

# THORAX

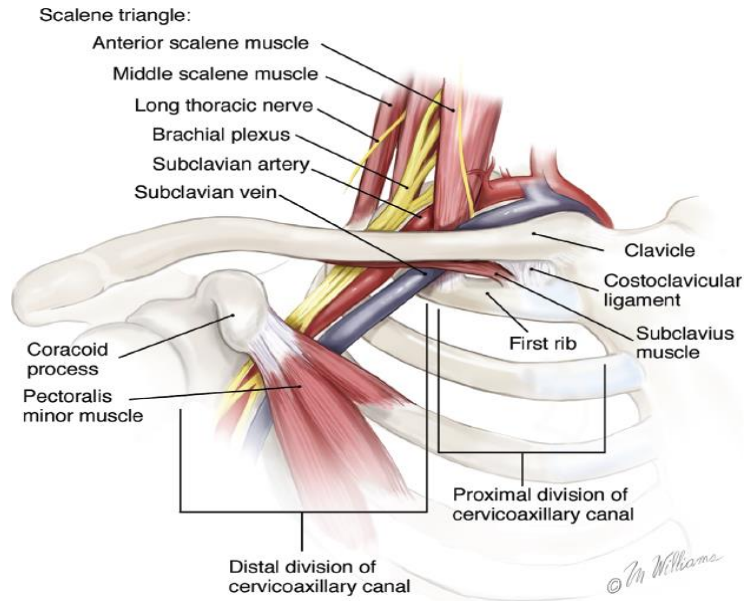
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KGMC

## THORAX OVERVIEW (FROM SNELL'S ANATOMY)

- The adult sternum consist of three parts: Manubrium, body and xiphoid process
- The suprasternal notch is easily palpable, concave notch in the superior border of manubrium
- The sternal angle is an important landmark for thoracic anatomy because it marks:
  1. The manubriosternal joint
  2. Attachment points of second costal cartilage
  3. Horizontal line that typically projects posteriorly onto the T4 intervertebral disc
  4. Plane of separation between the superior and inferior mediastina
- RIBS:
  - True Ribs (Pairs 1 to 7) – connected directly to sternum via costal cartilage
  - False Ribs (Pairs 8 to 10) – connected to sternum via individual costal cartilages that join together and attach collectively to seventh costal cartilage
  - Floating Ribs (Pairs 11 and 12) – do not attach to sternum
- Typical Rib Anatomy:
  - Head – posterior (vertebral) end of the rib having two facets for articulation with the numerically corresponding vertebral body and that of vertebra immediately above
  - Neck – flattened, slightly constricted portion situated between the head and the tubercle
  - Tubercle – A prominence on outer posterior surface of the rib at the junction of the neck with the body. It has a facet for articulation with the transverse process of numerically corresponding vertebra.
  - Body (Shaft) – A long, thin, flattened and twisted part that extends from tubercle to anterior (sternal) end
  - Costal groove – Elongate depression along the inferior aspect of internal surface of shaft of rib. This holds the intercostal vessels and nerve.
  - Angle – The point at which the body of the rib bends sharply and turns from a lateral to a more anteriorly directed orientation
  - Anterior (sternal) end has a depression for costal cartilage
- FIRST RIB

- Anterior scalenus muscle attached to upper surface and inner border of first rib
- Subclavian vein crosses the rib anterior to scalenus anterior
- Subclavian artery and lower trunk of brachial plexus cross the rib posterior to scalenus anterior and lie in contact with the bone



- The costal cartilages contribute significantly to the elasticity and mobility of the thoracic walls. In old age, the costal cartilages tend to lose some of its flexibility as a result of significant calcification.
- **COSTAL FACETS OF VERTEBRAE**
  - Typical thoracic vertebrae (2 to 8) have two costal facets on each side i.e. superior costal facet and inferior costal facet
  - These are the sites where the heads of the ribs articulates with the body
  - Because of each of these facets carries half of the rib articulation, each is commonly called a demifacet
  - T<sub>1</sub> vertebra have full costal facet for head of first rib, plus an inferior demifacet for the superior half of head of second rib
  - The T<sub>11</sub> and T<sub>12</sub> vertebrae each have full costal facets instead of demifacets and articulate only with their own individual ribs
- **TRANSVERSE COSTAL FACETS**
  - Small articular surfaces on the transverse processes
  - These are the sites where tubercle of each rib articulates with transverse process
  - Not present on T<sub>11</sub> and T<sub>12</sub> vertebrae
- **JOINTS**
  1. Manubriosternal Joint

- cartilaginous joint between manubrium and body of sternum
  - small amount of angular movement possible during respiration
- 2. Xiphisternal Joint
  - Cartilaginous joint between xiphoid process and body of sternum
  - Xiphoid process usually fuses with body of sternum during middle age
- 3. Joints of heads of ribs
  - Rib 1 and Rib 10, 11, 12 have a single synovial joint between their corresponding vertebral body
  - From ribs 2 to 9, the head articulates by means of a synovial joint with the corresponding vertebral body and that of vertebra above it
- 4. Joints of tubercles of ribs
  - Synovial joint between tubercle of rib and transverse process of corresponding vertebra
  - This joint is absent on 11<sup>th</sup> and 12<sup>th</sup> rib
- 5. Joints of ribs and costal cartilages
  - Cartilaginous joints
  - No movement permitted
- 6. Joints of costal cartilages with sternum
  - First costal cartilage articulate with manubrium by cartilaginous joints that do not permit movement
  - 2<sup>nd</sup> to 7<sup>th</sup> costal cartilages articulate with lateral border of sternum by synovial joints
  - 6<sup>th</sup> to 10<sup>th</sup> costal cartilages articulate with one another along their borders by small synovial joints
  - 11<sup>th</sup> and 12<sup>th</sup> ribs do not articulate with sternum and are embedded in abdominal musculature

- **Superior Thoracic Aperture or Thoracic Outlet** – The narrow opening through which chest cavity communicates with the root of the neck

**BOUNDARIES:**

- Posteriorly – body of first thoracic vertebra
- Laterally – medial edges of first ribs and their costal cartilages
- Anteriorly – superior margin of manubrium sterni

**CONTENTS:**

- Esophagus
- Trachea
- Several vessels and nerves

- **Inferior Thoracic Aperture** – A large opening through which thoracic cavity communicates with the abdomen

**BOUNDARIES:**

- Posteriorly – body of 12<sup>th</sup> thoracic vertebra

- Laterally – curving costal margin
- Anteriorly – xiphisternal joint

The diaphragm closes the inferior aperture. Structures passing between thoracic and abdominal cavities (e.g. esophagus, aorta) must either pierce the diaphragm or go around the diaphragm.

