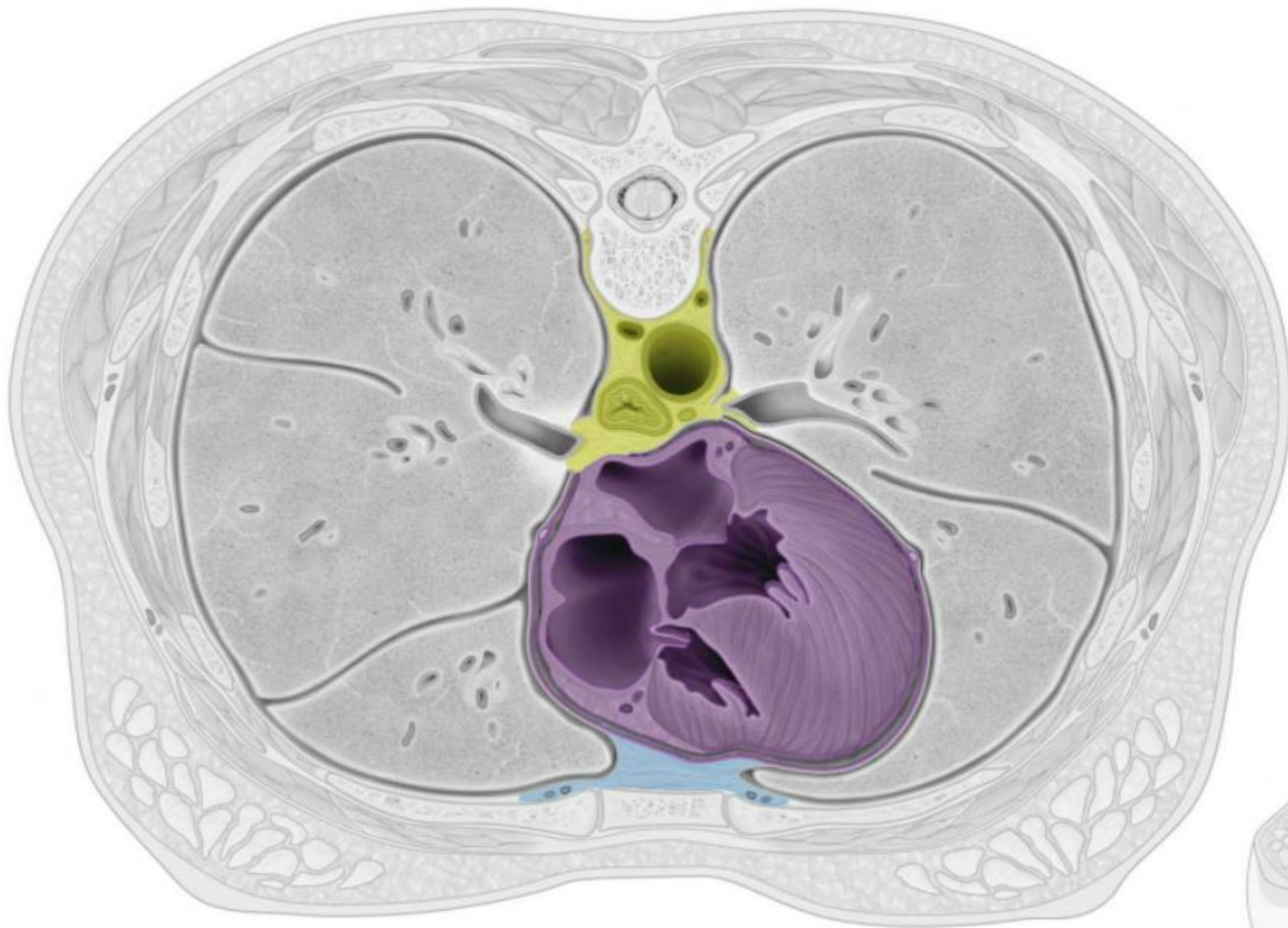


- Superior mediastinum
- Anterior mediastinum
- Middle mediastinum
- Posterior mediastinum

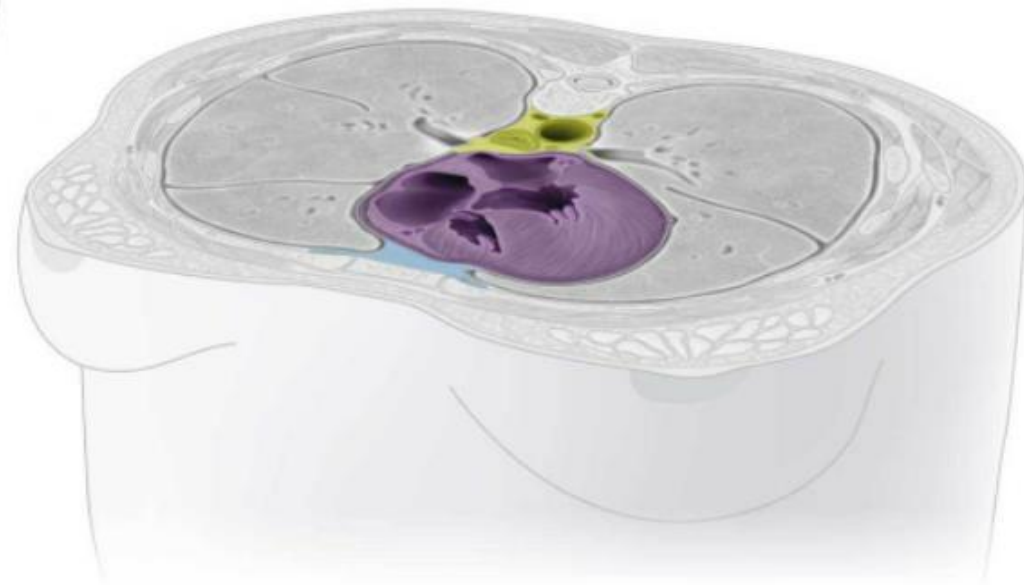
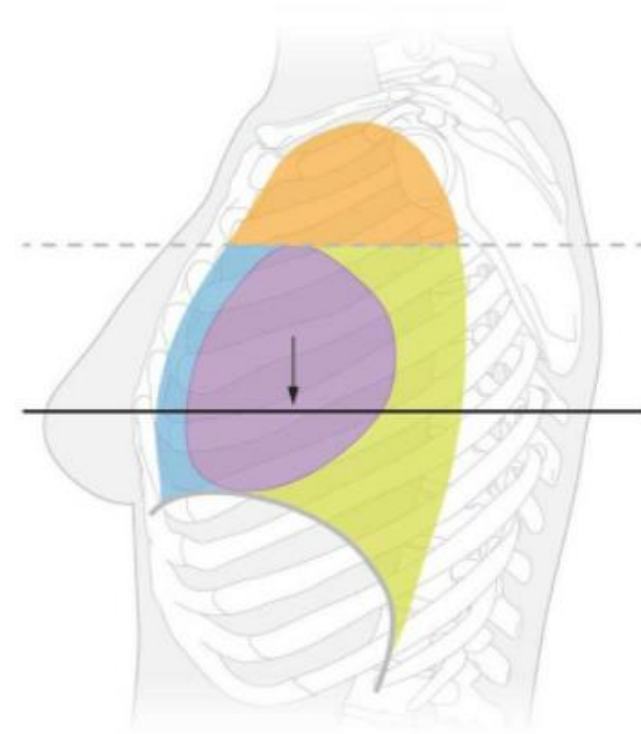
DIVISIONS

- The mediastinum is divided into 2 parts:
- 1. Superior mediastinum
- Lies above “transverse thoracic plane” that runs from the sternal angle anteriorly, fourth thoracic vertebra/intervertebral disc between T4 and T5 vertebrae posteriorly.
- 2. The inferior mediastinum is further subdivided into 3 parts by the pericardium (enclosing heart).
 - The part in front of the pericardium is referred to as anterior mediastinum.
 - The part supporting the pericardium is referred to as posterior mediastinum.
 - The pericardium and its contents (heart and roots of its great vessels) constitute the middle mediastinum.





- | | | |
|-----------------------|---|----------------------|
| |  | Superior mediastinum |
| Anterior mediastinum |  | Inferior mediastinum |
| Middle mediastinum |  | |
| Posterior mediastinum |  | |



Superior Mediastinum

→ retro Manubrium
→ prevertebral
→ Intermediate Structures

- **Borders**
- The superior mediastinum is bordered by the following thoracic structures:
 - **Superior:** – Thoracic inlet.
 - **Inferior** :– Continuous with the inferior mediastinum at the level of the sternal angle.
 - **Anterior** :– Manubrium of the sternum.
 - **Posterior** :– Vertebral bodies of T1-4.
 - **Lateral** :– Pleurae of the lungs.

• Contents:

A) Retromanubrial structures: (fatty lymphatic & venous layers) 4 Rt phrenic nerve

- These structures lie immediately behind the manubrium sterni and arranged **from anterior to posterior as follows:**

1) Remains of **thymus** gland: After puberty it undergoes gradual involution and replaced by fibro-fatty tissues. تند فتن بوفز

2) **Fat** and anterior mediastinal **lymph nodes**. fatty lymphatic layer (انكروم)

3) **Right brachiocephalic vein**: descends vertically behind the right margin of the manubrium. ①

4) **Left brachiocephalic vein**: runs obliquely from left to right above the arch of the aorta, crossing the origins of its 3 branches ②

Brachiocephalic Internal Jugular
head بجانب
subclavian
upper limb بجانب

③.

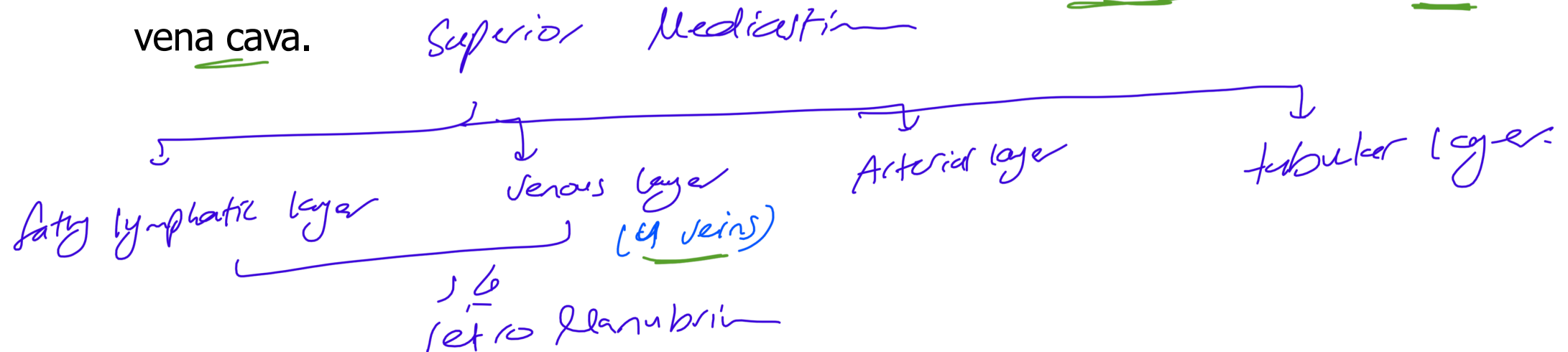
5) Left superior intercostal vein: ends in the left brachiocephalic vein.

④

6) Upper 1/2 of SVC: formed by the union of the right and left brachiocephalic veins, descends vertically behind the right margin of the manubrium and its posterior aspect receives the arch of the azygos vein.

diaphragm ← بجزيء

7) Right phrenic nerve on the right side of right brachio-cephalic vein & superior vena cava.



B) Intermediate structures: (2 arches & 4 nerves)

← arch of aorta → arch of azygos.

1) **Arterial layer: Arch of aorta** and its **3 branches**. (brachiocephalic, left common carotid and left subclavian arteries).

→ Anterior to the Anterior scalenus muscle

عروق صدری
تفرع میسر
subclavian vein and artery

2) **Left phrenic & left vagus** nerves: descend between left subclavian and left common carotid arteries then on the left side of aortic arch.

3) **Left recurrent laryngeal nerve**: it arises from the left vagus nerve and curves around the lower aspect of the arch of the aorta.

cardiac plexus → superficial
↳ deep

4) **Superficial cardiac plexus** below arch of aorta.

← in inferior mediastinum

5) **Arch of azygos.**

تجمع میسر
Nervus

A) Prevertebral structures: (3 tubes, 2 nerve)

- 1) **Trachea** with its **right vagus** on its right side. It descends behind the arch of aorta and its branches.
- 2) **Oesophagus** : It descends posterior to the trachea .
- 3) **Thoracic duct**: ascends on the left border of oesophagus.
- 4) **Left recurrent laryngeal nerve** ascends in between the trachea and oesophagus.

