

1 The thoracic wall I

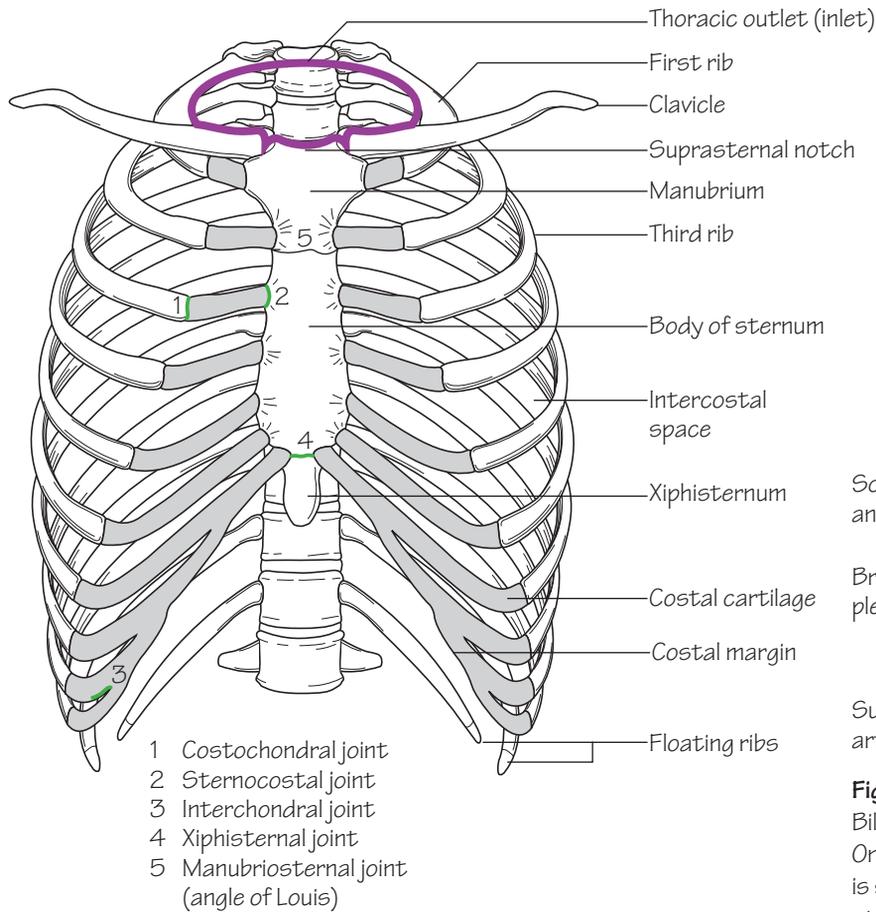


Fig.1.1
The thoracic cage. The outlet (inlet) of the thorax is outlined

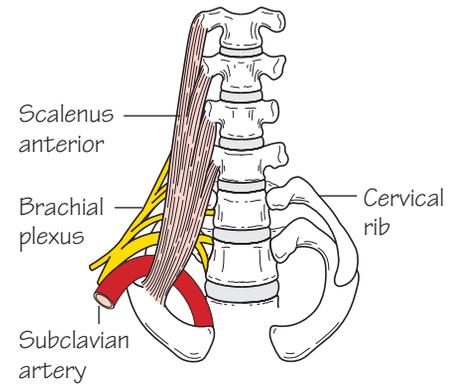


Fig.1.3
Bilateral cervical ribs. On the right side the brachial plexus is shown arching over the rib and stretching its lowest trunk

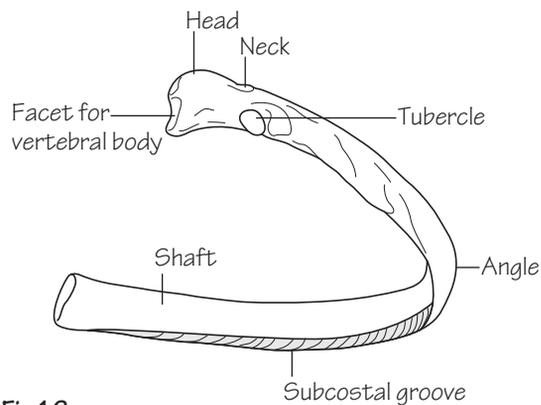


Fig.1.2
A typical rib

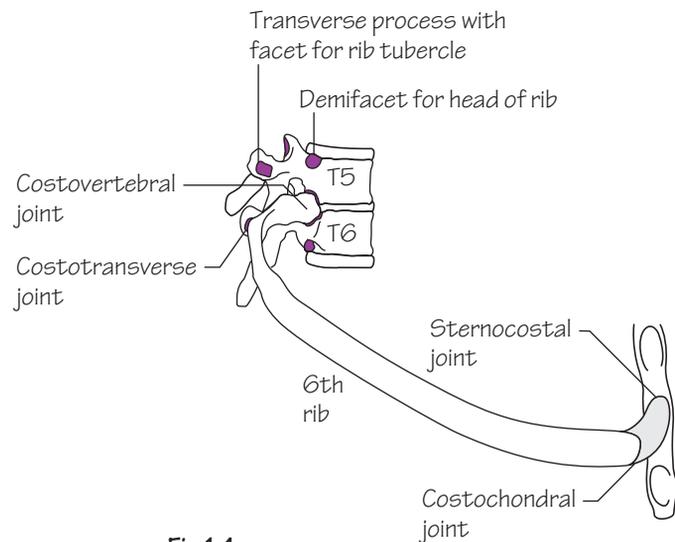


Fig.1.4
Joints of the thoracic cage

The thoracic cage

The thoracic cage is formed by the sternum and costal cartilages in front, the vertebral column behind and the ribs and intercostal spaces laterally.