- **Suprapleural Membrane** – A dense fascial layer that closes the thoracic outlet. It protects the underlying cervical pleura and resists the changes in intrathoracic pressure occurring during respiratory movements.

BOUNDARIES:

Laterally – medial border of first rib and costal cartilage

Medially – fascia investing the structures passing from thorax into neck

Apex – tip of transverse process of C<sub>7</sub> vertebra

- **Endothoracic Fascia** is a thin layer of loose connective tissue that separates the parietal pleura from the thoracic wall. The suprapleural membrane is a thickening of this fascia.

- **Intercostal spaces** are the gaps between adjacent ribs.

Structural layers of intercostal spaces (from superficial to deep):

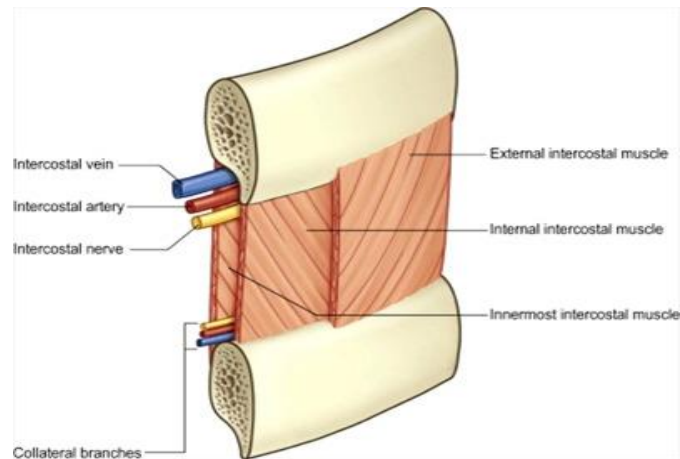
1. Skin
2. Superficial fascia
3. Deep fascia
4. Intercostal muscles
  - a. External intercostals
  - b. Internal intercostals
  - c. Innermost intercostals
5. Endothoracic fascia
6. Extrapleural fatty layer
7. Parietal pleura

- The intercostal nerves and blood vessels run between the middle and innermost layer of intercostal muscles.

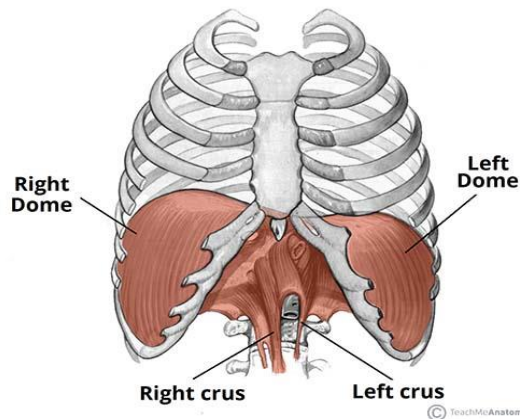
They are arranged in following order from above downward:

(Mnemonic VAN)

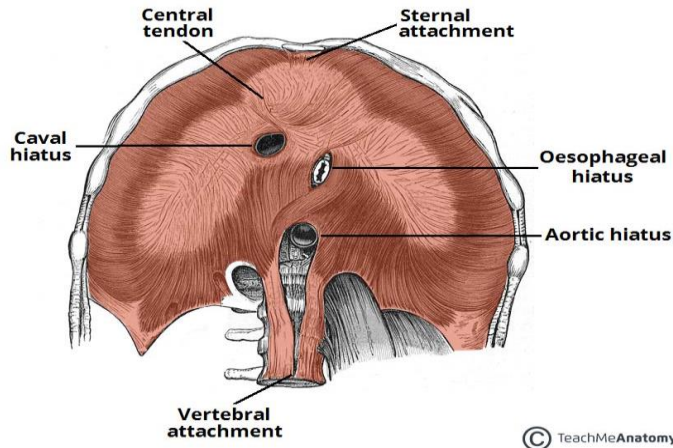
- Intercostal vein
- Intercostal artery
- Intercostal nerve



- Origin of diaphragm can be divided into three parts
  1. **Sternal part** arising from posterior surface of xiphoid process
  2. **Costal part** arising from deep surfaces of lower six rib and their costal cartilages
  3. **Vertebral part** arising by vertebral columns (crura) and from the arcuate ligaments
    - The **right crus** arises from sides of the bodies of first three lumbar vertebrae and the intervertebral discs
    - The **left crus** arises from sides of bodies of the first two lumbar vertebrae and the intervertebral discs
    - Lateral to the crura, the diaphragm arises from **medial and lateral arcuate ligaments**.



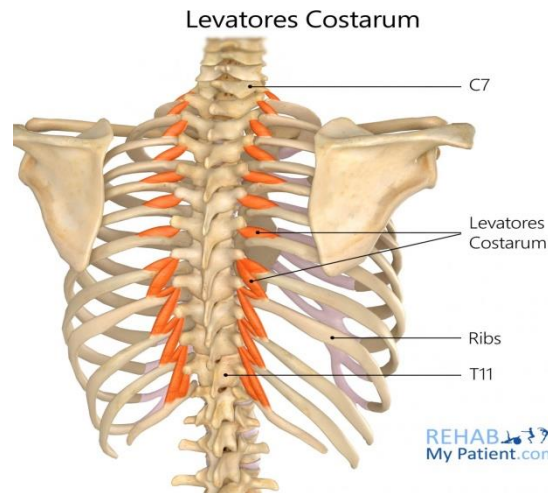
- The diaphragm inserts into a central tendon which is shaped like three leaves. Some of the fibers of the right crus pass up to the left and surround the esophageal orifice in a slinglike loop. These fibers appear to act as a sphincter and possibly assist in the prevention of regurgitation of the stomach contents into the thoracic part of esophagus.



