Mediastinum

The mediastinum is the space in the middle of the thoracic cavity located between the left and right mediastinal pleura. It contains all the organs of the chest except the lungs. It is divided by the plane between the angle of the sternum and the intervertebral discs between the Th4 and Th5 vertebrae into the **superior** and **inferior mediastinum**. The inferior mediastinum is further divided by the pericardium into:

- *anterior mediastinum* – in front of the pericardium;
- *middle mediastinum* – contains the heart itself in the pericardium;
- *posterior mediastinum* – located behind the pericardium.

Boundary

Mediastinum:

- cranially – superior thoracic aperture ;
- caudally – diaphragm ;
- ventrally – sternum ;
- dorsally – vertebral bodies Th1–12;
- laterally – mediastinal pleura .

Superior mediastinum:

- cranially – superior thoracic aperture ;
- caudally – plane between the sternal angle and the intervertebral discs between Th4–5;
- ventrally – manubrium of the sternum ;
- dorsally – vertebral bodies Th1–4;
- laterally – mediastinal pleura .

Inferior mediastinum:

- cranially – plane between the sternal angle and the intervertebral discs between Th4–5;
- caudally – diaphragm ;
- ventrally – body of the sternum ;
- dorsally – Th5–12;
- laterally – mediastinal pleura .

Anterior mediastinum:

- cranially – plane between the sternal angle and the intervertebral discs between Th4–5;
- caudally – diaphragm ;
- ventrally – body of the sternum ;
- dorsally – pericardium;
- laterally – mediastinal pleura .

Mediastinum medium:

- cranially – plane between the sternal angle and the intervertebral discs between Th4–5;
- caudally – diaphragm ;
- ventrally – pericardium;
- dorsally – pericardium or tracheal bifurcation ;
- laterally – mediastinal pleura .

Posterior mediastinum:

- cranially – plane between the sternal angle and the intervertebral discs between Th4–5;
- caudally – diaphragm ;
- ventrally – pericardium, bronchopericardiac membrane , tracheal bifurcation , pulmonary arteries and veins ;
- dorsally – vertebral bodies Th5–12;
- laterally – mediastinal pleura .

Superior mediastinum

The superior mediastinum is a relatively small space located behind the manubrium of the sternum from the superior thoracic aperture to the plane between the sternal angle and the intervertebral discs between the Th4 and Th5 vertebrae. It communicates with the space of the neck and retroperitoneum, therefore infections or tumor growth can easily spread to these areas.

In ventrodorsal order, it contains these main structures: thymus, veins, arteries, trachea, oesophagus. In addition, the superior mediastinum also contains nerves, lymph nodes and part of the thoracic duct.

Thymus

The thymus, or thymus gland, is the most ventrally located organ of this space, has a pink-gray color and is a primary lymphatic organ.Its main role is the maturation of T-lymphocytes. It is most developed in children, it atrophies with age and is replaced by adipose tissue, but it never completely disappears. Small islands of lymphatic tissue are also present in it in old age.

Veins

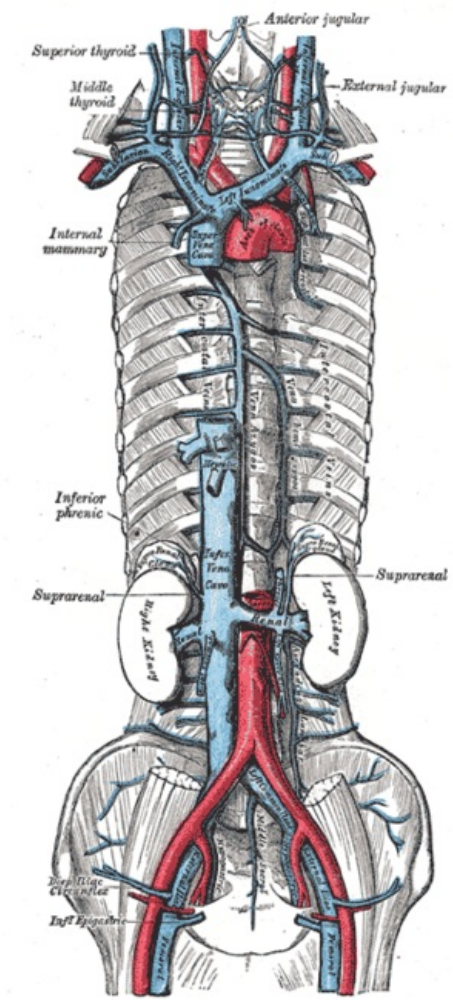
Behind the thymus, in the superior mediastinum, there are left and right brachiocephalic veins and the upper part of the superior vena cava.