It is separated from the abdominal cavity by the diaphragm and communicates superiorly with the root of the neck through the *thoracic inlet* (Fig. 1.1).

The ribs (Fig. 1.1)

- Of the 12 pairs of ribs, the first seven articulate with the vertebrae posteriorly and with the sternum anteriorly by way of the costal cartilages (*true ribs*).
- The cartilages of the 8th, 9th and 10th ribs articulate with the cartilages of the ribs above (*false ribs*).
- The 11th and 12th ribs are termed 'floating' because they do not articulate anteriorly (*false ribs*).

Typical ribs (3rd–9th)

These comprise the following features (Fig. 1.2):

- A *head* which bears two demifacets for articulation with the bodies of: the numerically corresponding vertebra and the vertebra above (Fig. 1.4).
- A *tubercle* which comprises a rough non-articulating lateral facet as well as a smooth medial facet. The latter articulates with the transverse process of the corresponding vertebra (Fig. 1.4).
- A *subcostal groove*: the hollow on the inferior inner aspect of the shaft which accommodates the intercostal neurovascular structures.

Atypical ribs (1st, 2nd, 10th, 11th, 12th)

- The **1st rib** (see Fig. 66.2) is short, flat and sharply curved. The head bears a single facet for articulation. A prominent tubercle (*scalene tubercle*) on the inner border of the upper surface represents the insertion site for scalenus anterior. The subclavian vein passes over the 1st rib anterior to this tubercle, whereas the subclavian artery and lowest trunk of the brachial plexus pass posteriorly.
- The **2nd rib** is less curved and longer than the 1st rib.
- The **10th rib** has only one articular facet on the head.
- The **11th and 12th ribs** are short and do not articulate anteriorly. They articulate posteriorly with the vertebrae by way of a single facet on the head. They are devoid of both a tubercle and a subcostal groove.

The sternum (Fig. 1.1)

The sternum comprises a manubrium, body and xiphoid process.

- The *manubrium* has facets for articulation with the clavicles, 1st costal cartilage and upper part of the 2nd costal cartilage. It articulates inferiorly with the body of the sternum at the *manubriosternal joint*.
- The *body* is composed of four parts or *sternebrae* which fuse between 15 and 25 years of age. It has facets for articulation with the lower part of the 2nd and the 3rd to 7th costal cartilages.
- The *xiphoid* articulates above with the body at the *xiphisternal joint*. The xiphoid usually remains cartilaginous well into adult life.

Costal cartilages

These are bars of hyaline cartilage which connect the upper seven ribs directly to the sternum and the 8th, 9th and 10th ribs to the cartilage immediately above.

Joints of the thoracic cage (Figs 1.1 and 1.4)

- The *manubriosternal joint* is a symphysis. It usually ossifies after the age of 30 years.
- The *xiphisternal joint* is also a symphysis.
- The *1st sternocostal joint* is a primary cartilaginous joint. The rest (2nd to 7th) are synovial joints. All have a single synovial joint except for the 2nd which is double.
- The *costochondral joints* (between the ribs and costal cartilages) are primary cartilaginous joints.
- The *interchondral joints* (between the costal cartilages of the 8th, 9th and 10th ribs) are synovial joints.
- The *costovertebral joints* comprise two synovial joints formed by the articulations of the demifacets on the head of each rib with the bodies of its corresponding vertebra together with that of the vertebra above. The 1st and 10th–12th ribs have a single synovial joint with their corresponding vertebral bodies.
- The *costotransverse joints* are synovial joints formed by the articulations between the facets on the rib tubercle and the transverse process of its corresponding vertebra.

Clinical notes

- **Cervical rib**—a cervical rib is a rare 'extra' rib which articulates with C7 posteriorly and the 1st rib anteriorly. A neurological deficit and vascular insufficiency arise as a result of pressure from the rib on the lowest trunk of the brachial plexus (T1) and subclavian artery, respectively (Fig. 1.3).
- **Rib fracture**—rib fractures are usually caused by trauma. Although significant injury is generally required to damage the bony thoracic wall, pathological rib fractures (i.e. fractures occurring in diseased bone—usually metastatic carcinoma) can result from minimal trauma. Many rib fractures are not visible on X-rays unless complications, such as a pneumothorax or a haemothorax, are present. Treatment of simple rib fractures aims to relieve pain. Inadequate analgesia can lead to poor chest expansion and consequent pneumonia. In severe trauma, multiple adjacent rib fractures can give rise to a 'flail' segment. When this occurs, ventilatory compromise can supervene. The latter generally results from associated traumatic lung injury but, in addition, the flail segment moves paradoxically with respiratory movements, thereby aggravating ventilatory/perfusion mismatch.
- **Pectus excavatum and carinatum**—deformities of the chest wall are uncommon. Pectus excavatum represents a visible furrow in the anterior chest wall that results from a depressed sternum. In contrast, pectus carinatum (pigeon chest) is a clinical manifestation that results from a sternal protrusion. Rarely do either of these conditions require surgical correction.