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SUPERIOR VENA CAVA

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I – INTRODUCTION:

The superior vena cava is a large vein, formed by the union of the right and left brachiocephalic veins.

It returns venous blood from the supradiaphragmatic regions of the body to the right atrium.

II – DESCRIPTIVE ANATOMY:

1. Situation:

The superior vena cava is located in the anterior and superior mediastinum.

2. Origin :

It arises from the junction of the right and left brachiocephalic venous trunks.

The point of junction is located:

- Anterior to the brachiocephalic arterial trunk,
- Posterior to the first chondro-costal joint,
- At the level of T3.

III- BRANCHES OF ORIGIN:

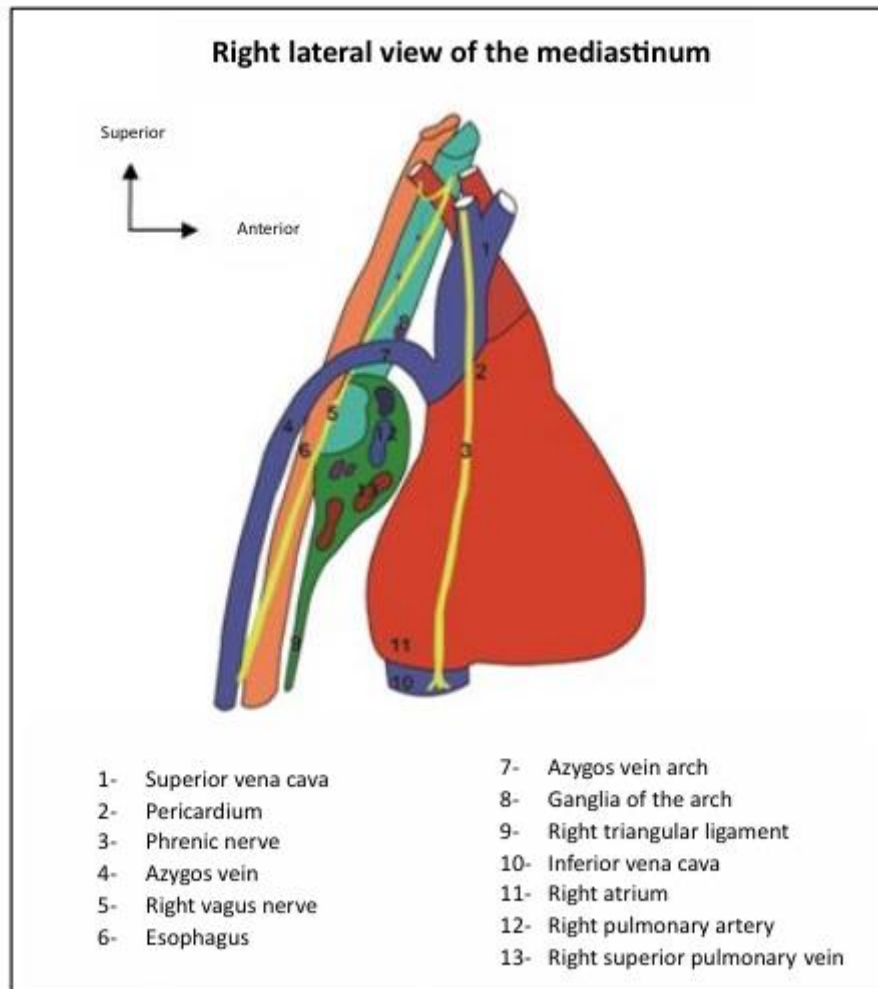
1. Right brachiocephalic vein :

❖ Origin – path – termination :

It arises from the right internal jugular vein and the right subclavian vein, at the level of the medial end of the right clavicle.

It then runs almost vertically downward and to the left, while remaining on the right side of the midline.

It terminates opposite the first right sternocostal joint.



