THORACIC WALL

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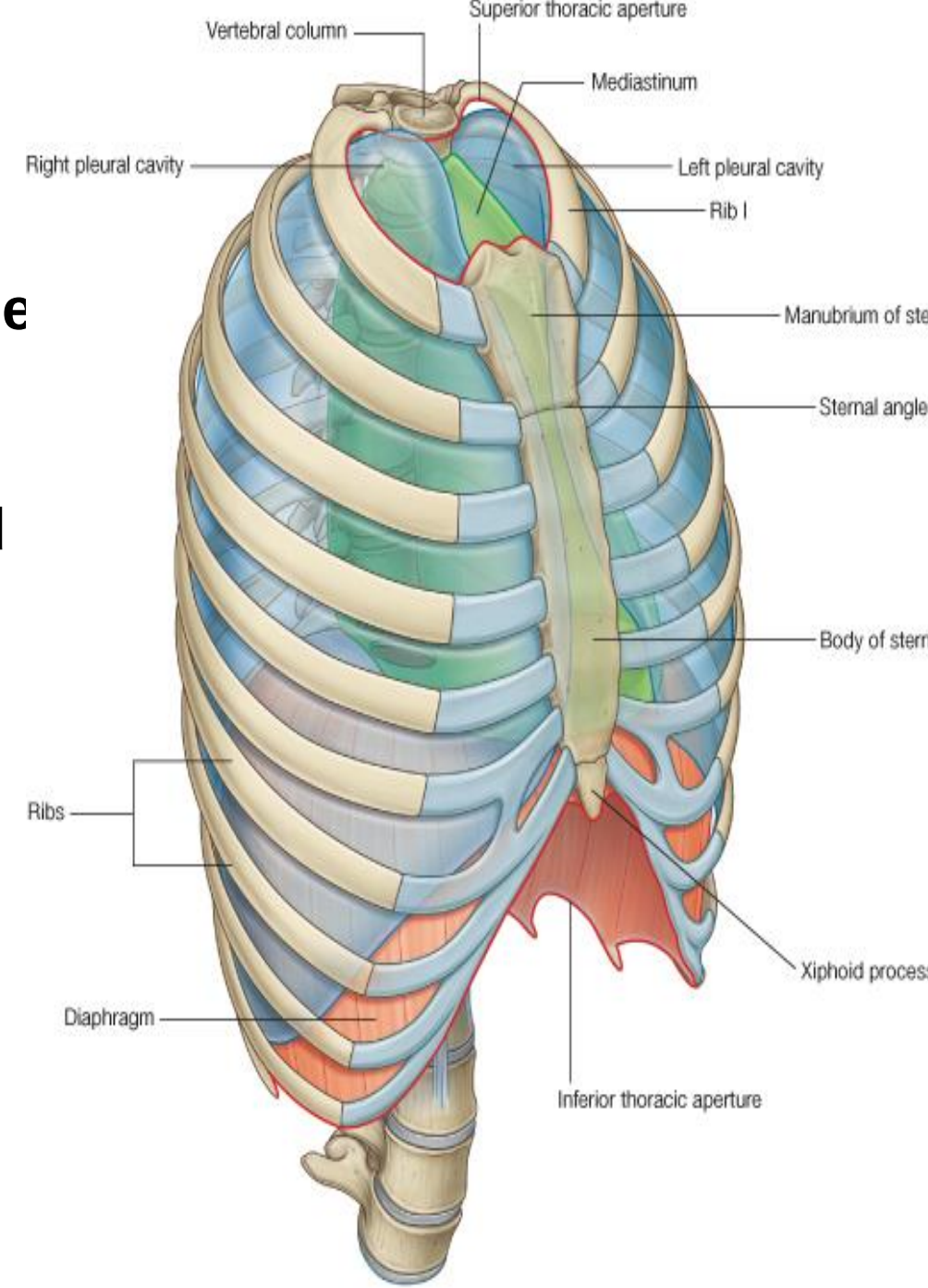
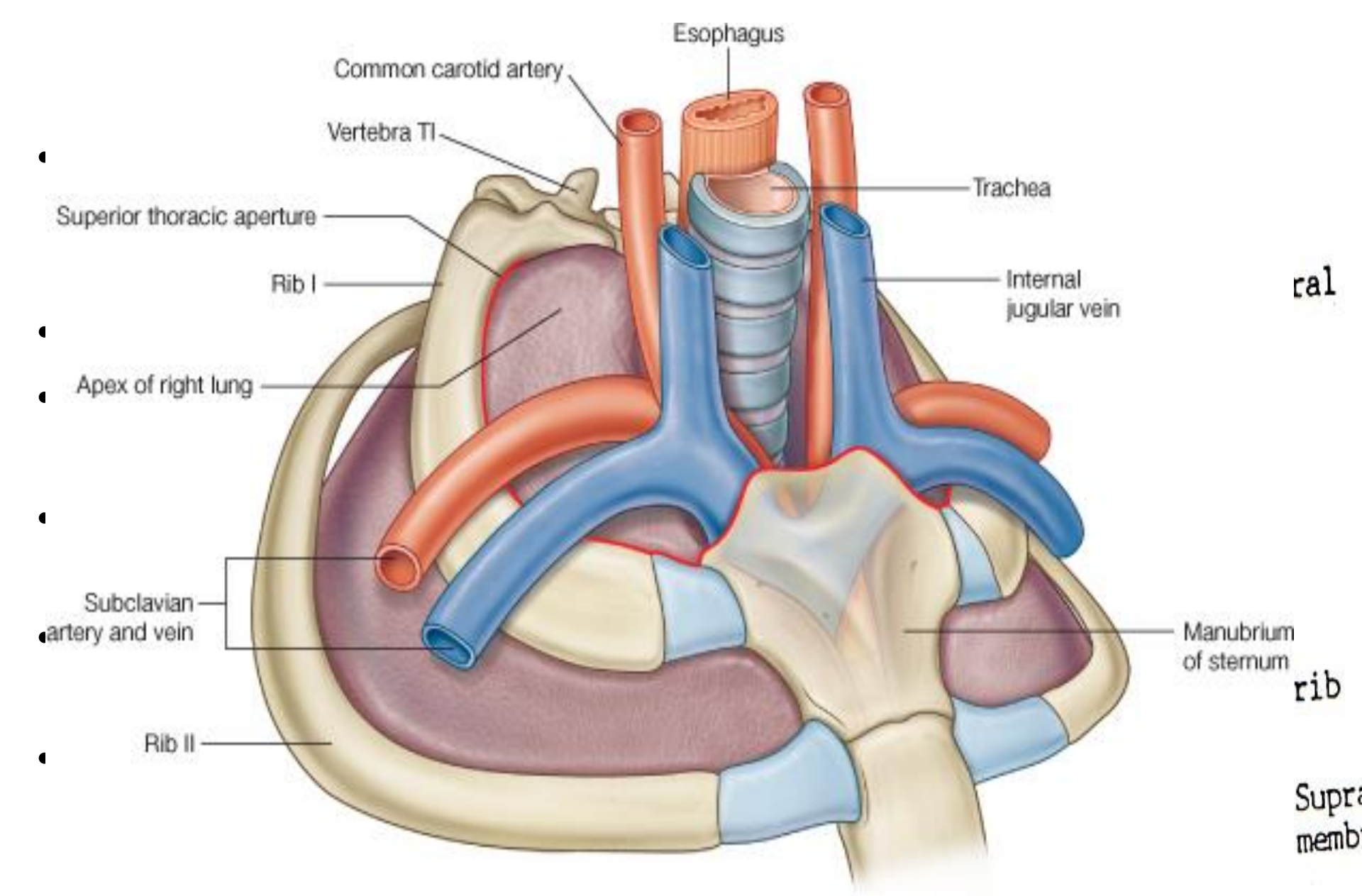
أخصائي جراحة صدر

- Thoracic cage is an osteo-cartilagenous conical cage which has a narrow inlet & a wide outlet **?**
- **Boundaries of thoracic cage**
- **Ant:** Sternum, Costal cartilages and ribs.
- **Post**: Thoracic vertebrae and ribs.
- **Lat**: Ribs.
  - **Thoracic Inlet (or outlet)**
- **Ant**: Upper border of manubrium sterni.
- **Post**: 1st thoracic vertebra.
- **On each side**: 1st rib & 1st costal cartilage.
- It is sloping downwards & forward.





- T
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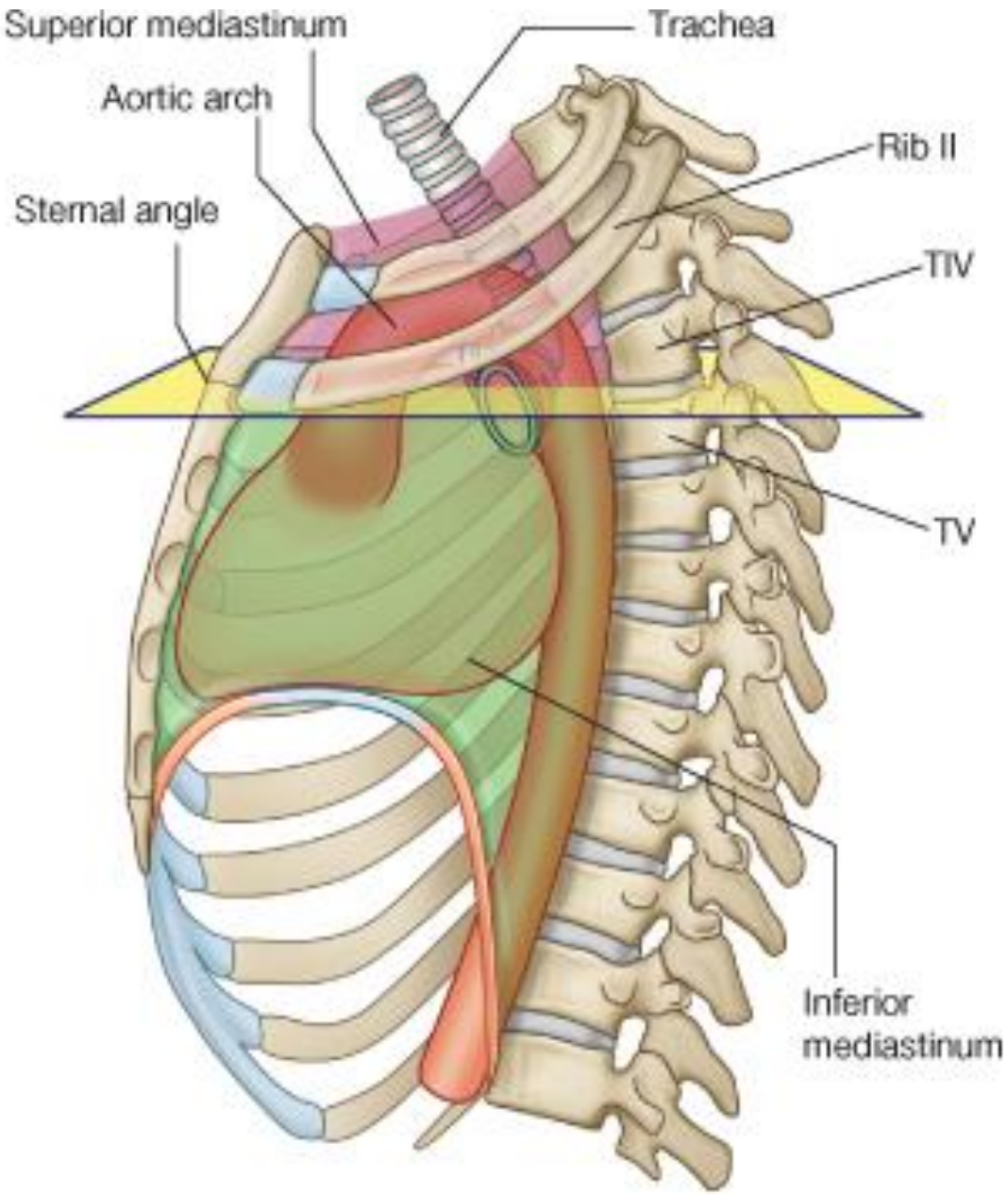