Left and right brachiocephalic veins

The **right brachiocephalic vein** is formed by the confluence of the right internal jugular vein and right subclavian vein in the right venous angle, which is located behind the right sternoclavicular joint and we no longer classify it in the mediastinum from the right venous angle to the mouth of the right lymphatic duct. The **left brachiocephalic vein** arises on the left side in the same way.

Right brachiocephalic vein - it lies behind the right edge of the manubrium of the sternum, it goes vertically down laterally from the brachiocephalic trunk (see arteries). Receives right supreme intercostal, right vertebral and right internal thoracic veins (if it does not flow into the superior vena cava).

Left brachiocephalic vein - it extends from its origin in the venous angle obliquely down to the right to the confluence with the right brachiocephalic vein and together forms the superior cava. During its transition, branches of the aortic arch cross anteriorly. In adults, it is located behind the manubrium of the sternum, in children it is uncovered above it, and is therefore slightly vulnerable. It receives left supreme intercostal, inferior thyroid, thymic, left vertebral, left internal thoracic and left superior intercostal veins.



Veins

Superior vena cava

Its lower part belongs to the upper mediastinum, the azygos vein flows into it, and intermittently the right internal thoracic (see above).

Arteries

Behind the manubrium of the sternum, first in front, later to the left of the trachea, is the **aortic arch** . It sends the arterial **brachiocephalic trunk** located right lateral to the trachea and medial to the right brachiocephalic vein. It also sends out the **left common carotid artery** lateral to the trachea and **left subclavian** even more laterally. All these branches are located behind left brachiocephalic vein. In front of the aortic arch we find **anterior mediastinal lymph nodes**, which collect lymph from the heart and lungs.

Trachea

It lies behind the arteries in the **anterior median line**. Its thoracic part belongs to the superior mediastinum, i.e. from Th1 to the bifurcation at the level of Th4/5. The bifurcation of the trachea also extends into the middle mediastinum (in the inferior mediastinum). **Paratracheal lymph nodes** are found around the trachea.

Oesophagus

The oesophagus extends from C6 to its opening into the cardia of the stomach, but only the upper part of the thoracic part of the oesophagus, i.e. from Th1 to Th4, belongs to the superior mediastinum. It runs behind the trachea and continues into the posterior mediastinum. In the vicinity of the oesophagus are **posterior mediastinal lymph nodes**. (*Oesophagus* more closely: see posterior mediastinum)

Nerves

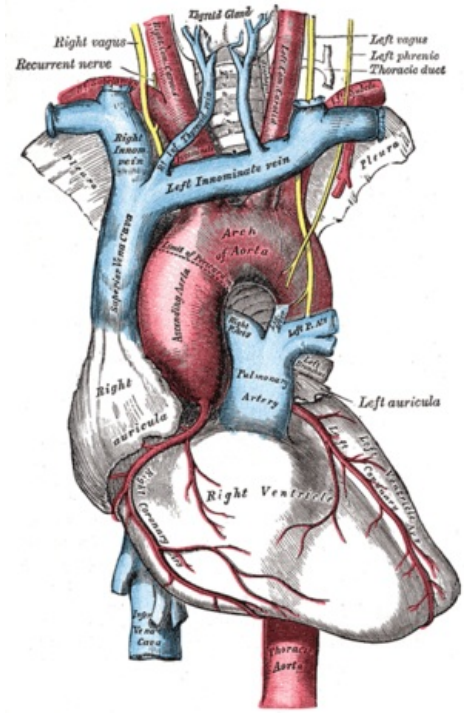
In the superior mediastinum we find **nn. phrenic, nn. vagus, superficial and deep cardiac plexuses and sympathetic trunk**.

