THORACIC WALL

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A TOTAL 23 OF FIGURES INSERTED IN THE TEXT

The thorax is between the neck and abdomen. Posterior surface is formed by the 12 thoracic vertebrae and the posterior parts of the ribs. Anterior surface is formed by the sternum and costal cartilages. Lateral surfaces are formed by the ribs. The ribs are separated from each other by the intercostal spaces. These spaces are 11 in number. They are occupied by the intercostal muscles and membranes. The intercostal space is named according to the number of the rib above. The intercostal space between 3rd and 4th rib is called the “third intercostal space”.

The floor of the thoracic cavity is deeply pushed upward by viscera of the abdominal cavity. The thorax includes the primary organs of the respiratory and cardiovascular systems. The majority of the thoracic cavity is occupied by the lungs. Most of the remainder of the thoracic cavity is occupied by the heart and structures involved in conducting the air and blood. The thorax is one of the most dynamic regions of the body. The thoracic wall muscles work in concert with the diaphragm and abdominal wall muscles. With each breath, they vary the volume of the thoracic cavity. First they expand the capacity of the cavity. As a result they cause the lungs to expand and draw air in and then. This occurs due to lung elasticity and muscle relaxation. Decreasing the volume of the cavity causes them to expel air.

THORACIC WALL

The thoracic wall includes the thoracic cage and the muscles between the ribs as well as the skin, subcutaneous tissue, muscles, and fascia covering its anterolateral aspect. The same structures covering its posterior aspect are considered to belong to the back. The mammary glands of the breasts lie within the subcutaneous tissue of the thoracic wall.

The domed shape of the thoracic cage has several functions. The thoracic cage:
- Protects vital thoracic and abdominal organs (most air or fluid filled) from external forces.
- Resists the negative (sub-atmospheric) internal pressures generated by the elastic recoil of the lungs and inspiratory movements.
- Provides attachment for and support the weight of the upper limbs.
- Provides the anchoring attachment (origin) of many of the muscles that move and maintain the position of the upper limbs relative to the trunk. It also provides attachments for muscles of the abdomen, neck, back, and respiration.

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SKELETON OF THORACIC WALL

The thoracic skeleton forms the osteocartilaginous thoracic cage. It protects the thoracic viscera and some abdominal organs. The thoracic skeleton includes 12 pairs of ribs and associated costal cartilages, 12 thoracic vertebrae and the intervertebral discs interposed between them, and the sternum. The ribs and costal cartilages form the largest part of the thoracic cage. Both are identified numerically, from the most superior (1st rib or costal cartilage) to the most inferior (12th).

THORACIC APERTURES

While the thoracic cage provides a complete wall peripherally, it is open superiorly and inferiorly. The superior opening is a passageway allowing communication with the neck and upper limbs. The larger inferior opening provides the ring-like origin of the diaphragm. It completely closes the opening. Important structures pass between the thoracic cavity and the neck through the superior thoracic aperture. Some of them are trachea, esophagus, nerves, and vessels that supply and drain the head, neck, and upper limbs.

JOINTS OF THORACIC WALL

The joints between the bones of the thorax have limited movement ability. But the whole outcome of these movements permits expansion of the cavity during inspiration. During inspiration, the thoracic cavity can expand in antero-posterior, vertical and transverse dimensions.
1. **Costovebral joints**
2. **Sternocostal joints**
3. **Costochondral joints**
4. **Interchondral joints**
5. **Sternal joints**

**MUSCLES OF THORACIC WALL**

Some muscles attached to and/or covering the thoracic cage are primarily involved in serving other regions. Several (axioappendicular) muscles extend from the thoracic cage (axial skeleton) to bones of the upper limb (appendicular skeleton). Muscles, such as sternocleidomastoid muscle, abdominal muscles, pectoral muscles, function as accessory muscles of respiration. They work in forced respiration. When the person needs to breathe in and out more than usual; 100 meter sprinters, patients with respiratory problems these muscles work.

**Muscles of the thoracic wall are**
- **Serratus posterior muscles**
- **Levatores costarum muscles**
- **Intercostal muscles (External, internal and innermost)**
- **Subcostal muscle**
- **Transversus thoracis muscle [1]**

All these muscles either elevate or depress the ribs helping to increase the volume of the thoracic cavity. The **transversus thoracis muscles** are deep to the internal thoracic vessels. They secure these vessels to the thoracic wall.