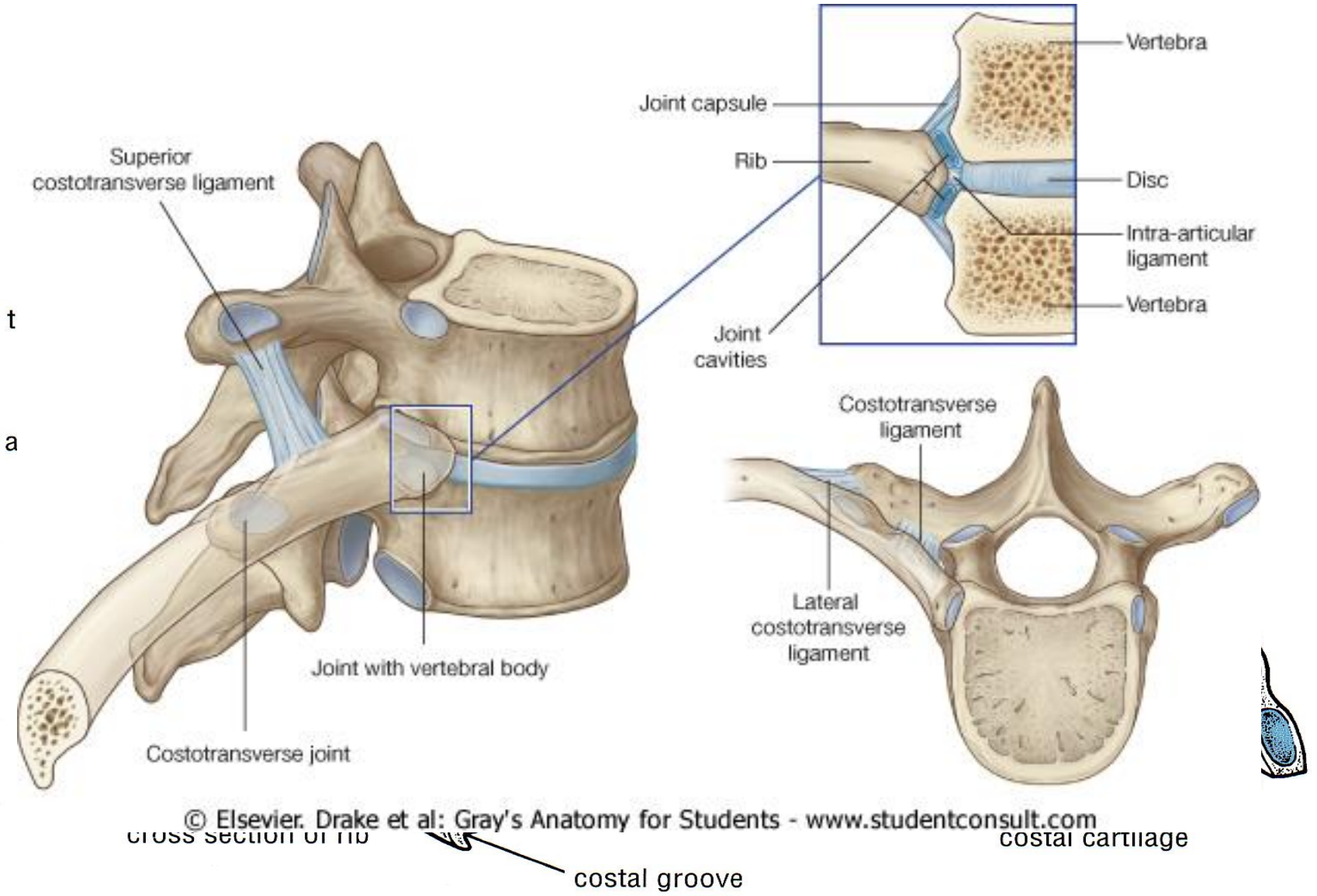
cess

tubercle

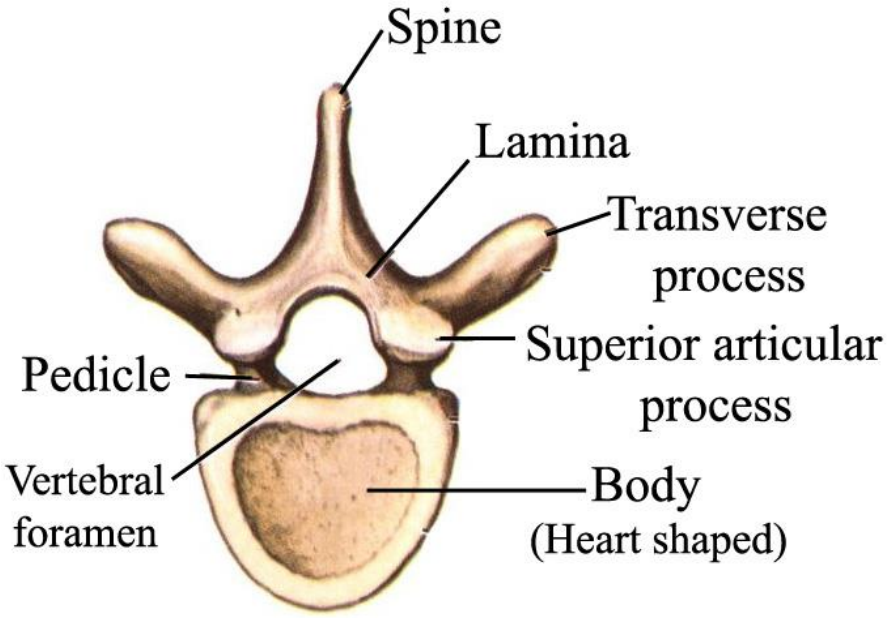
ır process

ib head

Articulation between Thoracic

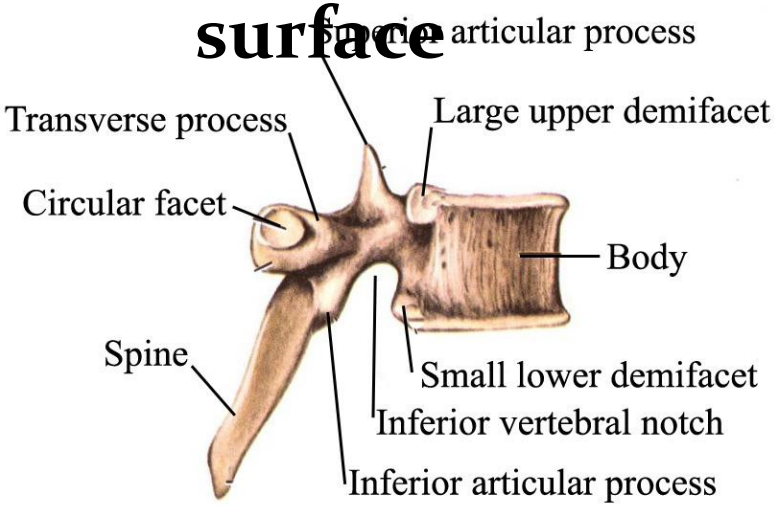


Typical thoracic vertebra



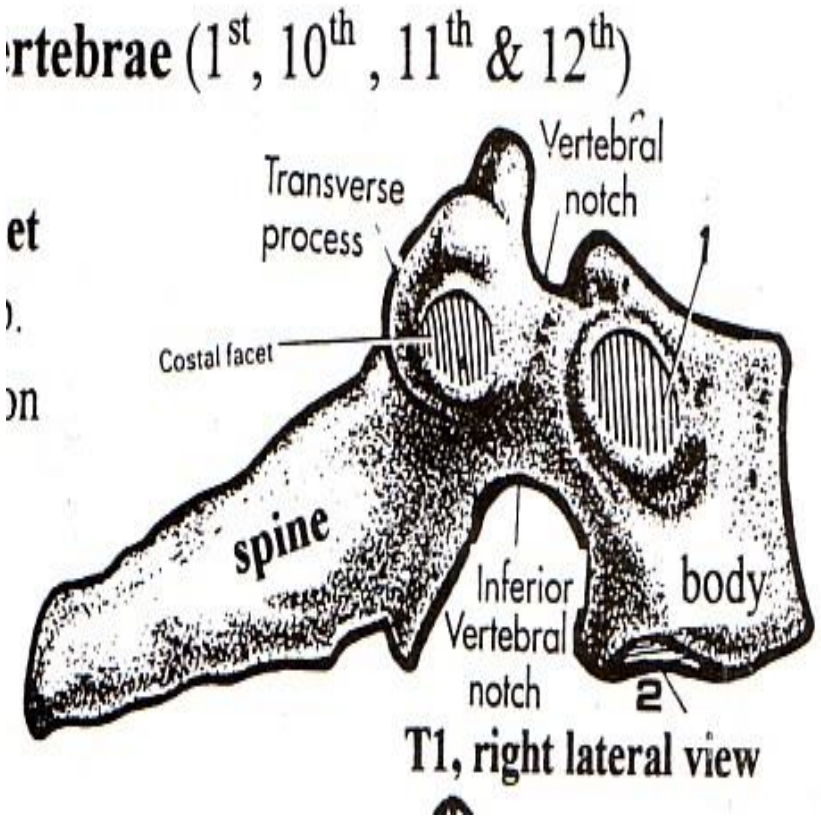
Superior surface

Lateral surface



1st Thoracic Vertebra

- **Atypical (Non typical)** thoracic vertebrae.
- **1st, 10th,11th and 12th**
  - **T1:**
- Has a complete facet.
- One very small inferior demifacet.
- Spine nearly horizontal
- Has costal facet in transverse process for the tubercle of first rib.
- It has a small body, looks like a cervical vertebra.



- **T10**

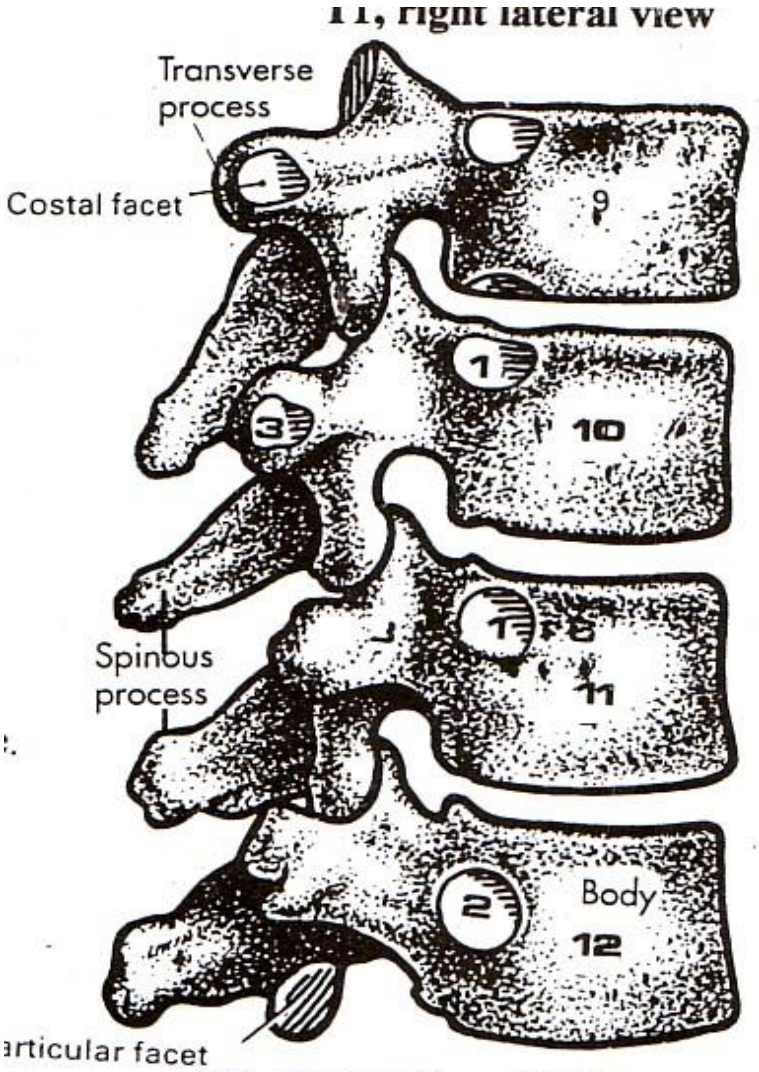
- **One** complete facet tangential with the upper border
- Small costal facet on transverse process.

- **T11**

- **One** complete circular facet away from upper border.
- ***No costal facet***

- **T12**

- Broad body & short, oblong spine.
- **One** complete facet midway between upper & lower borders.
- ***No costal facet***



T9, T10, T11 and T12, right lateral view

Ribs

Classification of ribs according to their attachments to the sternum:

- There are **twelve** ribs on each side classified as:

A: True ribs --------- Upper **seven** ribs (their anterior end is *attached to* the sternum).

B: False ribs --------- Lower **three** ribs (they are *not attached* anteriorly to the sternum).

- The lower **two** ribs are called the ***floating ribs*** because they are *free* anteriorly.

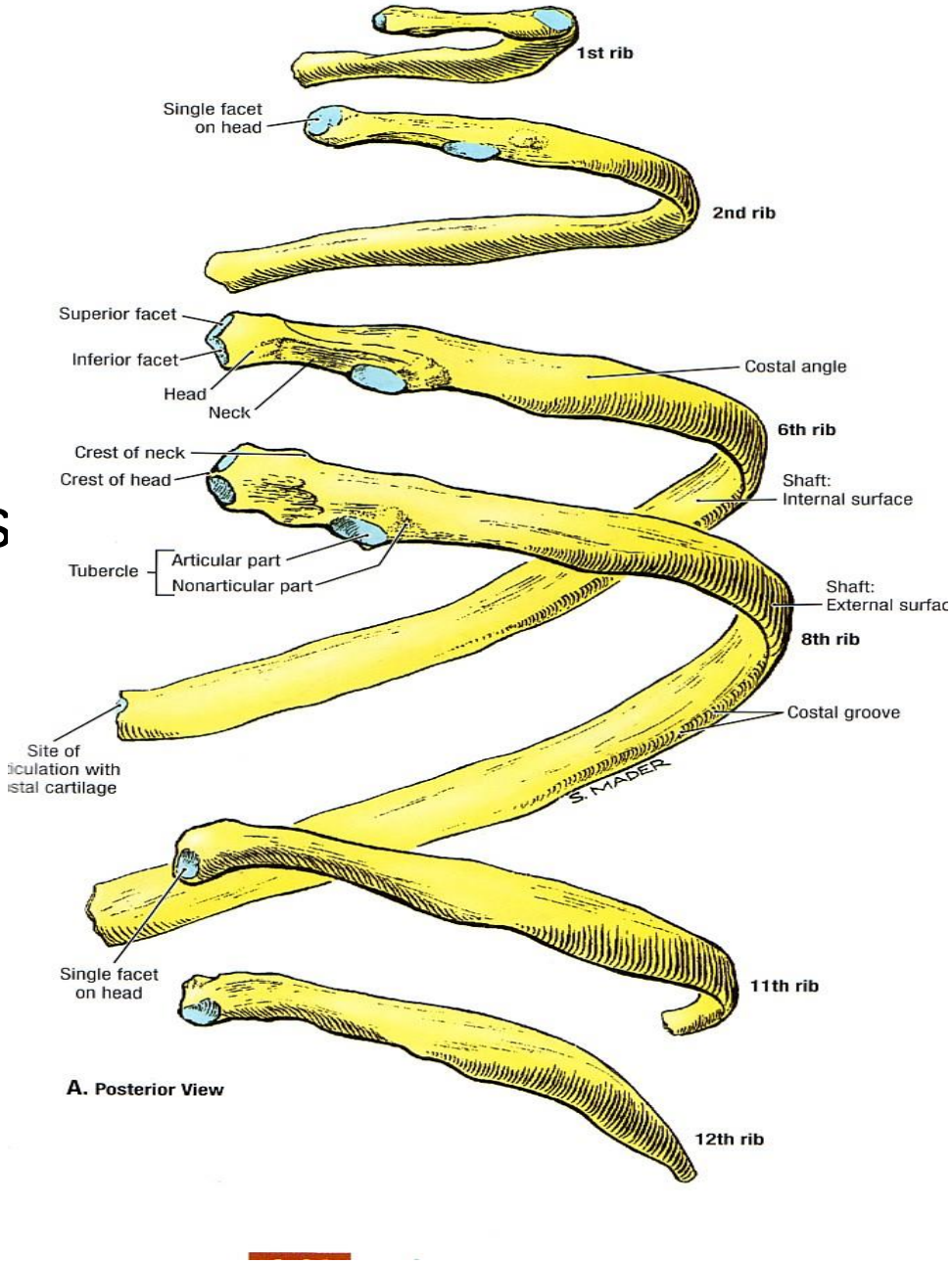
Classification of ribs according to their structure:

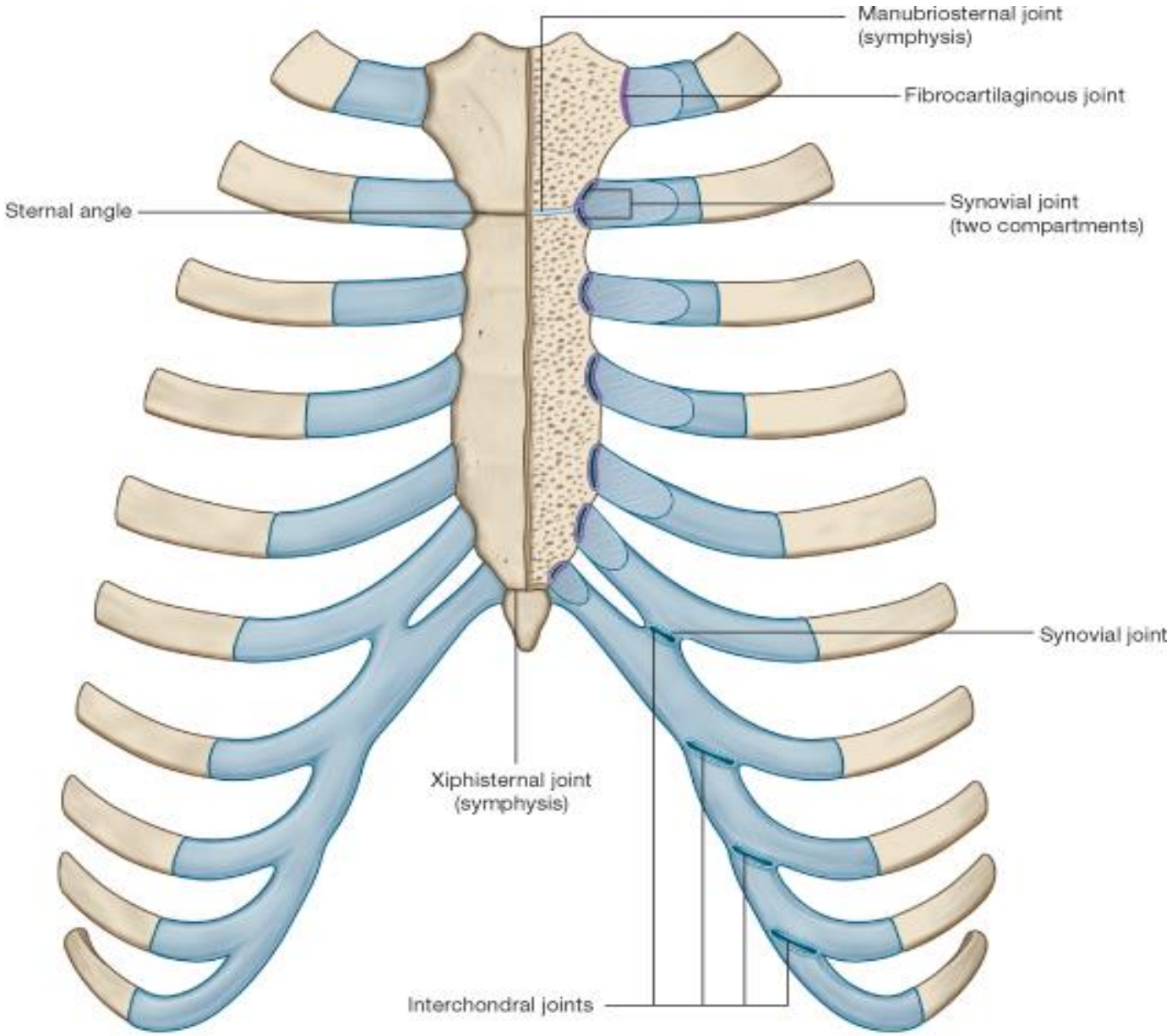
A: Typical ---------- **3rd - 9th** ribs.

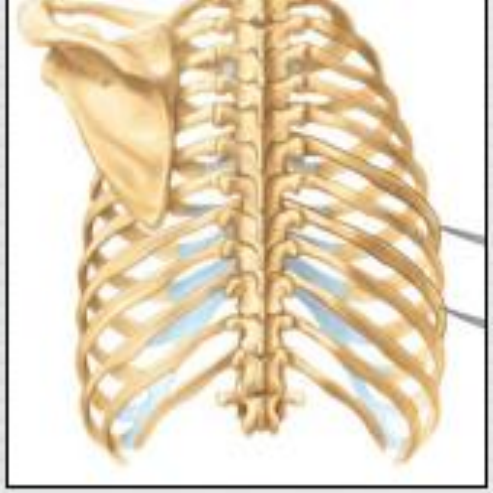
B: Atypical ---------- **1st, 2nd, 10th, 11th,** and **12th** ribs**. (first two and last 3) ribs)**

- **Ribs**

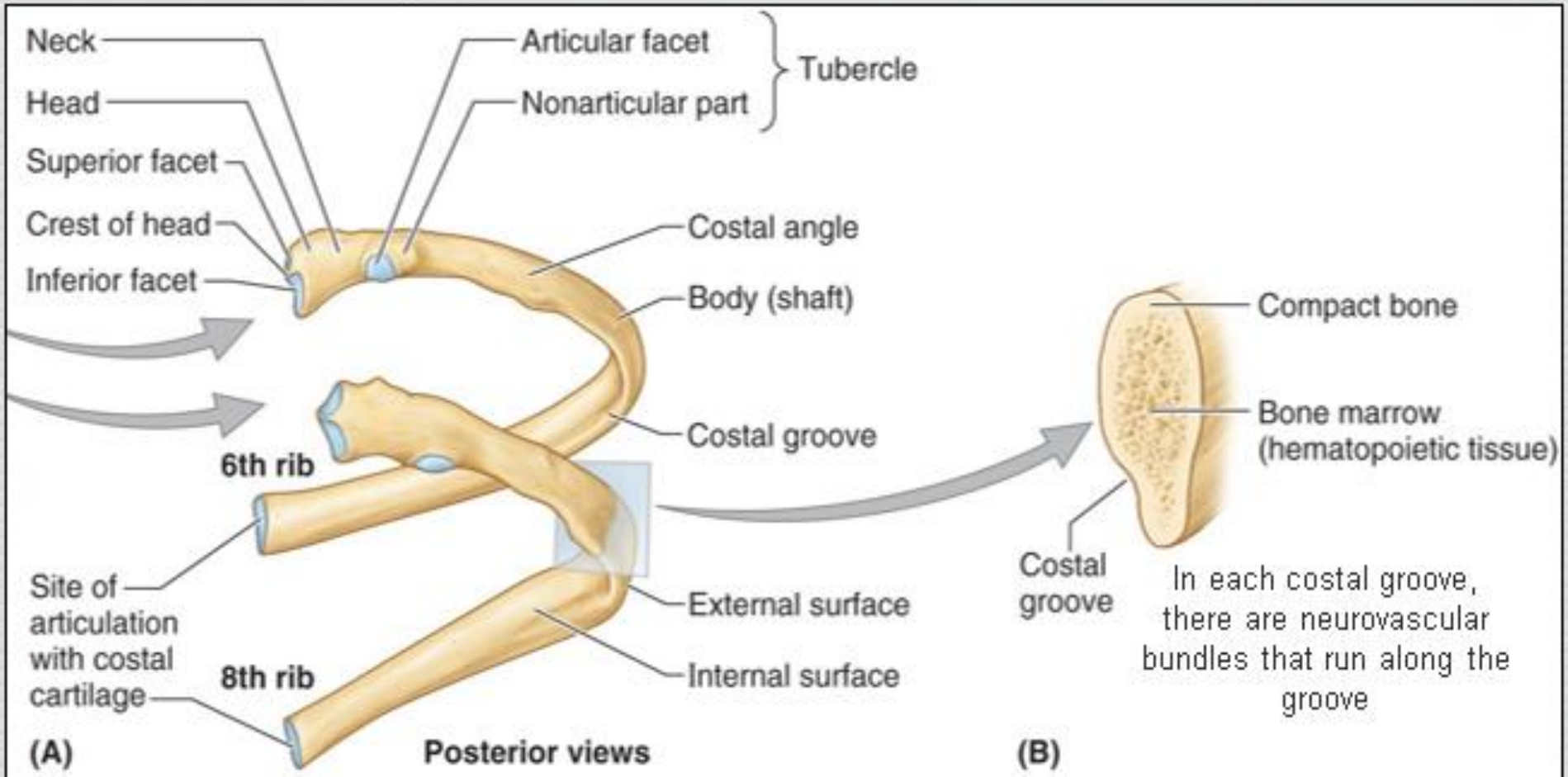
- 12 pairs, all are attached posteriorly to thoracic vertebrae.
- True: upper 7 pairs.
- False: 8th,9th &10th pairs
- Floating ribs: 11th & 12th
- The ribs from 3rd to 9th are called ***Typical ribs.***
- Atypical (Non Typical) are 1st,2nd, 10th,11th & 12th.