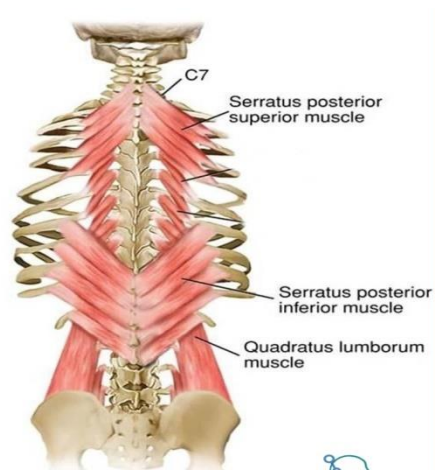
- The right dome reaches as high as upper border of the fifth rib
  - The left dome may reach the lower border of fifth rib
  - The central tendon lies at level of xiphisternal joint
  - The domes support the right and left lungs, whereas the central tendon supports the heart
  
- NERVE SUPPLY OF DIAPHRAGM
  - Motor nerve supply comes from right and left phrenic nerves (C<sub>3</sub>, C<sub>4</sub>, C<sub>5</sub>)
  - For sensory nerve supply, the phrenic nerves supply the parietal pleura and peritoneum covering central surfaces of diaphragm
  - The lower six intercostal nerves supply the periphery of diaphragm
  
- DIAPHRAGM OPENINGS
  1. Aortic opening
    - Lies anterior to the body of 12<sup>th</sup> thoracic vertebra and between the crura
    - It transmits:
      - Aorta
      - Thoracic duct
      - Azygos vein
  2. Esophageal opening
    - Lies at level of 10<sup>th</sup> thoracic vertebra in a sling of muscle fibers derived from right crus
    - It transmits:
      - Esophagus
      - Right and left vagus nerves
      - Esophageal branches of left gastric vessels
      - Lymphatics from lower third of esophagus
  3. Caval opening
    - Lies at level of 8<sup>th</sup> thoracic vertebra, in the central tendon
    - It transmits:
      - Inferior vena cava

- Right phrenic nerve

- Levatores Costarum muscles
  - Comprise 12 pairs
  - Each is triangular in shape and inserts into rib below its origin

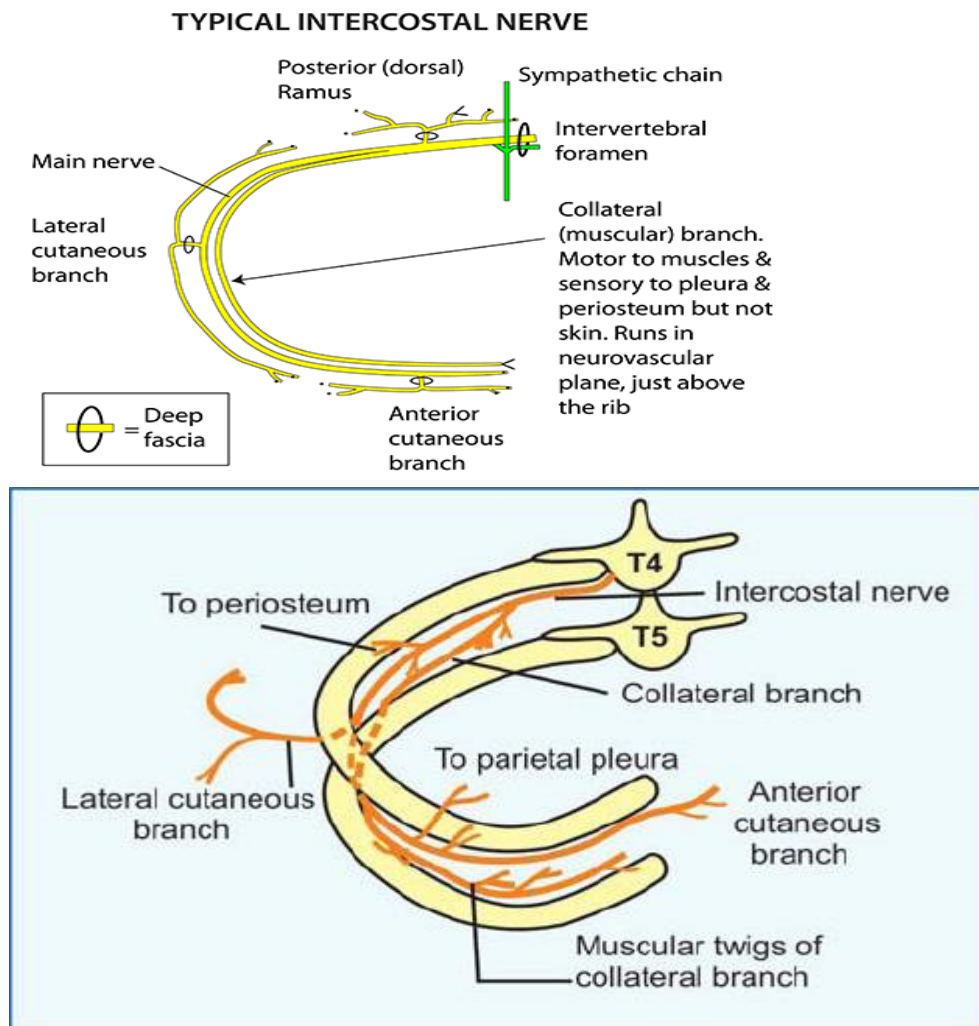


- Serratus Posterior muscles
  - The **serratus posterior superior** and **serratus posterior inferior** are thin, flat muscles that comprise the intermediate layer of muscles of the back
  - The superior muscle passes downward and laterally and inserts into the upper ribs.
  - The inferior muscle passes upward and laterally and inserts into the lower ribs.