❖ Relations :

Accompanied by a lymphatic chain (right anterior mediastinal), it is positioned as follows:

- **Anteriorly :** to the sternal end of the clavicle and the sternal part of the first costal cartilage.
- **Posteriorly :**
 - to the right brachiocephalic arterial trunk,
 - to the right vagus nerve,
 - and to the internal thoracic artery at its origin.
- **To the right:**
 - to the pleura and right lung,
 - to the right phrenic nerve,

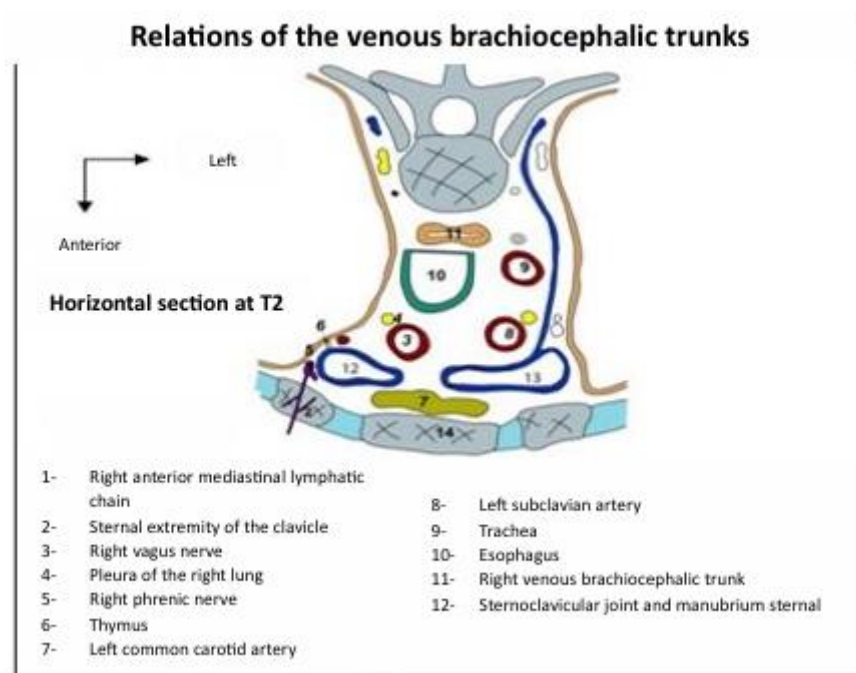
- **To the left and toward the midline:** to the trachea.

2. Left brachiocephalic vein :

❖ **Origin – course – termination :**

- It arises from the union of the left internal jugular vein and the left subclavian vein.
- It originates opposite the medial end of the left clavicle and measures 6 cm in length.
- It follows a horizontal course, directed downwards and to the right, then crosses the midline to join its right counterpart opposite the first sternocostal joint.

❖ **Relations :**



Accompanied by the transverse anterior mediastinal lymphatic chain, it is in relation to:

- **Anteriorly :**
 - The thymus or its remnants,
 - The left sternoclavicular joint and the manubrium of the sternum.
- **Posteriorly :**
 - The brachiocephalic trunk,
 - The left common carotid artery,

- The left subclavian artery,
 - The left phrenic nerve,
 - The left vagus nerve,
 - The left internal thoracic artery.
- **Inferiorly** : The second segment of the aorta.

III – SUPERIOR VENA CAVA:

1. Extra-pericardial or supra-pericardial relations :

- It follows an oblique course downwards and backwards, curving around the ascending part of the aortic arch.
- It ends at the superior wall of the right atrium, opposite the third costal cartilage and T6.

