Unit 13: Posterior Mediastinum and Review of Superior Mediastinum

Dissection Instructions:

Remove the remnants of the pericardial sac. Clean the vagus nerves from the neck to the esophagus, noting the difference in the location of branching of the left and right recurrent laryngeal nerves (Plates 205, 222, 228, 236; 1.59, 1.61, 1.63, 1.72, 1.75, 1.76). When the vagus nerves reach the esophagus they form the esophageal plexus. Clean this plexus without destroying the venous drainage of the esophagus or the thoracic duct. Note the contributions from the sympathetic trunk to the esophageal plexus. The blood supply to the esophagus comes from the inferior thyroid artery above and from direct branches off the descending aorta at lower levels. Most of the blood empties into the azygos system of veins from the esophagus.

In the superior mediastinum, the esophagus lies immediately in front of the vertebral column and behind the trachea (Plates 202, 207, 208; 1.61, 1.63). The descending thoracic aorta begins at TV5 and at first lies to the left of the vertebral column and esophagus. Inferiorly, the aorta wedges its way between the vertebral column and esophagus to reach the mid-line at TV12 (Plates 233; 1.70, 1.72, 1.76, 1.77). Because of the dome shape of the diaphragm, the esophagus passes through the fleshy part of the diaphragm in front and to the left of the aorta at the level of TV10, while the aorta leaves the thoracic cavity at the level of TV12.

Look for branches coming off the anterior surface of the descending aorta (Plates 203, 233; 1.70). These are small branches and supply, from above downward, the bronchi, esophagus, mediastinum, pericardial sac and diaphragm. Posteriorly, the intercostal arteries can be seen leaving the aorta to travel to the intercostal spaces (Plates 205, 233, 226, 227; 1.70, 1.76). The highest aortic intercostal arteries go to the third intercostal space, but help supply the second space along with the highest intercostal arteries from the costocervical trunk of the subclavian artery.

The intercostal veins travel with the intercostal arteries, but when they reach the posterior mediastinum and superior mediastinum, they have their own system of venous collection called the azygos system of veins (Plates 226, 227, 234; 1.73-1.75, 1.77, 1.78). The first two intercostal veins empty into vessels in the neck, usually the subclavian veins. The third through 5th intercostal veins form the superior intercostal vein. On the right, the superior intercostal vein delivers blood to the azygos vein as the azygos arches over the right primary bronchus to enter the superior vena cava. On the left, the superior intercostal vein crosses the aortic arch to reach the left brachiocephalic vein. On the right side, the remaining intercostal veins empty into the azygos vein. The intercostal veins from the mid-thoracic left intercostal spaces form the accessory hemiazygos vein below the superior intercostal vein and the lower intercostal veins form the hemiazygos vein. The accessory hemiazygos and hemiazygos veins cross the vertebral column to empty into the azygos vein. The azygos and hemiazygos veins are upward continuations of the ascending lumbar veins in the abdominal cavity (Plates 234; 1.73-1.75).

Behind and to the right of the esophagus locate the thoracic duct (Plates 202, 235; 1.71, 1.74, 8.16, 8.21). It lies on the vertebral column and ascends to the level of TV5, crosses to the left side and continues up to the neck before arching forward over the subclavian artery to reach the junction of the internal jugular and subclavian veins. The mid-section of the thoracic duct receives lymph vessels from the intercostal spaces, but the vessels from the lower intercostal spaces drains into the cisterna chyli. The upper segment receives intercostal lymph vessels from the left side only.
Within the medial portion of the intercostal spaces the muscle seen posteriorly is the external intercostal muscle, as the internal intercostal muscle posteriorly is replaced by the posterior intercostal membrane (Plates 184, 187, 191: 1.15-1.18, Table 1.1, p-21). The intercostal nerves can be found entering the intercostal spaces from the intervertebral foramina behind the bodies of the corresponding vertebrae. They join the vessels and are usually arranged in order from above downwards, vein, artery and nerve. When the nerve, artery and vein reach the fleshy part of the internal intercostal muscle, they split the muscle into innermost intercostal and internal intercostal. In the region of the angles of the ribs, muscle fibers parallel to the fibers of the internal intercostal muscle are seen arising from one rib and inserting on the second rib above. These fibers form the subcostal muscle.

