MEDICAL EDUCATION RESOURCE

Mediastinum A-Z

Mediastinum — Introduction

Definition

The **mediastinum** is the **central compartment of the thoracic cavity**, situated between the **two pleural sacs**. It acts as a partition separating the **right and left pleural cavities** and contains nearly all thoracic organs except the lungs and pleurae.

Boundaries

- **Superiorly:** Thoracic inlet (plane of 1st rib and manubrium).
- **Inferiorly:** Diaphragm.
- **Anteriorly:** Sternum.
- **Posteriorly:** Bodies of thoracic vertebrae (T1–T12).
- **Laterally:** Mediastinal pleura of both lungs.

Divisions

The mediastinum is divided into **superior and inferior parts** by an imaginary plane passing from the **sternal angle (Angle of Louis)** to the **lower border of T4 vertebra** (the **transverse thoracic plane**).

1. **Superior Mediastinum** — above this plane.

2. **Inferior Mediastinum** — below this plane, further divided into:
    - **Anterior mediastinum** (in front of pericardium)
    - **Middle mediastinum** (containing heart and pericardium)
    - **Posterior mediastinum** (behind pericardium)

(You requested not to go into details of each mediastinum, so substructures are omitted.)

Contents (Overview)

The mediastinum contains:

- **Heart and great vessels**
- **Trachea and primary bronchi**
- **Oesophagus**
- **Thymus**
- **Thoracic duct**
- **Lymph nodes and nerves** (vagus, phrenic, sympathetic trunks)

Dissection Notes (Summary)

During dissection:

- The mediastinum is approached by removing the **sternum (median sternotomy)**.
- The **pericardium** enclosing the heart is exposed centrally.

- The **great vessels**, **trachea**, and **oesophagus** are identified in relation to it.
- The **phrenic nerves** lie on each side of the pericardium, while **vagus nerves** pass posteriorly.
- The **thoracic duct** runs upward in the posterior mediastinum, between the aorta and azygos vein.

Clinical Importance (Overview)

- **Mediastinitis:** infection following oesophageal rupture or surgery.
- **Mediastinal masses:** may compress trachea, superior vena cava, or heart.
- **Mediastinal shift:** occurs due to pleural effusion, pneumothorax, or lung collapse.
- **Mediastinoscopy:** used for biopsy and diagnostic visualization of mediastinal structures.

Superior Mediastinum

Boundaries

- **Anteriorly:** Manubrium sterni.
- **Posteriorly:** Upper four thoracic vertebrae (T1–T4).
- **Superiorly:** Thoracic inlet (plane of 1st rib).
- **Inferiorly:** Transverse thoracic plane — from the sternal angle to the lower border of T4 vertebra.

- **Laterally:** Mediastinal pleura of the right and left lungs.

Contents (Listed from Anterior to Posterior)

1. Thymus (or its remnants in adults)

- Lies just behind the manubrium.
- Large and active in children; undergoes fatty degeneration in adults.
- Supplied by internal thoracic and inferior thyroid arteries.

---

2. Large Veins

- **Brachiocephalic veins (right and left):** formed by union of internal jugular and subclavian veins behind sternoclavicular joints.
- **Superior vena cava (SVC):** formed by union of brachiocephalic veins and descends vertically to enter the right atrium.
- **Left superior intercostal vein:** drains upper intercostal spaces into left brachiocephalic vein.

---

3. Large Arteries

- **Arch of the aorta** and its **three branches**:
    - **Brachiocephalic trunk** ? divides into right common carotid and right subclavian arteries.
    - **Left common carotid artery.**

    - **Left subclavian artery.**

- Arch gives rise to **aortic knuckle** on chest X-ray.
- Ligamentum arteriosum connects arch to pulmonary trunk — remnant of fetal ductus arteriosus.

---

4. Nerves

- **Vagus nerves (right and left):**
    - Right ? passes behind root of right lung.
    - Left ? gives off **left recurrent laryngeal nerve** that hooks under aortic arch.
- **Phrenic nerves:** descend anterior to root of lungs, supplying diaphragm.
- **Cardiac nerves:** from cervical sympathetic chain and vagus; form cardiac plexuses.

---

5. Trachea and Esophagus

- **Trachea:** lies anterior to esophagus, begins at lower border of cricoid cartilage (C6) and ends at sternal angle (T4) where it bifurcates.
- **Esophagus:** flattened muscular tube, posterior to trachea, entering thorax behind the aortic arch.

---

6. Thoracic Duct

- Lies on the **left side** of esophagus, between aorta and azygos vein.

- Crosses to the left at T5 and opens into the **junction of the left subclavian and internal jugular veins**.