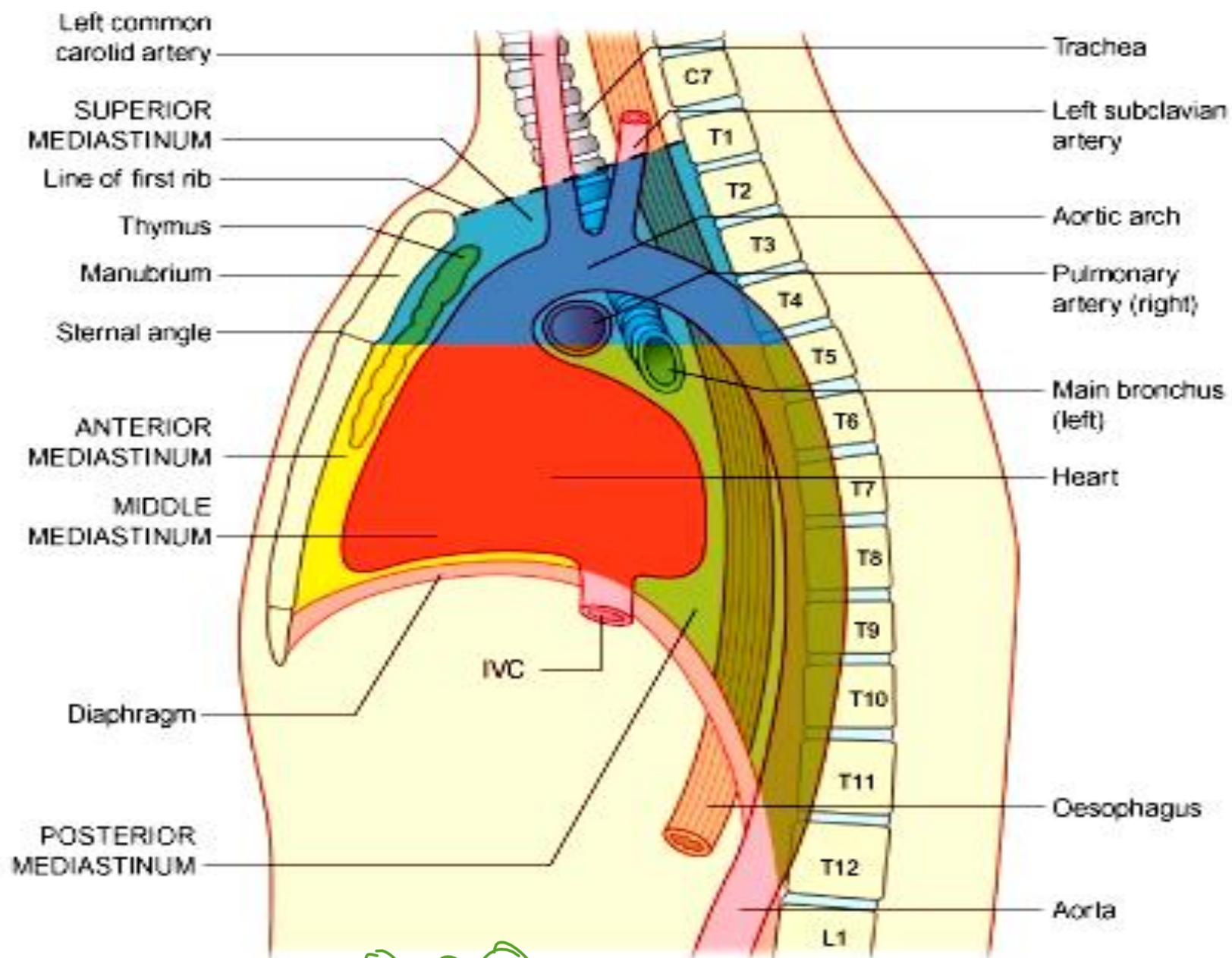
→ in superior Mediastinum

عبرها يقطع شريان

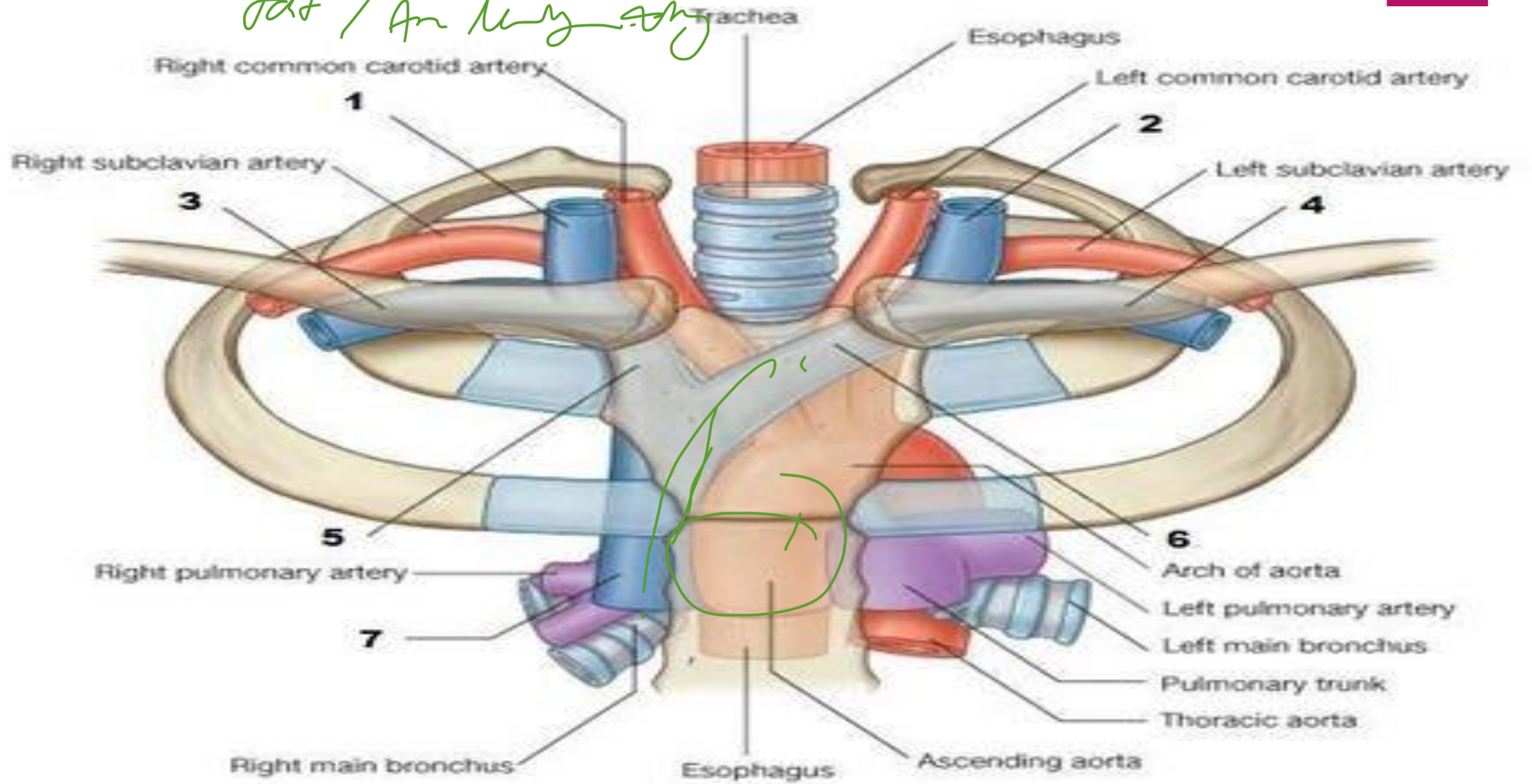
الشريان ولفج سريري
arch of

aorta
يصلح يقطع ولفج في

tracheo oesophageal groove



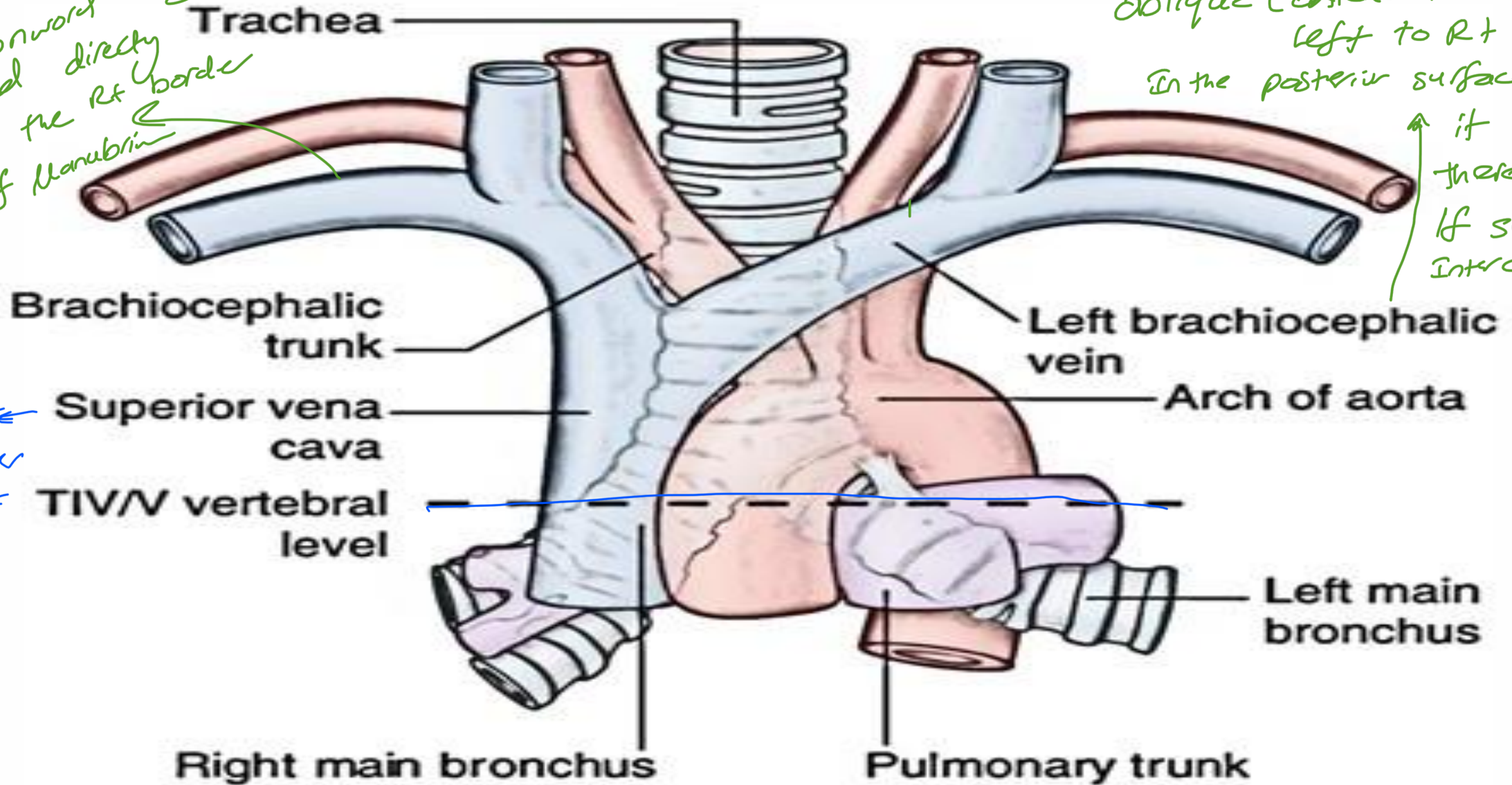
fat / Am lung artery

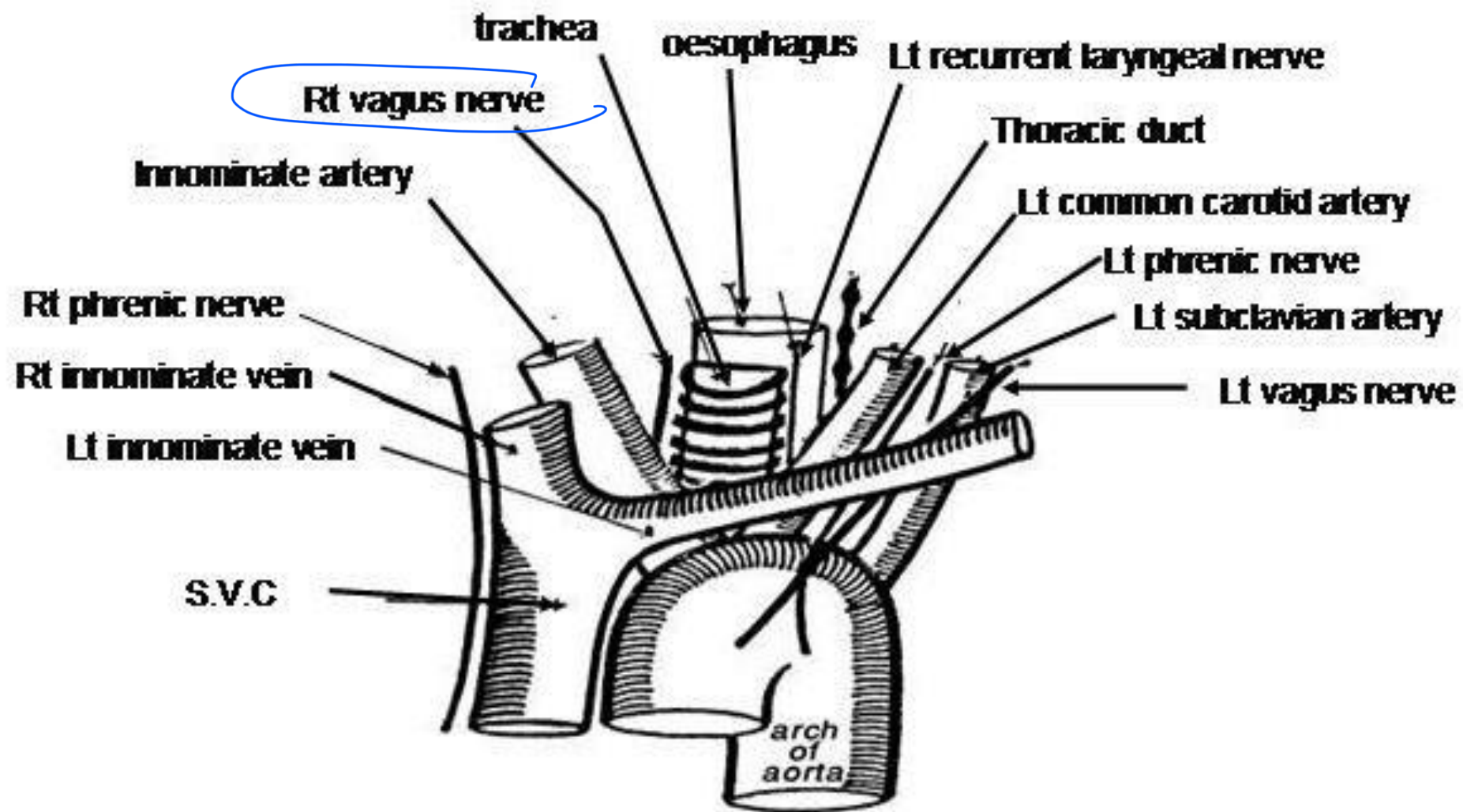


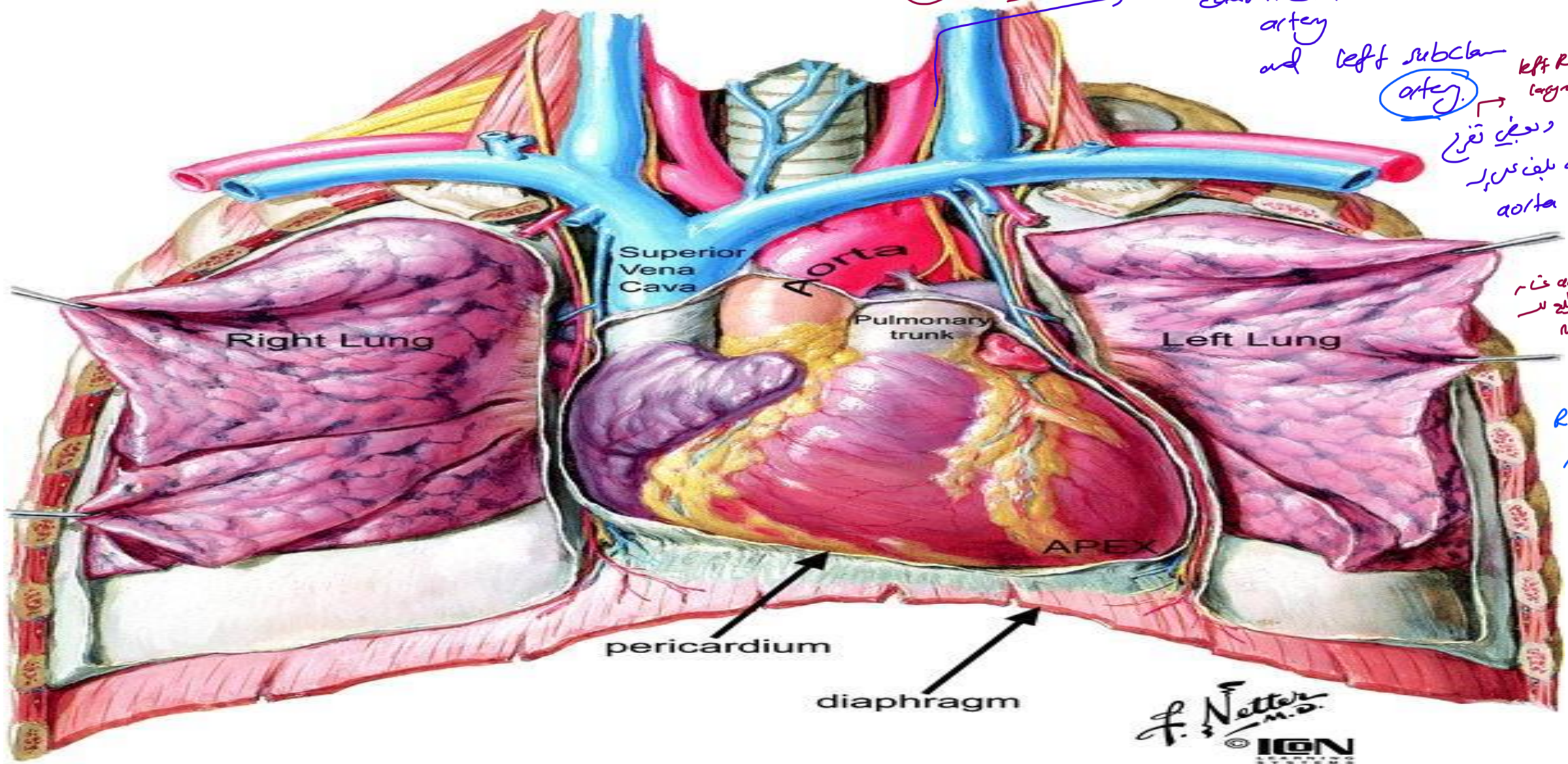
Rt Brachio cephalic
downward and directly
to the Rt border
of Manubrium