The **external intercostal muscles** are between the inferior margin of the rib above and the superior margin of the rib below. Its fibers pass obliquely anteroinferiorly. They are most active in inspiration. The internal intercostal muscles lie in the opposite direction to external ones. They are most active in expiration. The neurovascular bundle in an intercostal space lies on the plane between the internal and innermost intercostal muscles.

The diaphragm is a shared wall (actually floor/ceiling) separating the thorax and abdomen. Although it has functions related to both components of breathing, expiration is considered as a passive process.

When we need more air while breathing (running fast or problems in the lung), we used the accessory respiratory muscles such as pectoralis major muscle, sternocleidomastoid muscle, trapezius muscles. Abdominal muscles are accessory muscles for expiration. These muscles extend the space so that more air can enter.

**VASCULATURE OF THORACIC WALL**

In general, the pattern of vascular distribution in the thoracic wall reflects the structure of the thoracic cage. The vessels run in the intercostal spaces, parallel to the ribs. The anterior and posterior intercostal arteries are in the intercostal spaces; between ribs. The anterior intercostal arteries originate from the internal thoracic artery. The posterior intercostal arteries originate from branches of the subclavian artery.

**NERVES OF THORACIC WALL**

The intercostal nerves supply the thoracic wall. The thoracic spinal nerves are formed in the intervertebral foramina. As soon as they leave these openings, the mixed thoracic spinal nerves divide into two branches. These branches are the anterior and posterior (primary) rami or branches. The anterior rami of nerves T1-T11 form the intercostal nerves. The anterior ramus of T12 spinal nerve is called subcostal nerve. It lies inferior to the twelfth rib. The intercostal nerves run along the extent of the intercostal spaces. The intercostal nerves run in or just inferior to the costal grooves. They are inferior to the intercostal arteries. The intercostal arteries are inferior to the intercostal veins in the costal groove. (V.A.N. from superior to inferior in the intercostal space) The neurovascular bundles (and especially the vessels) are thus sheltered by the inferior margins of the overlying rib.

**MOVEMENTS OF THE THORACIC WALL**

One of the principal functions of the thoracic wall and the diaphragm is to alter the volume of the thorax. As a result the air is moved in and out of the lungs.
During breathing, dimensions of the thorax change in the vertical, lateral, and anteroposterior directions. Elevation and depression of the diaphragm significantly change the vertical dimensions of the thorax. Depression results when the muscle fibers of the diaphragm contract. Elevation occurs when the diaphragm relaxes.

**DERMATOMES**
Through its posterior ramus and the lateral and anterior cutaneous branches of its anterior ramus, most thoracic spinal nerves supply a strip-like dermatome of the trunk extending from the posterior median line to the anterior median line. The skin area supplied by a segment of the spinal cord is called dermatome.

<table>
<thead>
<tr>
<th>T2</th>
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<th>T6</th>
<th>T8</th>
<th>T10</th>
<th>T12</th>
</tr>
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<tbody>
<tr>
<td>Sternal angle</td>
<td>Nipple</td>
<td>Xiphoid process</td>
<td>Costal arch</td>
<td>Umbliculus</td>
<td>Midpoint between umbilicus and symphysis pubis</td>
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**BREASTS**
The breasts are the most prominent superficial structures in the anterior thoracic wall. The breasts (L. mammae) consist of glandular and supporting fibrous tissue. This tissue is within a fatty matrix, together with blood vessels, lymphatics, and nerves. Both men and women have breasts. Normally they are well developed only in women. The mammary glands are in the subcutaneous tissue overlying the pectoralis major muscles. At the greatest prominence of the breast is the nipple. The nipple is surrounded by a circular pigmented area of skin: areola (L. small area).

The mammary glands within the breasts are accessory to reproduction in women. They are rudimentary and functionless in men. They only have a few small ducts or epithelial cords. Usually, the fat present in the male breast is not different from that of subcutaneous tissue elsewhere. The glandular system does not normally develop.

**Female Breasts**
The amount of fat surrounding the glandular tissue determines the size of non-lactating breasts. The roughly circular body of the female breast rests on a bed that extends transversely from the lateral border of the sternum.
The lymphatic drainage of the breast is important due to its role in the metastasis of cancer cells. Most lymph, especially from the lateral breast quadrants, drains to the axillary lymph nodes (70% of the lymph drainage). Most of the remaining lymph, particularly from the medial breast quadrants, drains to the parasternal lymph nodes or to the opposite breast. The lymph from the inferior quadrants passes deeply to abdominal lymph nodes.