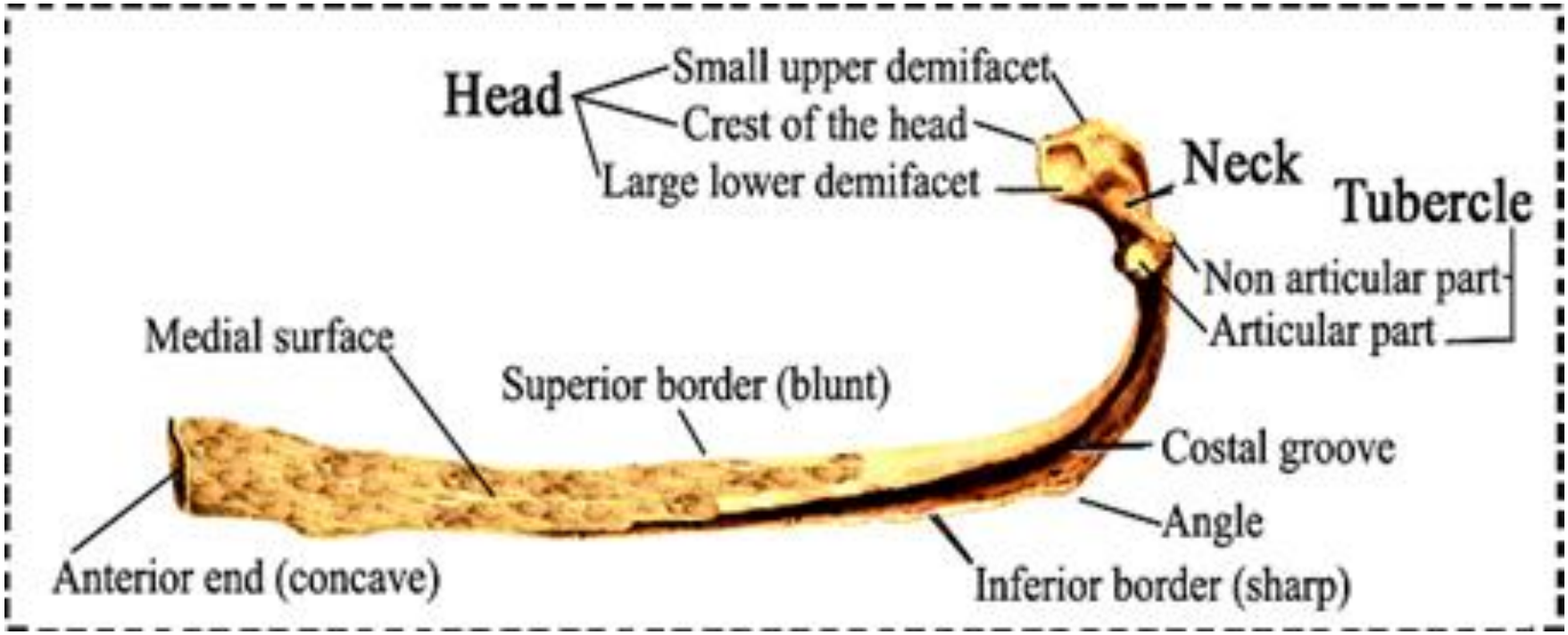




Ribs articulate with vertebrae behind and are oriented DOWNWARD when they go anterior



Typical rib

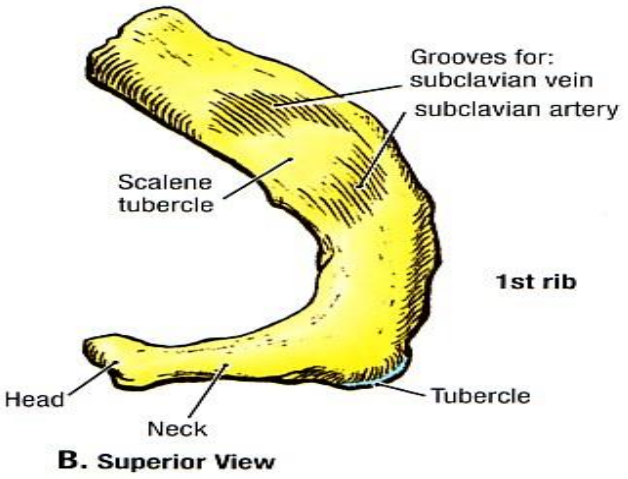

Head
Small upper demifacet
Crest of the head
Large lower demifacet
Neck
Tubercle
Non articular part
Articular part
Medial surface
Superior border (blunt)
Costal groove
Angle
Anterior end (concave)
Inferior border (sharp)

- **1st rib**

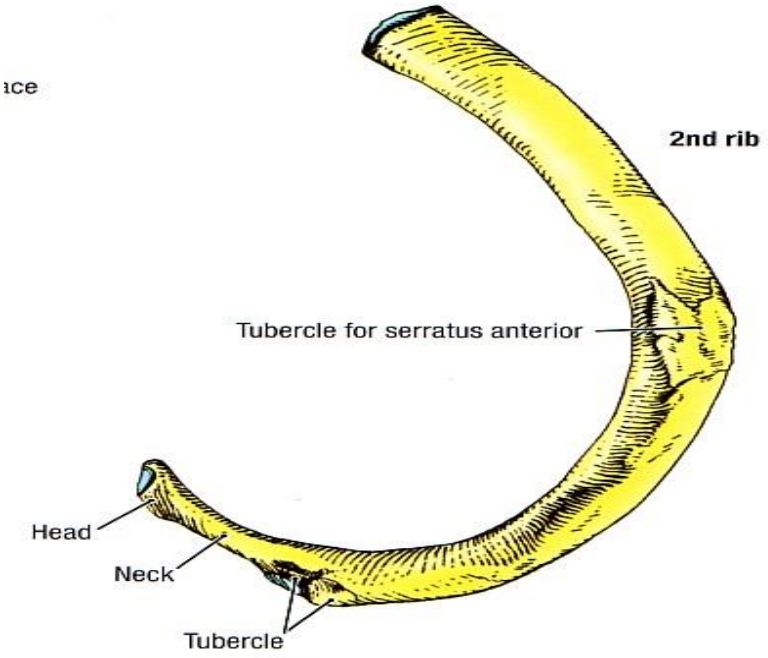
- Shortest C- Shaped
- Ant end: cup shape.
- Post end: It has Head, neck and tubercle.
- Head: One facet
- Surfaces: Sup. & Inferior
- Borders: Outer (lateral) & Inner (media).

- **2nd rib**

- Twice the length of 1st
- Head has 2 facet
- Surfaces of shaft are in between that of 1st & typical



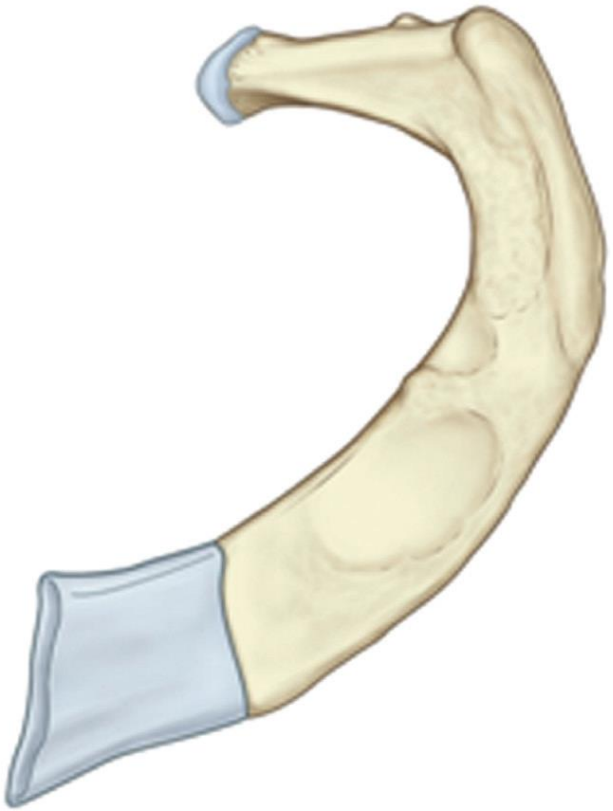
B. Superior View



C. Superior View

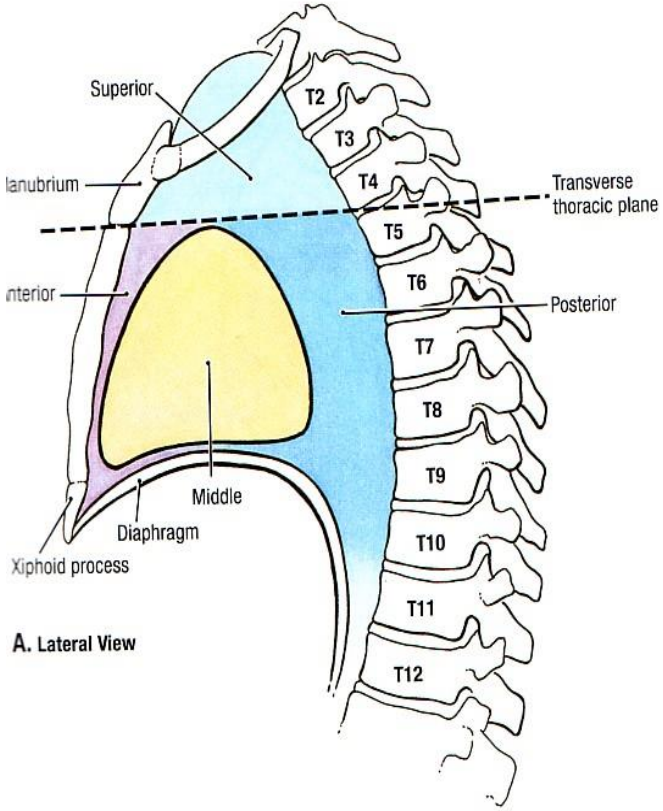
First rib

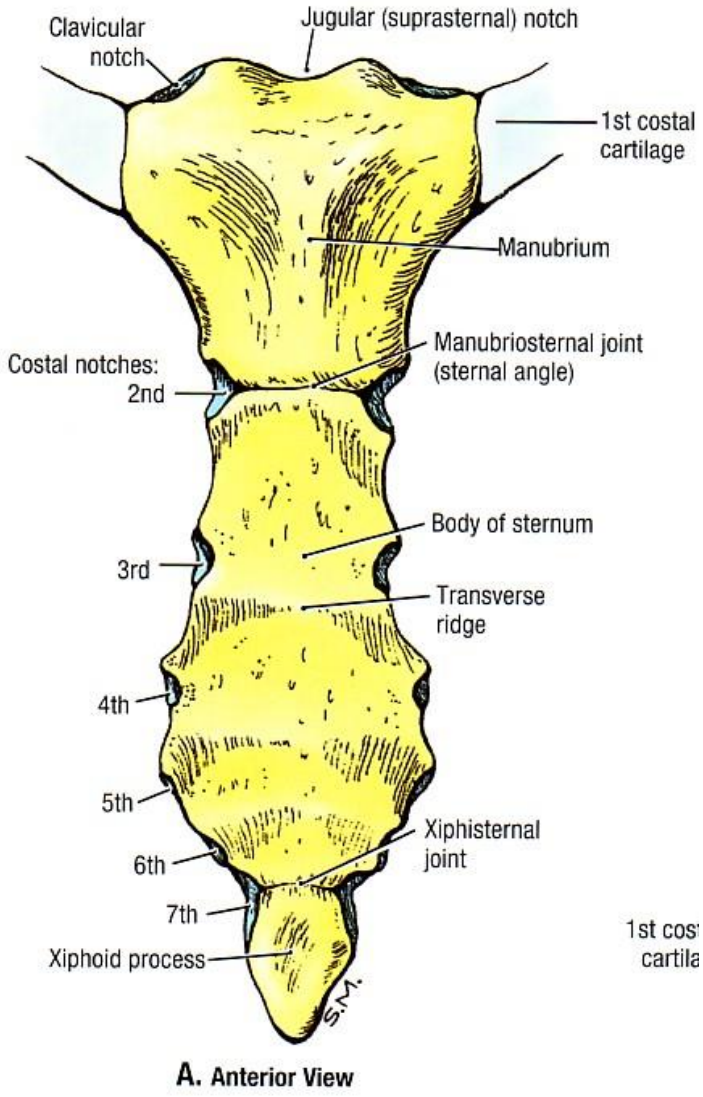
- **1. Neck**
- **2. Tubercle**
- **3. Area for attachment of serratus anterior**
- **4. Costal cartilage**
- **5. Groove for subclavian vein**
- **6. Scalene tubercle (attachment of anterior scalene)**
- **7. Groove for subclavian artery**
- **8. Area for attachment of middle scalene**
- **9. Head with articular facet**



Sternum

- 3 parts: Manubrium, Body * Xiphoid process.
- **Manubrium**: Lies opposite T3,4. **Body:** T5 toT8
- **Xiphoid** T9





Intercostal Spaces

It contains:

1- Intercostal muscles.

2- Intercostal nerves.

3- Intercostal arteries.

4- Intercostal veins.