oblique (extended from
left to Rt)
In the posterior surface of
it
there's
If superior
intercostal
vein

$\frac{1}{2}$ ~ PP ~





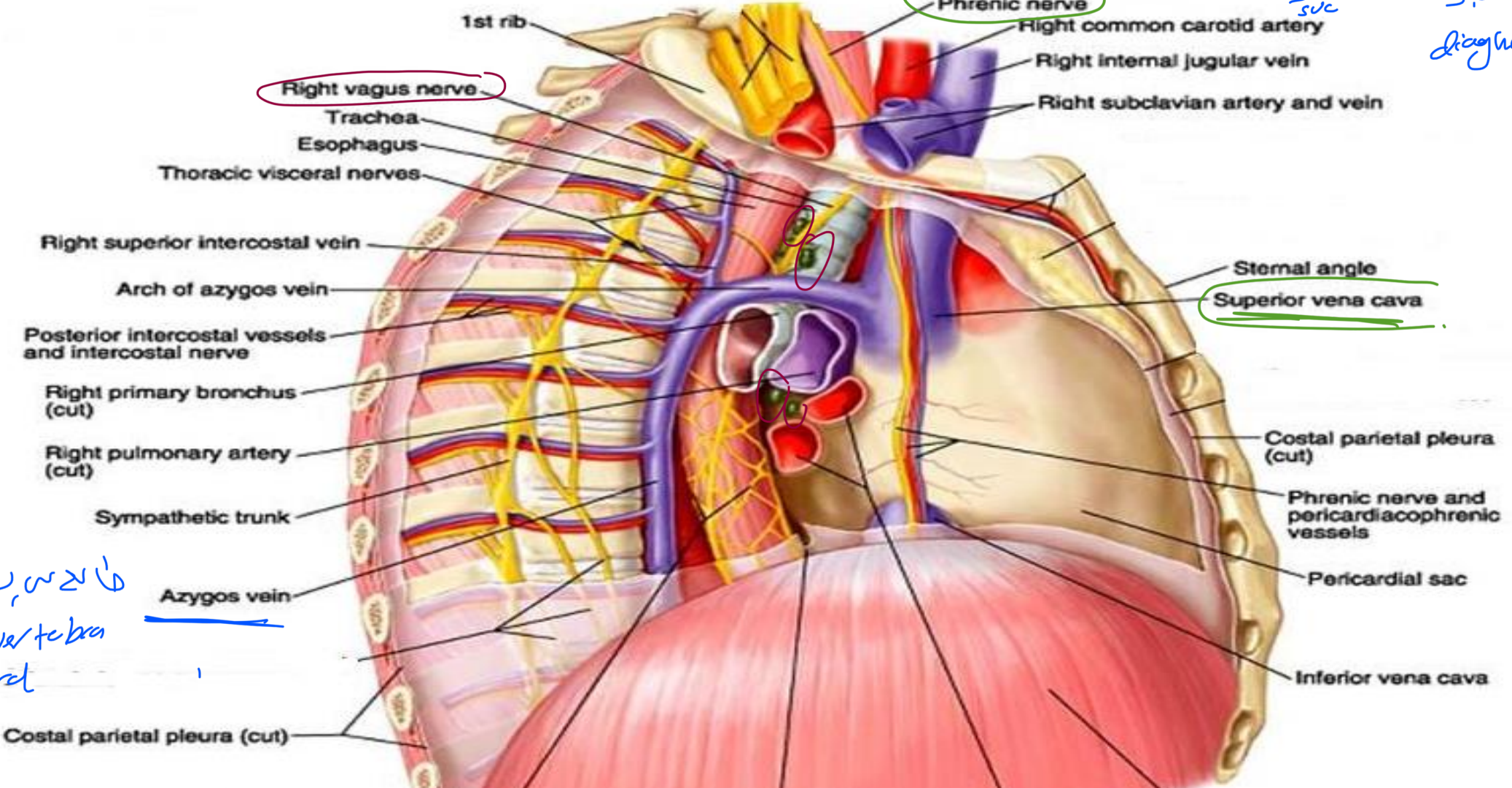


left vagus nerve
left common carotid artery
and left subclavian artery
left Recurrent laryngeal Nerve
دعوى قفج
منه بلفس
aorta

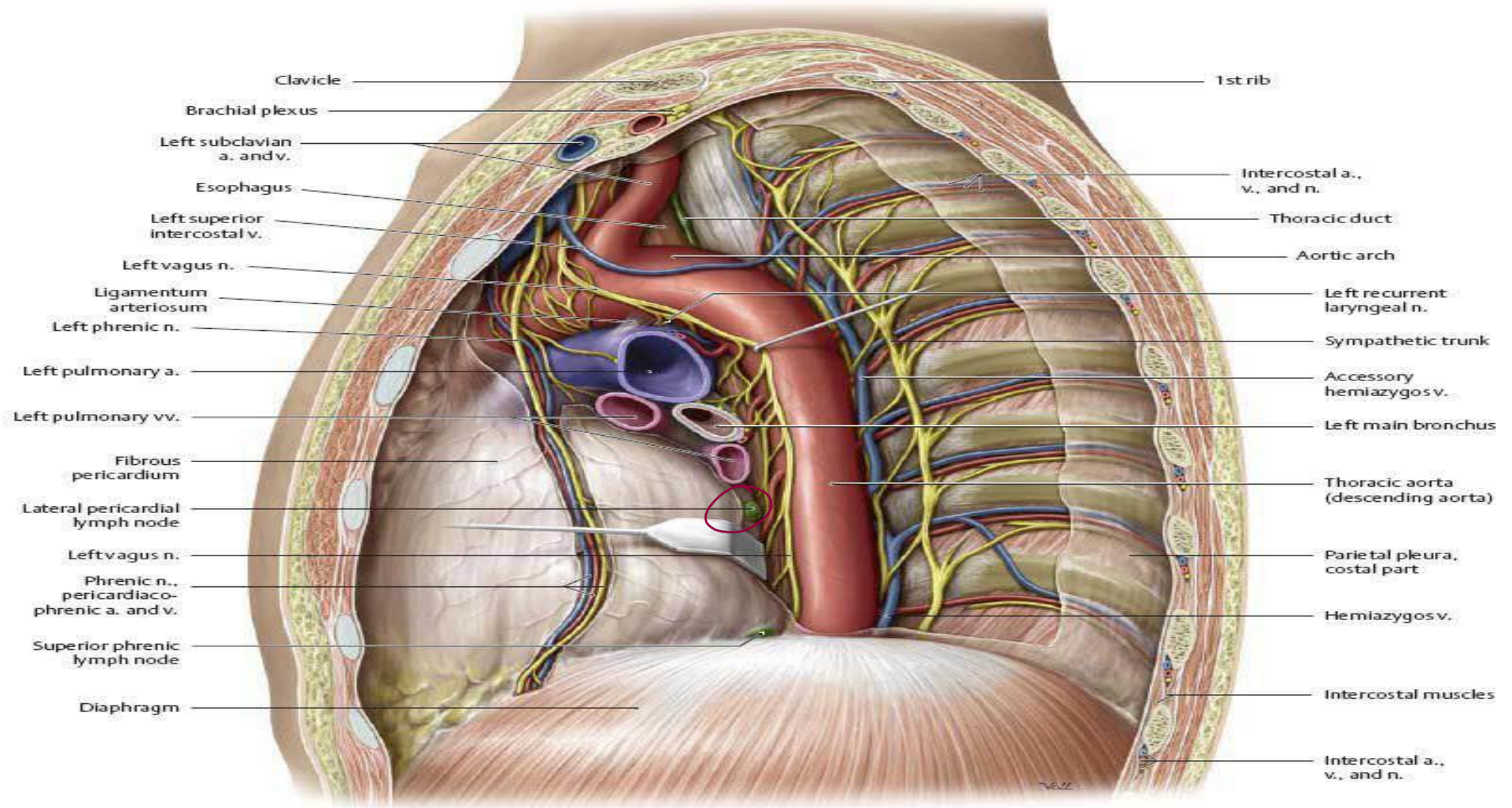
لفس
ها aorta
رجع بطح
Neck
أفا
Rt phrenic
nerve
ضوضه
ار
Neck
دعوى
لفس
phrenic

