SUPERIOR MEDIASTINUM / NERVES AND ARTERIES OF MEDIASTINUM

Thymus: Anterior most structure in posterior mediastinum. Atrophied in adults but prominent in children.

Ligamentum Arteriosum: Connective tissue connecting the Aorta to the Pulmonary Trunk, helping to hold both structures in place. Left side of heart, superior to the Pulmonary Trunk.

- Developmentally, it is the former Ductus Arteriosus (Left 6th Aortic Arch) in the embryonic heart.

The Great Veins: Anterior to the great arteries, in the superior mediastinum.

- **Superior Vena Cava**: Formed by the combining of the right brachiocephalic vein and left brachiocephalic vein.
  - Combination of Right and Left Brachiocephalic Vein occurs at the articulation of the 1st rib.

- **Right Brachiocephalic Vein**: Right branch of Superior Vena Cava.
  - **Right Internal Jugular Vein**: Converges on the Right Brachiocephalic Vein.
  - **Right Subclavian Vein**: Converges on the Right Brachiocephalic Vein, and runs anterior to the Subclavian Artery.

- **Left Brachiocephalic Vein**: Left branch of Superior Vena Cava.
  - **Left Internal Jugular Vein**: Converges into the Left Brachiocephalic just lateral to the Common Carotid Artery.
  - **Left Subclavian Vein**: Converges into the Left Brachiocephalic Vein and runs anterior to the Subclavian Artery.

The Great Arteries: Posterior to the great veins.

- **Aorta**: Ascending Aorta curves posteriorly and a bit to the left. It has three branches:
  - **Brachiocephalic Trunk**: Right-most branch off of the Aortic Arch.
    - **Right Subclavian Artery**: Branches off the brachiocephalic trunk.
      - **Left Common Carotid Artery**: The center of the three branches off the Aortic Arch.
      - **Left Subclavian Artery**: The left-most branch off the Aortic Arch.

Internal Thoracic Arteries: Continue off of each of the Subclavian Arteries. They move down the Thorax into the abdomen, lateral to the Sternum.

Phrenic Nerves: Both originate from C3, C4, C5. Both Phrenic Nerves are more lateral than the Vagus nerves.

- **Right Phrenic Nerve**:
  - Runs laterally along the Right Internal Jugular Vein.
  - Continues lateral to the Superior Vena Cava.
  - Then rungs along the Fibrous Pericardium.
  - Finally into the diaphragm.

- **Left Phrenic Nerve**:
  - Rungs laterally along the Left Internal Jugular Vein.
  - Anterior to the Arch of the Aorta
  - Then along the Fibrous Pericardium
  - Into the diaphragm.

Both Phrenic Nerves:
  - They run anterior to the roots of the lungs

Vagus Nerves: Both Vagus Nerves are more medial than the Phrenic Nerves.
• **Left Vagus Nerve:**
  o Runs lateral to the Aortic Arch.
  o Gives off a branch for the Left Recurrent Pharyngeal Nerve.
  o Runs anterior to the subclavian, then posterior to vena cava and brachiocephalic veins.
  o Continues medially and runs toward the diaphragm lateral to the Esophagus. In the thorax, it tends to go to the anterior portion of the esophagus.

• **Right Vagus Nerve:**
  o Runs lateral to the Right Common Carotid Artery (medial to Phrenic Nerve).
  o Gives off a branch for the Right Recurrent Laryngeal Nerve.
  o In the thorax, it tends to go to the posterior part of the esophagus.

• Both Vagus Nerves:
  o Run posterior to the roots of the lungs.
  o Both give off branches for the **Pulmonary Plexus, Cardiac Plexus, and Eosphageal Plexus.**
    - Right and left fibers mix to form the eosphageal plexus.

Recurrence Laryngeal Nerves: Both branch off the Vagus nerves and go back superiorly toward the larynx.

• **Left Recurrent Laryngeal Nerve:** Off of the Left Vagus.
  o Runs back up, lateral to the Trachea, into the Larynx.
  o Is different in position than the Right Laryngeal, due to the degeneration of the right 6th Aortic Arch (see below).