Vagus nerves

Left and right vagus nerves ensure **parasympathetic** autonomic innervation of the chest organs. They also contain afferent fibers but not pain fibers. They broadcast oesophageal and pulmonary branches to the pulmonary plexus and cardiac branches to the cardiac plexus .

Right vagus nerve

The right vagus nerve, after entering the chest, is placed **between the right brachiocephalic vein and the brachiocephalic trunk**, on the oesophagus , turns from its right side to the posterior side and forms the **posterior vagal trunk**. Together with the oesophagus, it continues beyond the **lung root** into the posterior mediastinum. The left and right vagus nerves and the oesophagus pass over the diaphragm together through the **oesophageal hiatus**.



Large arteries, veins and vagus nerves

Left vagus nerve

After passing into the chest, **the left vagus nerve** is located behind the brachiocephalic vein, between the left common carotid and subclavian arteries. It is deposited on the aortic arch and sends from under the arch lateral to the *ligamentum arteriosum,* the **left recurrent laryngeal nerve**, which goes back cranially between the trachea and the oesophagus . The **right recurrent laryngeal nerve does not belong to the mediastinum**, as it separates from the right vagus nerve still in the region of the neck (returns under right subclavian artery). The recurrent laryngeal nerves innervate all muscles of the larynx except the cricothyroid. In its further course, the left vagus nerve is deposited on the oesophagus on the left, turns to its front side, where it forms the **anterior vagal trunk** and passes behind the root of the lung into the posterior mediastinum.

Phrenic nerves

The phrenic nerves serve for **motor and sensitive innervation of the diaphragm**, at the same time they contain afferent fibers from *pericardium fibrosum* and mediastinal pleura . The right phrenic nerve passes into the abdominal cavity through the foramen of the inferior vena cava and the left in the area below the apex of the heart. They broadcast phrenicoabdominal branches .

Right phrenic nerve

The right phrenic nerve lies **lateral to the right vagus nerve**. After passing into the thoracic cavity, it gets **behind the right brachiocephalic vein**, gradually passes in a caudal direction to its right side, and then passes along the **right side of the superior vena cava**. It enters the mediastinum medium in front of the lung root.

Left phrenic nerve

It lies **lateral to the left vagus nerve, behind the left brachiocephalic vein**. It passes caudally **in front of the aortic arch** and along the surface of the pericardium in front of the lung root into the middle mediastinum .

Superficial and deep cardiac plexuses

Superficial cardiac plexus is located in front of the aortic arch and in its concavity. **The deep cardiac plexus** lies behind the aortic arch in front of the trachea. **Parasympathetic fibers** from the nerves enter both plexuses; *vagal (cardiac branches)*, which slow down the heart's activity, and **sympathetic fibers** from the *sympathetic trunk (cardiac nerves)* (see below), which speed up the heart's activity.

Sympathetic trunk

The sympathetic trunk is part of the autonomic nervous system. They form ganglia on the sides of the spine, which are connected to each other via interganglionary branches. The sympathetic trunks also continue into the posterior mediastinum (see below).

Thoracic duct

The thoracic duct is the largest lymphatic vessel in the body. It arises in the abdominal cavity from the intestinal trunk and the lumbar trunks as the **cisterna chyli** . In the superior mediastinum, it is located to the left of the oesophagus. It passes behind the subclavian artery and behind the aortic arch. It opens into the left venous angle , which, however, no longer belongs to the mediastinum.

Inferior mediastinum

The inferior mediastinum is divided by the pericardium into the anterior, middle and posterior mediastinum.