left
down word

rt
منه ينزل
rt brachiocephalic
صاعدا



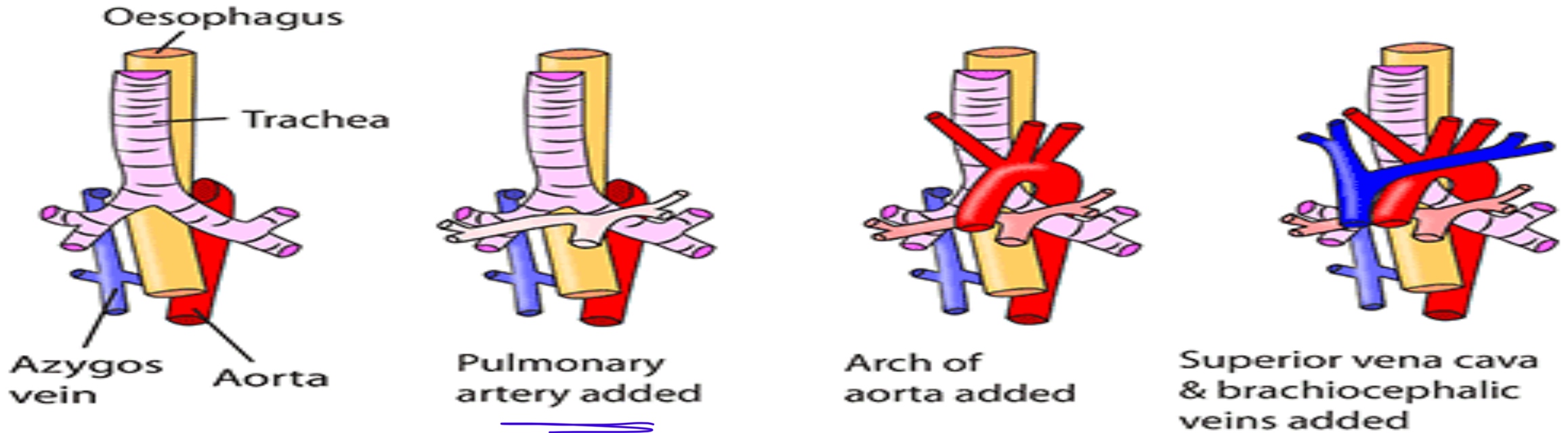
Mediastinum (right lateral view)



B Left lateral view, parasagittal section. *Removed:* Left lung and parietal pleura. *Revealed:* Posterior mediastinal structures.

Mediastinum (left lateral view)

RELATIONS IN THE MEDIASTINUM



- ★ Structures of superior mediastinum can be classified from anterior to posterior into fatty lymphatic layer , venous layer , arterial layer , tubular layer.

Contents(detail)

محتويات

- **Great Vessels**

- **Arch of Aorta** with three major branches are within the superior mediastinum:

- **Brachiocephalic artery** – supplying the right side of the head & neck and the right upper limb.
 - **Left Common carotid artery** – to the left side of the head & neck.
 - **Left Subclavian artery** – to the left upper limb.

- **Superior Vena Cava** with its tributaries are located within the superior mediastinum:

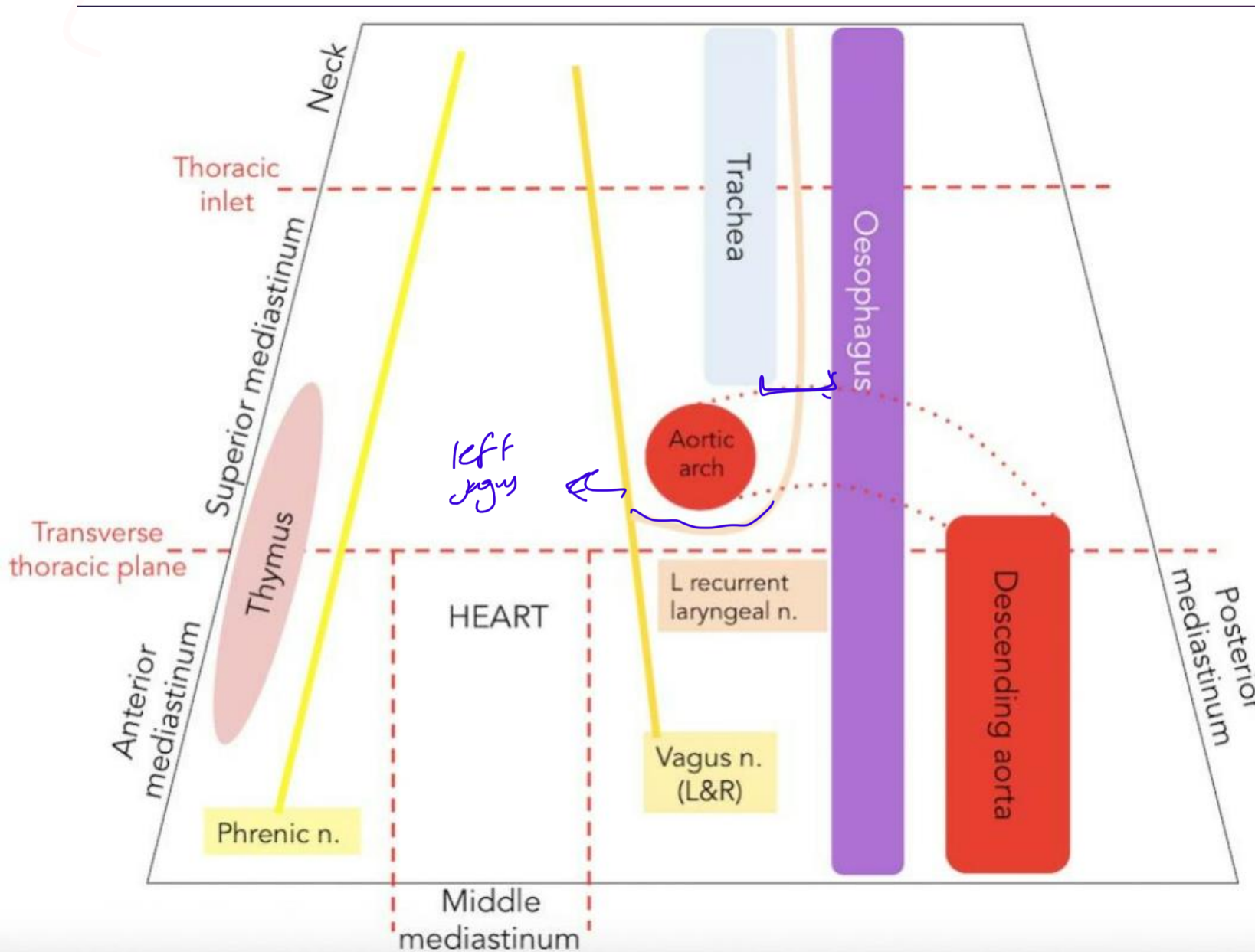
- **Brachiocephalic veins** – draining blood from the upper body.
 - **Left superior intercostal vein** – collects blood from the left 2nd and 3rd intercostal vein. It drains into the left brachiocephalic vein.
 - **Supreme intercostal vein** – drains the vein from first intercostal space directly into the brachiocephalic veins.
 - **Azygos vein** – receiving blood from the right posterior intercostal veins. The left intercostal veins drain first into the hemiazygos and accessory hemiazygos veins before joining the azygos vein around T7-T9.

Nerves

- ***Right vagus nerve*** – runs parallel to the trachea and passes posteriorly to the superior vena cava and the right primary bronchus.
- ***Left vagus nerve*** – enters the superior mediastinum between the left common carotid and the left subclavian arteries.
- ***The left recurrent laryngeal nerve*** arises from the left vagus nerve as it passes the aortic arch.
- ***Phrenic Nerve*** From the anterior surface of the anterior scalene muscle, the phrenic nerves (roots C3, C4 and C5) enter the superior mediastinum lateral to the great vessels.
- **Other Nerves**
 - ***Cardiac nerves*** – originate from the superior, middle and inferior cardiac ganglion and form the superficial and deep cardiac plexuses in the superior mediastinum.
- ***Sympathetic trunk*** – runs bilaterally to the vertebral bodies along the entire length of the vertebral column.

Other Structures in the Superior Mediastinum

- **Thymus** :The thymus gland is the most anterior structure within the superior mediastinum. It sits flush against the posterior surface of the sternum and extends into the anterior mediastinum and can often reach into the neck.
- **Trachea**: The trachea bifurcates into the primary bronchi posterior to the ascending aorta at the level of the sternal angle.
- **Esophagus** :The esophagus ascends towards the pharynx, which it joins at the level of C6.
- **Thoracic duct** :the superior mediastinum, the thoracic duct passes to the left of the esophagus on its path to the junction of the left internal jugular and subclavian veins.
- **Muscles**: The sternohyoid and sternothyroid muscles originate from the posterior surface of the manubrium. They are part of the infrahyoid muscle group of the neck.
- The inferior aspect of the longus colli muscle also originates within the superior mediastinum



The **left** recurrent laryngeal nerve arises from the **left** vagus nerve as it passes the aortic arch. It loops under the arch, to the **left** of **ligamentum arteriosum**, before continuing its journey to the larynx in the tracheal-esophageal groove.

II) Inferior mediastinum:

❖ **Lies below** a line drawn from the angle of Louis to the disc between T4 and T5 vertebrae.

❖ It is **divided into**: *related to pericardium*

- ↳ Anterior
- ↳ Middle
- ↳ posterior

a) Anterior mediastinum:

↳ continuation to the Retro Manubriostructures (fatty lymphatic layer) + sternopericardial ligament

- It is a narrow space **between** body of **sternum** and **pericardium**.
- It **contains**: (2 lymphatic tissues & 2 ligaments)