Intercostal muscles

I. Outer layer ----- External intercostal muscle

II. Intermediate layer ----- Internal intercostal muscle

III. Inner layer ----- Transversus thoracis group, *subdivided into:*

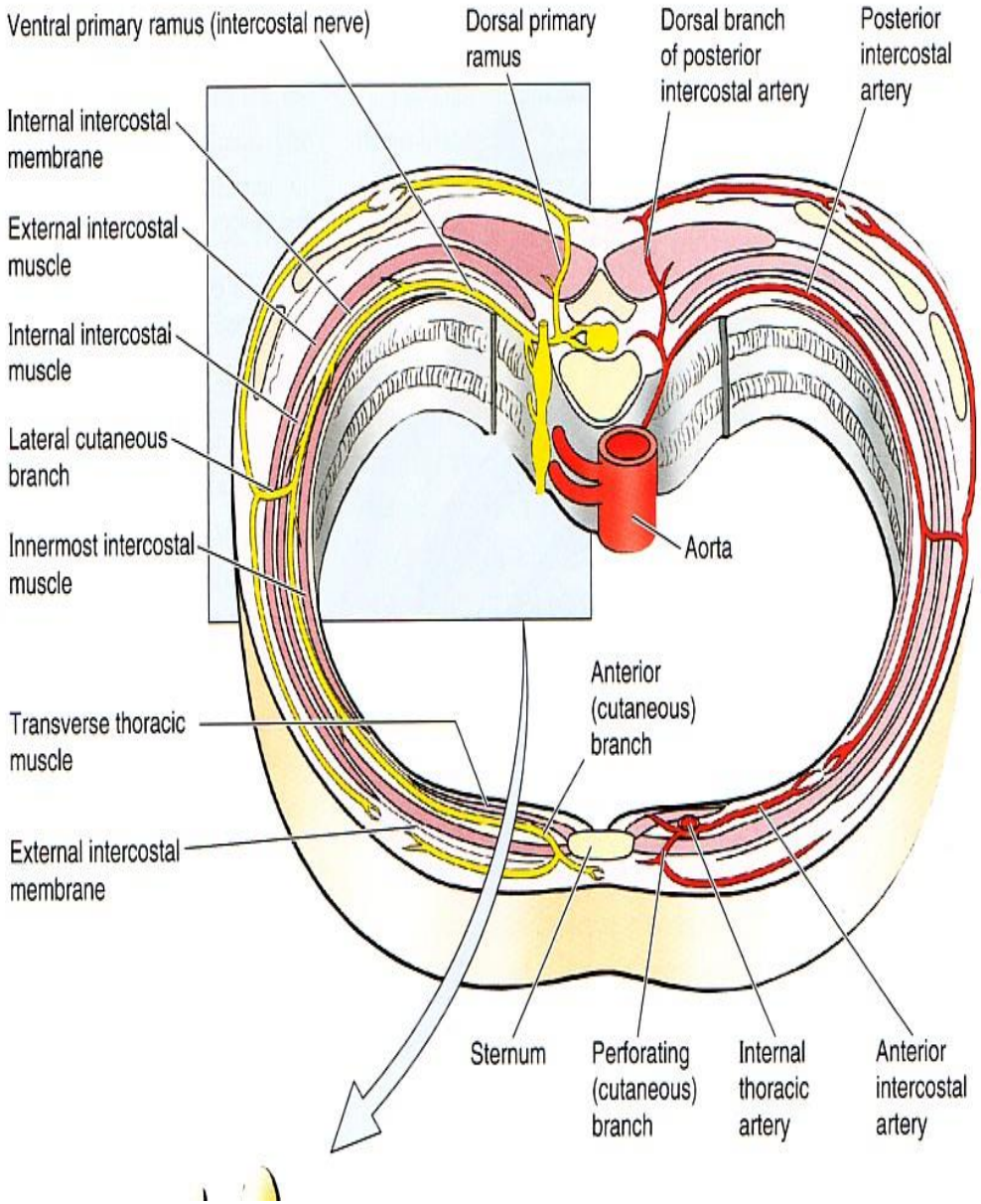
1. Innermost inter-costalis

2. Sterno-costalis

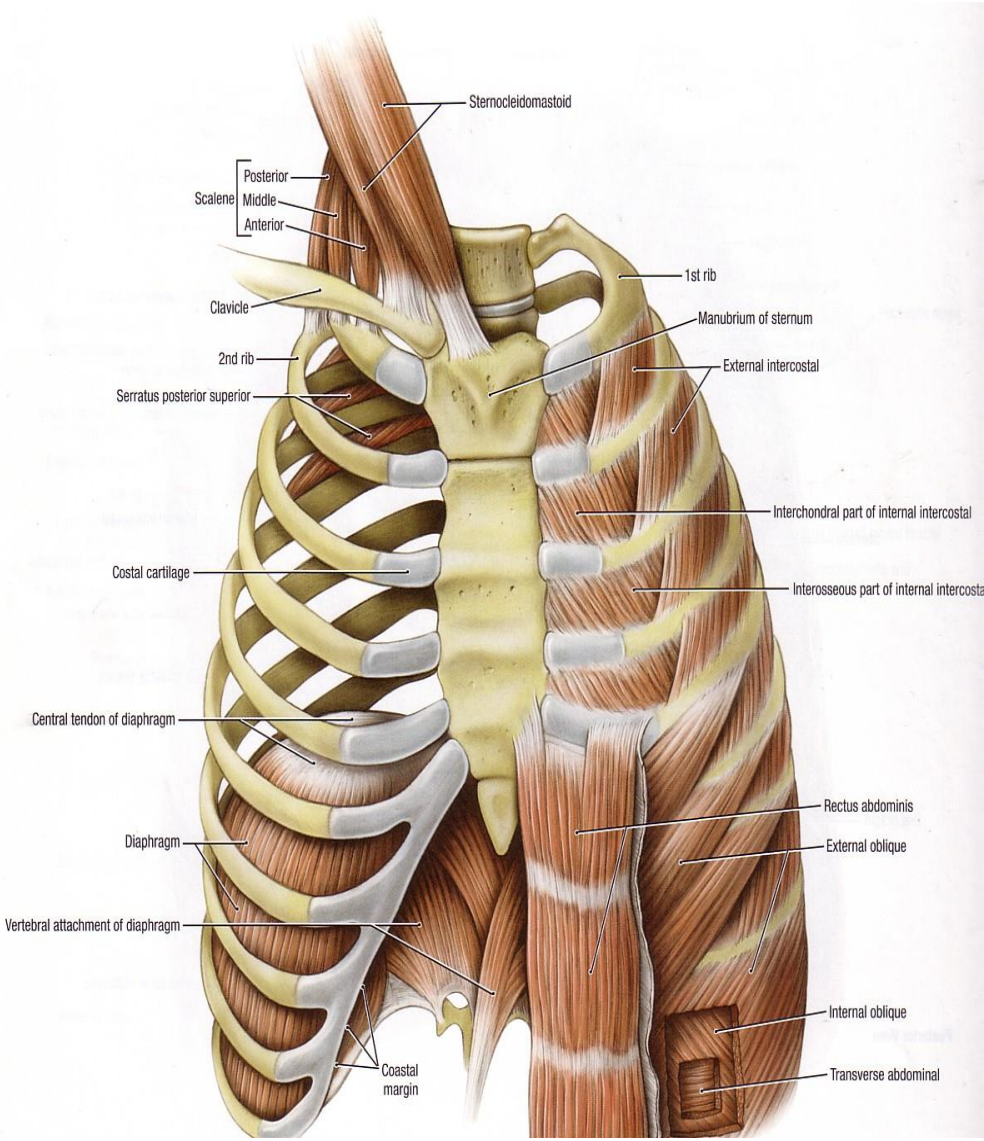
3. Sub-costalis

- **Intercostal Spaces**

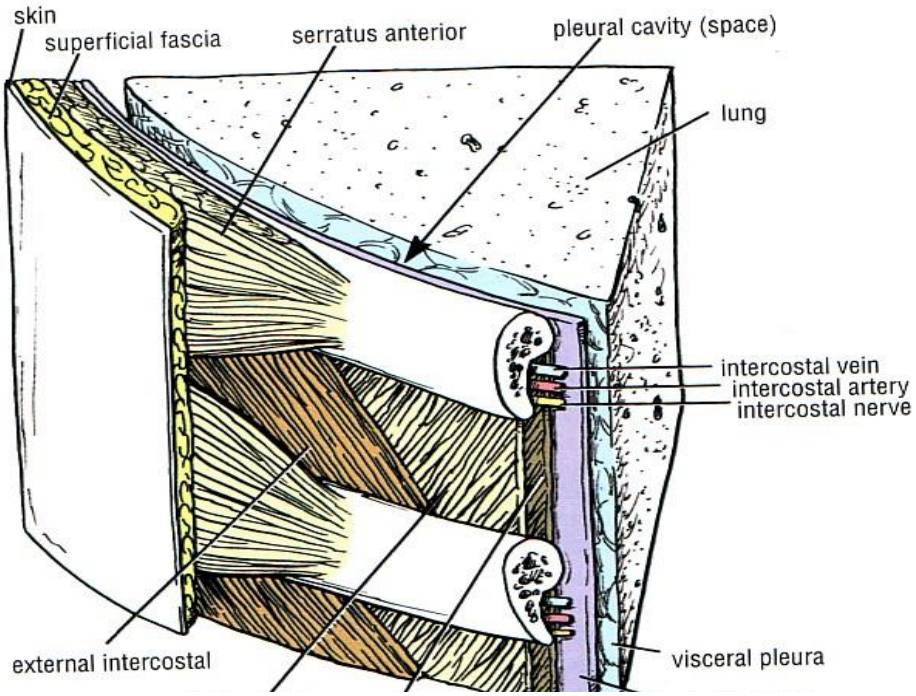
- There are **9** anterior and **11** posterior
- Each space contains:
- **<u>1- Intercostal muscles</u>**: (External, Internal and transversus thoracicus)
- **<u>2- An Intercostal nerve</u>.**
- **<u>3- Intercostal vessels:</u>**
- **a. Intercostal arteries**
  (Anterior & Posterior)
- **b. Intercostal veins**
  (Anterior & Posterior).

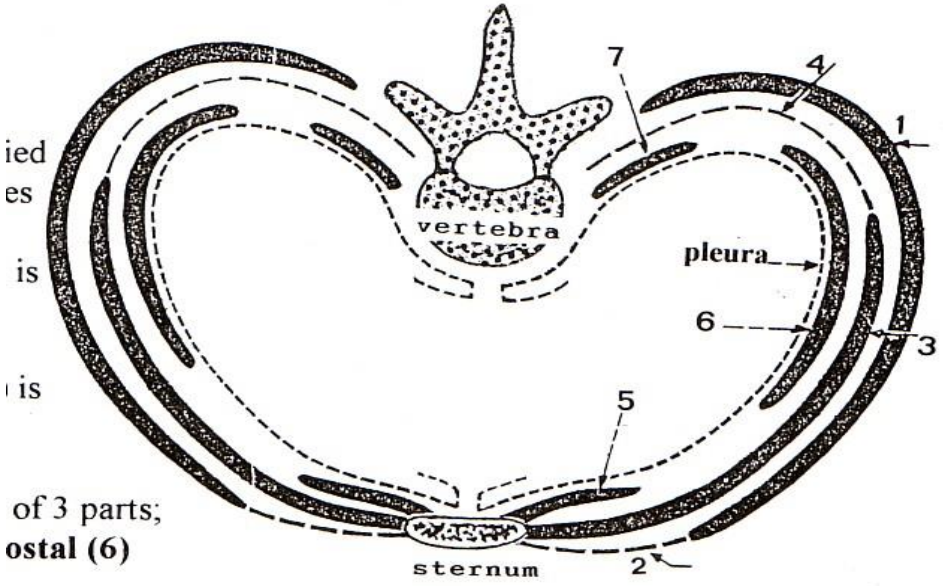


- **EXTERNAL INTERCOSTAL**
- **Origin:** From the lower border of the rib above
- **Insertion**: Into outer lip of upper border of rib below
- Fibers are **directed** from above **downward** and **forwards**
- Begins from **post. end** of Intercostal space close to the tubercle of the rib.
- Ends at the **costochondral junction** where it is replaced by **external** or **anterior** Intercostal membrane.
- It **elevates** the rib during inspiration



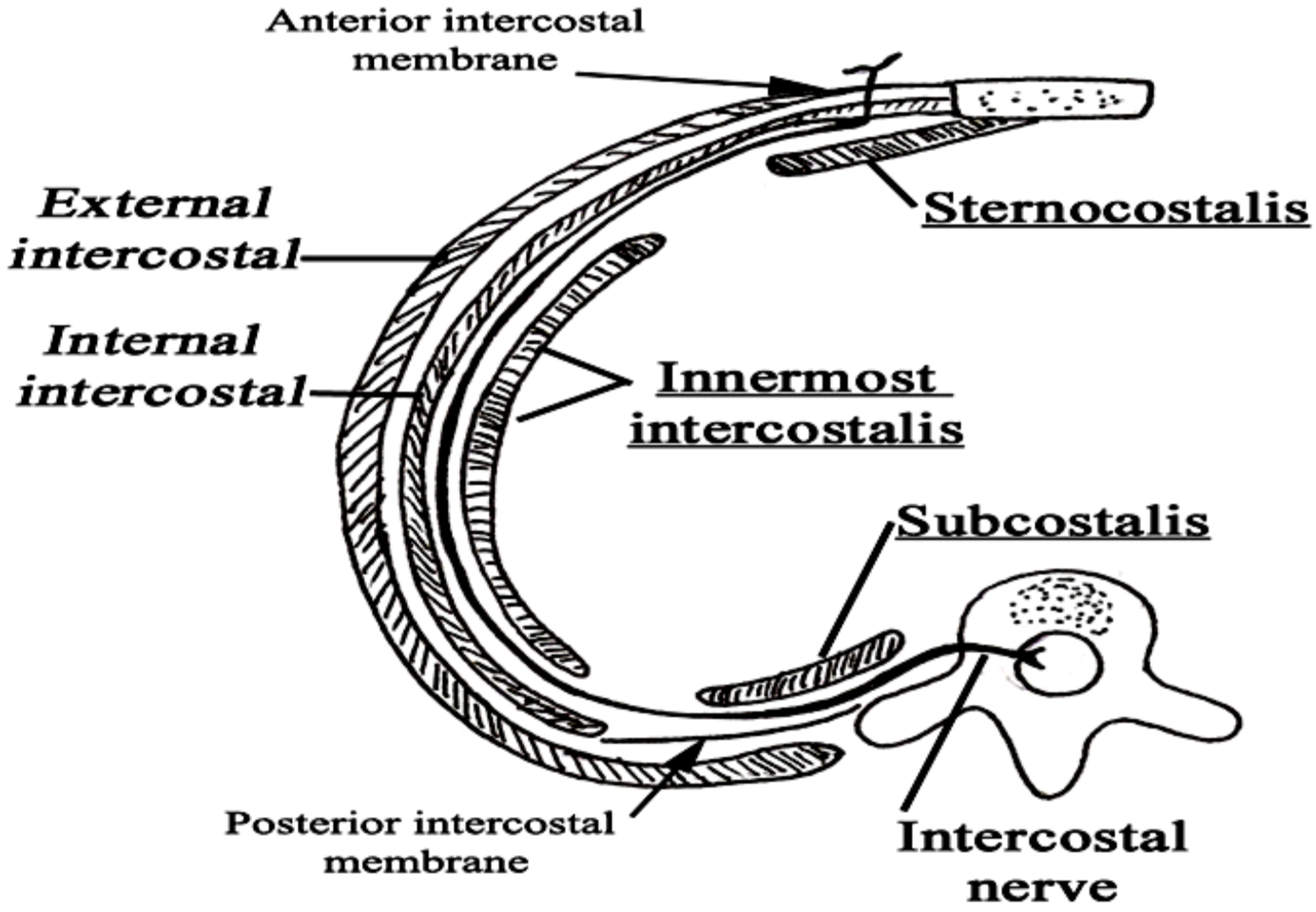
- **INTERNAL INTERCOSTAL**
- *Origin:* Floor of costal groove
- *Insertion:* Inner lip of upper border of rib below
- Fibers are directed from above downwards & backward
- *Begins* from anterior end of space close to the sternum.
- *Ends* at the angle of the rib, where it is replaced by post. Or internal Intercostal membrane.
- *Action:* Depresses the rib downwards during expiration