2. Dimensions

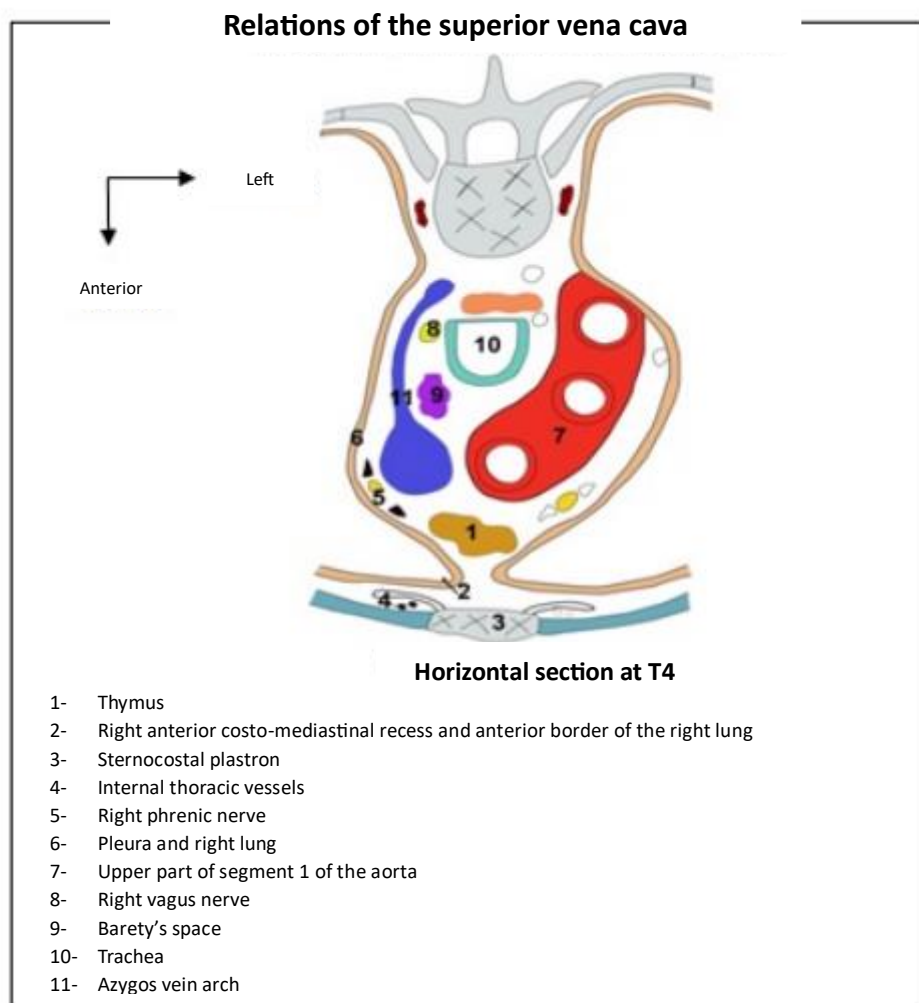
- **Length**: 6 to 8 cm.
- **Width**: Between 20 and 25 mm.

3. Anatomical relations :

❖ Extra-pericardial relations :

- **Anteriorly** :
 - The right anterior mediastinal lymphatic chain,
 - The thymus or its remnants,
 - The anterior border of the right lung,
 - The sterno-costal junction, behind which the internal thoracic vessels are applied.
- **Posteriorly, from top to bottom**:
 - The right vagus nerve,

- The arch of the azygos vein,
 - The right phrenic nerve.
- **To the right:** The pleura and the right lung,
- **To the left:** The ascending part of segment 1 of the aorta.
- **Superiorly :** The right subclavian vein and artery.



❖ **Intra-pericardial relations:**

- It is shorter (2.5 to 3 cm) and deeper. The pericardium is traversed by the superior vena cava.
- The pericardium forms an asymmetrical sheath, rising higher on the left side of the vein.

❖ **In the pericardial sac :**

Inside the pericardial sac, the superior vena cava is in relation to:

- **Anteriorly:** the right atrium.
- **On the left:** the aorta.
- **Posteriorly :** the right superior pulmonary vein and the right pulmonary artery.

❖ **Outside the pericardial sac :**

The superior vena cava is in relation to:

- **Anteriorly:** to the sternal extremity of the 2nd intercostal space, at the upper border of the 3rd costal cartilage.
- **Posteriorly:**
 - The right pulmonary artery.
 - And the right superior pulmonary vein.
- **On the right:**
 - The pleura and the right lung.
 - The right phrenic nerve.

IV – COLLATERAL BRANCHES:

The main collateral of the superior vena cava is the azygos vein, or the great azygos vein.