Relations (Simplified)

From **anterior to posterior**, remember the mnemonic:
“Thymus – Veins – Arteries – Trachea – Esophagus – Duct – Spine”

Clinical Anatomy

- **Mediastinal widening** on chest X-ray may indicate aortic aneurysm, lymphadenopathy, or mediastinal tumors.
- **Compression of trachea or SVC** by enlarged thymus, aortic aneurysm, or malignancy causes **dyspnea and venous congestion**.
- **Aortic aneurysm** may cause **hoarseness of voice** by pressing on the **left recurrent laryngeal nerve**.
- **Thymoma** (tumor of thymus) is associated with **myasthenia gravis**.

The **superior mediastinum** is thus the **highway of the thorax**, through which nearly every major **vascular, nervous, and aerodigestive structure** passes before continuing to the neck, lungs, or abdomen.

Inferior Mediastinum

Definition

The **inferior mediastinum** is the portion of the mediastinum **below the transverse thoracic plane** (from the sternal angle to the lower border of T4 vertebra) and **above the diaphragm**.

It is divided into **three parts** — anterior, middle, and posterior — depending on their relation to the **pericardium**.

Boundaries (Overall)

- **Superior:** Transverse thoracic plane.
- **Inferior:** Diaphragm.
- **Anterior:** Sternum and costal cartilages.
- **Posterior:** Bodies of T5–T12 vertebrae.
- **Lateral:** Mediastinal pleura of lungs.

---

1. Anterior Mediastinum

(Lies between the sternum and the pericardium)

Contents:

- Loose areolar connective tissue and fat.
- Remnants of **thymus** (in adults).
- **Lymph nodes** and small branches of **internal thoracic vessels**.
- **Sternopericardial ligaments** attaching pericardium to sternum.

Clinical Note:

- Site for **retrosternal goitre** or **thymic cysts/tumors**.
- Can be approached surgically through a **sternal incision**.

2. Middle Mediastinum

(Lies between the anterior and posterior mediastina — essentially occupied by the pericardium and its contents.)

Contents:

- **Pericardium** and **heart**.
- **Ascending aorta**, **pulmonary trunk**, and **SVC**.
- **Main bronchi** and **pulmonary vessels** at the roots of the lungs.
- **Phrenic nerves** with **pericardiacophrenic vessels** running anterior to the root of each lung.
- **Lymph nodes** (tracheobronchial and cardiac).

Clinical Note:

- **Pericardial effusion** (fluid accumulation) may compress the heart, causing **cardiac tamponade**.
- **Pericardiocentesis** is done through the left 5th intercostal space near sternum.

---

3. Posterior Mediastinum

(Lies behind the pericardium and in front of the vertebral column.)

Contents:

- **Descending thoracic aorta** and its branches (posterior intercostal, esophageal, bronchial arteries).

- **Azygos vein** (on right) and **hemiazygos/accessory hemiazygos veins** (on left).
- **Thoracic duct** — lies between aorta and azygos vein.
- **Esophagus** and **esophageal nerve plexus** (from vagus).
- **Sympathetic trunks** and **splanchnic nerves** (greater, lesser, least).

Clinical Note:

- Common site for **aortic aneurysm**, **esophageal carcinoma**, or **lymph node enlargement**.
- **Posterior mediastinal tumors** may compress the esophagus or spinal nerves.

Mnemonic for Inferior Mediastinal Contents

A-M-P:

- **A** ? Anterior: Areolar tissue, remnants of thymus.
- **M** ? Middle: Heart and pericardium.
- **P** ? Posterior: Pipes (aorta, esophagus, thoracic duct) and nerves (vagus, splanchnic, sympathetic).

Radiological and Surgical Importance

- The **middle mediastinum** forms the **cardiac silhouette** on chest X-ray.
- Knowledge of mediastinal subdivisions is essential for **locating masses or lymph nodes** in radiological imaging (CT, MRI).

- **Mediastinal shift** toward one side indicates **lung collapse**; shift away suggests **pleural effusion or pneumothorax**.

The **inferior mediastinum** thus acts as a **corridor of circulation and innervation**, housing the **heart, major vessels, esophagus, and autonomic pathways** that link the thoracic and abdominal cavities.

Anterior Mediastinum

Position and Boundaries

The **anterior mediastinum** is the **smallest subdivision** of the inferior mediastinum.
It lies **in front of the pericardium** and **behind the sternum**.

- **Anteriorly:** Body of sternum and left costal cartilages (4th–7th).
- **Posteriorly:** Fibrous pericardium.
- **Superiorly:** Continuous with superior mediastinum at the level of the sternal angle.
- **Inferiorly:** Diaphragm.
- **Laterally:** Mediastinal pleura of both lungs.

Contents

The space contains **mainly connective and lymphatic structures**, along with remnants of embryonic tissues.