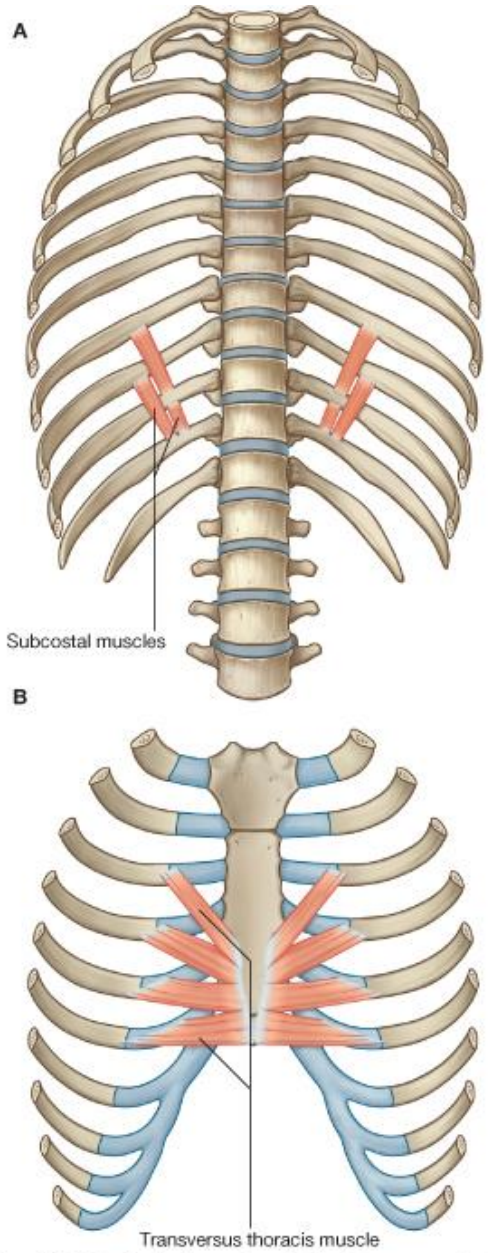


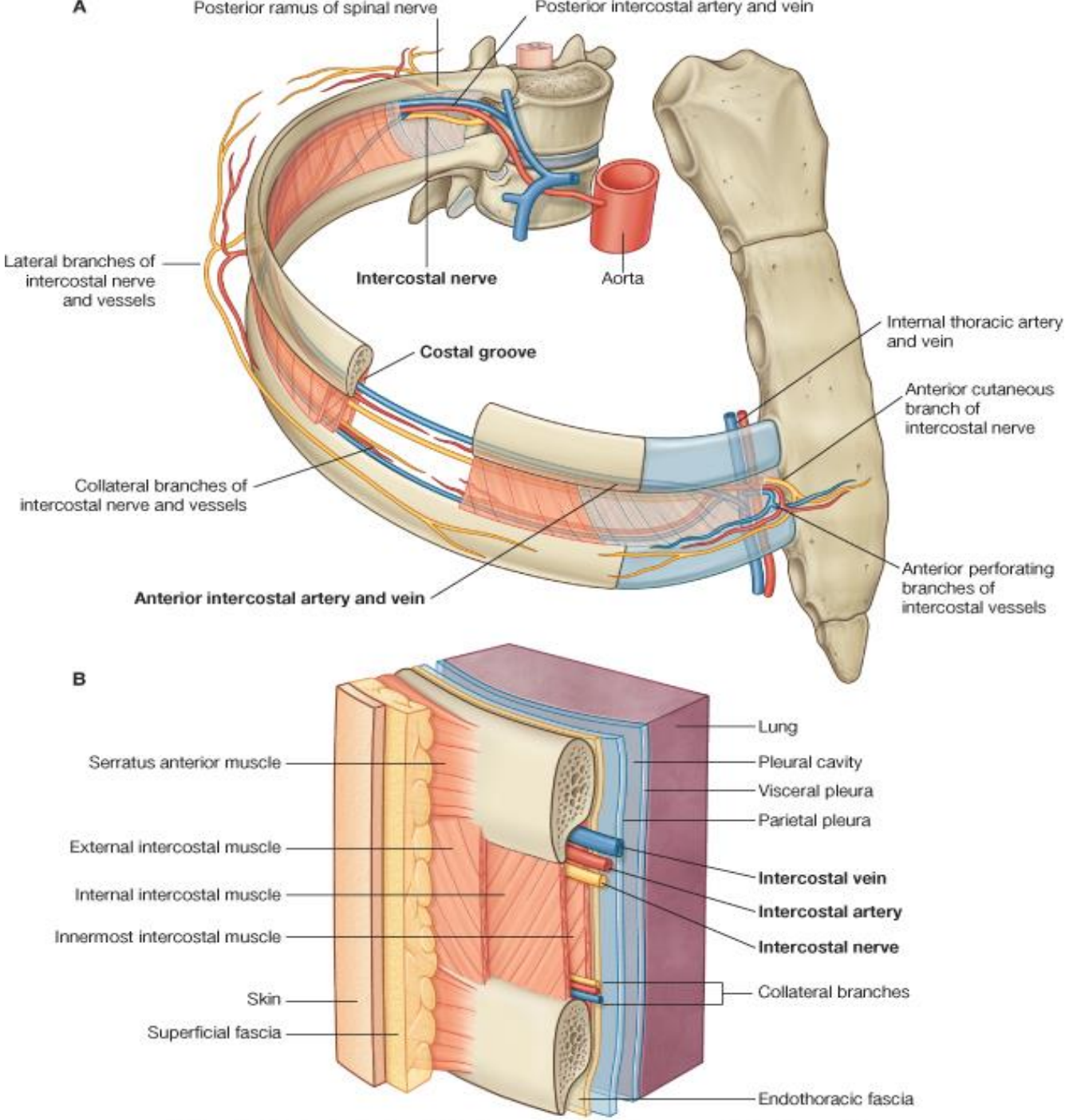


Transversus thoracis group

Arrangements and extension of the muscles





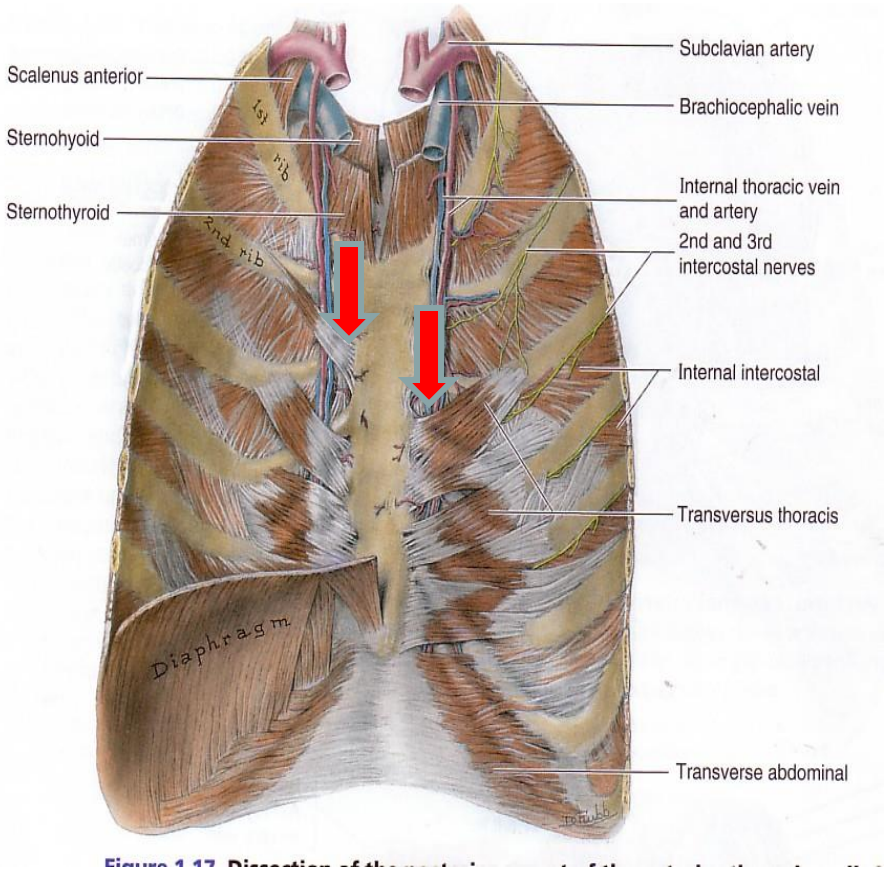


- **Sternocostalis**

- 4 to 5 slips which arise from inner surface of lower part of body of sternum and costal cartilages
- Inserted into inner surface of costal cartilages from 2 to 6.

- **Subcostalis muscle**

- Thin bands of muscle fibers.
- Mainly in lower 6 spaces.
- Only in post. part of spaces.
- **<u>Origin</u>**: Inner surface & lower border of rib above.
- **<u>Insertion</u>**: Upper border of 2nd or 3rd rib below.



CHEST WALL MUSCLES

External intercostals

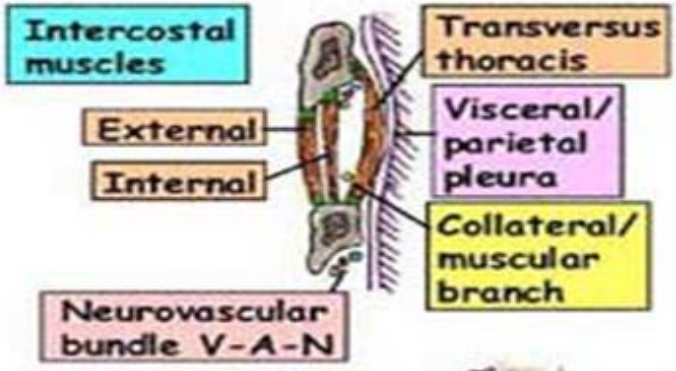
From sharp edge of rib above - downwards/forwards to rounded edge of rib below, from superior costotransverse ligament posteriorly to costochondral junction anteriorly. Then anterior intercostal membrane beyond this

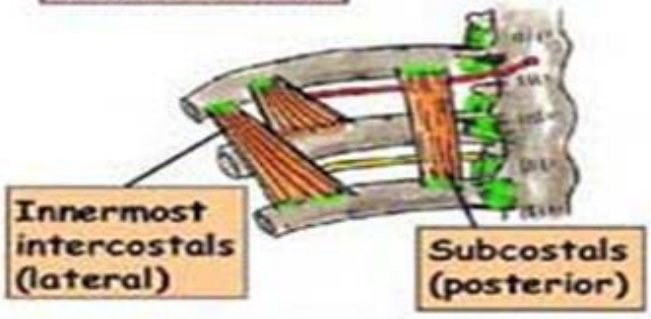
Internal intercostals

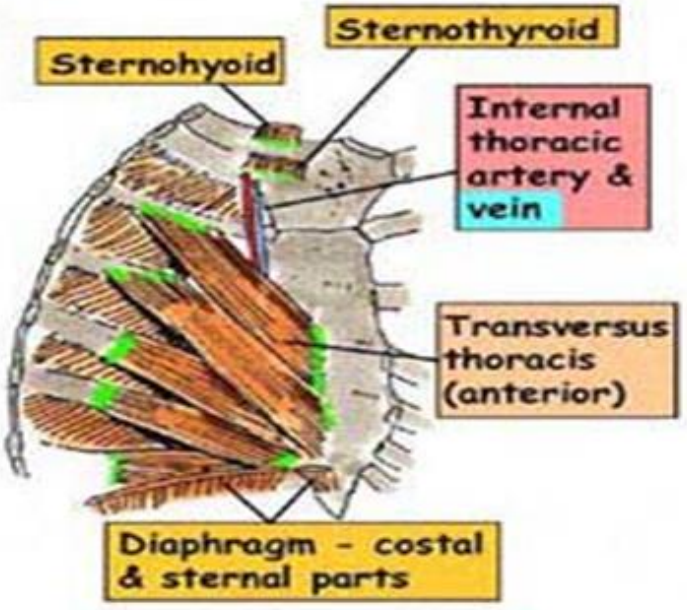
From costal groove above - downwards/backwards to upper border of rib below, from sternal edge to angle of rib. The posterior intercostal membrane beyond this

Transversus thoracis

At back: Subcostals. In lower chest. Wider below
At side: Innermost intercostals. Extend for more than one space
At front: Transversus thoracis (previously Sternocostalis) from lower sternum to costal cartilages 2-6







Intercostal Arteries

Intercostal Arteries:

1- Anterior Intercostal Arteries.

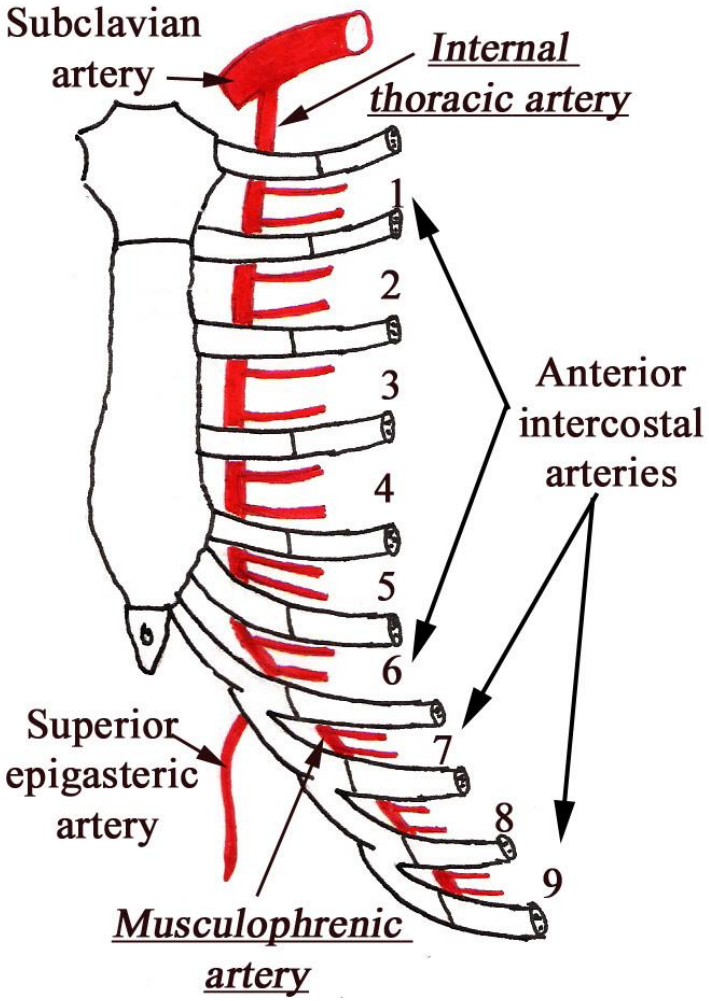
2- Posterior Intercostal Arteries.

Anterior Intercostal Arteries

Each anterior intercostal space contains **two** anterior intercostal arteries (except in the lower two inter-costal spaces).

a. The upper **6** pairs arise from the **internal thoracic artery.**

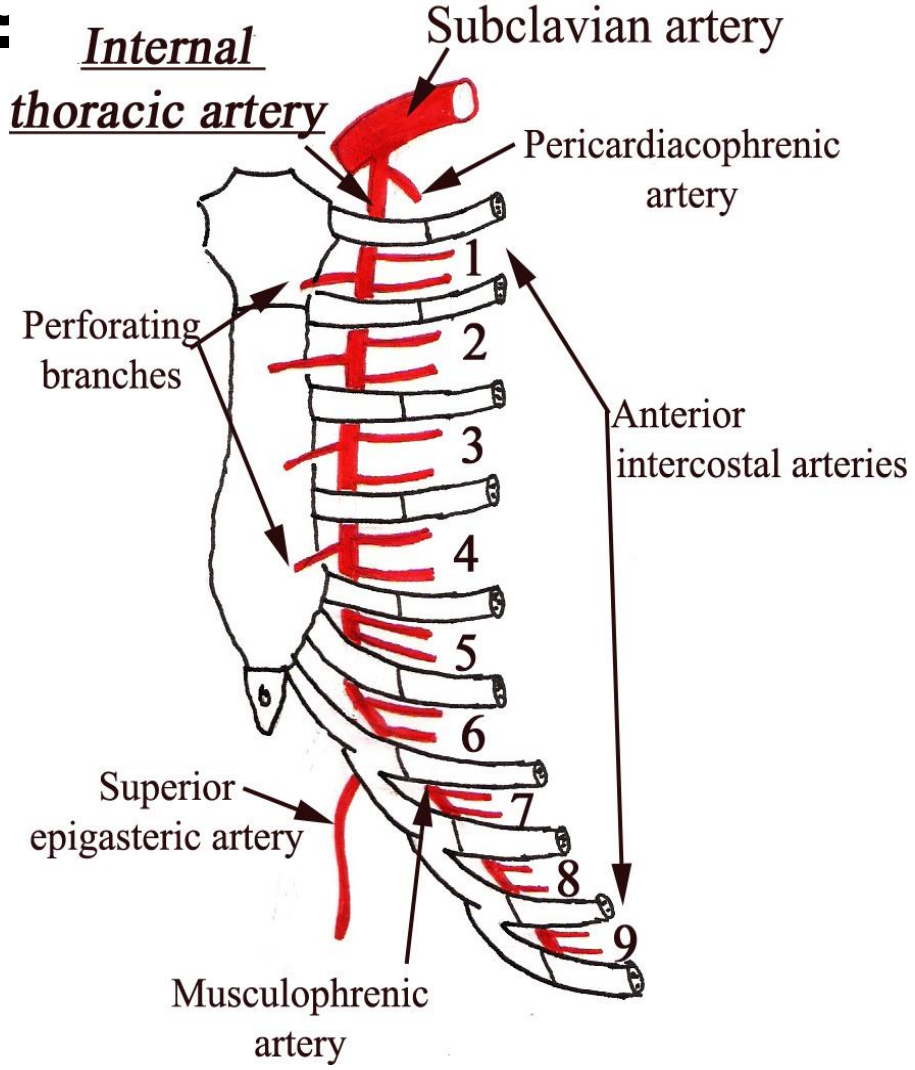
b. The **7th, 8th,** and **9th** pairs arise from the **musculo-phrenic artery.**



Internal thoracic (mammary) artery

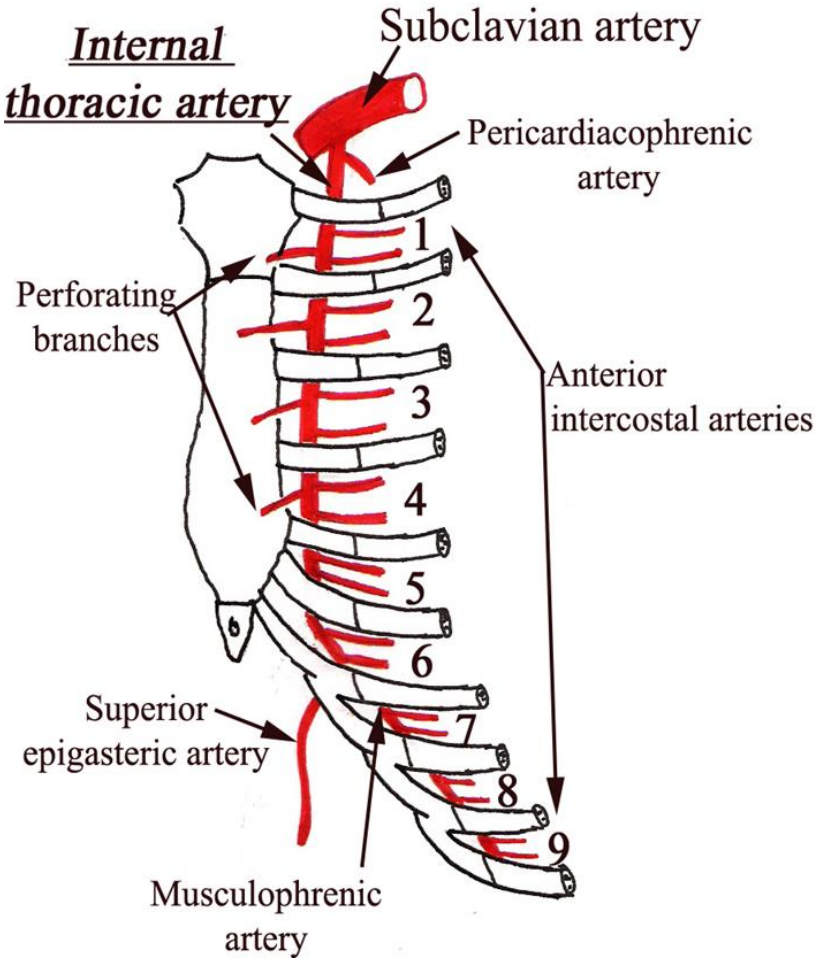
Origin: From the ***first part of the subclavian artery.***

Termination: opposite the **sixth** intercostal space by dividing into ***superior epigastric*** **and** ***musculo-phrenic arteries*****.**



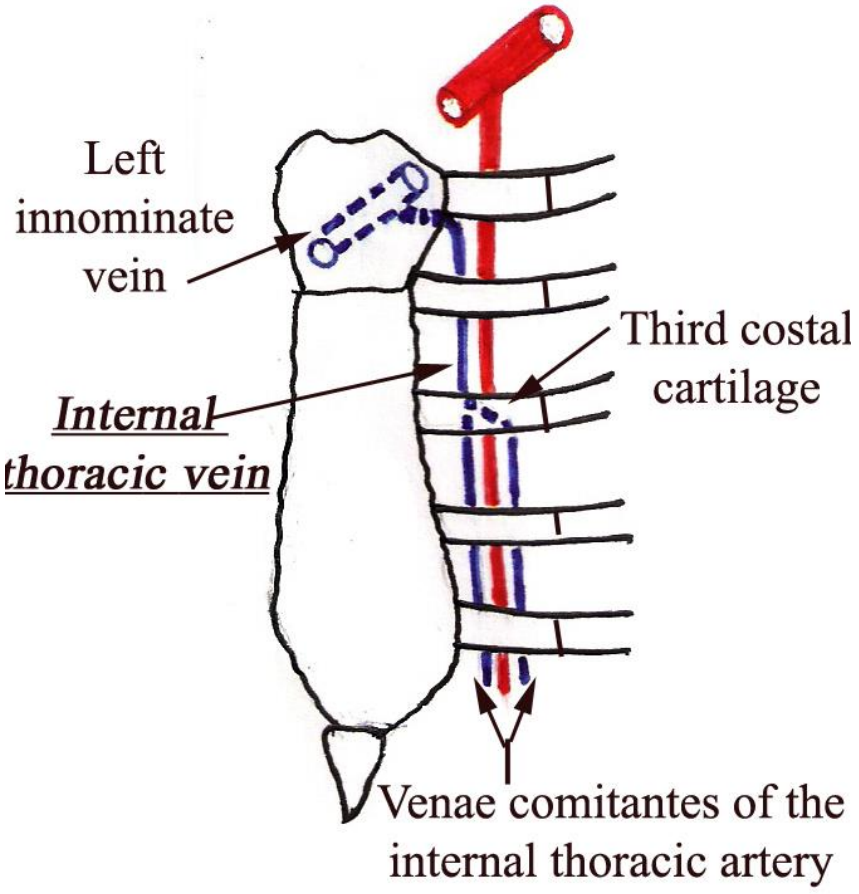
Branches:

1. Pericardial branches.
2. Pericardiaco-phrenic ar
3. Mediastinal branches.
4. Sternal branches.
5. Perforating branches for the mammary gland.
6. Anterior intercostal arteries (upper **6** spaces).
7. Superior epigastric artery.
8. Musculo-phrenic artery



Internal thoracic (mammary) vein

- It is formed by the union of the ***two venae comitantes*** of the internal thoracic artery behind the **third** costal cartilage.
- It ascends close to the artery to terminate in the corresponding **innominate vein**.