- The **intercostal nerves** supply the entire thoracic wall. These nerves are the anterior rami of the first 11 thoracic spinal nerves.
- Branches of intercostal nerves:
  1. **Rami communicantes** – connects intercostal nerve to ganglion of sympathetic trunk
  2. **Collateral branch** – runs forward inferiorly to the main nerve on the upper border of the rib below

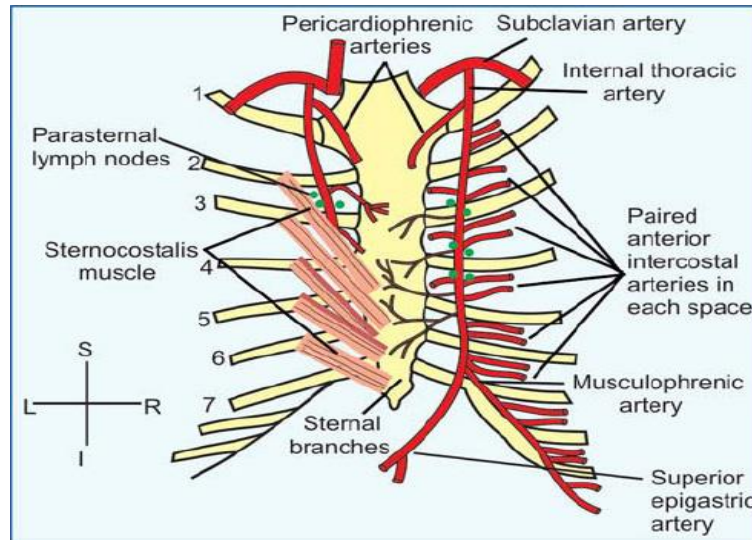
3. **Lateral cutaneous branch** – reaches skin on side of chest. It is divided into anterior and posterior branch
4. **Anterior cutaneous branch** – the terminal portion of main trunk, reaches the skin near midline. It divides into medial and lateral branch
5. **Muscular branches** – run to intercostal muscles
6. **Pleural sensory branches** – goes to parietal pleura
7. **Peritoneal sensory branches** (7<sup>th</sup> to 11<sup>th</sup> intercostal muscles only) – run to parietal peritoneum



- The **first intercostal nerve** joins the brachial plexus by a large branch that is equivalent to the lateral cutaneous branch of typical intercostal nerves.
- The **second intercostal nerve** joins the medial cutaneous nerve of the arm by a large branch named **intercostobrachial nerve**, which is equivalent to lateral cutaneous branch of other nerves. Therefore, the second intercostal nerve supplies skin of armpit and upper medial side of arm. *In coronary artery disease pain is referred along this nerve to medial side of arm.*

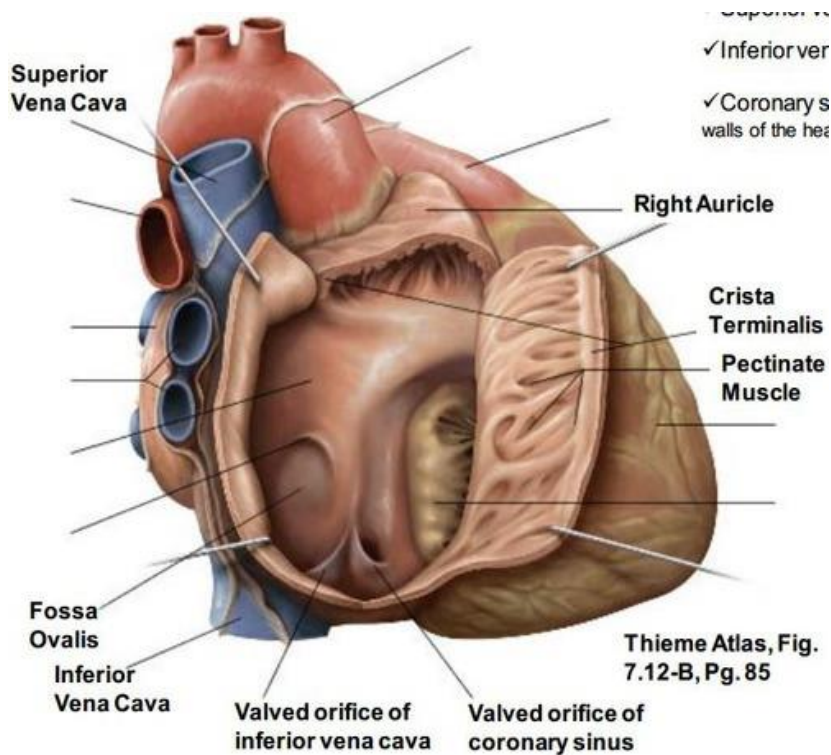


- The first six intercostal nerves supply:
  - Skin and parietal pleura covering outer and inner surface of each intercostal space
  - Intercostal muscles of each intercostal space
  - Levatores costarum
  - Serratus posterior muscles
- 7<sup>th</sup> to 11<sup>th</sup> intercostal nerves supply
  - Skin and parietal peritoneum covering the outer and inner surfaces of abdominal wall
  - Anterolateral abdominal wall muscles which include external oblique, internal oblique, transversus abdominus, and rectus abdominus muscles.
  
- The **supraclavicular nerves** (C3 and C4) provide the cutaneous innervation of the anterior chest wall above the level of sternal angle.  
 Below this level, the **anterior and lateral cutaneous branches** of the intercostal nerves supply oblique bands of skin in regular sequence.  
 The skin on the posterior surface of chest wall is supplied by **posterior rami of spinal nerves**.
  
- **ARTERIES SUPPLYING THORACIC WALL**
  - The subclavian artery, axillary artery and thoracic aorta supplies the thoracic walls.
  - The subclavian artery provides blood through its superior intercostal and internal thoracic branches
  - The axillary artery supplies via its superior thoracic and lateral thoracic branches
  - The thoracic aorta gives off posterior intercostal and subcostal branches
  
- **Internal Thoracic Artery**
  - Supplies anterior wall of body from clavicle to umbilicus
  - It is a branch of first part of the subclavian artery in the neck
  - It descends vertically on the pleura behind the costal cartilages, a fingerbreadth lateral to the sternum and ends in sixth intercostal space by dividing into superior epigastric and musculophrenic arteries
  
