



VISCERAL OSTEOPATHIC MANIPULATION

WORKSHOP 2 - DIAPHRAGM

1. THE DIAPHRAGM - ANATOMY

DEFINITION: it is a dome-shaped muscle that separates the thoracic and abdominal cavities; it has a fleshy peripheral part and a clover-shaped **tendinous central part**.

INSERTIONS: On the last six ribs (K7-K12) and relative costal cartilages and on the sternum on the posterior aspect of the xiphoid process. We have two pillars (crus), right and left: they originate from the central area of the phrenic center. The right is longer and ends in L3 while the left ends in L2 (liver presence). The diaphragm insert on the central tendon. Both starts from L1 vertebra.

There are **5 arcuate ligaments**:

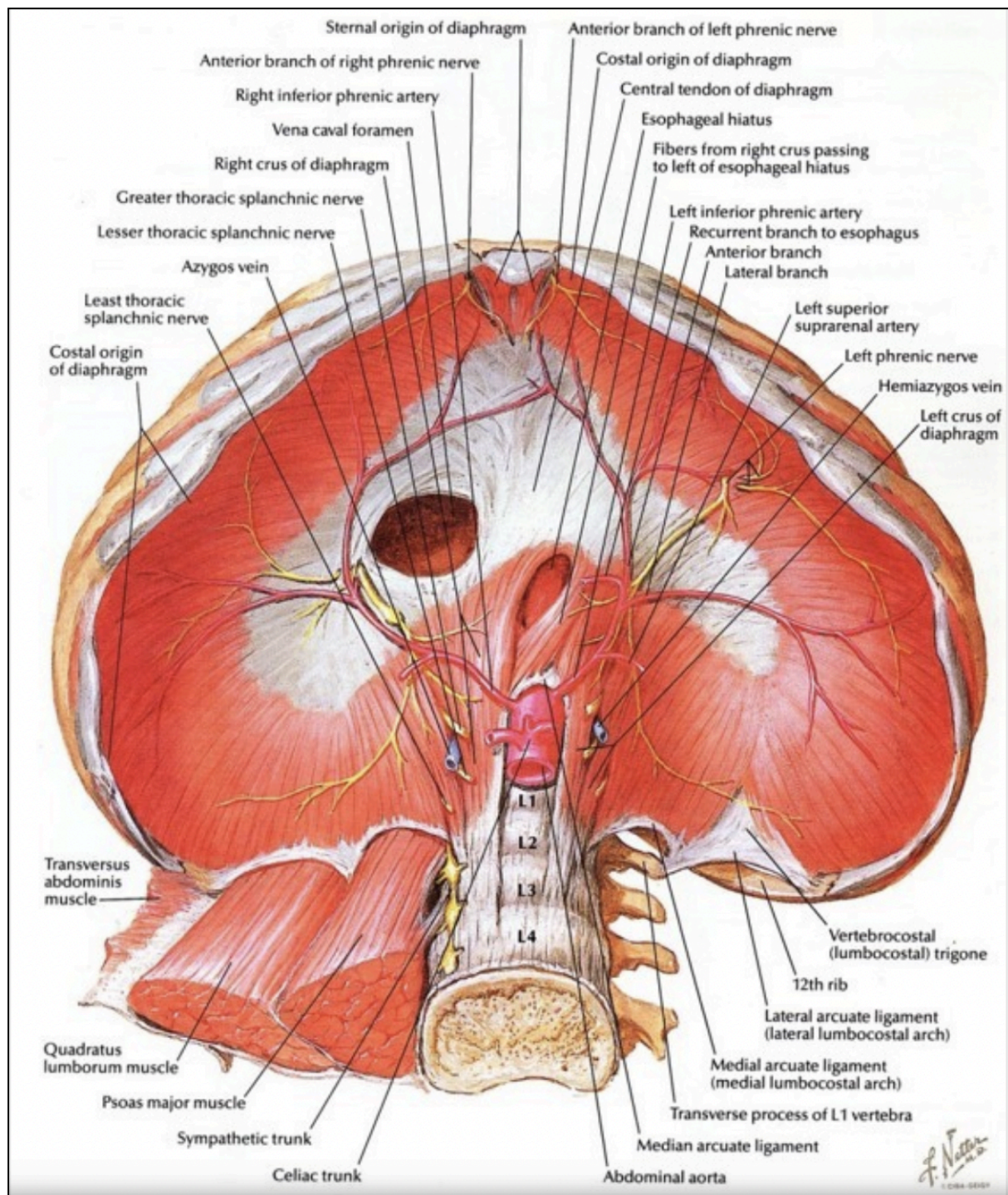
- two arches originate from the lateral layers of the phrenic center: the psoas arch is reinforced by a ligament which is a thickening of the psoas major muscle fascia (**medial arcuate ligament** of the diaphragm); the mm psoas major and minor pass behind this arch, together with the sympathetic trunk.
- the arch of the quadratus lumborum is instead strengthened by a ligament which is called the **lateral arcuate ligament** of the diaphragm.
- the **median arcuate ligament** contributes to the formation of the aortic hiatus, which gives the passage of the Aorta, the Thoracic duct and the Azygous vein. It attaches to the anterolateral bodies of the 1st and 2nd Lumbar vertebrae.