- **Loose areolar connective tissue and fat**

- **Remnants of thymus** (more prominent in children, replaced by fat in adults)
- **Lymph nodes and small lymph vessels** (draining anterior part of pericardium and diaphragm)
- **Small branches of internal thoracic arteries and veins**
- **Sternopericardial ligaments**, which anchor the fibrous pericardium to the posterior surface of the sternum

---

Relations

- **Anteriorly:** Sternum and anterior thoracic wall.
- **Posteriorly:** Pericardium enclosing the heart.
- **Superiorly:** Continuous with superior mediastinum.
- **Inferiorly:** In contact with upper surface of diaphragm.

Developmental Note

- The **thymus** originates from the **third pharyngeal pouch** and descends into the anterior mediastinum.
- It is large in childhood, aiding in immune function, and later **involutes into fatty tissue** in adulthood.

Clinical Anatomy

- **Thymic enlargement** (thymoma) may cause **pressure symptoms** on the trachea or great veins.

- **Retrosternal goitre** or **anterior mediastinal tumors** may project into this space and cause **dyspnea, dysphagia, or venous congestion**.

- **Pericardiocentesis** may be performed through this region — a needle is inserted through the **5th or 6th left intercostal space near the sternum** to drain fluid from the pericardial cavity.

- **Anterior mediastinal masses** often include **thymic, teratomatous, thyroid, and lymphoid** origins — remembered by the mnemonic **"4 T's"**:
  Thymoma, **T**eratoma, **T**hyroid (ectopic), **T**errible lymphoma.

Summary Mnemonic for Contents

"Fat Thymic Lymph Tissue Small Vessels Ligaments" ?
Fat, Thymus remnants, Lymph nodes, Small vessels, Sternopericardial ligaments.

The **anterior mediastinum**, though narrow, has great **diagnostic and surgical relevance** — being the site of important **thymic and lymphatic structures**, and a key **approach area** for pericardial and thoracic interventions.

Middle Mediastinum

Position and Boundaries

The **middle mediastinum** is the **largest and most central part** of the inferior mediastinum.
It contains the **heart enclosed in the pericardium** and structures closely related to it.

- **Anteriorly:** Anterior mediastinum (behind the sternum).

- **Posteriorly:** Posterior mediastinum (in front of vertebral column).
- **Superiorly:** Continuous with superior mediastinum (at the level of sternal angle).
- **Inferiorly:** Diaphragm.
- **Laterally:** Mediastinal pleura and roots of the lungs.

Contents

The middle mediastinum houses the **heart and its major vascular and neural connections**.

1. **Pericardium** (fibrous and serous layers) enclosing the heart.
2. **Heart** itself — with atria, ventricles, and coronary vessels.
3. **Roots of the great vessels:**
    - **Ascending aorta** (from left ventricle, giving coronary arteries).
    - **Pulmonary trunk** (dividing into right and left pulmonary arteries).
    - **Superior vena cava** (receiving blood from head, neck, and upper limbs).
    - **Inferior vena cava** (opening into right atrium).
    - **Pulmonary veins** (two from each lung entering left atrium).
4. **Phrenic nerves** — descend on each side between pleura and pericardium to the diaphragm.
5. **Pericardiacophrenic vessels** — accompany phrenic nerves.

6. **Tracheal bifurcation and main bronchi.**
7. **Lymph nodes** — tracheobronchial and cardiac nodes.
8. **Small portions of the vagus nerves** near the roots of lungs.

Relations

- **Anteriorly:** Sternum and anterior mediastinum.
- **Posteriorly:** Posterior mediastinum (containing esophagus and descending aorta).
- **Superiorly:** Continuous with great vessels of superior mediastinum.
- **Inferiorly:** Fibrous pericardium rests on the diaphragm.

Pericardium (Overview)

- **Fibrous pericardium:** Tough outer layer attached to the diaphragm and sternum (via sternopericardial ligaments).
- **Serous pericardium:** Has **parietal** and **visceral (epicardium)** layers enclosing pericardial cavity containing a thin film of lubricating fluid.

Applied Anatomy

- **Pericardial effusion:** Accumulation of fluid in the pericardial cavity compresses the heart, leading to **cardiac tamponade** — impaired filling of ventricles and circulatory collapse.

- **Pericardiocentesis:** Fluid is aspirated via a needle inserted in the **left 5th intercostal space close to the sternum**, avoiding injury to coronary vessels.
- **Mediastinal widening or shift:** Seen in cases of **enlarged heart**, **pericardial effusion**, or **tumors**.
- **Phrenic nerve palsy:** May lead to **paralysis of diaphragm** on the affected side.
- **Trauma or surgery** in this area requires care to preserve **phrenic and vagus nerves**.

