7.4: The Thoracic Cage

Skills to Develop

• Discuss the components that make up the thoracic cage
• Identify the parts of the sternum and define the sternal angle
• Discuss the parts of a rib and rib classifications

The thoracic cage (rib cage) forms the thorax (chest) portion of the body. It consists of the 12 pairs of ribs with their costal cartilages and the sternum (Figure \(\PageIndex{1}\)). The ribs are anchored posteriorly to the 12 thoracic vertebrae (T1–T12). The thoracic cage protects the heart and lungs.

**Figure \(\PageIndex{1}\): Thoracic Cage.** The thoracic cage is formed by the (a) sternum and (b) 12 pairs of ribs with their costal cartilages. The ribs are anchored posteriorly to the 12 thoracic vertebrae. The sternum consists of the manubrium, body, and xiphoid process. The ribs are classified as true ribs (1–7) and false ribs (8–12). The last two pairs of false ribs are also known as floating ribs (11–12).
**Sternum**

The sternum is the elongated bony structure that anchors the anterior thoracic cage. It consists of three parts: the manubrium, body, and xiphoid process. The **manubrium** is the wider, superior portion of the sternum. The top of the manubrium has a shallow, U-shaped border called the **jugular (suprasternal) notch**. This can be easily felt at the anterior base of the neck, between the medial ends of the clavicles. The **clavicular notch** is the shallow depression located on either side at the superior-lateral margins of the manubrium. This is the site of the sternoclavicular joint, between the sternum and clavicle. The first ribs also attach to the manubrium.

The elongated, central portion of the sternum is the body. The manubrium and body join together at the **sternal angle**, so called because the junction between these two components is not flat, but forms a slight bend. The second rib attaches to the sternum at the sternal angle. Since the first rib is hidden behind the clavicle, the second rib is the highest rib that can be identified by palpation. Thus, the sternal angle and second rib are important landmarks for the identification and counting of the lower ribs. Ribs 3–7 attach to the sternal body.

The inferior tip of the sternum is the **xiphoid process**. This small structure is cartilaginous early in life, but gradually becomes ossified starting during middle age.

**Ribs**

Each rib is a curved, flattened bone that contributes to the wall of the thorax. The ribs articulate posteriorly with the T1–T12 thoracic vertebrae, and most attach anteriorly via their costal cartilages to the sternum. There are 12 pairs of ribs. The ribs are numbered 1–12 in accordance with the thoracic vertebrae.

**Parts of a Typical Rib**

The posterior end of a typical rib is called the **head of the rib** (see [link](https://med.libretexts.org/Bookshelves/Anatomy_and_Physiology/Book%3A_Anatomy_and_Physiology_(OpenStax)/Unit_2%3A_Support_and_Movement/7.04%3A_The_Thoracic_Cage)). This region articulates primarily with the costal facet located on the body of the same numbered thoracic vertebra and to a lesser degree, with the costal facet located on the body of the next higher vertebra. Lateral to the head is the narrowed **neck of the rib**. A small bump on the posterior rib surface is the **tubercle of the rib**, which articulates with the facet located on the transverse process of the same numbered vertebra. The remainder of the rib is the **body of the rib** (shaft). Just lateral to the tubercle is the **angle of the rib**, the point at which the rib has its greatest degree of curvature. The angles of the ribs form the most posterior extent of the thoracic cage. In the anatomical position, the angles align with the medial border of the scapula. A shallow **costal groove** for the passage of blood vessels and a nerve is found along the inferior margin of each rib.

**Rib Classifications**

The bony ribs do not extend anteriorly completely around to the sternum. Instead, each rib ends in a **costal cartilage**. These cartilages are made of hyaline cartilage and can extend for several inches. Most ribs are then attached, either directly or indirectly, to the sternum via their costal cartilage (see Figure 

"https://med.libretexts.org/Bookshelves/Anatomy_and_Physiology/Book%3A_Anatomy_and_Physiology_(OpenStax)/Unit_2%3A_Support_and_Movement/7.04%3A_The_Thoracic_Cage")]. The ribs are classified into three groups based on their relationship to the sternum.
Ribs 1–7 are classified as **true ribs** (vertebrosternal ribs). The costal cartilage from each of these ribs attaches directly to the sternum. Ribs 8–12 are called **false ribs** (vertebrochondral ribs). The costal cartilages from these ribs do not attach directly to the sternum. For ribs 8–10, the costal cartilages are attached to the cartilage of the next higher rib. Thus, the cartilage of rib 10 attaches to the cartilage of rib 9, rib 9 then attaches to rib 8, and rib 8 is attached to rib 7. The last two false ribs (11–12) are also called **floating ribs** (vertebral ribs). These are short ribs that do not attach to the sternum at all. Instead, their small costal cartilages terminate within the musculature of the lateral abdominal wall.

**Chapter Review**

The thoracic cage protects the heart and lungs. It is composed of 12 pairs of ribs with their costal cartilages and the sternum. The ribs are anchored posteriorly to the 12 thoracic vertebrae. The sternum consists of the manubrium, body, and xiphoid process. The manubrium and body are joined at the sternal angle, which is also the site for attachment of the second ribs.