Hiati:

1. ORIFICE OF THE VENA CAVA: posteriorly it is located at the level of T8
2. ESOPHAGEAL ORIFICE: esophagus and esophageal veins T10, vagal nerve (ant and post trunks)

3. AORTIC ORIFICE: for the passage of the aorta, it is located at the level of T12 posteriorly.

Other structure: the ligament of Treitz, or Suspensory muscle of the Duodenum (we will cover this one when approaching the duodenum/stomach/esophagus). It is important for upper abdominal pathology/physiology.



VASCULARISATION: it is given by the inferior and superior diaphragmatic arteries and the posterior mediastinal artery. Veins correspond to arteries.

MECHANICAL LINK

Osteoarticular link: From T7 to T12 + ribs:

- Sternal portion: Post apon face. Xiphoid
- Costal portion: Post face and costal cartilages of ribs VII to XII
- Lumbar Portion: Right pillar (L1 – L3), left pillar (L1 – L2) in the body, vertebrae and discs

Muscle relationships:

- Psoas Major (Lateral to pillars: Medial arched ligament)
- Quadratus lumborum (+ Lat: Lateral arched ligament)

Visceral link:

- Organs above Df: Heart, lung, Esophagus (esophageal hiatus).
- Organs under Df: Kidneys, Liver, Stomach, Spleen, Large intestine. (direct or indirect ligamentous unions with Df)

Motor and sensory innervation: 2 Phrenic nerves: C3 – C5 (towards each dome). Sensory innervation border of the diaphragm N. Intercostals: D6 – D12

Nervous topographical relationship: Sympathetic trunk: (in psoas arch or medial arcuate lig). N. Greater and lesser splanchnicus, N. Phrenic, N. Vagus (through esophageal hiatus).

2. THE DIAPHRAGM - PHYSIOLOGY

BREATHING

PHYSIOLOGICAL BREATHING:

During inhalation the phrenic center lowers, crushing the viscera downwards, allowing the vertical diameter of the thorax to increase.

The lateral diameter → is increased due to the contraction of the internal Intercostals while the vertical diameter → is increased thanks to the contraction of the Scalenes and the SCOM which tend to traction the sternum upwards.

Exhalation, on the other hand, is a passive return allowed by the elasticity of the osteocartilaginous structures of the thorax, with a decrease in all diameters.

FORCED BREATHING:

Forced inspiration: We have the intervention of other muscle groups called accessory respiratory muscles such as: scalenes, serratus anterior, and pectoralis minor, often contracted and overstressed in anxious people, causing neck pain and irradiated pain also

in the shoulders. Forced exhalation also involves the abdominals, in particular the transversus abdominis.

