

Central Tendon

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What is it?

The central tendon is imperative to breathing and the exchange of essential gases. The central tendon controls the movement of the diaphragm. The diaphragm contains the central tendon and skeletal muscle that consists of several peripheral muscles. Peripheral muscles are made up of radial muscle fibers that originate on the ribs, sternum, and spine and insert on the central tendon. When relaxed, the diaphragm has a dome shape. When the muscles contract the diaphragm flattens, causing the chest cavity to expand and the lungs to fill with air. Upon relaxation the diaphragm raises and exhalation of air from the lungs occurs.

Where is it?

The central tendon runs down the midline and through the center of the diaphragm, which separates the thorax (chest cavity) from the abdomen. It is an anatomical landmark and an important area for energy transformation. Transpiration, blood flow, and nutrient exchange all occur due to the function of the central tendon. The inferior vena cava, which is the largest vein in the body and is responsible for unoxygenated blood return to the heart, runs through the diaphragm. The heart and pericardium sits directly above it. The diaphragm runs perpendicular to the spine at the thirteenth rib and thoracolumbar junction. While the central tendon and diaphragm cannot be directly palpated, several surrounding areas that have an effect on its function can be. This includes bones: sternum, ribs, vertebrae; muscles: intercostals, latissimus.

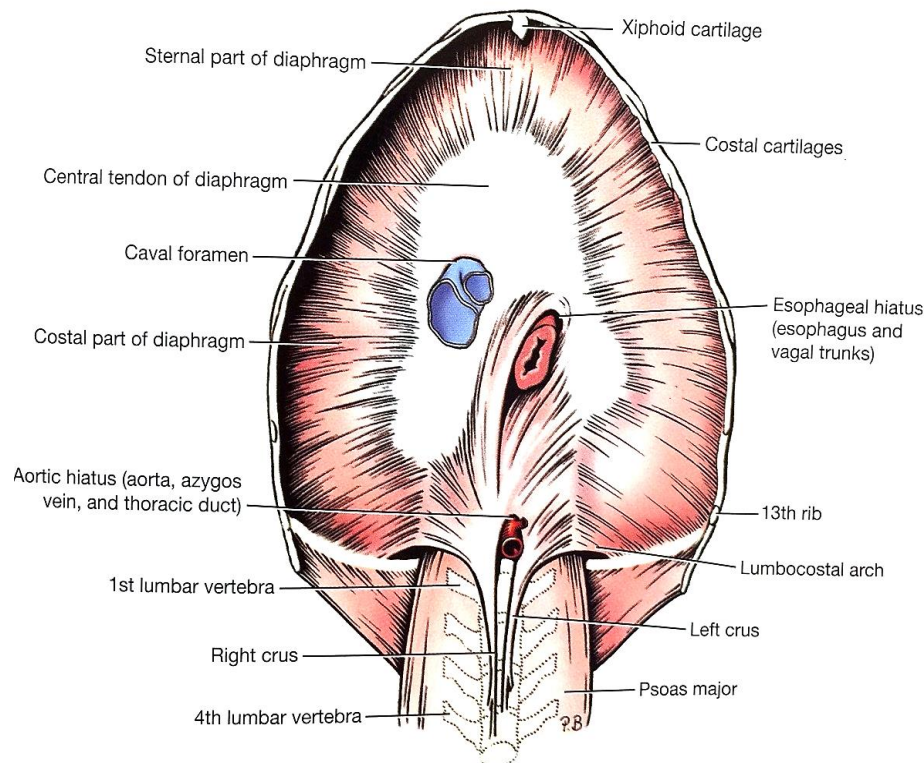
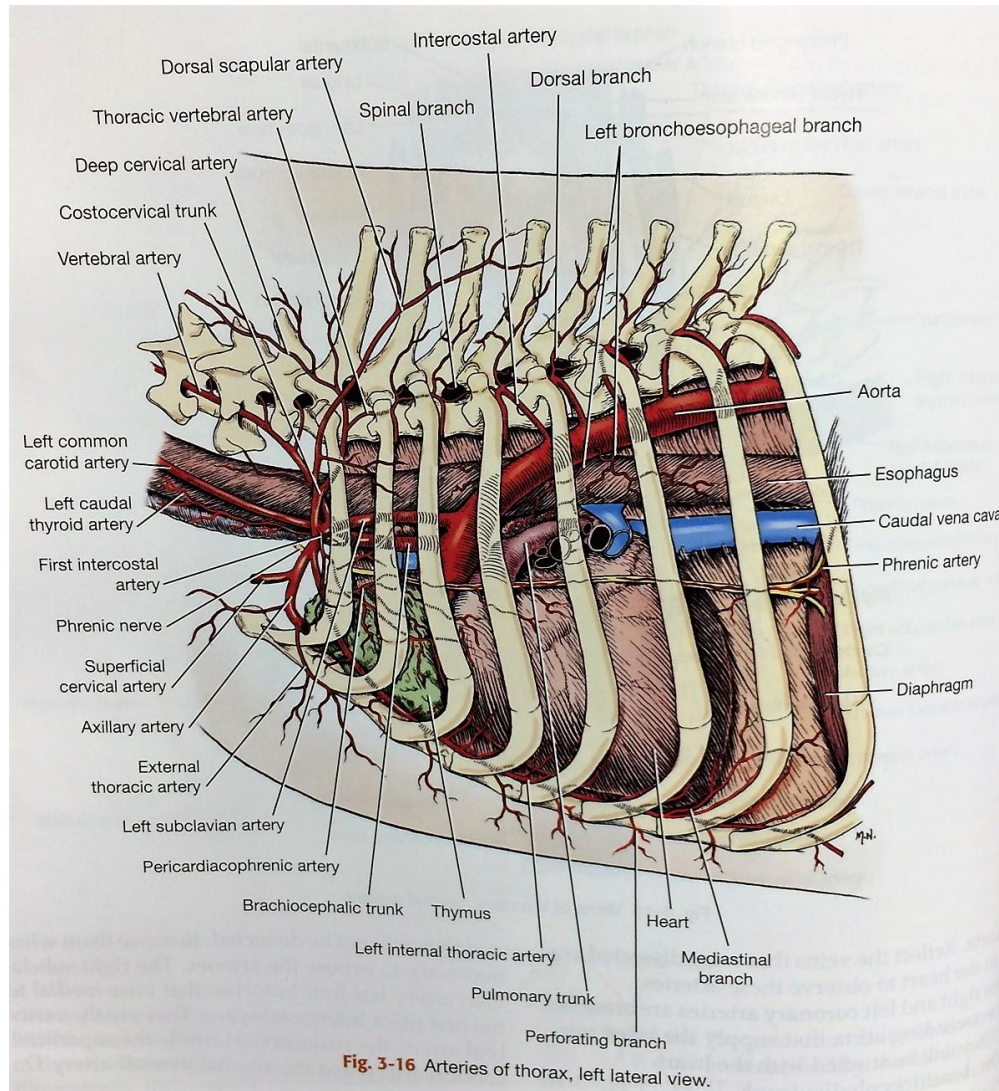