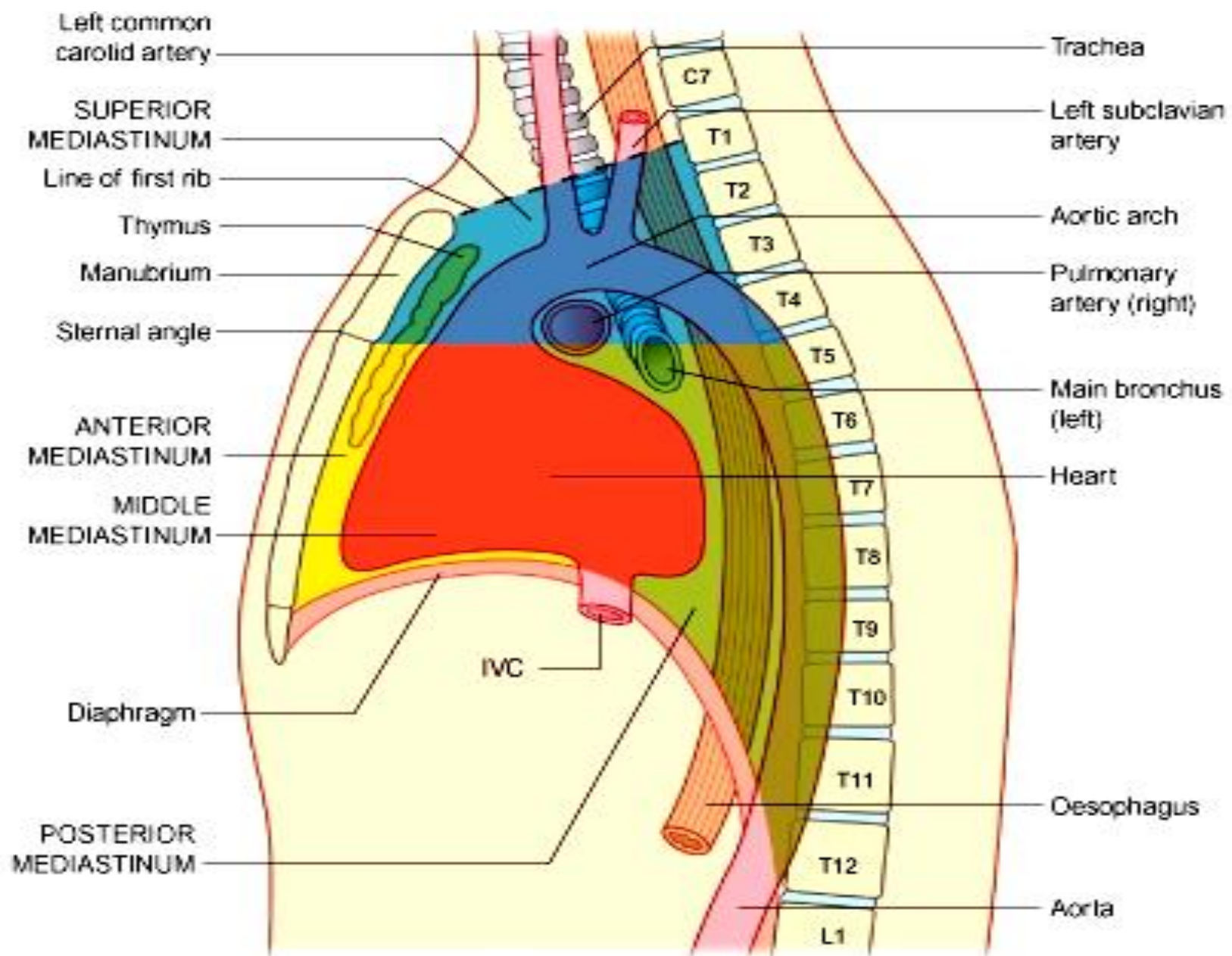
- Fat, lymph nodes, lower part of thymus gland
- Superior and inferior **sternopericardial ligaments**.

pericardium ~ sternum

The anterior mediastinum

Borders

- **Lateral borders:**
 - Mediastinal pleura (part of the parietal pleural membrane).
- **Anterior border:**
 - Body of the sternum and the transversus thoracis muscles.
- **Posterior border:**
 - Pericardium.
- **Roof:**
 - Continuous with the superior mediastinum at the level of the sternal angle. *Imaginary line*
- **Floor:**
 - Diaphragm.



b) Middle mediastinum:

- It lies **between** anterior and posterior mediastinum.

- **Contents:**

1) **Pericardium and structure inside it:** heart, ascending aorta, pulmonary trunk, lower 1/2 of SVC, terminal parts of IVC and 4 pulmonary veins.

2) **Structures outside pericardium:**

- **Bifurcation of trachea** into two bronchi.
- **Deep cardiac plexus** in front of tracheal bifurcation
- **Tracheobronchial lymph nodes** around tracheal bifurcation.
- **Arteries:** right and left pulmonary arteries.
- **Veins:** 2 right and 2 left pulmonary veins.
- **Phrenic nerves** & pericardiophrenic vessels on each side of pericardium.

2 ventricles and 2 atria
→ left ventricle

→ Rt ventricle

1, 2, 3, 4 → Rt left pulmonary artery atrium
pericardium

vein → الی ریح القلب
artery → خارج من القلب

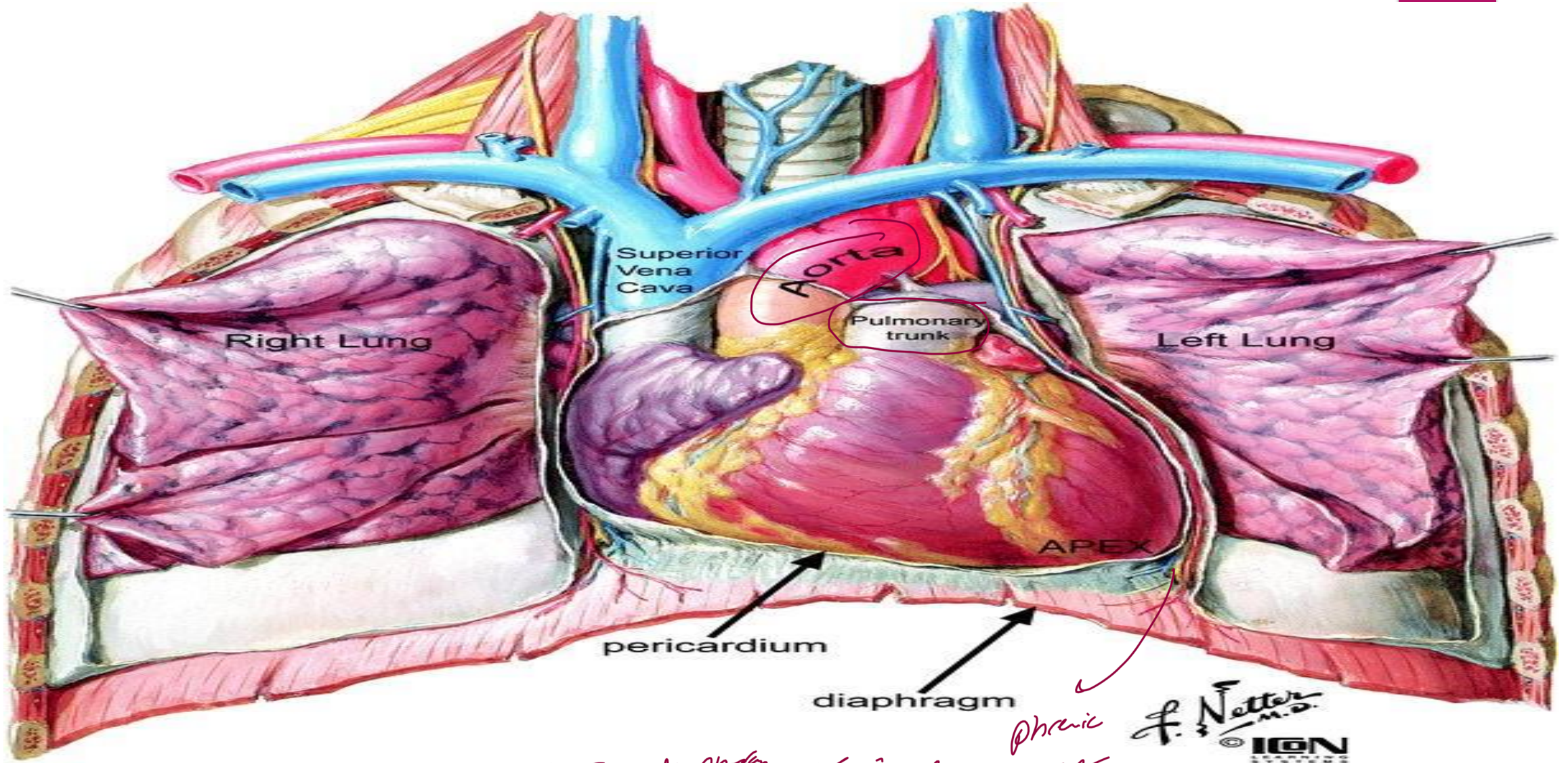
heart and diaphragm
← تنزیر

The Middle Mediastinum

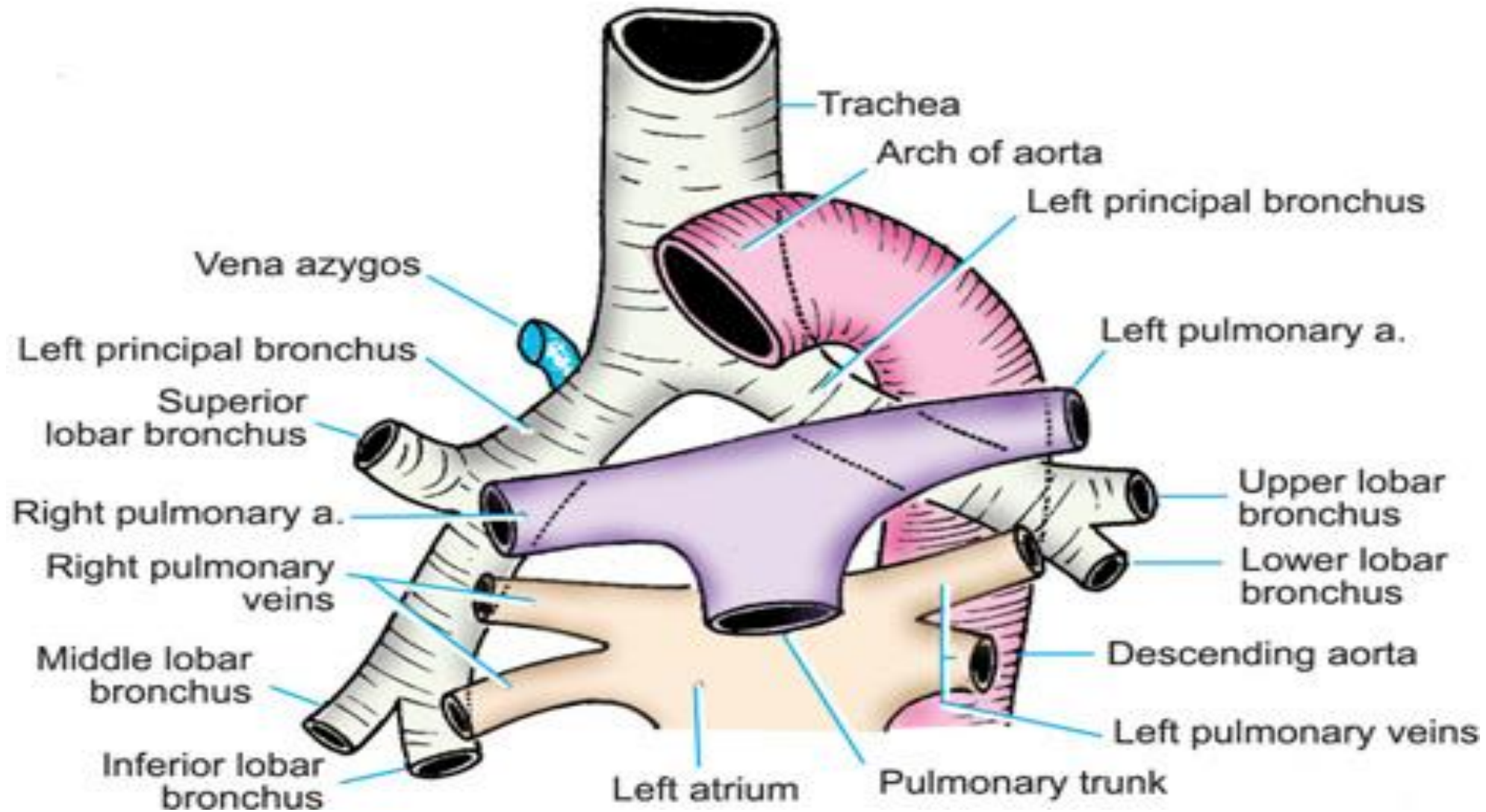
Borders

The middle mediastinum is bordered by the following thoracic structures:

- **Anterior:** Anterior margin of the pericardium.
- **Posterior:** Posterior border of the pericardium.
- **Laterally:** Mediastinal pleura of the lungs.
- **Superiorly:** Imaginary line extending between the sternal angle (the angle formed by the junction of the sternal body and manubrium) and the T4 vertebrae.
- **Inferiorly:** Superior surface of the diaphragm.



pericardium نزلی ریه قوسه در دیافراگما و ریه خلیع در



Middle mediastinum

crossing
 descending thoracic aorta
 heart
 esophagus

a) Posterior mediastinum:

- Lies between pericardium and vertical part of diaphragm anteriorly, and lower 8 thoracic vertebrae posteriorly.

- Contents:**
 esophageal plexus
 vagus
 nerves

1) **Oesophagus:** on **right** side of descending thoracic aorta till the level of **T₇** vertebra where it **crosses in front** of descending thoracic aorta.

2) **2 vagi** forming oesophageal nerve plexuses .

3) **Descending thoracic aorta** and its branches:

➤ It descends on **left side** of esophagus till the level of **T₇** vertebra then **crosses behind** it)

4) **Azygos vein** and **2 hemiazygos** veins **cross** from left to right.