VACUUM FUNCTION

Its goal is to reduce the weight of the viscera. There are differences between the work of the diaphragm in adults and in children. This has reference to the costal insertions of the diaphragm.

VISCERAL MOBILITY

The diaphragm has a **central tendon** in the phrenic center. This has the function of supporting the diaphragm, and unites it with the cervical spine. It is known as Richet's fascia. This fascia starts from the cervical C3 – C4, wrapping the Thyroid gland and goes to the pericardium and diaphragm. This fixation of the phrenic center will cause the domes to lower. This will cause the mobility of organs and viscera

3. DIAPHRAGM OSTEOPATHIC/CLINICAL REASONING

The ligamentous insertions in the lumbar portion of the diaphragm are interesting for their systematic relationships, forming different arches:

- Aortic hiatus with passage for the aorta: tendon arch (median arcuate lig.), pillar R and L of the diaphragm (L1-L3, L1-L2).
- Psoas arch: tendinous arch (medial arched lig.) from L2 to the costal apof of L2.
- Arch of the quadratus lumborum: tendinous arch (lateral arcuate lig) from the costal apof. of L2 to the tip of the 12th rib.

PASSAGE POINTS FOR THE VESSELS IN THE ABDOMINAL DIAPHRAGM:

- Aortic hiatus (T12): abdominal aorta, thoracic duct and azygos vein.
- esophageal hiatus (T10): esophagus, vagus D and I and the lymphatics of the lower 1/3 of the esophagus.
- Foramen of the vena cava (caval hiatus T8): v. dig inf.
- Sternocostal triangle: a. and V. superior epigastric, a. and V. internal thoracic.
- Lumbocostal triangle: region located between the lumbar portion and the costal portion, closed only by connective tissue (also called Grynfelt's triangle or Bochdalek's triangle); In this space there is the possibility of treating the kidney from the dorsal side through the renal cell.
- Other small crossing points. The sup, med, and inferior splanchnic nerves pass through the crura, the sympathetic nerves pass posteriorly to the medial arcuate ligaments on each side. The phrenic nerve I passes through the vault to innervate the peritoneum on its internal part. Neurovascular fibers from the 7-12 intercostal space pass into the muscle from its costal origin.

INDICATIONS: the diaphragm is a decisive component of the central tendon, the indications for diaphragm treatment are multiple and for any osteopathic treatment.

- all symptomatic symptoms have some relationship with the central tendon.
- c3-c5 blocks.
- thoracolumbar transition zone blocks
- rib blocks from the 7th to the 12th.
- all visceral dysfunctions
- all circulatory disorders.

CONTRAINDICATIONS: tumor diseases, infectious diseases, recent iq, heart disease, acute inflammation of thoracic and abdominal organs, acute pulmonary processes.