• **Right Recurrent Laryngeal Nerve:** Off of the right vagus.
  o Passes back up posterior to the Right Subclavian.
  o Runs back up, lateral to the Trachea, to the Larynx.

• **CLINICAL:** Carcinoma of the Lungs can affect the Recurrent Pharyngeals, causing a hoarse voice. They must be watched in surgery.

**Pericardiacophrenic Artery** and **Vein:** Run on either side of the Phrenic nerve all along its path in the Thorax.

**Cardiac Plexus:** Grouping of Vagal nerves innervating the heart.

**Pulmonary Plexus:** Grouping of Vagal nerves innervating the lungs.

**Aortic Arches:** The development of the Aortic Arches effected the positioning of the Right and Left Recurrent Laryngeal nerves. They are not symmetric with respect to each other.

- There are six Aortic Arches. The 1st, 2nd, and 5th degenerate, while the 3rd, 4th, and 6th remain behind.
- Initially the right and left laryngeal nerves pass inferior to the 6th Aortic arch, on both sides.
- Right 6th Aortic Arch degenerates! Consequently, the right 6th Laryngeal Nerve catches onto the 4th arch on the right side, which subsequently becomes the Right Subclavian Artery.
- The Left 6th Aortic Arch sticks around in the embryonic heart, as the **Ductus Arteriosus,** a failsafe shunt in case the foramen ovale passage fails.
  - After birth the Ductus Arteriosus becomes the Ligamentum Arteriosum.

**Bifurcation of the Trachea:**

- **Carina:** The cartilage that sticks out at the bifurcation.
- **Right Bronchus:** Fatter and shorter than the left bronchus. It branches off at a straighter angle, so things tend to lodge in the right Bronchus as opposed to the left.
- **Left Bronchus:** Branches off at a sharper angle than the right bronchus.

**Esophagus:** Displaced to the right in the Thoracic Cavity. It returns to the left after it crosses the diaphragm and goes into the abdomen.

• **Eosphageal Plexus:** Formed of Vagus nerve, innervates the esophagus.
  o When the plexus enters the abdomen, it coalesces back into two Vagus Nerves.
Thoracic Duct: The largest lymph vessel in the body.

- To the right of the Thoracic Vertebrae, posterior to the esophagus.
- It empties into Left Brachiocephalic and Internal Jugular veins.
- This duct drains the lower half of the body and the left side of the upper body.
- **Right Subclavian Lymphatic Duct** empties the right half of the upper body.

Azygos Vein: Posterior to Esophagus, to the right of the Thoracic Duct.

- It is an alternate route for the return of venous blood to the heart, rather than through the inferior vena cava.
- Intercostal veins empty into the azygos system, from both left and right (via Hemiazygous system) sides.
- Azygos vein connects to the inferior vena cava at the level of the kidneys.

Hemiazygos Vein System: Posterior to the descending Aorta on the left side of the vertebral column.

- It drains the left intercostal veins.
- It drains into the Azygos Vein.

Sympathetic Chain Ganglia: Lateral to the spinal column, from Cervical to Sacral.

- **Intercostal Nerves**: Come off of the Sympathetic Chain Ganglia in the thorax.
- **Splanchnic Nerves**:
  - Greater Splanchnic Nerve: Comes off of the sympathetic chain at T5 to T9.
  - Lesser Splanchnic Nerve: Comes off of the sympathetic chain at T10 and T11.
  - Least Splanchnic Nerve: Comes off of the sympathetic chain at T12.
- **Autonomic Nervous System**: Location of cell bodies
  - Sympathetic Nerves: The cell body is close to the spinal column. The synapse between pre-ganglionic and post-ganglionic nerves occurs in the Chain Ganglia near the spinal chord.
  - Parasympathetic Nerves: The cell body is close to the target organ. The synapse occurs near the target organ, with short axons innervating the target.
- **Rami Communicans**: The junctions where the pre-ganglionic nerves synapse with the post-ganglionic nerves, in the sympathetic chain ganglia.