- **Branches of Internal Thoracic Artery**
  - **Anterior intercostal artery** – supply upper six intercostal spaces
  - **Perforating arteries** – accompany the terminal branches of corresponding intercostal nerves
  - **Mediastinal arteries** – supply contents of anterior mediastinum (e.g. the thymus)
  - **Superior epigastric artery** – enters the rectus sheath of the anterior abdominal wall and supplies the rectus muscle as far as the umbilicus
  - **Musculophrenic artery** – runs around costal margin of diaphragm and supplies the lower intercostal spaces and diaphragm



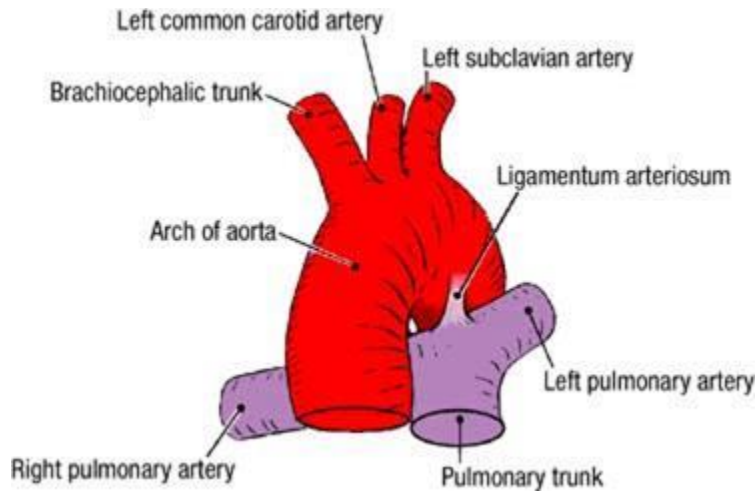
- The **internal thoracic vein** accompanies the internal thoracic artery and drains into brachiocephalic vein on each side.
- Intercostal arteries and veins
  - Each intercostal space contains a large single posterior intercostal artery and two small anterior intercostal arteries
  - The posterior intercostal arteries of the first two spaces are branches from superior intercostal artery, a branch of costocervical trunk of subclavian artery. The posterior intercostal arteries of lower nine spaces are branches of the descending thoracic aorta
  - The anterior intercostal arteries of the first six spaces are branches of the internal thoracic artery, which arise from the first part of subclavian artery. The anterior intercostal arteries of lower spaces are branches of musculophrenic artery, one of the terminal branches of internal thoracic artery.
  - The posterior intercostal veins drain posteriorly into azygos and hemiazygos veins
  - The anterior intercostal veins drain anteriorly into internal thoracic and musculophrenic veins.
- Manubriosternal joint → cartilaginous joint  
Xiphisternal joint → cartilaginous joint
- Branches of internal thoracic artery
  - Two anterior intercostal arteries
  - Perforating arteries
  - Pericardiophrenic artery
  - Mediastinal arteries
  - Superior epigastric artery
  - Musculophrenic artery

- Sternal angle
  - Joint between manubrium and body of sternum
  - Second costosternal joint
  - Demarcation between ascending aorta and arch of aorta
  - Demarcation between arch of aorta and descending thoracic aorta
  - Bifurcation of trachea
  - Level of left primary bronchus
  - T<sub>4</sub> intervertebral disc
  
- Main characteristics of bronchopulmonary segments
  - It is subdivision of a lung lobe
  - It is surrounded by connective tissue
  - It has a centrally located segmental (tertiary) bronchus
  - It has a segmental artery that accompanies the segmental bronchus
  - It has inter-segmental veins located in connective tissue walls between adjacent bronchopulmonary segments
  - It has its own lymph vessels and autonomic nerves
  - Because it is a structural unit, a diseased segment can be removed surgically
  
- Diaphragm contraction increases the vertical diameter of thoracic cavity
  
- Anteroposterior diameter of thorax is increased by raising of ribs and sternum
  
- Contraction of external intercostals increase the transverse diameter of thorax
  
- Borders of heart
  - Right border – right atrium
  - Left border – left auricle and left ventricle
  - Inferior border – right ventricle
  
- Tricuspid valve – three cusps  
 Bicuspid valve – two cusps  
 Aortic valve – three cusps  
 Pulmonary valve – three cusps
  
- Crista terminalis marks the inner boundary between right atrium proper and auricle.  
 Crista terminalis is not present in left atrium



- SA node is located in the wall of the right atrium at the junction of crista terminalis and superior vena cava
- AV node is located on the right, lower side of the atrial septum, between the attachment of septal cusp of the tricuspid valve and the opening of coronary sinus
- Coronary sinus lies in the posterior part of atrioventricular groove
- Great cardiac veins drain most of the areas of heart supplied by left coronary artery  
Middle and small cardiac veins drain most of the areas normally supplied by right coronary artery
- Anterior cardiac veins drain the anterior surface of heart and empty directly into right atrium
- Branches of ascending aorta
  1. Right coronary artery
  2. Left coronary artery
- Branches of aortic arch
  1. Brachiocephalic artery
  2. Left common carotid artery
  3. Left subclavian artery

- Branches of brachiocephalic artery
  1. Right subclavian artery
  2. Right common carotid artery
- The ligamentum arteriosum is a fibrous band that connects the bifurcation of the pulmonary trunk to the lower concave surface of the aortic arch



- The two brachiocephalic veins join to form the superior vena cava  
The azygos vein joins the posterior aspect of the superior vena cava just before it enters the pericardium
- The upper third of esophagus is supplied by the inferior thyroid artery  
Middle third by esophageal branches from descending thoracic aorta  
Lower third by branches from left gastric artery
- Sternal angle is at the level of intervertebral disc between T<sub>4</sub> and T<sub>5</sub>.  
In clinical applications, the sternal angle can be palpated at the T<sub>4</sub> vertebral level
- The typical intercostal nerves supply only the thoracic wall
- Sensory nerve provide sensory innervation to:
  1. Diaphragm
  2. Pleura
  3. Pericardium
- Phrenic nerve roots – C<sub>3</sub>, C<sub>4</sub>, C<sub>5</sub>
- Openings into the right atrium
  1. Superior vena cava
  2. Inferior vena cava
  3. Coronary sinus