Carefully clean the sympathetic trunk or chain (Plates 173, 205, 226, 227; 1.15, 1.72, 1.75-1.77) keeping in mind that it has both anterior and posterior branches. The largest anterior branch is the greater splanchnic nerve which receives fibers from T5-9. It is sometimes confused with the continuation of the trunk. Below this is the lesser splanchnic nerve with fibers from T10-11. The least splanchnic nerve from T12 cannot be seen at this time. The greater, lesser and least splanchnic nerves go through or behind the diaphragm to reach the abdominal cavity. On its way, the greater splanchnic nerves supply some fibers to the esophageal plexus. Above TV5, nerves go to thoracic viscera, including the esophagus, trachea, lungs and heart. The sympathetic trunk is connected to all thoracic nerves by communicating rami. Dissect the white communicating rami, the more distal of and the gray communicating rami the more proximal communicating ramus (Plates 205, 226, 227; 1.15, 1.72). The more distal of these are the white communicating rami containing myelinated nerve fibers. The fibers in the white communicating rami are portions of the preganglionic neurons whose cell bodies are in the intermediolateral cell column in the gray matter of the spinal cord and are traveling to the sympathetic trunk. Also in the white communicating rami are visceral afferent (sensory) fibers. These fibers are carrying sensory information from thoracic or abdominal viscera and have their cell bodies in the dorsal root ganglion. The other communicating ramus is the gray communicating ramus. It contains portions of the postganglionic fibers carrying impulses from the sympathetic trunk to the spinal nerves for distribution to smooth muscle and glands in the body wall and limbs.

The preganglionic sympathetic neurons have axons traveling from the spinal cord by way of the ventral root, spinal nerve, anterior primary ramus, white communicating ramus and sympathetic trunk. Once in the sympathetic trunk, they have several options. They may synapse in a ganglion at the level where they enter the trunk, or they may travel up or down the trunk to other ganglia, or they may pass through the trunk in splanchnic nerves to synapse in collateral ganglia.

At this time it is appropriate to review the groups of lymph nodes in the thorax and their direction of drainage. Three groups of lymph nodes lie on the diaphragm, anterior, middle and posterior phrenic nodes. The anterior phrenic nodes lie in the region of the xiphoid process. They receive lymph from the liver, diaphragm, anterior abdominal wall and middle phrenic nodes and drain upwards to the sternal or internal thoracic nodes. The middle phrenic nodes are located near the points where the phrenic nerves pierce the diaphragm. They receive lymph from the diaphragm and on the right side from the liver. Most of their lymph goes anteriorly to the anterior phrenic nodes, but some goes to the posterior phrenic nodes. The posterior phrenic nodes are related to the crura of the diaphragm adjacent to the thoracic aorta. They receive some lymph from the diaphragm and the middle phrenic nodes. They drain upwards to the posterior mediastinal nodes. The sternal or internal thoracic nodes lie along the internal thoracic vessels in the upper three or four intercostal spaces. They receive lymph from the anterior thoracic wall, including the medial aspect of the mammary gland, the upper part of the abdominal wall and from the anterior phrenic nodes. They may drain into the bronchomediastinal lymph trunk, the major lymph ducts which empty into the terminal part of the subclavian veins or into the veins directly. The intercostal spaces drain primarily into the intercostal nodes which lie in the spaces near the heads of the ribs. The inferior five spaces form trunks which descend to the cisterna chyli. Spaces three
to six empty directly into the thoracic duct. The upper spaces empty upwards to the subclavian veins. The anterior mediastinal lymph nodes lie in relation to the brachiocephalic veins, thus are in the superior mediastinum, not the anterior mediastinum. They receive lymph from the thymus, upper pericardium and pleura, and right side of the heart. They drain with the tracheobronchial nodes and sternal nodes to form the bronchomediastinal lymph trunk. The lungs and trachea produce lymph which is drained through superior and inferior tracheobronchial nodes in association with the primary bronchial. Tracheal or paratracheal nodes drain the trachea. The visceral pleura has lymph vessels but not lymph nodes. Pulmonary nodes are located inside the lung in the regions of the bronchopulmonary segments. Bronchopulmonary nodes are related to the lobar bronchi, receiving lymph from the pulmonary nodes and passing it to the tracheobronchial nodes. The right lung lymph tends to stay on the right side, that from the left upper lobe tends to stay on the left, but the lower left lobe may drain to either side. The tracheobronchial nodes drain into the bronchomediastinal lymph trunk. The lymphatic vessels draining the heart follow the coronary vessels. Those following the right coronary artery pass over the aortic arch to reach the anterior mediastinal nodes. Those following the left coronary artery pass deep to the aortic arch and enter the tracheobronchial nodes. The lymphatics of the esophagus drain into inferior deep cervical nodes, paratracheal nodes, posterior mediastinal nodes or superior gastric nodes.

Be sure to identify all of the following in this unit:

- vagus nerve
- right & left recurrent laryngeal nerves
- esophagus
- esophageal plexus
- descending thoracic aorta
- intercostal arteries & veins
- highest intercostal arteries
- superior intercostal vein
- azygos vein
- hemiazygos vein
- accessory hemiazygos vein
- thoracic duct
- intercostal spaces
- external & internal intercostal muscle
- posterior intercostal membrane
- innermost intercostal muscle
- intercostal artery, vein, & nerve
- subcostal muscle
- sympathetic trunk
- greater splanchnic nerve
- lesser splanchnic nerve
- least splanchnic nerve
- white communicating rami
- gray communicating rami
- lymph nodes (finding them depends how large)
- cisterna chyli