

Ribs and Costal Cartilages

Introduction

- The **thorax** is an **osseocartilaginous cavity** that provides **protection and support** to vital thoracic viscera (heart, lungs, and great vessels).
 - The thoracic cage is **dynamic**, not rigid—it moves at its joints to increase or decrease its diameters during **respiration**.
 - **Functionally:**
 - Expansion = **Inspiration**
 - Contraction = **Expiration**
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Bones of Thorax

- The skeleton of the thorax consists of:
 1. **12 thoracic vertebrae** (posteriorly)
 2. **12 pairs of ribs and costal cartilages** (laterally)
 3. **Sternum** (anteriorly)
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Ribs (Costae)

- There are **12 ribs on each side** forming the major part of the thoracic skeleton.

- Number may vary (presence of cervical or lumbar rib; absence of 12th rib).

Features:

- Ribs are **bony arches**, one below another, with **intercostal spaces** in between.
- **Obliquity**: Increases up to the 9th rib, then decreases toward the 12th.
- **Length**: Increases from 1st to 7th; decreases thereafter.
- **Breadth**: Decreases from above downward.

Classification:

1. According to articulation with sternum:

- **True ribs (1–7)**: Attach directly to sternum via costal cartilages.
- **False ribs (8–10)**: Join cartilage of rib above (vertebrochondral).
- **Floating ribs (11–12)**: Free anterior ends (vertebral ribs).

2. According to morphology:

- **Typical ribs**: 3rd–9th
- **Atypical ribs**: 1st, 2nd, 10th, 11th, 12th

Typical Rib – Features

- Each rib has **two ends** and a **shaft**:

- **Anterior (sternal) end:** Oval and concave for costal cartilage.
- **Posterior (vertebral) end:** Head, neck, and tubercle.
- **Shaft:** Convex outward; **costal groove** along lower inner surface for **intercostal vessels and nerve**.

Side Determination:

- Head posterior, costal groove inferior, convexity lateral.
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Ossification of a Typical Rib

- Each typical rib ossifies from **three centers**:
 1. **One primary center** for the **shaft** (in 2nd month of fetal life).
 2. **Two secondary centers**—one for the **head**, one for the **tubercle** (appear at puberty and fuse by 20 years).

11th and 12th ribs:

- Ossify from **two centers** — one for shaft, one for head.
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Costal Cartilages

- Represent the **unossified anterior parts** of ribs made of **hyaline cartilage**.
- Provide **elasticity** to thoracic wall.

Attachments:

- **1st–7th ribs:** Costal cartilages attach directly to sternum.
- **8th–10th ribs:** Join each other forming the **costal margin**.
- **11th–12th ribs:** Small, free ends in the abdominal wall muscles.

Muscle Attachments:

- **Anterior surface:**
 - 1st cartilage ? Subclavius, costoclavicular ligament.
 - 2nd–6th ? Pectoralis major.
 - Lower cartilages ? Abdominal wall muscles.
- **Posterior surface:**
 - 1st ? Sternothyroid.
 - 2nd–6th ? Sternocostalis.
 - 7th–12th ? Transversus abdominis and diaphragm.

Clinical Anatomy

- **Rib fractures:**
 - Common at the **angle** due to indirect trauma.
 - **Upper two ribs** protected by clavicle; **lower two** flexible—rarely fractured.

- **Cervical rib:**

- Arises from C7, compressing **brachial plexus** or **subclavian artery** (Thoracic Outlet Syndrome).

- **Rib variations:**

- Absence of 12th rib or presence of extra cervical/lumbar ribs possible.

- **Costochondritis:**

- Inflammation at costochondral junction causing chest pain mimicking cardiac pain.

Summary Table

STRUCTURE	FEATURE / FUNCTION
True ribs	1st–7th, attach to sternum
False ribs	8th–10th, join cartilage above
Floating ribs	11th–12th, free anteriorly
Ossification centers	Shaft (primary), head & tubercle (secondary)
Costal cartilage	Hyaline cartilage, elasticity to thorax
Common fracture site	Rib angle
Clinical relevance	Rib fracture, cervical rib, costochondritis