4. Right atrioventricular orifice guarded by tricuspid valve
- The following tributaries drain into the coronary sinus
    1. Great cardiac vein
    2. Middle cardiac vein
    3. Small cardiac vein
    4. Oblique vein of left atrium
    5. Posterior vein of left ventricle
  - The azygos vein drains into superior vena cava
  - Atypical intercostal nerves are T<sub>1</sub>, T<sub>2</sub>, T<sub>7</sub> – T<sub>11</sub>
  - Contents of superior mediastinum
    1. Thymus
    2. Right and left brachiocephalic veins
    3. Superior vena cava
    4. Arch of aorta with its three large branches
    5. Trachea
    6. Esophagus
    7. Thoracic duct
    8. Sympathetic trunks
  - Contents of inferior mediastinum
    1. Thymus
    2. Heart within the pericardium with phrenic nerves on each side
    3. Esophagus
    4. Thoracic duct
    5. Descending aorta
    6. Sympathetic trunks
  - Contents of posterior mediastinum
    1. Thoracic part of descending aorta
    2. Azygos vein
    3. Two hemiazygos veins
    4. Vagus and splanchnic nerves
    5. Esophagus
    6. Thoracic duct
  - Posterior mediastinum does not include trachea
  - The thoracic duct terminates at the junction of left internal jugular vein and the left subclavian vein

- The first posterior intercostal vein drains into the brachiocephalic vein
- In diaphragm, the caval opening lies at the level of 8<sup>th</sup> thoracic vertebra  
the esophageal opening lies at the level of 10<sup>th</sup> thoracic vertebra  
the aortic opening lies at the level of 12<sup>th</sup> thoracic vertebra
- Ribs are most commonly fractured in angle region
- Left peripheral bronchus is longer than the right
- Xiphisternal joint lies horizontally opposite the T<sub>9</sub> vertebra
- The lowest extent of pleural cavity into which lung tissue does not extend is known as costodiaphragmatic recess
- Occlusion of the left anterior descending coronary artery (LAD) may cause infarction of the anterior wall of left ventricle, manifested as precordial ST-segment elevations
- The vertebral venous plexus is a highly anastomotic network of valveless veins running along the entire length of vertebral column  
The vertebral veins drain into bronchiocephalic veins.  
This venous plexus can provide a channel for the spread of the colon, rectum, and prostate
- Cisterna chyli is a dilated sac at the lower end of the thoracic duct into which lymph from the intestinal trunk and two lumbar lymphatics flow  
Cisterna chyli is located at the level of L<sub>1</sub> and L<sub>2</sub> vertebral bodies immediately right to the aorta behind the right crus of the diaphragm
- Thoracic duct ascends posterior to the esophagus and pericardium
- Tension pneumothorax is a life-threatening condition that develops when air is trapped in the pleural cavity under positive pressure, displacing mediastinal structures and compromising cardiopulmonary function
- Parasympathetic motor nerve fibers are responsible for regulating bronchoconstriction of the airways  
Sympathetic motor fibers regulate bronchodilation of the airways
- Aortic arch branch into
  1. Brachiocephalic trunk
  2. Left common carotid artery
  3. Left subclavian artery

- Brachiocephalic artery divides into
  1. Right subclavian artery
  2. Right common carotid artery
  
- The sternal angle is at the level of lower border of T<sub>4</sub> vertebra
  
- Right lymphatic duct receives lymph from right side of head, neck, right upper limb and right side of thorax
  
- Internal thoracic artery is a branch of subclavian artery
  
- Aspirated foreign bodies usually become lodged in the right main bronchus
  
- The neurovascular bundle lies between the internal and innermost intercostal muscles
  
- Thoracic duct drains lymph from
  - Both lower limbs
  - Abdomen (except the convex area of liver)
  - Left hemithorax
  - Left upper limb
  - Left face and neck
  
- The anterior cardiac vein drains directly into the right atrium
  
- During drainage of pleural effusion, a physician keeps the needle just above the upper border of lower rib to avoid injury to the neurovascular bundle
  
- Eparterial bronchus is a synonymous term for the right superior lobar bronchus. Its name is derived from the bronchus being the only one originating superior to the level of pulmonary artery
  
- The bronchopulmonary segments receive their own air and blood supply. Each bronchopulmonary segment is supplied by a segmental bronchus, and two arteries – a pulmonary artery and a bronchial artery
  
- Behind the hilus and the attachment of the pulmonary ligament is a vertical groove for the esophagus
  
- Internal thoracic artery is a branch of the first part of subclavian artery
  
- Structures passing through aortic opening  
Mnemonic: AAT
  - Aorta



- Azygos vein
- Thoracic duct
  
- Structures passing through esophageal opening  
Remember: LEV
  - Esophagus
  - Left and right **V**agus nerve (remember as 'g' present both in esophagus and vagus)
  - Lymphatics from lower third of esophagus
  
- Structures passing through caval opening  
Mnemonic: VP
  - Inferior **V**ena cava
  - Right **P**hrenic nerve

# THORAX OVERVIEW

## FROM GRAY'S ANATOMY

- **ARTERIAL SUPPLY OF BREAST**
  1. Laterally – vessels from axillary artery, superior thoracic, thoraco-acromial, lateral thoracic, and subscapular
  2. Medially – branches from internal thoracic artery
  3. Second to fourth intercostal arteries
- **COSTOTRANSVERSE JOINT** – synovial joint between tubercle of rib and transverse process of related vertebrae
- **COSTOTRANSVERSE LIGAMENT**
  - Medial to costotransverse joint
  - Attaches neck of rib to transverse process of vertebra
- **LATERAL COSTOTRANSVERSE LIGAMENT**
  - Lateral to costotransverse joint
  - Attaches tip of transverse process of vertebra to roughened non-articular part of tubercle of rib
- **SUPERIOR COSTOTRANSVERSE LIGAMENT**
  - Attaches neck of rib to transverse process of vertebra above
- **CONTENTS OF COSTAL GROOVE OF RIBS**

(superior to inferior) Mnemonic – VAN

  1. Intercostal vein
  2. Intercostal artery
  3. Intercostal nerve (often not protected by groove)
- **Endothoracic Fascia** – present deep to intercostal spaces and ribs, separating them from underlying pleura
- External intercostal muscles are most active in inspiration  
Internal intercostal muscles are most active during expiration
- Vessels that supply the thoracic wall consist mainly of posterior and inferior intercostal arteries, which pass around the wall between adjacent ribs in intercostal spaces.  
These arteries originate from aorta and internal thoracic arteries, which in turn arise from the subclavian arteries in the root of the neck.