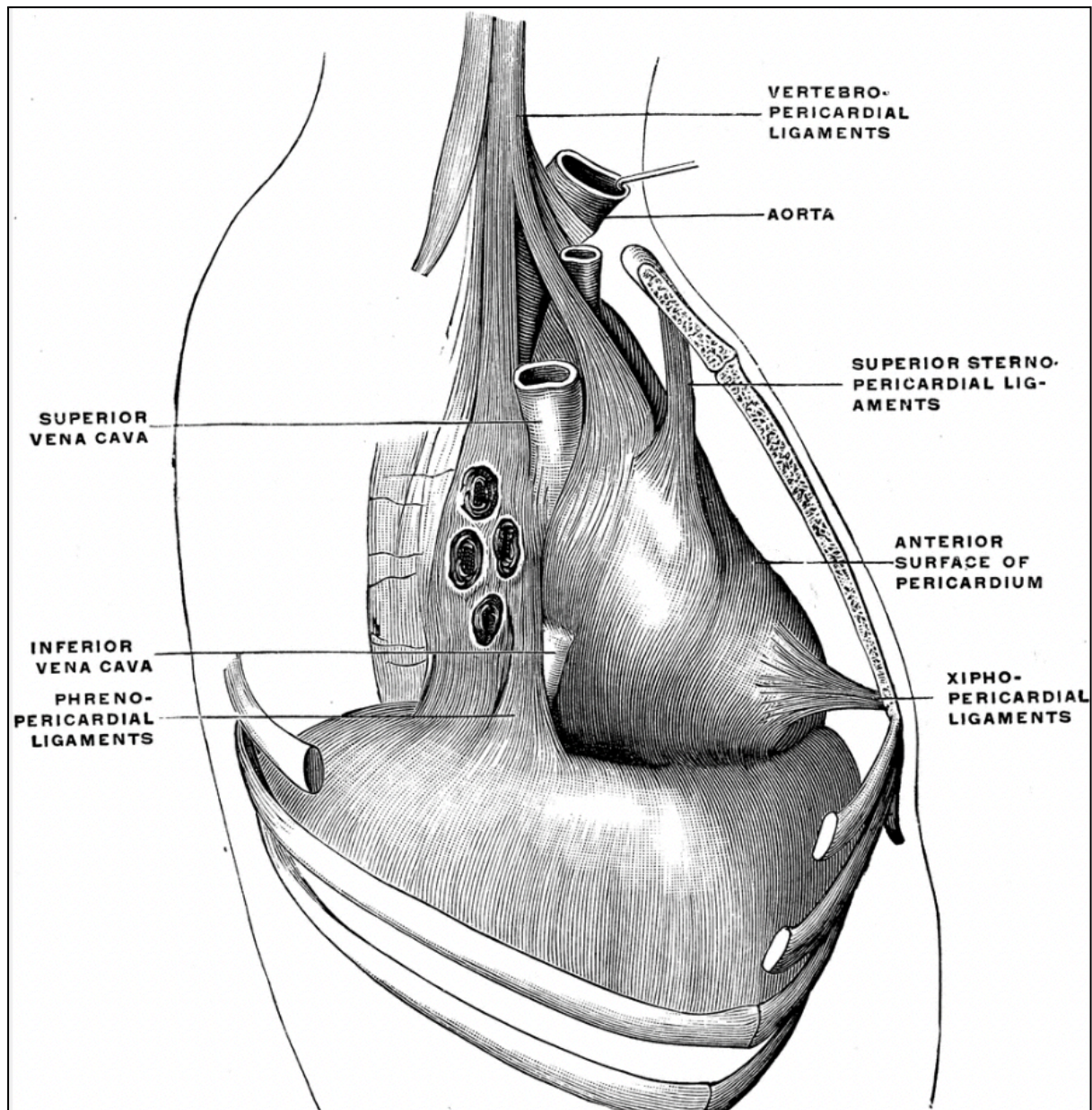
4. ASSESSMENT & PALPATION of THE DIAPHRAGM

- Standing Examination:** Observation of asymmetries between the 2 domes, lateral VS vertical breathing, activations of other muscular groups (cervical/intercostal, pectoralis, TES/LES or QLs, etc)
- Standing Palpation of ribcage** during breathing/check asymmetries and quality of movements
- Standing Palpation of the abdominal wall** during breathing/check asymmetries and strength of movements
- Standing spring tests** on the ribcage (structured or functional feedback)
- Palpation of each dome from sitting**
- General Palpation from sitting** (both domes)
- Supine fascial listening of the central tendon**

5. TREATMENT of THE DIAPHRAGM

- **Supine fascial direct techniques** (both or single domes techniques)
- **Supine fascial indirect double hand (top and bottom)** for fascial unwinding
- **Supine pillars + breathing**
- **Supine fascial release of the central tendon + ribcage + cervical + upper thoracic outlet**
- **Sitting single dome fascial direct technique**
- **Exercises for diaphragmatic breathing in supine (hands and book)**

OTHER TECHNIQUES or OSTEO CONSIDERATIONS?? RELATION WITH PELVIC FLOOR and other diaphragms?



NOTES:

September (date TBC) NEXT Visceral Manipulation WORKSHOP : Stomach&Esophagus