5) **Thoracic duct:** Passes **behind the right border of oesophagus** till the level of **T₅** vertebra

6) Posterior mediastinal **lymph nodes**.

trachea
 esophagus
 heart vessels
 heart vessels

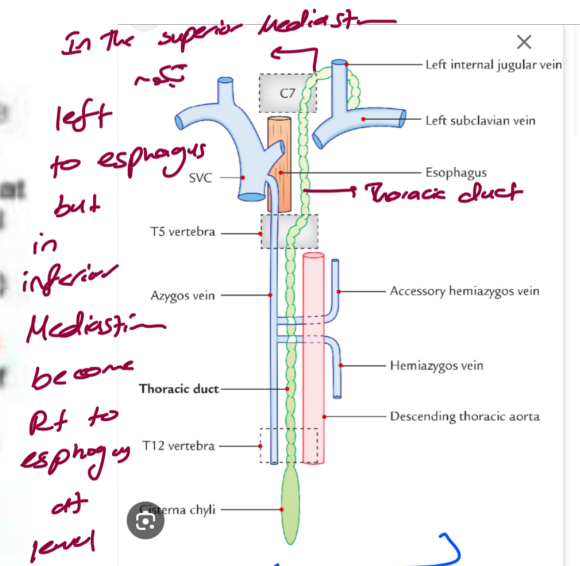
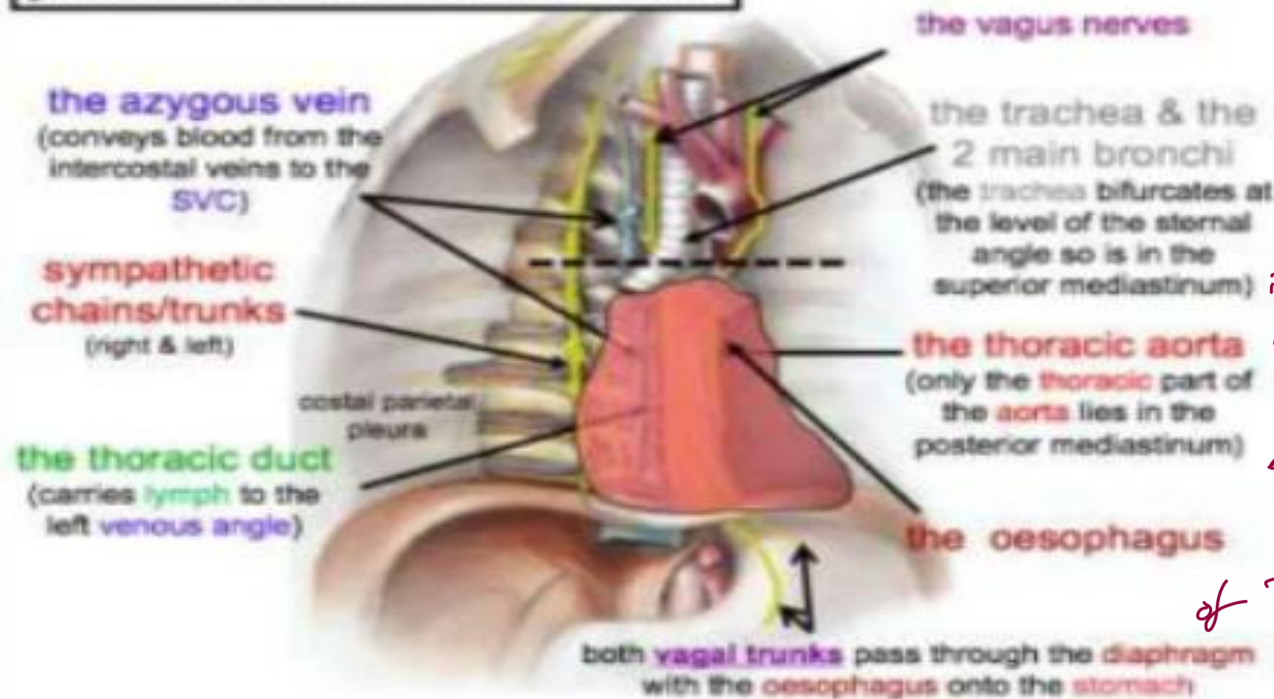
from
 Inter
 Costal
 vein in
 the R+ side

esophagus have 2 crossing
 with thoracic aorta
 in T₇
 with thoracic duct
 in T₅

Boundaries of the posterior mediastinum:

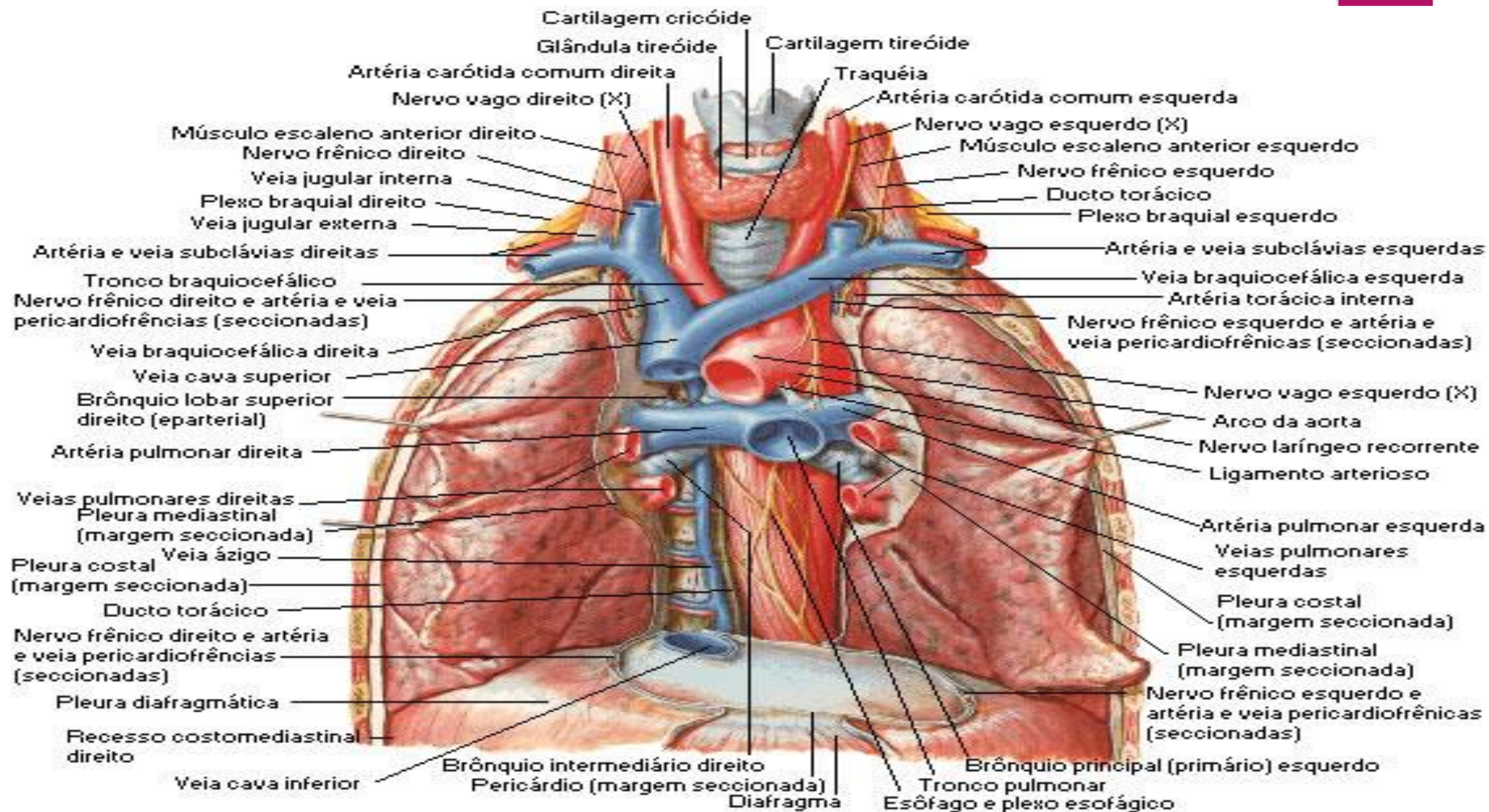
Superior	the plane between the sternal angle and the T4/T5 intervertebral disc (i.e. superior mediastinum)
Inferior	diaphragm
Anterior	pericardium (i.e. middle mediastinum)
Posterior	posterior thoracic wall & vertebral column

posterior mediastinum

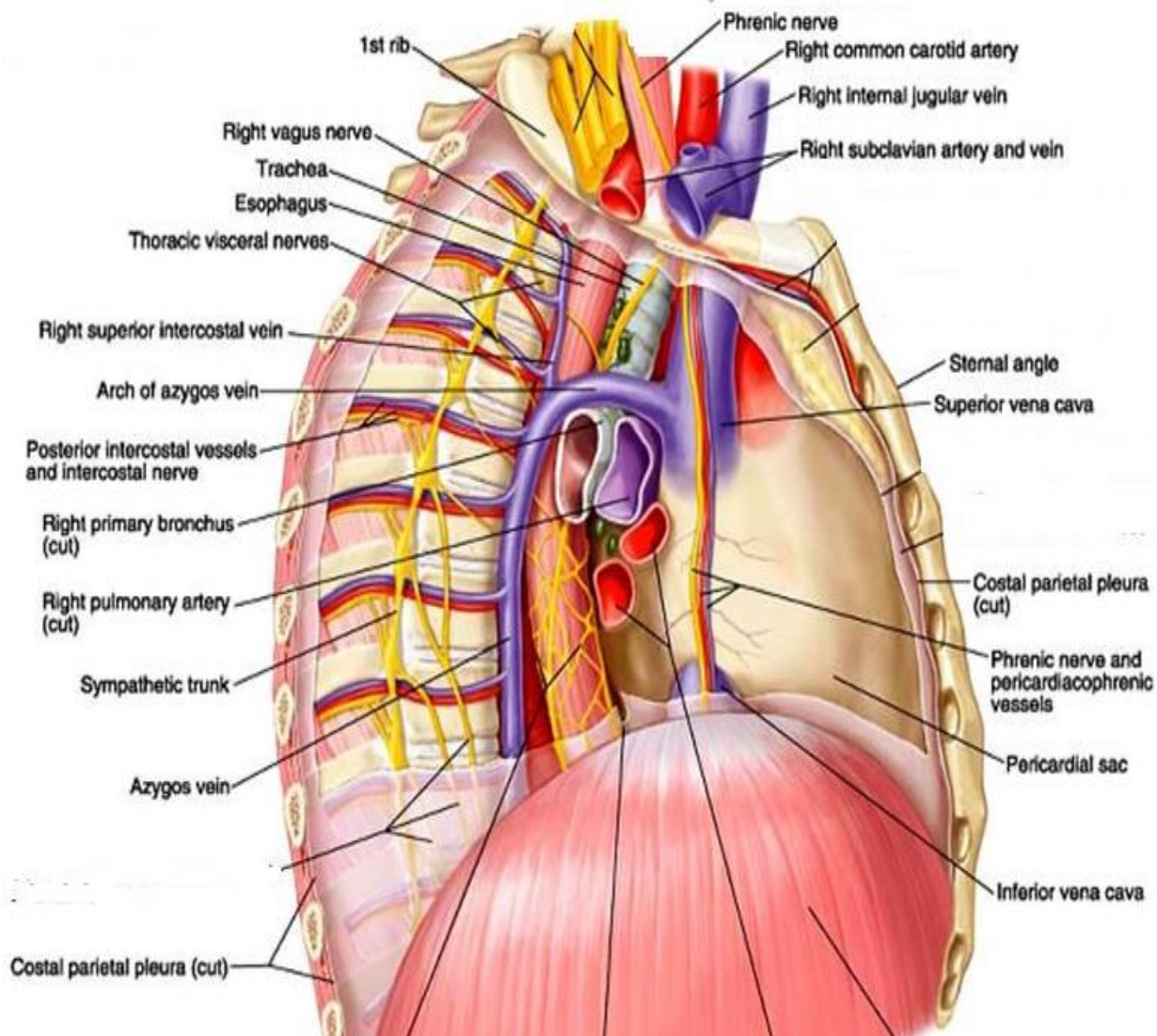


left to esophagus but in inferior Mediastinum become Rt to esophagus at level of T5

