MEDICAL EDUCATION RESOURCE

Typical Intercostal Spaces,Arteries,Veins,Lymphatics,Internal Thoracic Artery

Typical Intercostal Spaces

- A **typical intercostal space** is found between the **3rd and 6th ribs**; it contains muscles, vessels, and nerves arranged in a definite order.
- Each space is filled by:
    1. **External intercostal muscle**
    2. **Internal intercostal muscle**
    3. **Innermost intercostal muscle**
    4. **Intercostal vessels and nerve**

Arrangement of structures (from above downward):
Vein – Artery – Nerve (V-A-N) located in the **costal groove** on the lower border of the upper rib.

Contents of a typical intercostal space:

- **Posterior intercostal artery** (from thoracic aorta).
- **Anterior intercostal artery** (from internal thoracic or musculophrenic artery).
- **Intercostal vein** (drains into azygos/hemiazygos or internal thoracic vein).

- **Intercostal nerve** (anterior ramus of thoracic spinal nerve).
- **Lymphatics** accompanying these vessels.

Muscular plane arrangement (from superficial to deep):

- External intercostal ? Internal intercostal ? Innermost intercostal (subcostal and transversus thoracis portions).

Function:

- Provides rigidity to thoracic wall, assists in respiration, and serves as passage for neurovascular bundles.

Intercostal Arteries

Each intercostal space receives **two sets of arteries**:
1. Posterior intercostal arteries and **2. Anterior intercostal arteries.**

Posterior Intercostal Arteries

- **Origin:**
  - First two ? from **superior intercostal artery** (branch of costocervical trunk of subclavian artery).
  - Remaining nine ? from **thoracic aorta**.
- **Course:**
  - Each passes between internal and innermost intercostal muscles in the costal groove.

- Accompanied by intercostal vein (above) and nerve (below).

- **Branches:**
  - **Dorsal branch:** supplies vertebrae, spinal cord, and back muscles.
  - **Collateral branch:** runs along upper border of rib below.
  - **Lateral cutaneous branch:** to overlying skin.
  - **Muscular branches:** to intercostal muscles.

Anterior Intercostal Arteries

- **Origin:**
  - From **internal thoracic artery** (upper six spaces).
  - From **musculophrenic artery** (lower spaces).
- **Course:**
  - Each space receives **two anterior intercostal arteries**—one near upper border and one near lower border.
  - They anastomose with **posterior intercostal arteries** in the mid-axillary line.
- **Distribution:**
  - Supply intercostal muscles, ribs, costal cartilages, and overlying skin.

Intercostal Veins

- Each intercostal space has **posterior and anterior intercostal veins**, corresponding to the arteries.
- **Arrangement:** Vein lies **above the artery** and **nerve below** in the costal groove.

Posterior Intercostal Veins

- Drain into:
  - **Right side:** into **azygos vein**.
  - **Left side:**
    - Upper two or three ? **left superior intercostal vein** (to left brachiocephalic vein).
    - Remaining ? **hemiazygos** or **accessory hemiazygos veins**.
- Communicate with **vertebral venous plexuses**, providing alternate venous return pathways.

Anterior Intercostal Veins

- Drain into **internal thoracic** or **musculophrenic veins**, which then open into **brachiocephalic veins**.

Clinical Relevance:

- The **posterior intercostal veins** form vital anastomoses between the **systemic and portal circulation**, significant in conditions like **portal hypertension**.
- **Azygos system** serves as a collateral pathway for venous blood to bypass the inferior vena cava if it is obstructed.

Lymphatics of an Intercostal Space

- The **lymphatic drainage** of each intercostal space is divided into **anterior** and **posterior** groups.
- **Anterior group:**
    - Lymphatics from the **anterior part** of each intercostal space drain into the **anterior intercostal (internal mammary) lymph nodes**.
    - These nodes lie along the **internal thoracic artery**.
    - The **efferent vessels** from these nodes join those of the **tracheobronchial** and **brachiocephalic nodes** to form the **bronchomediastinal trunk**.
    - This trunk opens into the **right lymphatic duct** on the right side and into the **thoracic duct** on the left.
- **Posterior group:**
    - Lymphatics from the **posterior part** of the intercostal space drain into **posterior intercostal lymph nodes**, located on the **heads and necks of the ribs**.
    - Efferents from the **lower four posterior intercostal spaces** unite to form a **lymphatic trunk** that descends to open into the **cisterna chyli**.
    - Efferents from the **upper spaces** drain into the **bronchomediastinal trunks** on both sides

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Internal Thoracic Artery

Origin:

- Arises from the **inferior aspect of the first part of the subclavian artery**, opposite the **thyrocervical trunk**.
- The origin lies about **2 cm above the sternal end of the clavicle**.

Course:

- Descends **medially and downward** behind the **sternal end of the clavicle** and **first costal cartilage**.
- Runs **vertically downwards**, about **2 cm from the lateral border of the sternum**, up to the **6th intercostal space**.
- Terminates by dividing into the **superior epigastric** and **musculophrenic arteries**.

Relations:

- **Anteriorly:** Covered by pectoralis major, first six costal cartilages, external intercostal membranes, internal intercostal muscles, and first six intercostal nerves.
- **Posteriorly:** Related to **endothoracic fascia and pleura** up to the 2nd or 3rd costal cartilage, and below this level by the **sternocostalis muscle**.
- **Accompaniment:** Paired **venae comitantes** that unite near the 4th costal cartilage to form the **internal thoracic vein**, which drains into the **brachiocephalic vein**.

Branches:

1. **Pericardiacophrenic artery** – accompanies the **phrenic nerve**, supplies **pericardium** and **pleura**.

2. **Mediastinal arteries** – small branches to **thymus**, **pericardium**, and **mediastinal fat**.

3. **Anterior intercostal arteries** – two branches to each of the **upper six intercostal spaces**.

4. **Perforating arteries** – in 2nd to 4th spaces, supply **mammary gland**.

5. **Terminal branches:**

    - **Superior epigastric artery** – enters rectus sheath to anastomose with **inferior epigastric artery**.

    - **Musculophrenic artery** – supplies **7th–9th intercostal spaces** and **diaphragm**

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Clinical Note:

- The **internal thoracic artery** is often used in **coronary artery bypass grafting (CABG)** because of its durability and resistance to atherosclerosis.

- It must be avoided during **pericardiocentesis**, as it lies **1 cm lateral to the sternum**.