Diaphragm and Radiology

Mrs. DS Pillay
Room 2P24
• Derived from hypaxial musculature of cervical segments.

• Motor innervation phrenic nerves (C3,4,5).

• Diaphragm is a muscular dome-shaped structure.
Connective tissue structures of the diaphragm

Three TYPES of ligaments, (five total).

Called ARCUATE LIGAMENTS.

(1) Median ligament.

(2) (Right and Left) Medial Ligaments

(2) (Right and Left) Lateral Ligaments
Right and left Crura (muscular columns that help attach diaphragm.)
Side view to see curvature of diaphragm…
<table>
<thead>
<tr>
<th>Opening</th>
<th>Transmits</th>
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</thead>
<tbody>
<tr>
<td>Aortic Opening (T12)</td>
<td>1. aorta</td>
</tr>
<tr>
<td></td>
<td>2. thoracic duct</td>
</tr>
<tr>
<td></td>
<td>3. azygos vein</td>
</tr>
<tr>
<td>Oesophageal Opening (T10)</td>
<td>1. oesophagus</td>
</tr>
<tr>
<td></td>
<td>2. R &amp; L vagus n</td>
</tr>
<tr>
<td></td>
<td>3. esophageal branch of L gastric vessels</td>
</tr>
<tr>
<td></td>
<td>4. lymphatics</td>
</tr>
<tr>
<td>Caval Opening (T8)</td>
<td>1. IVC</td>
</tr>
<tr>
<td></td>
<td>2. R phrenic n</td>
</tr>
</tbody>
</table>
THORACIC BREATHING

Based on RIB MOVEMENTS:
- Scalene muscles pull cranially (up) on 1st and 2nd ribs.
- Ribs move like bucket handles.
- Each successive rib pulls on the next via intercostal muscles.
- When ribs/bucket handles move up and out, VOLUME OF THORACIC CAVITY INCREASES.
Scalene muscles pull cranially (up) on 1st and 2nd ribs.

(Scalenes are segmentally innervated: C2-7.)
Ribs move like bucket handles.
Each successive rib pulls on the next via intercostal muscles.
When ribs/bucket handles move up and out, **VOLUME OF THORACIC CAVITY INCREASES**.

So what happens when volume increases?

**PRESSURE DECREASES...**
When PRESSURE DECREASES...

Air gets SUCKED IN.
ABDOMINAL BREATHING
(Use of the Diaphragm)
Remember the shape and structure of the diaphragm!!!
ABDOMINAL BREATHING

- Diaphragm is “dome-shaped.”
- When it contracts, the dome flattens out.
- This INCREASES THORACIC VOLUME.
So, when diaphragm contracts, **VOLUME OF THORACIC CAVITY INCREASES**.

So what happens when volume increases? **PRESSURE DECREASES...**
When PRESSURE DECREASES...

Air gets SUCKED IN.
FORCED BREATHING

- Inhalation can be increased by increasing the amplitude of the movements we just discussed.

- Forced Exhalation -- facilitated by all the muscles of the ribcage, pressurizing coelom, and contracting limb muscles around the axial body wall.
Forced Exhalation

Muscles of the ribcage (bucket handles move down).

Pressurizing coelom (pushes diaphragm back up into dome-shape)** -- decreases thoracic volume to push air out.

Contracting limb muscles around the axial body wall can help compress thoracic cavity.
NOTE:

Pressurizing coelom (pushes diaphragm back up into dome-shape)** -- decreases thoracic volume to push air out.

**Note: The double asterisk indicates that this is an important point or detail.**
VOLUMES OF AIR IN LUNGS

- Normal Breathing: about half a liter per breath.
- This is known as “TIDAL VOLUME.”
INNERVATIONS

- Diaphragm: PHRENIC NERVES (right and left)

- Breathing is “involuntary behavior powered by voluntary muscles.”
Diaphragm: PHRENIC NERVES (right and left)

Phrenic nerves pierce diaphragm near apex; send branches across inferior (abdominal) surface of diaphragm.
INNERVATION

- Motor– Phrenic nerve
- Sensory– Phrenic nerve (centrally, peripherally intercostal nerves (T5–T11) and subcostal n. (T12)

Arterial supply

- Superior aspect:
  - Pericardiophrenic artery from IT.
  - Musculophrenic artery from IT.
  - Superior phrenic artery from aorta.
- Inferior aspect:
  - Inferior phrenic artery from aorta

Venous Drainage
Musculophrenic & pericardiophrenic v. – internal thoracic v., superior phrenic–IVC
Radiological Anatomy
MEDICAL IMAGE TECHNIQUES

- Conventional radiograph (X-Rays)
- Computerized tomography (CT)
- Ultrasounds
- Magnetic resonance imaging (MRI)
- Nuclear medicine imaging
X-Ray Production

- inherent contrast
- film
- digital
- Contrast Radiography
- barium
- iodine
- Fluoroscopy
- CT (Computed Tomography)
OVERVIEW X-RAYS

- There are two main views that are generally examined:
  - PA – posteroanterior
  - Lateral
FIGURE 1.51. Orientation of patient’s thorax during radiography.
A. When taking a PA projection, the X-rays from the X-ray tube pass through the thorax from the back to reach the X-ray film or detector anterior to the person. B. When taking a lateral projection, the X-rays pass through the thorax from the side to reach the X-ray film adjacent to the person’s other side.
## INHERENT CONTRAST

<table>
<thead>
<tr>
<th>Tissue</th>
<th>Appearance on X-Ray</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air</td>
<td>Black</td>
</tr>
<tr>
<td>Fat</td>
<td>Dark grey</td>
</tr>
<tr>
<td>Soft tissues</td>
<td>Grey</td>
</tr>
<tr>
<td>Bone, calcium</td>
<td>White</td>
</tr>
<tr>
<td>Metal</td>
<td>Really white</td>
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</tbody>
</table>
Tissue type affects attenuation of the X-rays