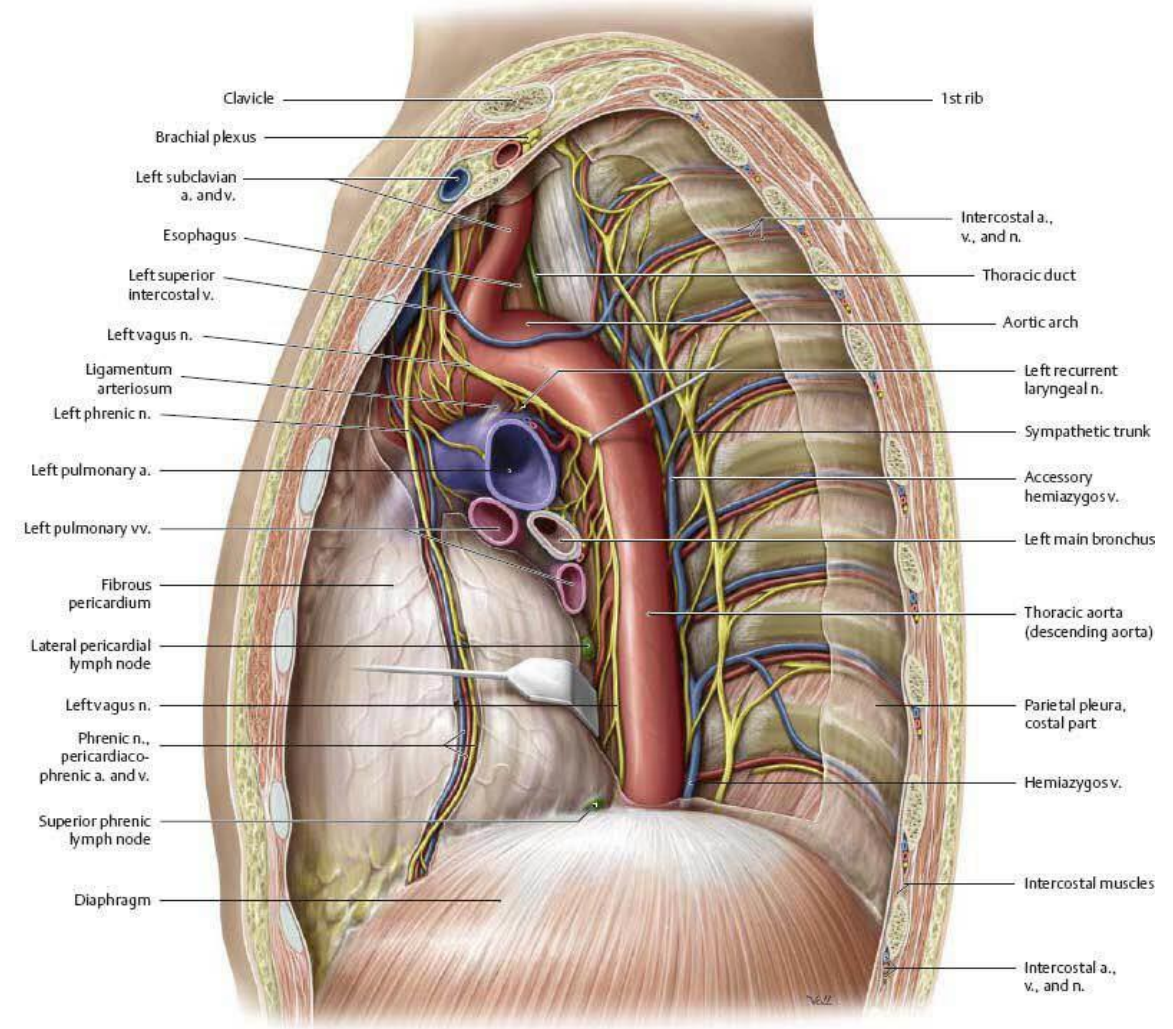
من الوريد الوداجي



Posterior mediastinum

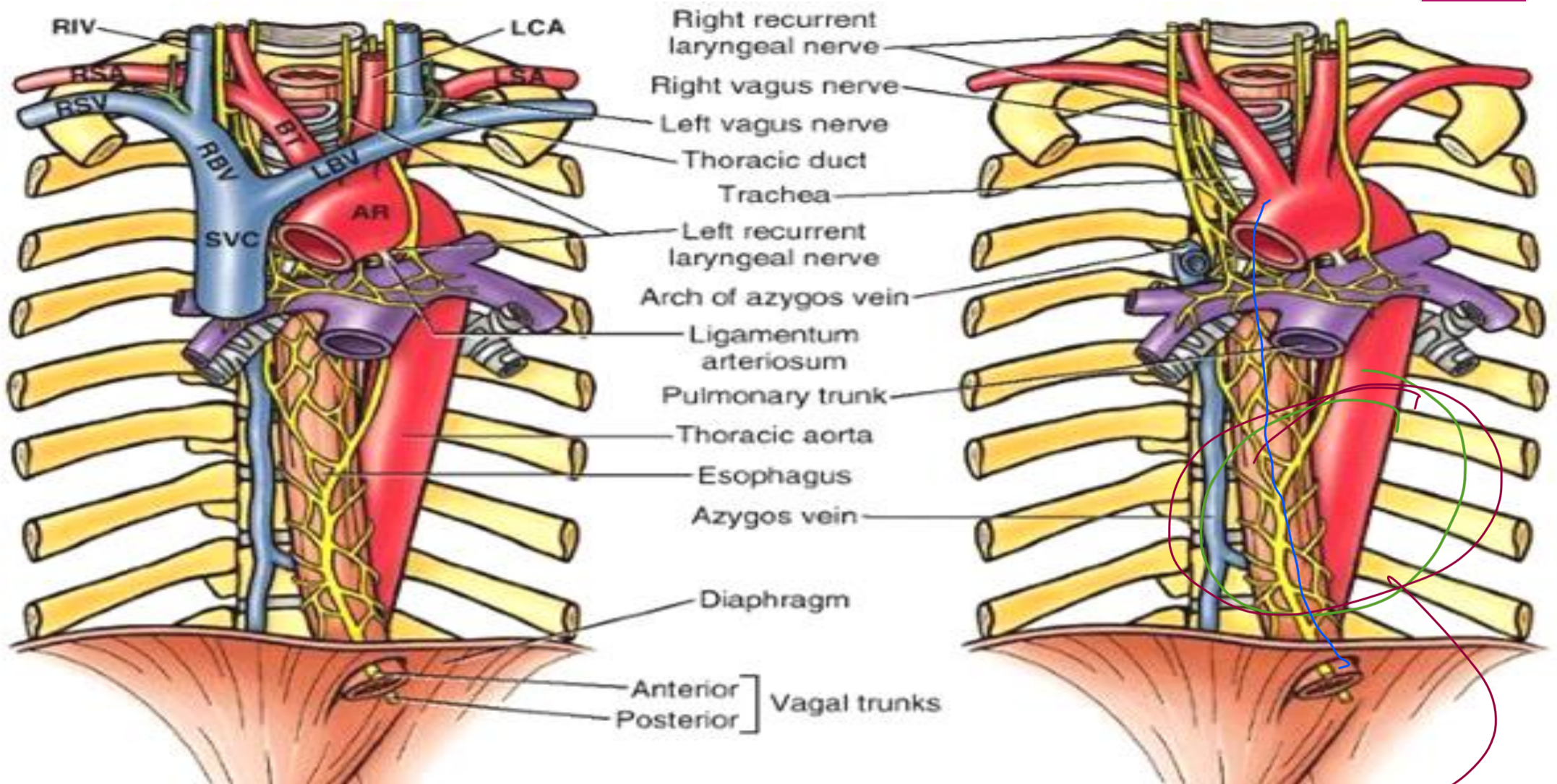


Mediastinum (right lateral view)



B Left lateral view, parasagittal section. *Removed:* Left lung and parietal pleura. *Revealed:* Posterior mediastinal structures.

Mediastinum (left lateral view)

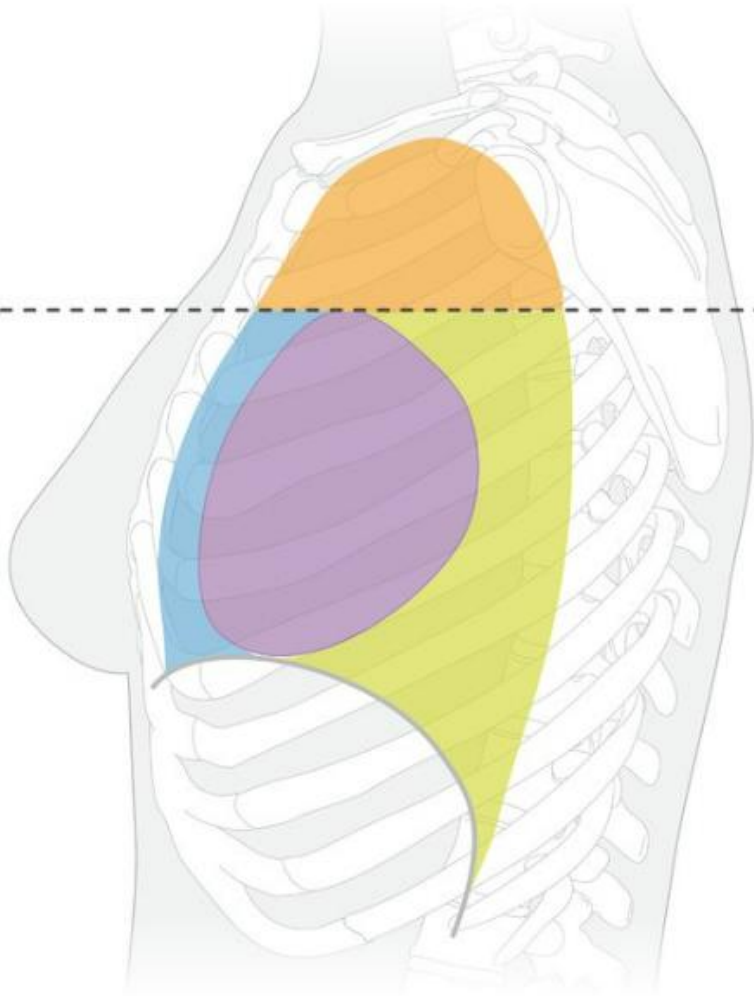


at level
of T7

Superior & Posterior mediastinum

esophagus, pulmonary trunk, aorta

crossing
over.



Superior mediastinum

Organs	Vessels	Nerves	Lymphatic vessels and lymph nodes
- Thymus - Inferior trachea, carina, and main bronchi - Esophagus	- Arch of aorta - Brachiocephalic trunk - Left common carotid artery - Left subclavian artery - Internal thoracic arteries - Internal thoracic veins - Superior vena cava - Brachiocephalic veins	- Vagus nerves - Left recurrent laryngeal nerve - Cardiac nerves - Phrenic nerves	- Left thoracic duct - Right lymphatic duct - Bronchomediastinal lymph trunks - Anterior mediastinal lymph nodes - Posterior mediastinal lymph nodes

Anterior mediastinum

Organs	Vessels	Nerves	Lymph nodes
	Internal thoracic vessels		Parasternal lymph nodes

Middle mediastinum

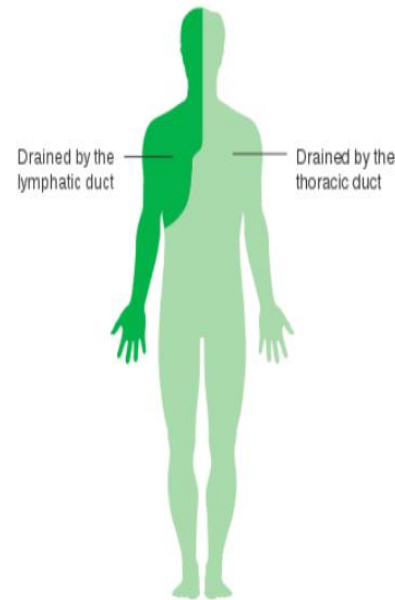
Organ	Vessels	Nerves	Lymphatic vessels and lymph nodes
Heart and pericardium	- Ascending aorta - Pulmonary trunk - Superior vena cava - Inferior vena cava - Azygos vein - Pulmonary veins - Pericardiophrenic vessels	Phrenic nerves	

Posterior mediastinum

Organ	Vessels	Nerves	Lymphatic vessel
Esophagus	- Thoracic aorta - Azygos vein - Hemiazygos vein	- Vagus nerves - Sympathetic trunks - Splanchnic nerves	Thoracic duct

Thoracic Duct

- ▶ The **thoracic duct** (also known as van Hoorne's canal) is the largest lymphatic vessel in the body, It is approximately 40 cm in length in adults, and approximately 5 mm in width at its abdominal origin.
- ▶ The thoracic duct drains the lymph from 75% of the body, aside from the right upper right limb, right breast, right lung and right side of the head and neck (which are drained by the right lymphatic duct) into the venous system.
- ▶ The thoracic duct is formed from the abdominal confluence of the left and right lumbar lymph trunks, as well as the left and right intestinal lymph trunks between T12 and L2. If the confluence of lymph trunks is saccular, it is referred to as **cisterna chyli**. The action of breathing helps chyle flow up the thoracic duct. The duct also contains smooth muscle within its walls, as well as interval valves (much like large veins), which prevent backflow of lymph.