Anterior mediastinum

The anterior mediastinum is a small space ventral to the pericardium. Here we find the thymus (the majority of which is located in the upper mediastinum), sternopericardial ligament, which fixes the pericardium to the sternum, fat tissue and sparse collagen tissue. In addition to these structures, there are also small branches from internal thoracic vessels.

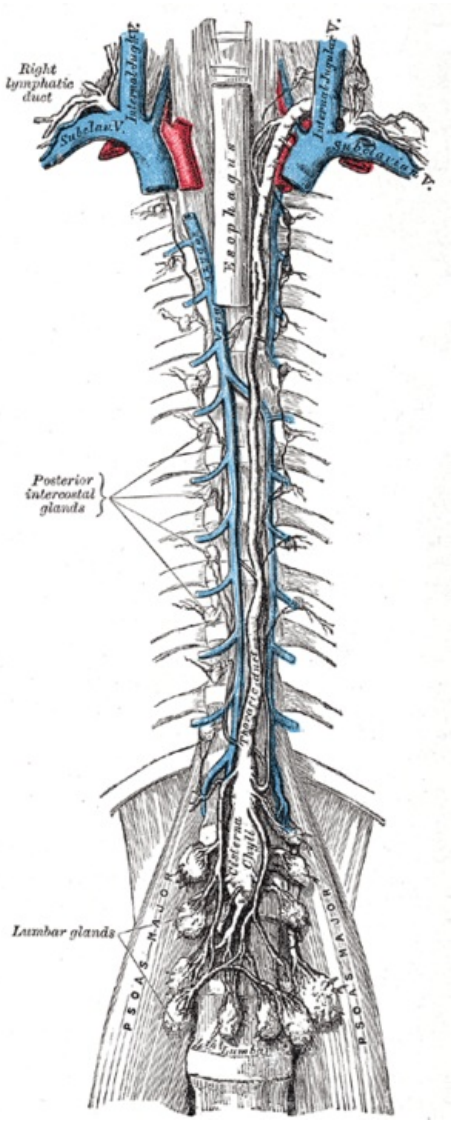
Mediastinum medium

The mediastinum medium mainly contains the **heart in the pericardium** , the ascending aorta, the lower part of the superior vena cava with the outlet of the azygos vein, the pulmonary trunk and pulmonary arteries, part of the inferior vena cava and deep cardiac plexus. On the surface of the fibrous pericardium lies the **phrenic nerve** together with the **pericardiacophrenic vessels** (branches of the internal thoracic artery). Furthermore, there are the tracheal bifurcation, principal bronchi and superior and inferior tracheobronchial lymphatic nodes, into which lymph flows from the lungs and from the heart.

Mediastinum posterius

In this space there are structures passing from the chest cavity to the abdominal cavity and vice versa. These include the **thoracic aorta, oesophagus, thoracic duct, vagus nerves, greater, lesser and least splanchnic nerves** and **sympathetic trunks** . Furthermore, in the posterior mediastinum there are also **azygos, hemiazygos and accessory hemiazygos veins** and **right and left posterior intercostal arteries**. Along the oesophagus and thoracic aorta lie **posterior lymph nodes**, which collect lymph from the oesophagus, mediastinum, posterior surface of the diaphragm, and from the left lobe of the liver.

For the sake of completeness, the following structures will also be described with parts that do not lie in the posterior mediastinum. The system of azygos veins and branching of the thoracic aorta is described in the articles Venous drainage of the chest wall and Arterial supply of the chest wall.



Oesophagus

In an adult, the oesophagus is a muscular tube about **25 centimeters** long. It is a direct continuation of the pharynx. It starts as '**Kilian's Mouth**' at the height of the **C6** vertebra or cricoid cartilage . It enters the chest cavity through the superior thoracic aperture. **It lies behind the trachea** in the neck and in the superior mediastinum. In the oesophagus, we distinguish ***pars cervicalis , pars thoracica and pars abdominalis***. There are 3 constant constrictions on it. The first narrowing is at its beginning at the height of C6. The second is located at the height where it is compressed between the aorta and the left bronchus, and the third at the obstructing passage in the **oesophageal hiatus** at the level of the Th10 vertebra. In the frontal plane, the oesophagus is first bent slightly to the left from the height of the C6 vertebra to Th5 (therefore, in its upper part, a surgical approach from the left is preferable). After the 8th thoracic vertebra, it is bent to the right and then, just above the passage through the oesophageal hiatus, it crosses from the front of the aorta to the left towards the stomach. In the sagittal plane, it follows the curvature of the spine.