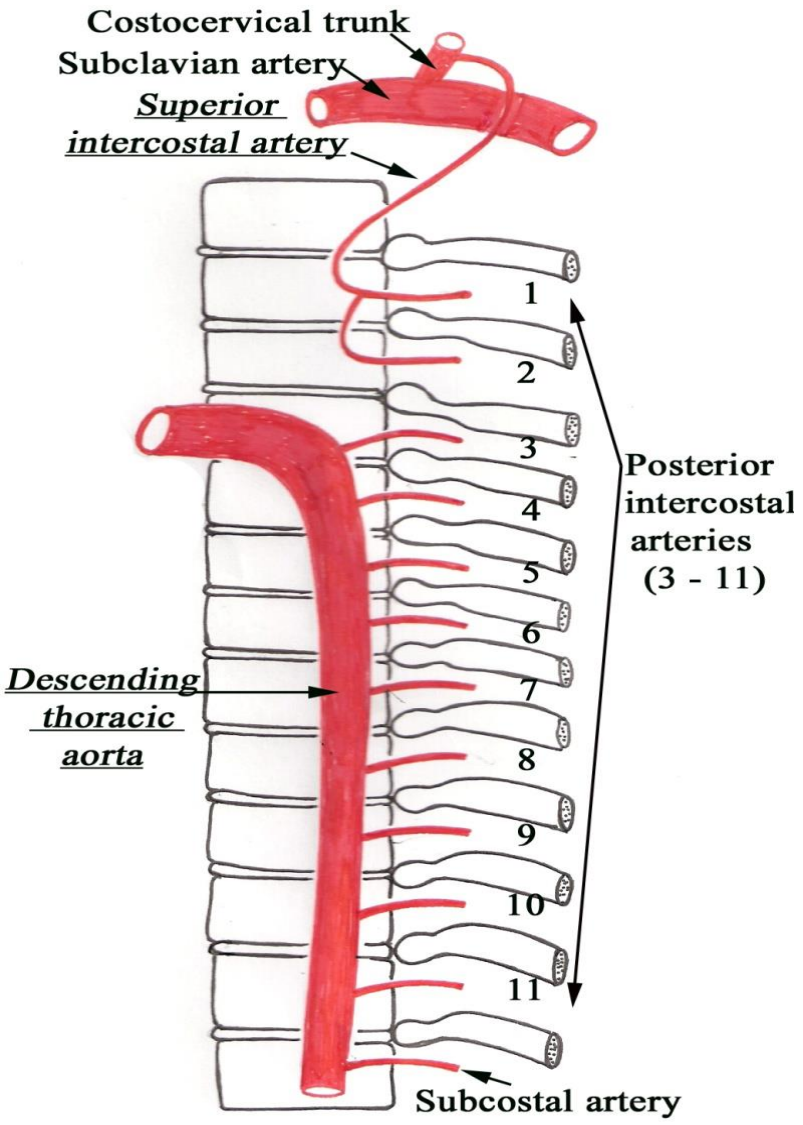


Posterior Intercostal Arteries

- Each posterior intercostal space contains **one** posterior intercostal artery which runs in the costal groove .
- Each artery gives a ***collateral branch*** which runs over the upper border of the rib *below.*

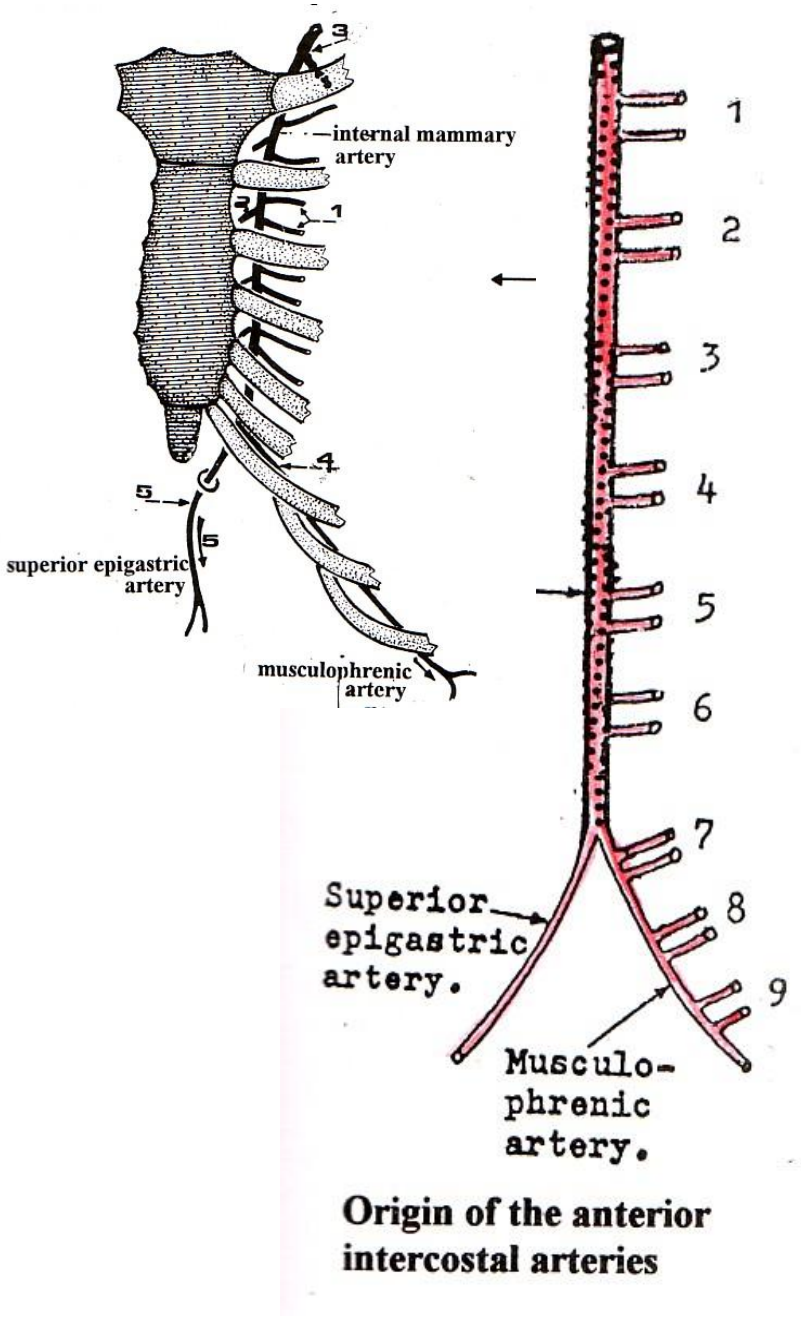
*The upper **two** posterior intercostal arteries →**superior intercostal artery** (**from the *costo-cervical trunk)* → 2nd part of subclavian artery.**

***** From **3 - 11** posterior intercostal arteries and subcostal artery →



- **Anterior Intercostal arteries**

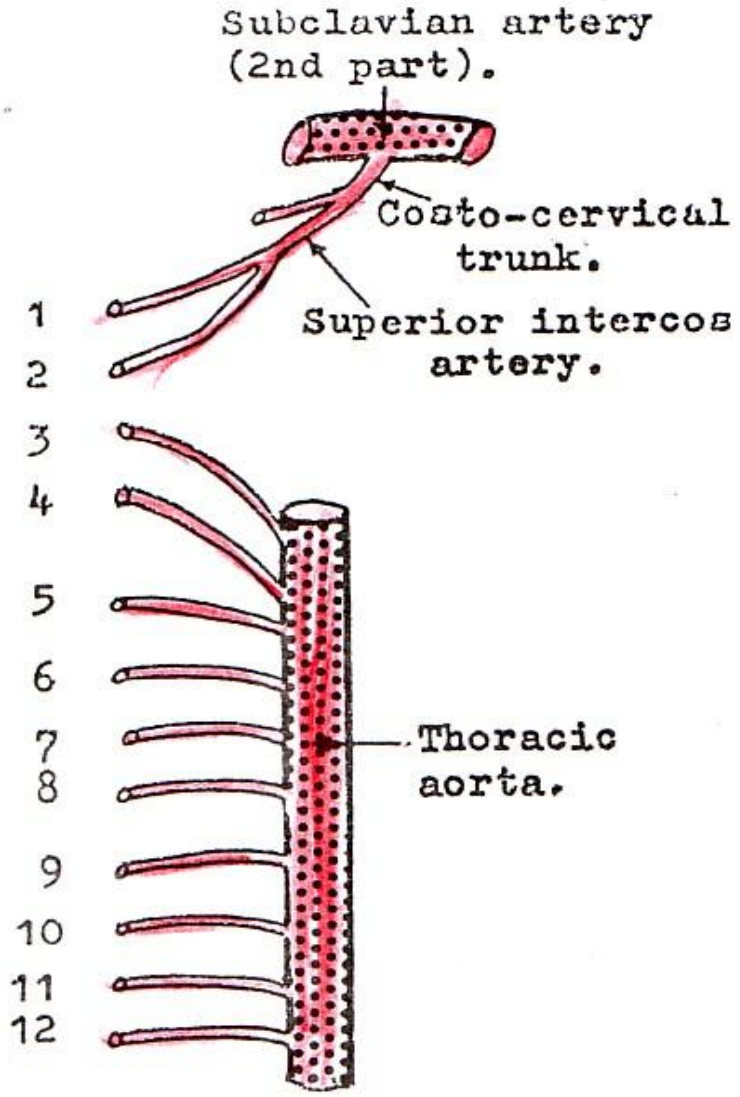
- 2 small arteries in each of the 9 spaces.
- The upper 6 from internal mammary artery
- The lower 3 from musculo-phrenic artery
- NB. Internal mammary or internal thoracic artery is a branch from1st part of subclavian artery



Origin of the anterior intercostal arteries

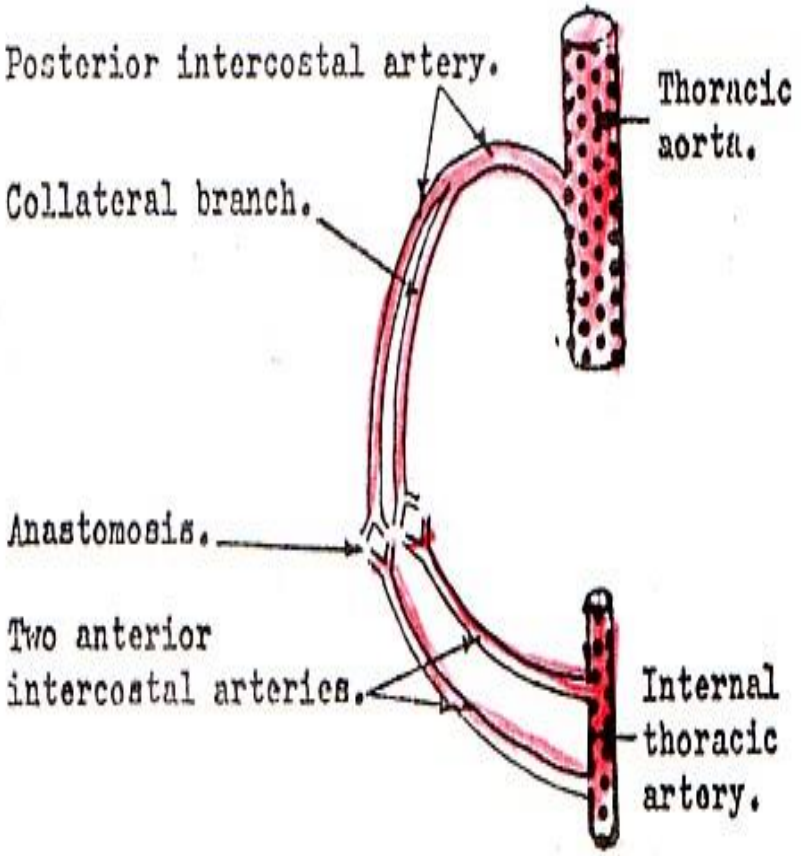
• Posterior Intercostal arteries

- One in each of the 11 spaces
- 1st & 2nd arise from superior Intercostal artery of costocervical trunk of 2nd part of subclavian artery
- The lower 9 arteries & subcostal artery arise from descending thoracic aorta.



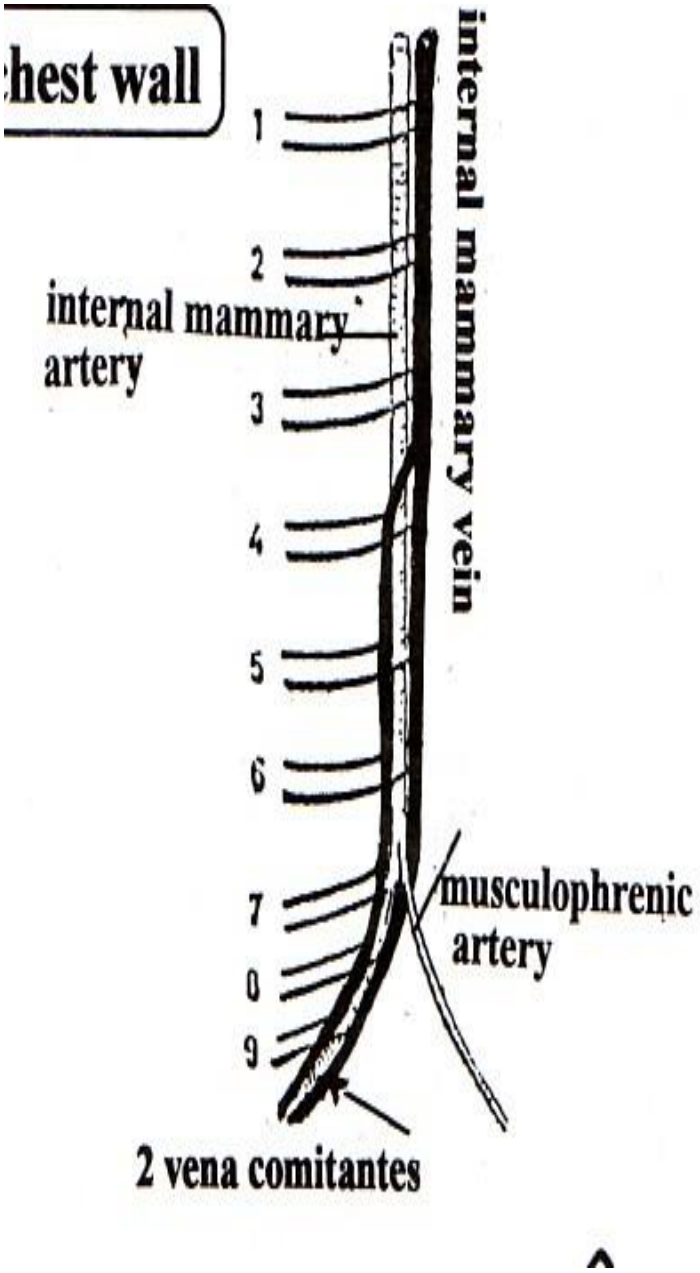
Origin of the posterior intercostal arteries

- In each space the posterior Intercostal artery and its collateral branch anastomose with the 2 anterior Intercostal arteries



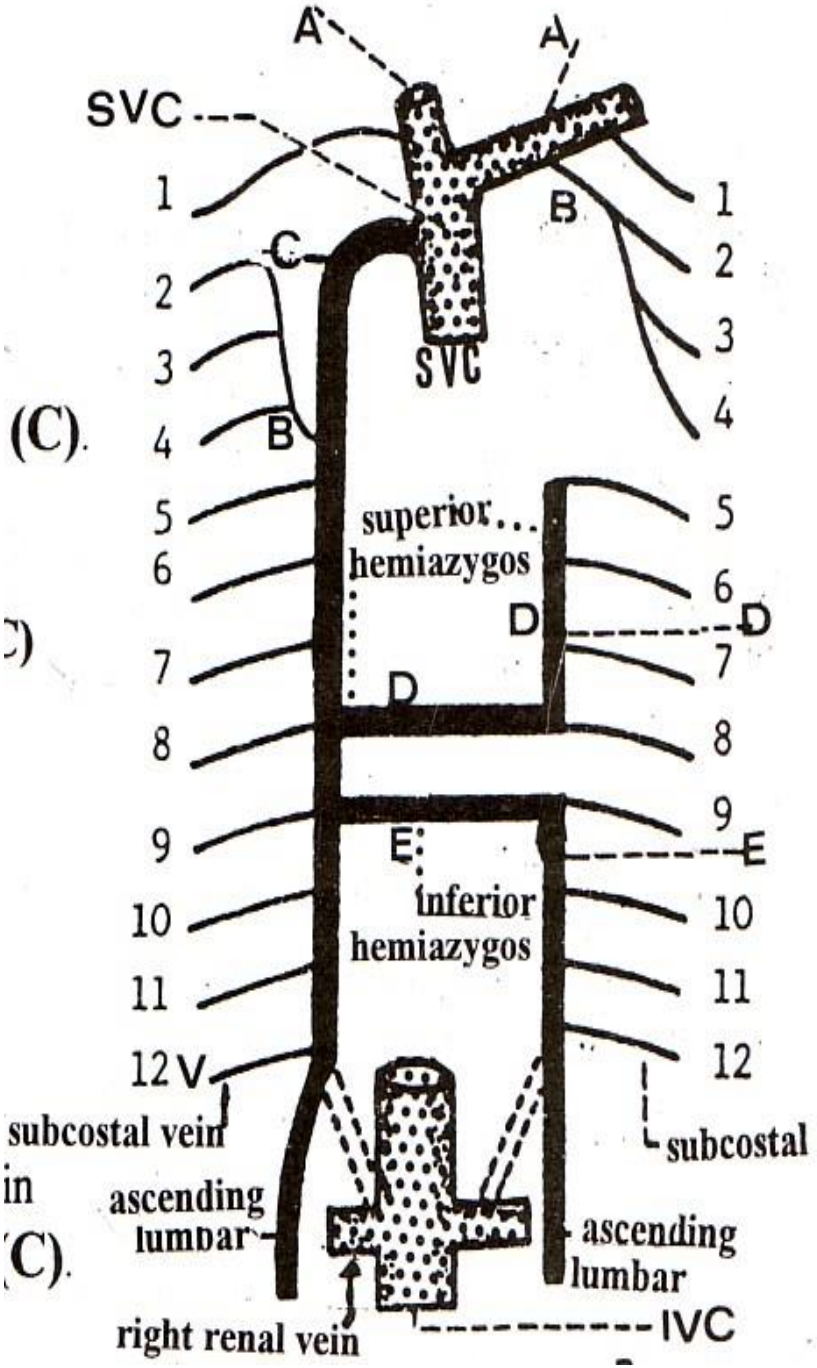
Anterior Intercostal veins

- 2 in each space.
- 9th,8th & 7th join the venae commitantes of musculo-phrenic artery
- 6th,5th & 4th join venae commitantes of internal mammary artery
- 3rd,2nd &1st join internal mammary vein
- Internal mammary vein drains into innominate (Brachiocephalic vein)