باقية الجسم من اليمين واليسار
thoracic duct

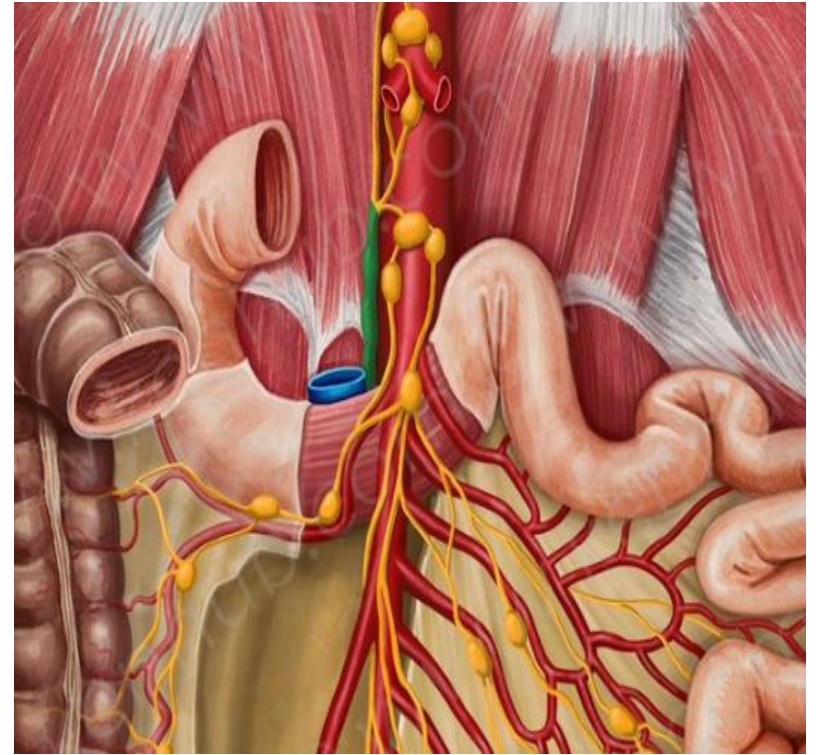
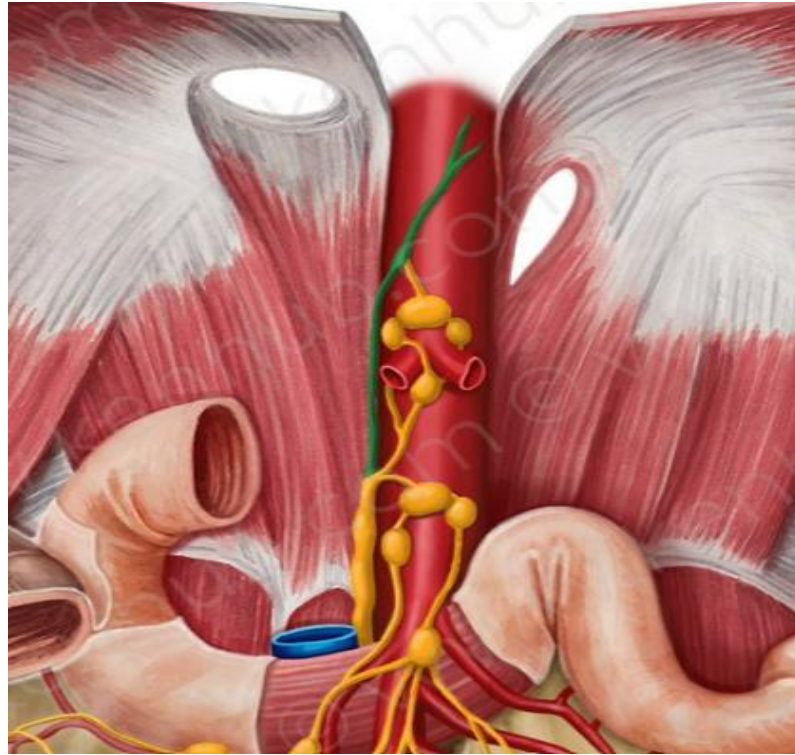
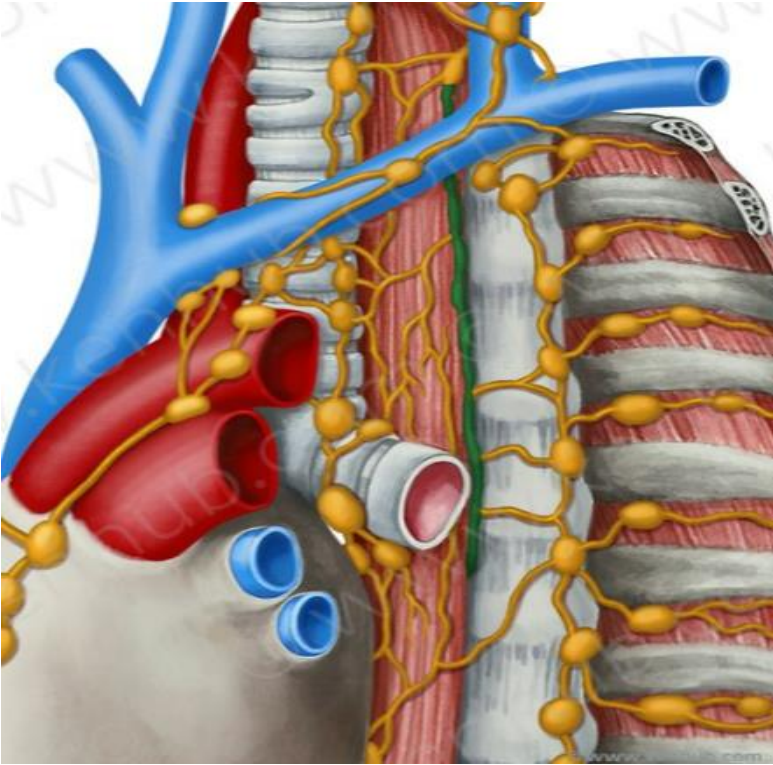
ال Thoracic duct
من اليمين واليسار
cisterna chyli
من اليمين واليسار

crossing ال Thoracic duct
Right T12 مع قبة ال aorta من اليمين واليسار
diaphragm ال Thoracic duct
من اليمين واليسار



- ▶ The duct enters the mediastinum via the **aortic hiatus**. It ascends to lie directly anterior to the T6-T12 vertebrae, before deviating left as it ascends into the superior mediastinum. While located in the posterior mediastinum, the thoracic duct receives lymphatic drainage from the intercostal spaces and neighboring anatomical structures through a number of branches.
- ▶ Within the thoracic duct, there is a milky white fluid containing both emulsified fats, and the lymph fluid found in the rest of the lymphatic system. This fluid is called chyle
- ▶ The lymph drains at the level of the **venous angle (Pirogoff's angle)** between the left subclavian vein and the left internal jugular vein, where it reenters the systemic venous circulation

↓
T6-T12 ~ 4 thoracic
duct



Clinical points

Chylothorax

Rupture of the thoracic duct causes chyle to leak into the pleural cavity. The aetiology of this condition includes traumatic and non-traumatic causes. **Traumatic** causes can be either iatrogenic (e.g. surgery, radiation) or non-iatrogenic (e.g. penetrating or blunt trauma to the chest wall, forceful emesis or cough). **Non-traumatic** causes include malignancies, other diseases such as tuberculosis, sarcoidosis, superior vena cava obstruction. Finally, it can also be **congenital** (e.g. Down, Noonan, Turner syndromes).

A chest radiograph would show a pleural effusion while cholesterol and triglyceride measurements in the pleural fluid would point towards the right diagnosis.

Virchow's node

Virchow's node

Virchow's node is a large lymph node in the left supraclavicular area that drains the lymph from the gut. When it is enlarged (positive **Trousseau's sign**), it can be one of the earliest signs of intra-abdominal malignancy, usually a gastric carcinoma following migration of tumour emboli through the thoracic duct. It is located in the venous angle, at the junction of the left subclavian vein and the thoracic duct.

الاضراب اليرقان يعني نخاع عظمي
dyspnea, distress
X-ray

المalignancy
فيلج سرطانة زهرية
بجانب فقر
Hemothorax
نقص في الدم
analysis

left supraclavicular
lymph node
(abdominal)

palpable enlargement
indication
to intra abdominal
cancer
Stomach cancer

أعراض نزول
Intra pleural
pressure
rupture of
the thoracic
cavity

Analysis

في مريض

fluid

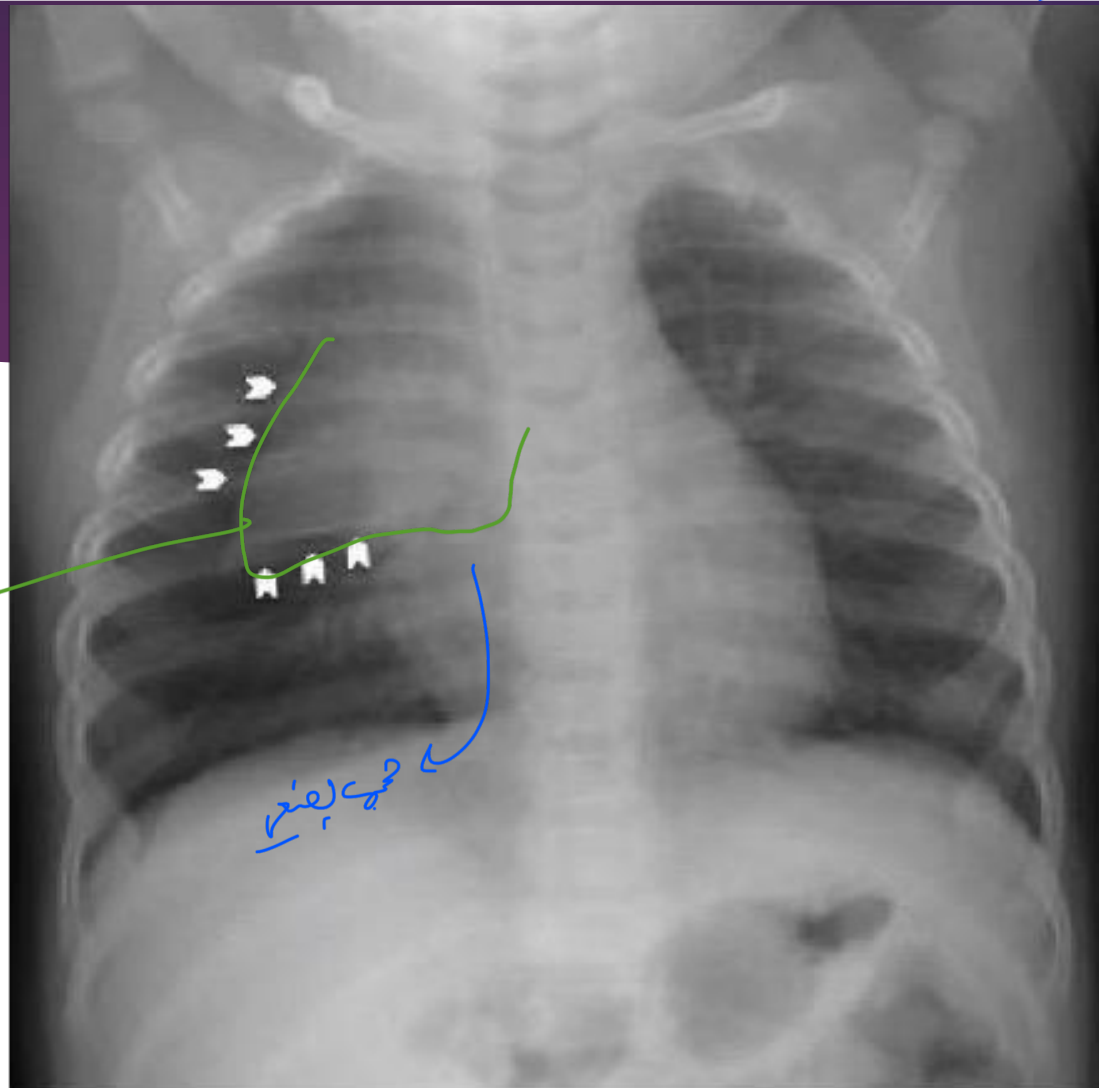
left internal
jugular S.C

caused by complete obstruction of the venous system, leading to congestion of the veins, flushing, and cyanosis.

collapsed
hypertension

تھوڑے سے دل کی دھڑکن
یا دل کی دھڑکن

triangular
thymic
gland

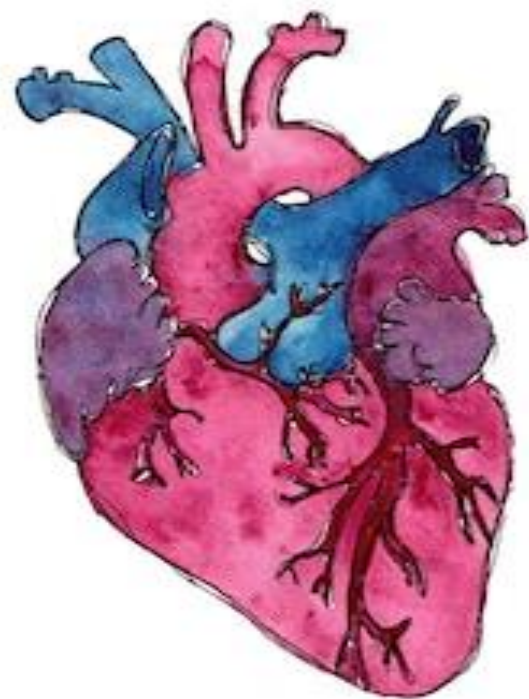


Mass differential diagnosis: congenital, acquired, or neoplastic.

Frontal view x-ray demonstrating thymic "sail sign" (arrows).

سیرالبرکب

THANK YOU



FROM THE APEX OF MY HEART



Love