Between the oesophagus and the trachea there are the recurrent laryngeal nerves. The thyroid gland extends to the side walls of the *pars cervicalis* of the oesophagus. **The *pars thoracica* runs to the right of the thoracic aorta** and creates the **oesophageal sulcus** on the right lung. The aortic arch crosses it at the back left. It is pressed by the left atrium and the left principal bronchus. On the lower part of the left lung, it also creates a short sulcus , because in this area it is directed to the left. It attaches to the thoracic duct , azygos vein and right posterior intercostal arteries.

The vagus nerves run along the wall of the oesophagus. The right vagus nerve turns to its back and the left vagus forward, they exchange fibers and form **anterior and posterior vagal trunks**. Both vagal trunks pass together with the oesophagus through the oesophageal hiatus. The vagus nerves provide parasympathetic innervation, i.e. they improve peristalsis and support the excretion of secretions (oesophageal branches from vagus nerves). Sympathetic innervation is provided from the sympathetic trunks. The oesophagus is not very sensitive, the autonomic nerves also contain a small amount of sensitive fibers.

The *pars abdominalis* is only approximately 2 centimeters long and is covered with serosa. It presses on the left lobe of the liver and opens into the stomach. The oesophagus is fixed to the diaphragm using the **phrenoesophageal membrane**, damage to which can cause herniation.

The arterial supply of the oesophagus in the *pars cervicalis* is from the inferior thyroid artery, in the ***pars thoracica*** **from the oesphageal branches from the thoracic aorta** and in the *pars abdominalis* from the left gastric artery.

Lymphatic drainage is ensured in the neck by deep cervical lymph nodes, in the **chest part by tracheobronchial lymph nodes and posterior mediastinal lymph nodes**. In the *pars abdominalis*, lymph drains from the oesophagus into the gastric lymph nodes.

Thoracic aorta

It is the thoracic part of the descending aorta. It extends from the level of the Th4 vertebra to Th12, where it passes through the diaphragm through the **aortic hiatus** together with the thoracic duct. Furthermore, it is placed to the left of the spine, where it creates the **aortic impression** on the bodies of the vertebrae, later it reaches the midline. On the left lung, it creates the **aortic sulcus**. To the right of the thoracic aorta lies the thoracic duct and even further to the right is the azygos vein. The hemiazygos vein lies dorsal to the aorta.

Sympathetic trunks, splanchnic nerves

The thoracic paravertebral ganglia of the sympathetic trunks are located in the posterior mediastinum. There are **twelve thoracic ganglia**. They lie in front of the heads of the ribs and are connected to each other through the **interganglionary branches**. From the sympathetic trunks, branches to the plexuses of the organs arise: pulmonary, cardiac and oesophageal plexuses. Neurons are interconnected in the ganglia. Some do not connect and continue directly into the abdominal cavity, such as the greater, lesser and least splanchnic nerves. The neurons of these nerves connect only in the prevertebral ganglia in front of the abdominal aorta in the abdominal cavity. The greater splanchnic nerve arises from the 5th to 9th thoracic ganglion, lesser from the 10th to 11th and least from the twelfth thoracic ganglion.

Links

Related Articles

- Arterial supply of the chest wall
- Venous drainage of the chest wall
- Tumors of the mediastinum

References

- ČIHÁK, Radomír. *Anatomie III.* 2., upr. a dopl edition. Grada Publishing, spol. s. r. o., 2004. 673 pp. ISBN 80-247-1132-X.
- ČIHÁK, Radomír. *Anatomie II.* 2. edition. Grada, 2001. 488 pp. ISBN 80-247-0143-X.