Fig. 4-15 Diaphragm, abdominal view.

How does it work?

Because the diaphragm is comprised of radial skeletal muscles, a nerve impulse is required for them to contract. The nerve signal originates from the respiratory control centers in the brainstem, specifically the medulla and pons.² When the center receive appropriate signals from chemoreceptors, signals are fired through the cranial motor neurons. Then, the signal to control muscular activity of the thorax and diaphragm travels through the spinal motor neurons.



The central tendon is controlled by electric signals sent by the phrenic nerve. The phrenic nerve arises from the ventral branches of the fifth, sixth, and usually seventh cervical nerves. Once it reaches the diaphragm, the phrenic nerve splits into a left and right phrenic nerve. The phrenic nerves function as both motor and sensory to the corresponding half of the diaphragm.

Oxygenated blood travels to the diaphragm through the phrenic arteries. Oxygen is used during the process of converting glucose to ATP, what muscles use for energy. A proper blood supply is necessary to make breathing possible. The blood returns to the heart through the vena cava.

How would it feel if it was restricted/relaxed?

During restriction of the central tendon, the peripheral muscles of the diaphragm contract, causing the diaphragm itself to flatten and the chest cavity to expand. This also causes contraction of the muscles along the spine, chest, and in the shoulders. Upon relaxation of the central tendon, the muscles within the diaphragm relax, allowing the chest to fall and air expiration. This allows the affiliated muscles to also relax.

How can massage manipulation affect it?

Massage can relax the muscles surrounding the chest cavity, allowing it to expand to its maximum capacity. Cupping and effleurage over the ribs can improve blood and lymph flow that may be restricting movement of the central tendon and diaphragm. Skin rolling can loosen and realign flow within the fascia.³ Although the movement of the diaphragm is involuntary, it can be moved voluntarily at will (like when you consciously change your breathing pattern). The massage practitioner can change their own breathing to directly change the dog's respiratory rate. For example, if the dog is panting and breathing very rapidly, the practitioner can take slow, deep breaths while placing their hands on the dog⁴ during vectoring or the assessment strokes.

Differences among breeds?

Overall, the central tendon and diaphragm maintain a similar shape, location, and proportional size. Differences in the size of the dog would warrant different amounts of force to be used with the massage techniques. However, a few conditions can impact the function of the complex.

In the case of pectus excavatum, the chest cavity is concave instead of convex. The odd shape of the chest cavity causes displacement of the heart, which can in turn impact lung capacity and exertion required for breathing. Breeds of dogs with short noses who are susceptible to brachycephalic syndrome, such as the Pug, Shih Tzu, and Boston Terrier, are also at risk.

Diaphragmatic hernia is a condition that occurs when there is a weakening and abnormal opening in the diaphragm. Abdominal organs can shift and wind up in the chest cavity, crowding the lungs and heart which reduces respiratory and cardiac function⁵. This can be congenital or due to a traumatic injury.

References

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