- **ORIGIN OF POSTERIOR INTERCOSTAL ARTERIES**

Subclavian artery → Costocervical trunk → Supreme Intercostal artery → posterior intercostal arteries

Remaining 9 pairs arise from posterior surface of thoracic aorta

- **ORIGIN OF ANTERIOR INTERCOSTAL ARTERIES**

Subclavian artery → Internal thoracic arteries → Anterior intercostal arteries

- The intercostal veins ultimately drain either into:

1. Azygos veins
2. Brachiocephalic veins
  - Left superior intercostal vein empties into left brachiocephalic vein
  - Right superior intercostal vein empties into azygos vein

- The esophagus and inferior vena cava penetrate the diaphragm; the aorta passes posterior to the diaphragm

- **ARTERIAL SUPPLY TO DIAPHRAGM**

1. Pericardiophrenic arteries
2. Musculophrenic arteries
3. Superior phrenic arteries
4. Inferior phrenic arteries

- Elevation and depression of the diaphragm significantly alter the vertical dimensions of the thorax.

Depression results when muscle fiber of the diaphragm contract.

Elevation occurs when diaphragm relaxes.

- Changes in anteroposterior and lateral dimensions result from elevation and depression of the ribs

When ribs are elevated, they move the sternum upward and forward

When ribs are depressed, the sternum moves downward and backward

- **INNERVATIONS OF PLEURA**

1. Parietal pleura – somatic afferent fibers
2. Costal pleura – branches from intercostal nerves
3. Diaphragmatic pleura and mediastinal pleura – phrenic nerves
4. Visceral pleura – visceral afferent nerves

- Within each root and located in the hilum are

1. A pulmonary artery (superior)
  2. Two pulmonary veins (inferior)
  3. A main bronchus (posterior)
  4. Bronchial vessels
  5. Nerves
  6. Lymphatics
- The medial surface of right lung lies adjacent to a number of important structures in the mediastinum and the root of the neck. These include the:
    1. Heart
    2. Superior vena cava
    3. Inferior vena cava
    4. Azygos vein
    5. Esophagus
  - The medial surface of the left lung lies adjacent to a number of important structures in the mediastinum and root of neck. These include:
    1. Heart
    2. Aortic arch
    3. Thoracic aorta
    4. Esophagus
  - There are ten bronchopulmonary segments in each lung; some of them fuse in the left lung.
  - **Right pulmonary artery passes:**
    - Anteriorly and slightly inferiorly to the tracheal bifurcation and anteriorly to the right main bronchus, and
    - Posteriorly to ascending aorta, superior vena cava, and upper right pulmonary vein
  - Left pulmonary artery lies anterior to the descending aorta and posterior to superior pulmonary vein
  - Visceral efferents (in lung and visceral pleura) from
    - The vagus nerve constricts the bronchioles
    - From sympathetic system dilates the bronchioles
  - **MAJOR STRUCTURES IN ANTERIOR MEDIASTINUM:**
    1. Inferior extension of thymus gland
    2. Fat
    3. Connective tissue
    4. Lymph nodes

5. Mediastinal branches of internal thoracic vessels
6. Sternopericardial ligaments (passes from posterior surface of body of sternum to the fibrous pericardium)

- **MAJOR STRUCTURES IN MIDDLE MEDIASTINUM**

1. Heart
2. Pericardium
3. Origin of great vessels
4. Various nerves
5. Smaller vessels

- **MAJOR STRUCTURES IN SUPERIOR MEDIASTINUM**

1. Thymus
2. Right and left brachiocephalic veins
3. Left superior intercostal vein
4. Superior vena cava
5. Arch of aorta with its three large branches
6. Trachea
7. Esophagus
8. Phrenic nerves
9. Vagus nerves
10. Left recurrent laryngeal branch of the left vagus nerve
11. Thoracic duct
12. Other small nerves, blood vessels, and lymphatics

- **FIBROUS PERICARDIUM**

Nerve Supply – Phrenic nerves

Vessels – pericardiophrenic nerves

- **BASE OF HEART**

The base of the heart is quadrilateral and directed posteriorly. It consists of:

- The left atrium
- A small portion of the right atrium
- The proximal parts of great veins (superior and inferior venae cavae and pulmonary veins)

- **APEX OF HEART**

From the base the heart projects forward, downward, and to the left, ending in the apex. The apex of the heart is formed by the inferolateral part of the left ventricle.

- **SURFACES OF HEART**

1. **ANTERIOR SURFACE OF HEART**

- Consist mostly of right ventricle
- Some of right atrium on the right
- Some of left ventricle on the left

## **2. DIAPHRAGMATIC SURFACE OF HEART**

- Consist of left ventricle
- A small portion of right ventricle

## **3. LEFT PULMONARY SURFACE**

- Consist of left ventricle
- A portion of right atrium

## **4. RIGHT PULMONARY SURFACE**

- Consist of right atrium

## **• RADIOLOGICAL EVALUATION OF HEART**

### **1. RIGHT BORDER CONSIST OF**

- Superior vena cavae
- Right atrium
- Inferior vena cavae

### **2. LEFT BORDER**

- Arch of aorta
- Pulmonary trunk
- Left auricle
- Left ventricle

### **3. INFERIOR BORDER**

- Right ventricle
- Left ventricle at apex

### **4. LATERAL VIEW**

- Right ventricle seen anteriorly
- Left atrium visualized posteriorly

## **• Blood returning to the right atrium enters through one of the three vessels. These are:**

- The superior and inferior venae cavae; which together deliver blood to heart from body; and
- The coronary sinus, which returns blood from the walls of the heart itself.