Ribs are flattened, curved bones and are numbered 1–12. Posteriorly, the head of the rib articulates with the costal facets located on the bodies of thoracic vertebrae and the rib tubercle articulates with the facet located on the vertebral transverse process. The angle of the ribs forms the most posterior portion of the thoracic cage. The costal groove in the inferior margin of each rib carries blood vessels and a nerve. Anteriorly, each rib ends in a costal cartilage. True ribs (1–7) attach directly to the sternum via their costal cartilage. The false ribs (8–12) either attach to the sternum indirectly or not at all. Ribs 8–10 have their costal cartilages attached to the cartilage of the next higher rib. The floating ribs (11–12) are short and do not attach to the sternum or to another rib.

**Review Questions**

Q. The sternum ________.

   A. consists of only two parts, the manubrium and xiphoid process
   
   B. has the sternal angle located between the manubrium and body
   
   C. receives direct attachments from the costal cartilages of all 12 pairs of ribs
   
   D. articulates directly with the thoracic vertebrae

   Answer: B

Q. The sternal angle is the ________.

   A. junction between the body and xiphoid process
   
   B. site for attachment of the clavicle
   
   C. site for attachment of the floating ribs
D. junction between the manubrium and body

Answer: D

Q. The tubercle of a rib ________.

A. is for articulation with the transverse process of a thoracic vertebra
B. is for articulation with the body of a thoracic vertebra
C. provides for passage of blood vessels and a nerve
D. is the area of greatest rib curvature

Answer: A

Q. True ribs are ________.

A. ribs 8–12
B. attached via their costal cartilage to the next higher rib
C. made entirely of bone, and thus do not have a costal cartilage
D. attached via their costal cartilage directly to the sternum

Answer: D

Critical Thinking Questions

Q. Define the parts and functions of the thoracic cage.

A. The thoracic cage is formed by the 12 pairs of ribs with their costal cartilages and the sternum. The ribs are attached posteriorly to the 12 thoracic vertebrae and most are anchored anteriorly either directly or indirectly to the sternum. The thoracic cage functions to protect the heart and lungs.

Q. Describe the parts of the sternum.

A. The sternum consists of the manubrium, body, and xiphoid process. The manubrium forms the expanded, superior end of the sternum. It has a jugular (suprasternal) notch, a pair of clavicular notches for articulation with the clavicles, and receives the costal cartilage of the first rib. The manubrium is joined to the body of the sternum at the sternal angle, which is also the site for attachment of the second rib costal cartilages. The body receives the costal cartilage attachments for ribs 3–7. The small xiphoid process forms the inferior tip of the sternum.
Q. Discuss the parts of a typical rib.

A. A typical rib is a flattened, curved bone. The head of a rib is attached posteriorly to the costal facets of the thoracic vertebrae. The rib tubercle articulates with the transverse process of a thoracic vertebra. The angle is the area of greatest rib curvature and forms the largest portion of the thoracic cage. The body (shaft) of a rib extends anteriorly and terminates at the attachment to its costal cartilage. The shallow costal groove runs along the inferior margin of a rib and carries blood vessels and a nerve.

Q. Define the classes of ribs.

A. Ribs are classified based on if and how their costal cartilages attach to the sternum. True (vertebrosternal) ribs are ribs 1–7. The costal cartilage for each of these attaches directly to the sternum. False (vertebrochondral) ribs, 8–12, are attached either indirectly or not at all to the sternum. Ribs 8–10 are attached indirectly to the sternum. For these ribs, the costal cartilage of each attaches to the cartilage of the next higher rib. The last false ribs (11–12) are also called floating (vertebral) ribs, because these ribs do not attach to the sternum at all. Instead, the ribs and their small costal cartilages terminate within the muscles of the lateral abdominal wall.

Glossary

angle of the rib
portion of rib with greatest curvature; together, the rib angles form the most posterior extent of the thoracic cage

body of the rib
shaft portion of a rib

clavicular notch
paired notches located on the superior-lateral sides of the sternal manubrium, for articulation with the clavicle

costal cartilage
hyaline cartilage structure attached to the anterior end of each rib that provides for either direct or indirect attachment of most ribs to the sternum

costal groove
shallow groove along the inferior margin of a rib that provides passage for blood vessels and a nerve

false ribs
vertebrochondral ribs 8–12 whose costal cartilage either attaches indirectly to the sternum via the costal cartilage of the next higher rib or does not attach to the sternum at all

floating ribs
vertebral ribs 11–12 that do not attach to the sternum or to the costal cartilage of another rib

head of the rib
posterior end of a rib that articulates with the bodies of thoracic vertebrae

jugular (suprasternal) notch
shallow notch located on superior surface of sternal manubrium

manubrium
expanded, superior portion of the sternum
neck of the rib
narrowed region of a rib, next to the rib head

sternal angle
junction line between manubrium and body of the sternum and the site for attachment of the second rib to the sternum

true ribs
vertebrosternal ribs 1–7 that attach via their costal cartilage directly to the sternum

tubercle of the rib
small bump on the posterior side of a rib for articulation with the transverse process of a thoracic vertebra

Contributors

xiphoid process
small process that forms the inferior tip of the sternum