Mnemonic for Middle Mediastinal Contents

“HAPPIE Nerves”

- **H** ? Heart
- **A** ? Ascending aorta
- **P** ? Pulmonary trunk and veins
- **P** ? Pericardium
- **I** ? Inferior and superior vena cava
- **E** ? Epicardium
- **Nerves** ? Phrenic and vagus

The **middle mediastinum** forms the **central hub of thoracic circulation**, housing the **heart and major vessels**, the **motor nerves to the diaphragm**, and the **primary bronchi** — the vital crossroads of the cardiovascular and respiratory systems.

Posterior Mediastinum

Position and Boundaries

The **posterior mediastinum** is the **rearmost part** of the inferior mediastinum.
It lies **behind the pericardium** and **in front of the vertebral column**, forming a deep vertical compartment.

- **Anteriorly:** Fibrous pericardium and diaphragm.
- **Posteriorly:** Bodies of mid and lower thoracic vertebrae (T5–T12).
- **Superiorly:** Continuous with superior mediastinum (at T4 level).
- **Inferiorly:** Diaphragm.
- **Laterally:** Mediastinal pleura of both lungs.

Contents

The posterior mediastinum serves as a **conduit between the thorax and abdomen**, transmitting several major structures.

1. **Descending thoracic aorta**
    - Continuation of aortic arch beginning at T4 level.
    - Descends on the left side of the vertebral column.
    - **Branches:**
        - Posterior intercostal arteries (3rd–11th spaces)

- Subcostal arteries
- Bronchial arteries (to bronchi and lungs)
- Esophageal arteries
- Pericardial and mediastinal branches

---

2. **Azygos venous system**
    - Provides **venous drainage** of thoracic wall to **superior vena cava (SVC)**.
    - **Azygos vein:** on right side, ascends and arches over right lung root to open into SVC.
    - **Hemiazygos vein:** on left, crosses at T9 to join azygos.
    - **Accessory hemiazygos vein:** drains upper left thoracic wall and joins azygos around T7–T8.

---

3. **Thoracic duct**
    - Largest lymphatic channel of the body.
    - Begins at **cisterna chyli** (L1–L2), passes through aortic opening of diaphragm, and ascends between **aorta and azygos vein**, behind the esophagus.
    - Crosses to the left side at T5 and opens into the junction of **left subclavian and internal jugular veins**.
    - **Function:** drains lymph from entire body **except right upper quadrant**.

4. **Esophagus**

    - Muscular tube connecting pharynx to stomach.
    - Lies posterior to trachea in upper mediastinum, then anterior to vertebral column here.
    - Crossed by **aortic arch** and **left bronchus** in upper part, **descends behind the heart**, and passes through the **esophageal hiatus (T10)** of the diaphragm.
    - Supplied by esophageal branches of **aorta** and **left gastric artery**.

---

5. **Vagus nerves and esophageal plexus**

    - Right and left **vagus nerves** form a **plexus around the esophagus**, then reform below as **anterior and posterior vagal trunks**, which pass through the diaphragm with the esophagus.
    - Provide **parasympathetic supply** to thoracic and abdominal viscera.

---

6. **Sympathetic trunks and splanchnic nerves**

    - **Sympathetic chain** lies along the heads of ribs on either side of vertebral column.
    - Gives off **three splanchnic nerves** that pierce the diaphragm to reach abdominal ganglia:
        - **Greater splanchnic (T5–T9):** to celiac ganglion.
        - **Lesser splanchnic (T10–T11):** to aorticorenal ganglion.

- **Least splanchnic (T12):** to renal plexus.

Mnemonic for Contents

“DATE VSS”

- **D** ? Descending aorta
- **A** ? Azygos and hemiazygos veins
- **T** ? Thoracic duct
- **E** ? Esophagus
- **V** ? Vagus nerves (forming esophageal plexus)
- **S** ? Sympathetic trunk
- **S** ? Splanchnic nerves

Relations (Anterior to Posterior)

Pericardium ? Esophagus ? Thoracic duct ? Aorta ? Vertebral column.

Applied Anatomy

- **Aortic aneurysm:** Dilation of descending aorta may compress esophagus, thoracic duct, or left recurrent laryngeal nerve, causing **dysphagia or hoarseness**.
- **Esophageal carcinoma:** Can invade mediastinal structures, leading to **tracheoesophageal fistula** or **dysphagia**.

- **Azygos vein enlargement:** May occur in **SVC obstruction**, forming collateral pathway.
- **Posterior mediastinal tumors:** Often arise from **nerve sheaths or lymph nodes**; can compress sympathetic chain or aorta.
- **Hiatus hernia:** Protrusion of stomach into thoracic cavity through esophageal opening at T10.

The **posterior mediastinum** thus forms the **communication corridor** of the thorax — transmitting vital **vascular, lymphatic, and autonomic structures** between the neck, thoracic organs, and upper abdomen, and serving as a key region for both **diagnostic imaging and surgical access**.