## **• MUSCLES IN ATRIA**

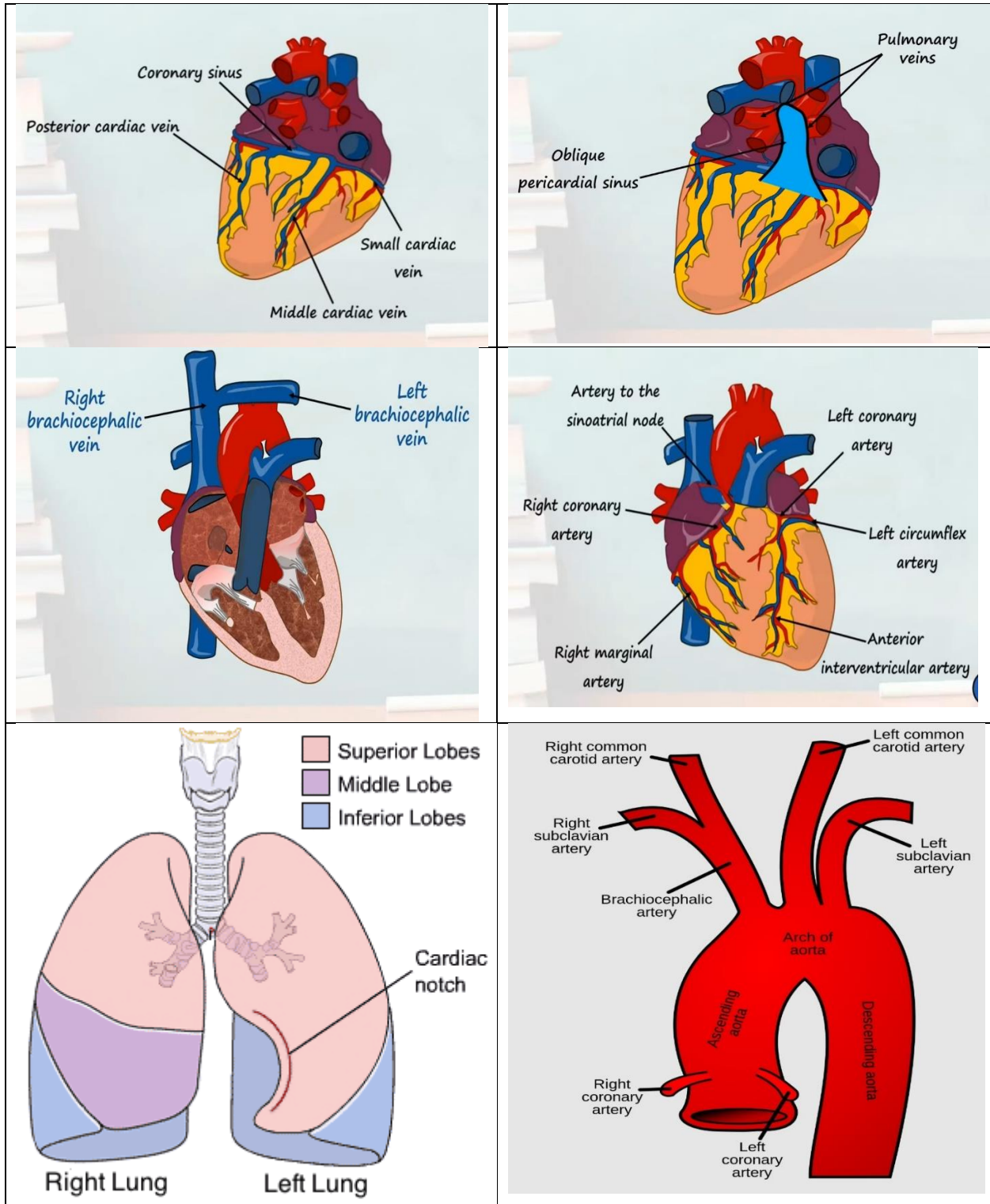
- Pectinate muscles

- **MUSCLES IN RIGHT VENTRICLE**
  - Three papillary muscles that attach to the cusps of the tricuspid valve
    1. Anterior papillary muscle
    2. Septal papillary muscle
    3. Posterior papillary muscle
  
- **MUSCLES IN LEFT VENTRICLE**
  - Two papillary muscles
    1. Anterior papillary muscle
    2. Posterior papillary muscle
  
- The papillary muscles and associated chordae tendinae keep the valves closed during the dramatic changes in ventricular size that occur during contraction.
  
- Pulmonary valve consist of three semilunar cusps; left, right and anterior semilunar cusps
  
- Unlike the crista terminalis in the right atrium, no distinct structures separates the two components of the left atrium
  
- Aortic valve consist of three semilunar cusps; right, left and posterior semilunar cusps. The right and left coronary arteries originate from right and left aortic sinuses.
  
- **BRANCHES OF RIGHT CORONARY ARTERY**
  1. Sinu-atrial nodal branch (supply SA node)
  2. Right marginal branch
  3. Posterior interventricular branch
  
- **BRANCHES OF LEFT CORONARY ARTERY**
  1. Anterior interventricular branch (Left anterior descending artery – LAD)
  2. Circumflex branch
  
- **RIGHT CORONARY ARTERY SUPPLIES**
  1. Right atrium
  2. Right ventricle
  3. SA node
  4. AV node
  5. Interatrial septum
  6. A portion of left atrium
  7. Postero-inferior one-third of interventricular septum
  8. A portion of posterior part of left ventricle

- **LEFT CORONARY ARTERY SUPPLIES**
  1. Left atrium
  2. Left ventricle
  3. Most of interventricular septum
  4. AV bundle and its branches
  
- **The coronary sinus receives four major arteries:**
  1. Great cardiac vein (anterior interventricular vein)
  2. Middle cardiac vein (posterior interventricular vein)
  3. Small cardiac vein – is a companion of the right coronary artery throughout its course
  4. Posterior cardiac vein – lies on the posterior surface of left ventricle just to the left of middle cardiac vein
  
- **Other veins of heart**
  1. Anterior veins of right ventricle (Anterior cardiac veins)
  2. Venae cordis minimae or veins of Thebesius
  
- **Basic components of cardiac conducting system**
  1. SA node
  2. AV node
  3. Atrioventricular bundle with its right and left bundle branches
  4. Purkinje fibers
  
- The pulmonary trunk is contained within the pericardial sac, is covered by visceral layer of serous pericardium, and is associated with ascending aorta in a common sheath.



# Thorax diagrams



**RIGHT ATRIUM**