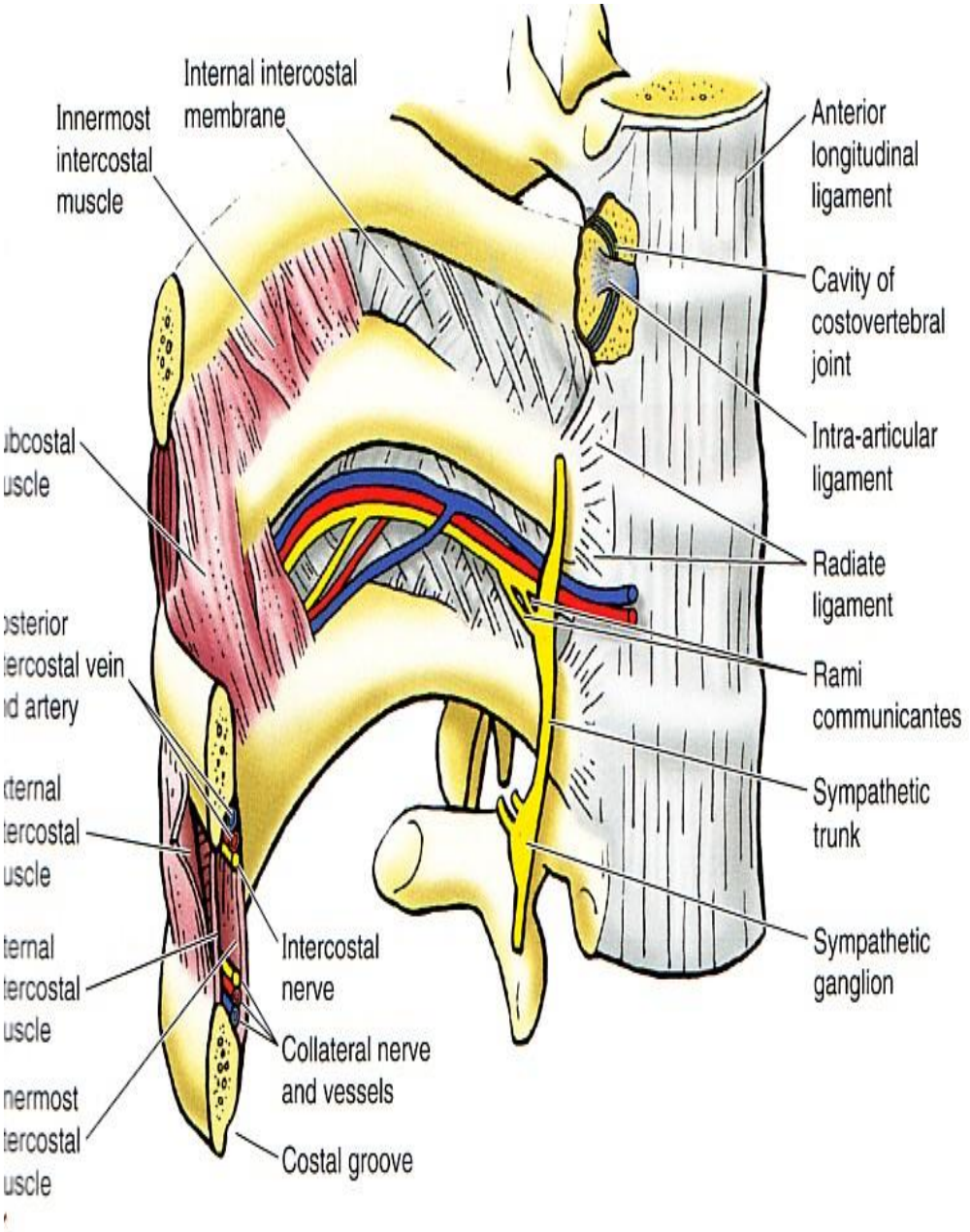
Posterior Intercostal veins

- One in each of the 11 spaces.
- **On the right:**
- 1st drains into Rt. Innominate v.
- 2nd,3rd & sometimes the 4th unite to form Rt. Superior Intercostal vein (B) which drains into **azygos vein**.
- From 5th to 11th & subcostal veins drain into **azygos vein ©.**
- **On the Left:**
- 1st drains into Lt. innominate V.
- 2nd,3rd& sometimes the 4th join to form Lt. Superior Intercostal vein which drains into Lt innominate vein.
- 5th,6th,7th, & 8th form ***superior hemiazygos vein*** to **azygos vein**
- 9th,10th.11th &Subcostal form ***inferior hemiazygos vein*** to **azygos vein.**



Intercostal Nerves

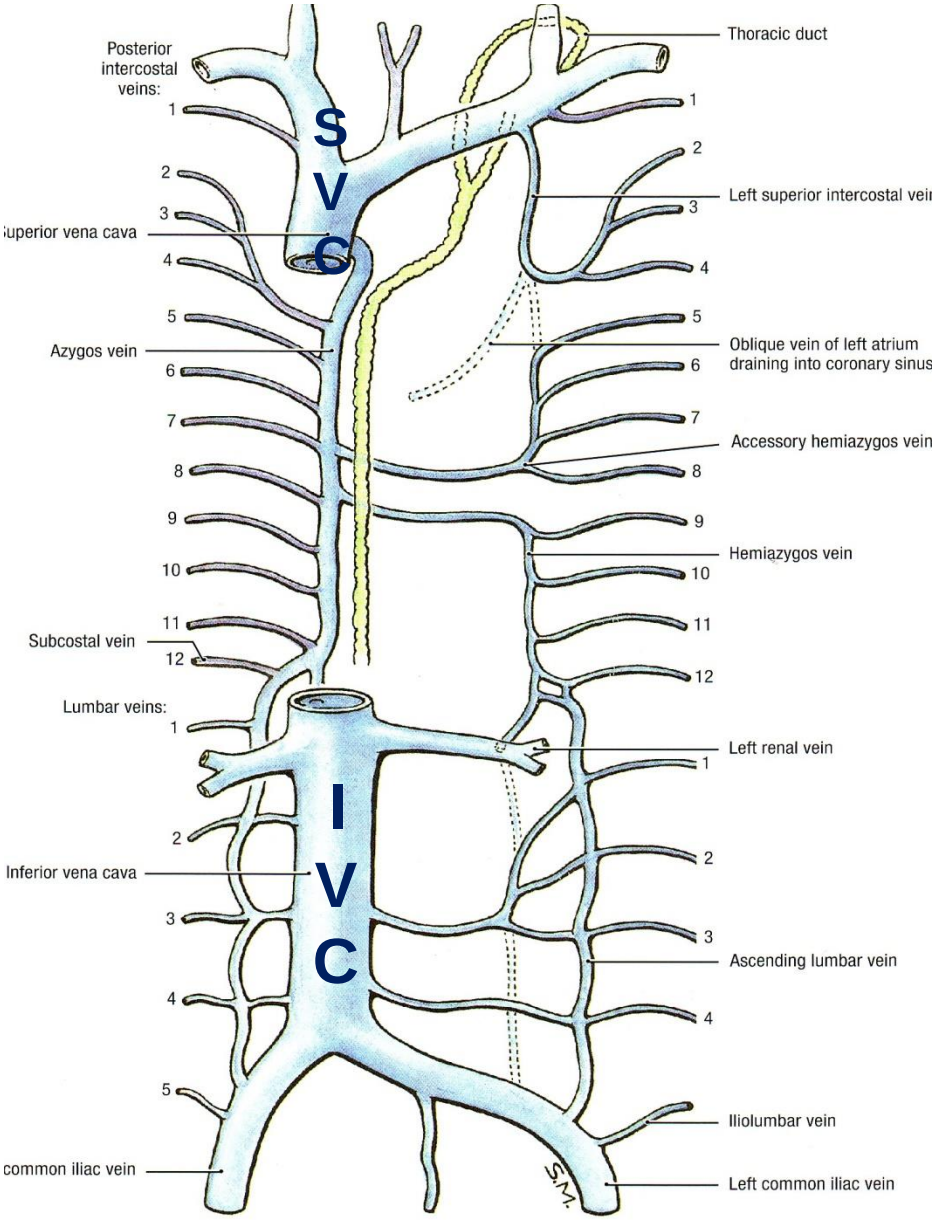
- They are the anterior primary rami of spinal thoracic nerves fromT1 to T11
- T3 toT6 are Typical
- T12 is called Subcostal
- The remaining nerves are called atypical (non-typical)
- Each nerve runs in the Intercostal space inferior to the Intercostal vessels

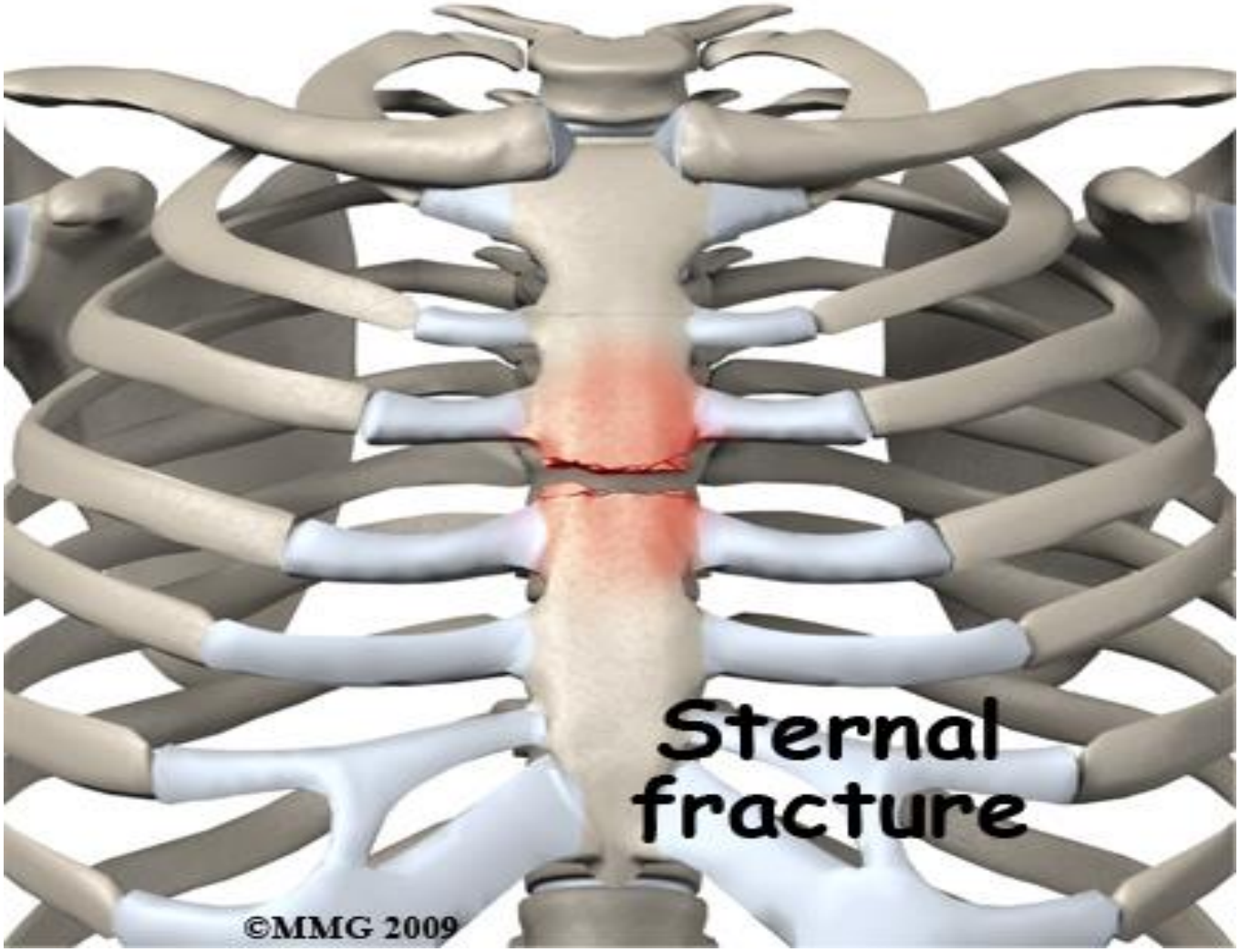


Azygos Vein

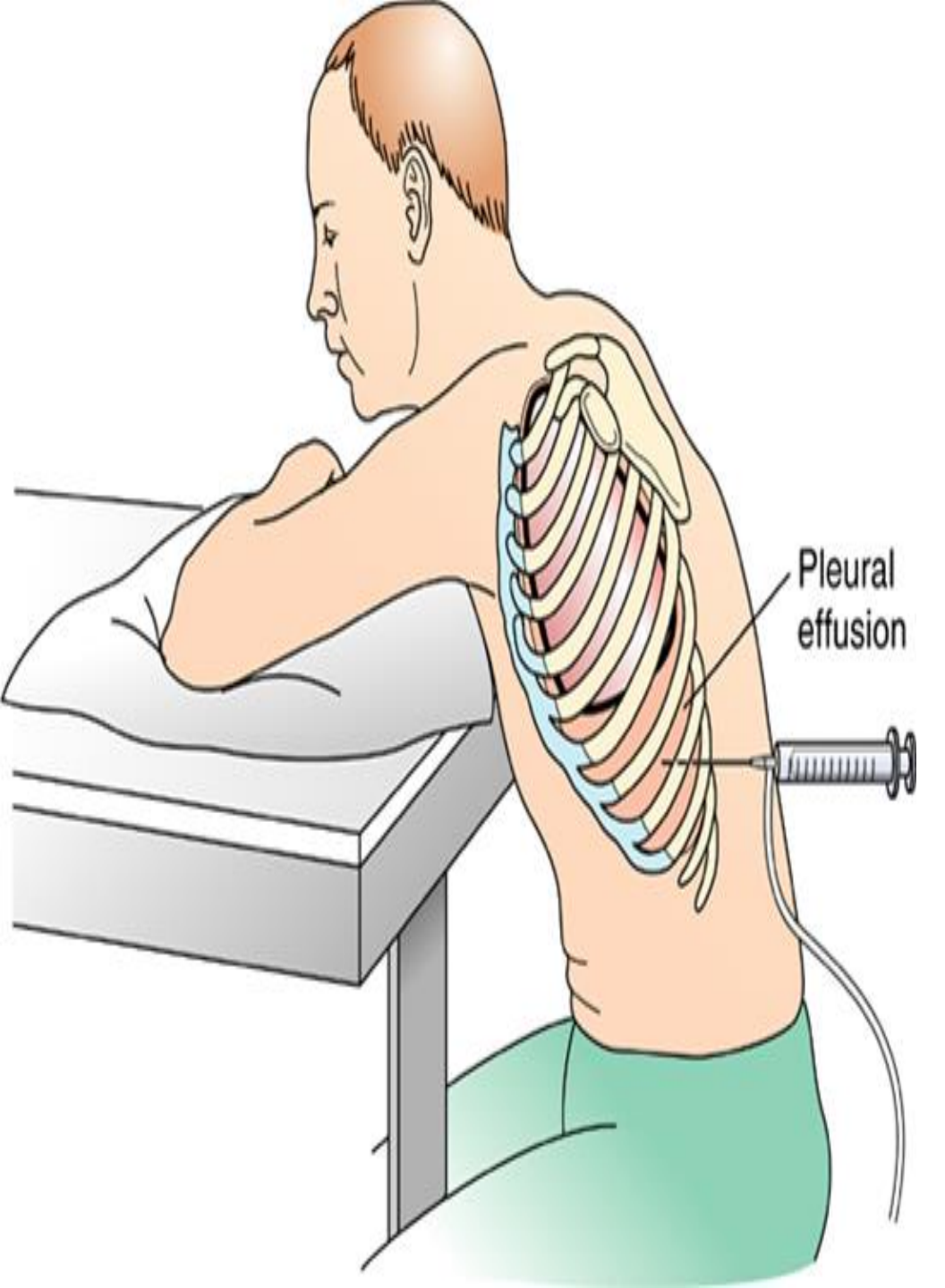
- Connects IVC with SVC
- Begins in abdomen from back of IVC at level of L2
- Enters thorax through Aortic opening of diaphragm on Rt. side of thoracic duct & aorta.
- In post. Mediastinum it passes behind Rt. Border of esophagus & root of rt. Lung
- In sup. Mediastinum (L4) it crosses above the root of rt. lung