1. Azygos vein:

❖ Origin :

The great azygos vein originates in the infra-mediastinal posterior space at the level of T11, from the junction of its two roots:

- **The internal root:** Inconstant.
- **The external root:** Constant, it is formed by the fusion of the right ascending lumbar vein and the twelfth intercostal vein.

❖ Trajectory :

- It ascends vertically in the posterior mediastinum, to the right of the midline.
- At the level of the 2nd intercostal space, it curves forward, forming the arc of the azygos vein. It then enters the thorax and follows the right lateral faces of the vertebral bodies.

❖ Termination :

It terminates at the lower part of the posterior face of the superior vena cava, at the level of the 4th thoracic vertebra.

V– COLLATERAL PATHWAYS:

In case of obstruction of the superior vena cava venous system, three anastomotic systems develop depending on the level of interruption:

1. Anastomoses between the brachiocephalic trunks and the azygos system:

In case of obstruction between the confluence of the brachiocephalic trunks and the junction of the azygos vein, the collateral pathways are:

- Internal mammary veins,

- External mammary veins,
- Superior right and left intercostal veins.

2. Anastomoses between the superior vena cava and the inferior vena cava:

In case of obstruction at or below the junction of the great azygos vein.

3. Transversal anastomoses:

In case of interruption at the junction of the brachiocephalic trunks.

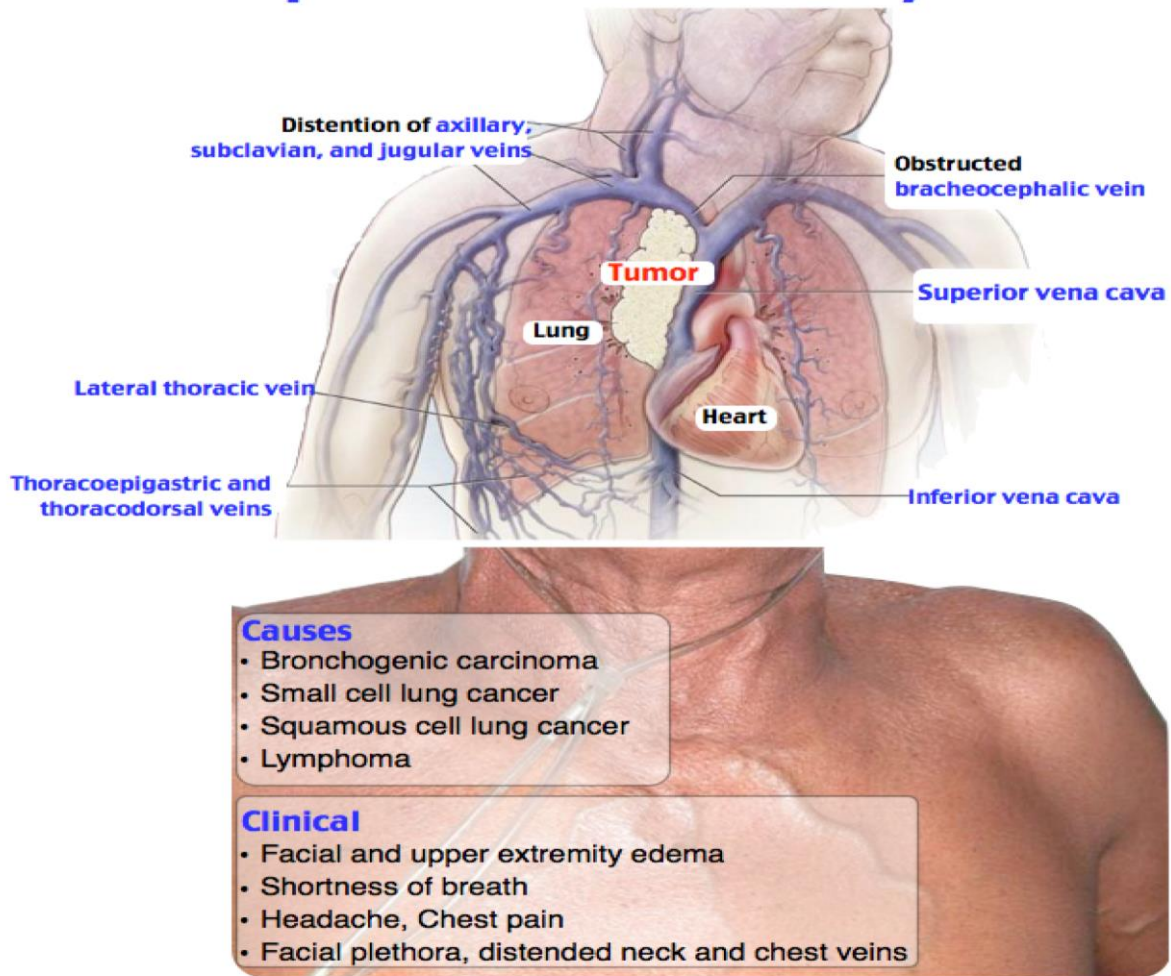
VI– CLINICAL APPLICATIONS:

❖ **Superior vena cava syndrome :**

It is the obstruction of the SVC caused by thrombosis or extrinsic compression, leading to venous hypertension in the supradiaphragmatic part of the body. It involves:

- Vertigo ;
- Visual disturbances ;
- Eyelid edema ;
- Swelling of the supraclavicular fossae ;
- Facial cyanosis ;
- Edema of the jugular veins.

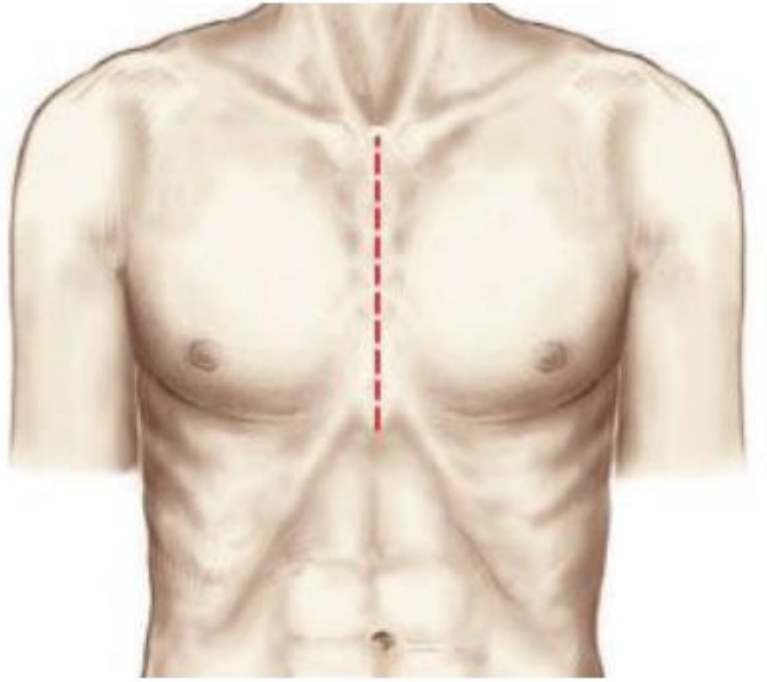
Superior Vena Cava Syndrome



VII– SURGICAL APPROACH ROUTES:

❖ Total vertical median sternotomy:

- The incision is median and vertical, from the sternal notch to beyond the xiphoid process.
- Access to the entire superior vena cava, both intra- and extrapéricardially, requires opening the pericardium along an axis from the diaphragm to its aortic reflection line.



❖ **Right thoracotomy:**

The thoracotomy is right postero-lateral with the section of the latissimus dorsi muscle. The incision is made in the fourth intercostal space, which provides the best exposure of the superior vena cava.

VIII– CONCLUSION:

- The superior vena cava is a large vein that returns venous blood from the supradiaphragmatic regions of the body.
- It is located in the upper part of the anterior mediastinum and is formed by the union of the right and left brachiocephalic veins at the level of T3.
- It terminates at the superior wall of the right atrium, with its main collateral being the azygos vein.
- In case of obstruction of the venous return system, collateral pathways develop depending on the level of interruption.