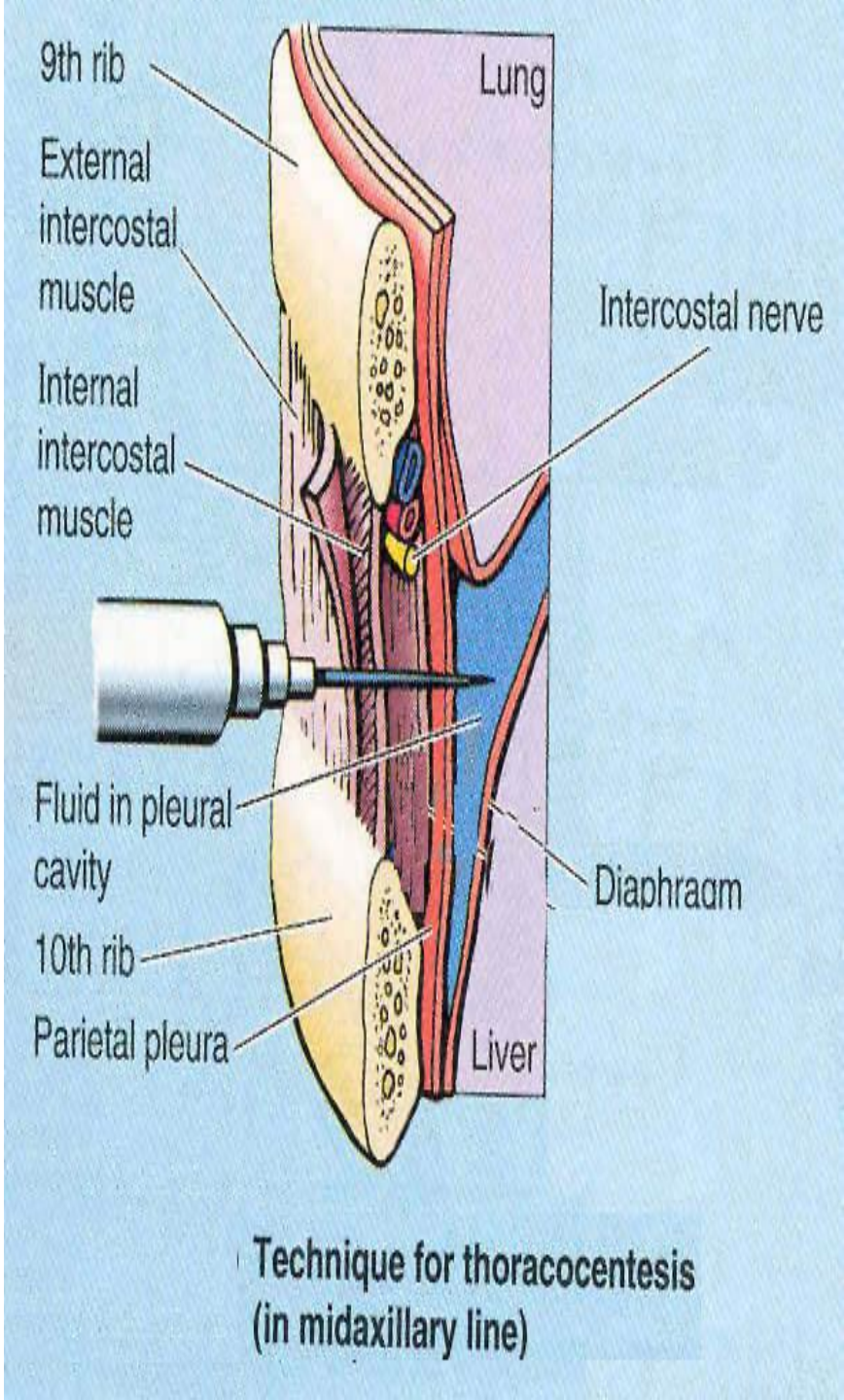
Enters the middle of the back of the SVC.



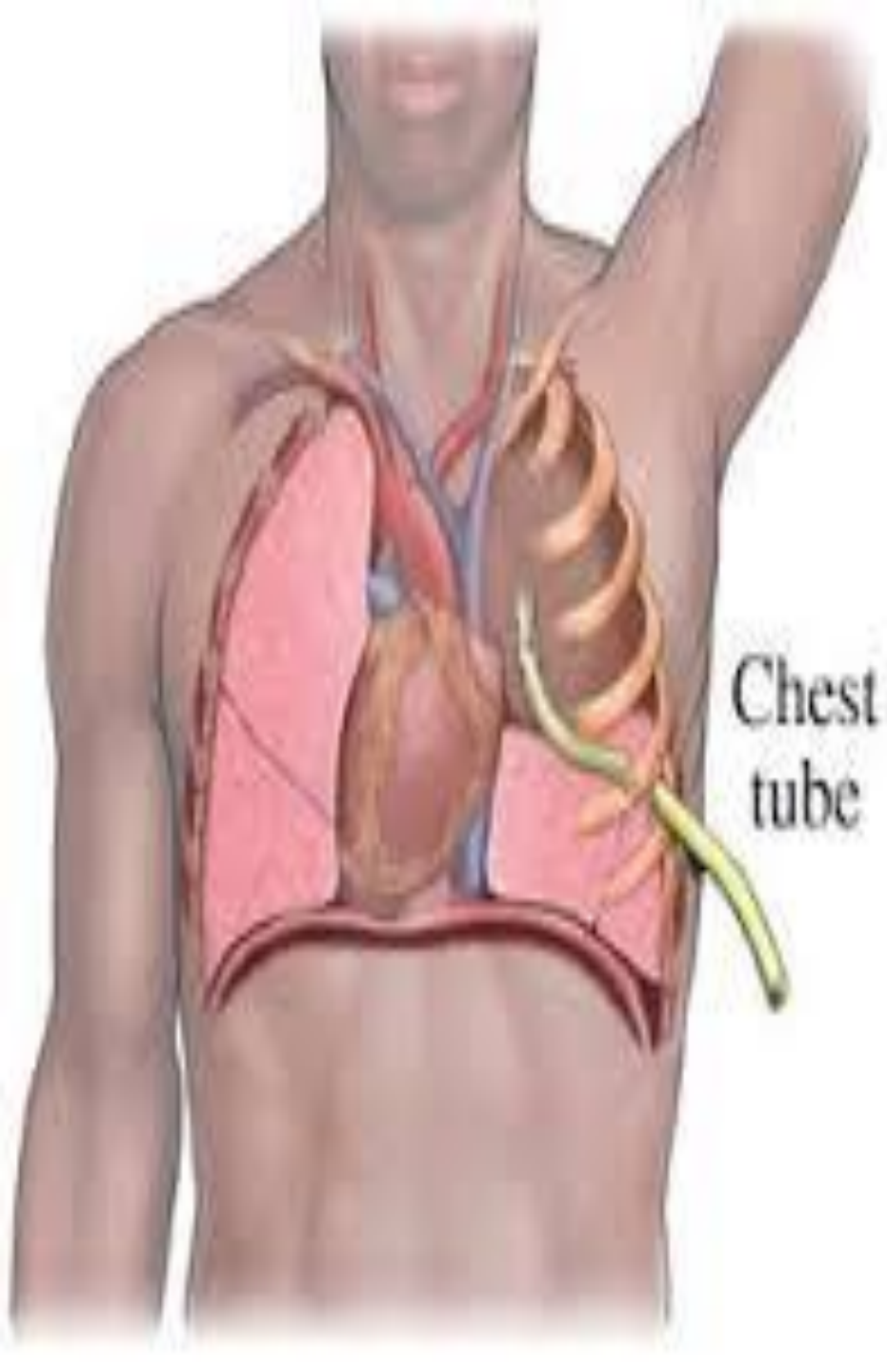

Sternal
fracture
©MMG 2009

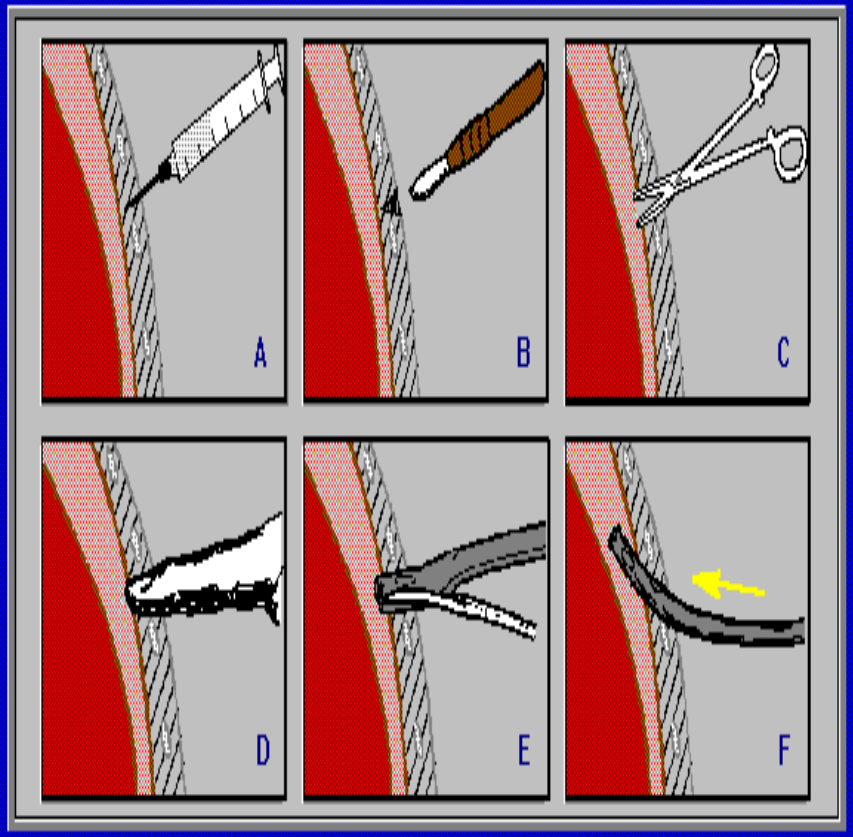

GHT





Technique for thoracocentesis (in midaxillary line)





CHEST TUBE INSERTION PROCEDURE

The distal end of the chest tube is clamped and, using the clamp as a guide, inserted into the incisional site (E above). At this time, the patient should be encouraged to take a deep breath; this will displace the diaphragm downward, minimizing the risk of its injury. The clamp is removed and the tube is then advanced into the pleural space and directed anteriorly or posteriorly depending on the material being drained (F above).

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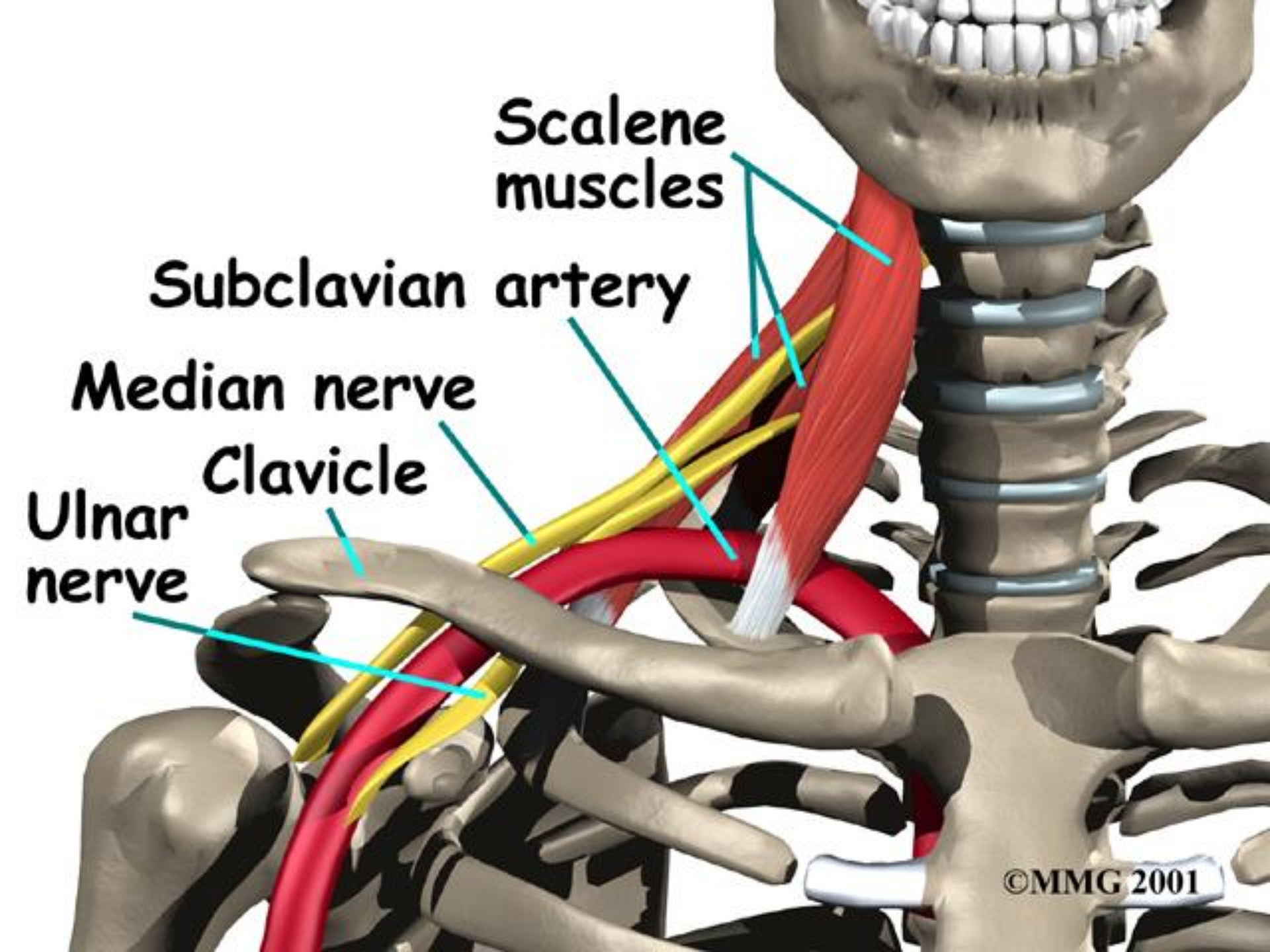
Scalene muscles
Subclavian artery
Median nerve
Clavicle
Ulnar nerve
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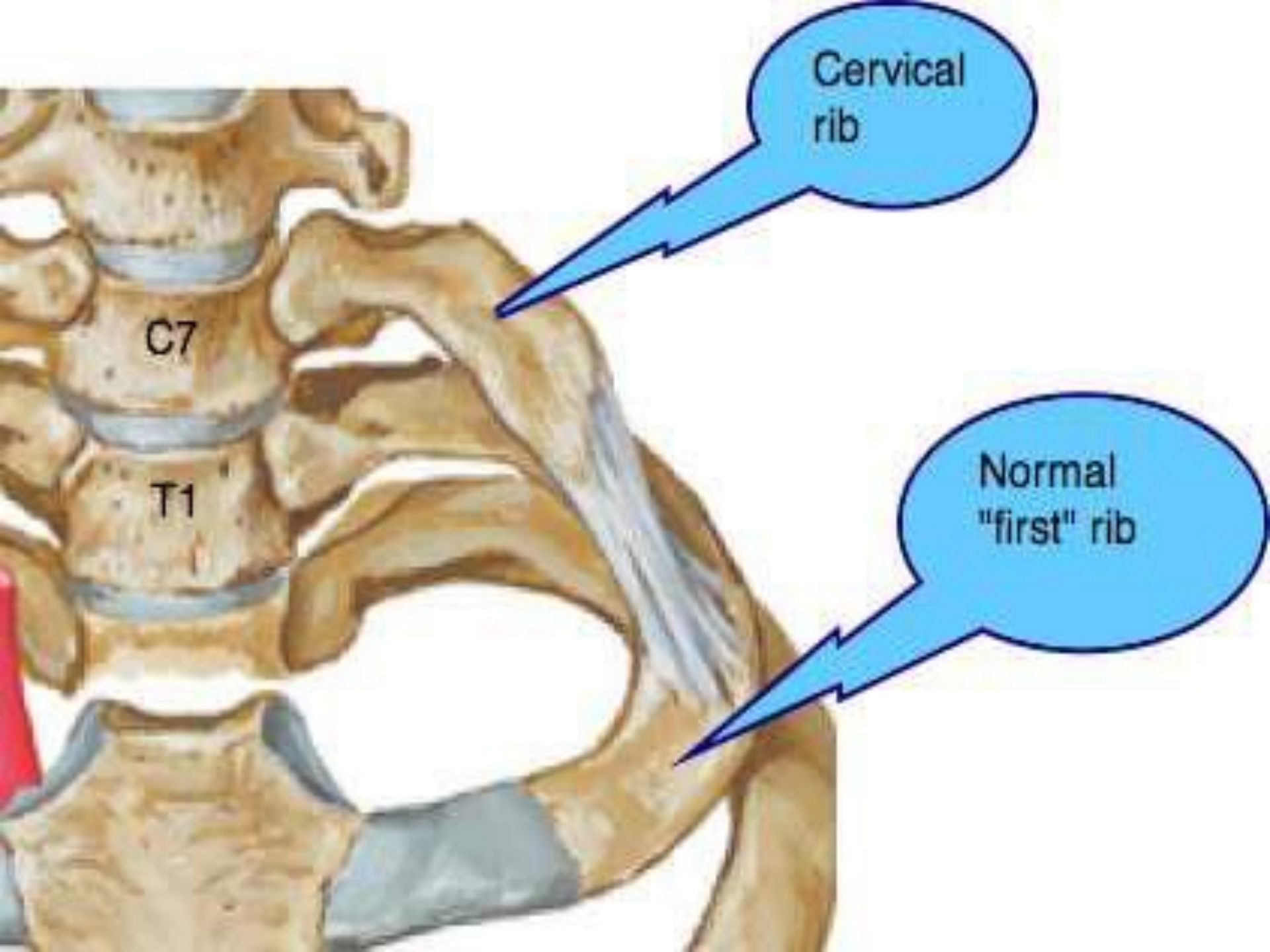
Cervical rib
C7
T1
Normal "first" rib

Thank You