

2019

# Session 1 - Cardiovascular System

SKMC Surface Anatomy

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**Surface Anatomy Program**  
Session 1 — Cardiovascular System  
Wednesday, November 29th or Wednesday, December 6th

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**Learning Objectives**

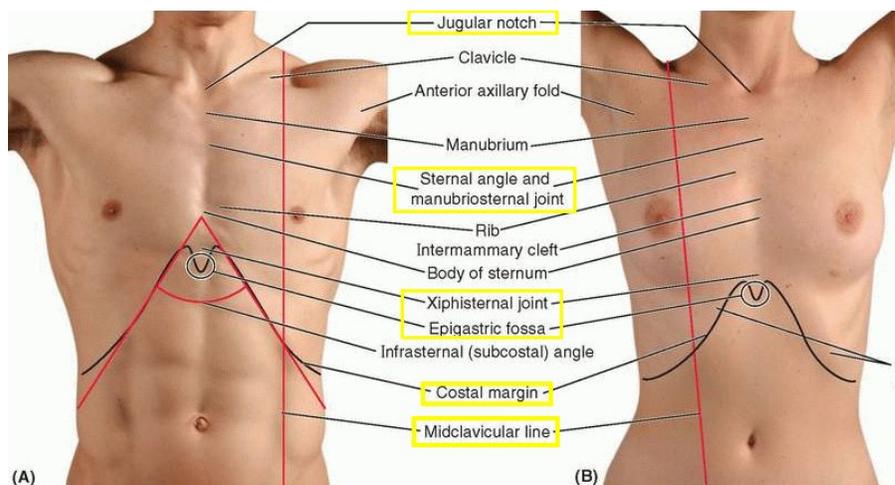
1. Highlight surface anatomy projections and understand their relationship with gross anatomy.
  2. Review auscultation and location of heart sounds. Be well acquainted with APTM-2245.
  3. Understand what cardiac tamponade is and how surface anatomy informs your procedure to fix it.
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**Surface Anatomy Projections of the Thorax**

<b>Midsternal Line</b>	Vertical line bisecting the sternum along a sagittal plane
<b>Midclavicular Line</b>	Vertical line that starts at the middle of each clavicle along a sagittal plane (p100-103)
<b>Midaxillary Line</b>	Vertical line through the axillary fossa along a coronal plane (p102-103)
<b>Jugular Notch</b>	Found at vertebral level <b>T2</b> (p78)
<b>Sternal Angle of Louis</b>	Manubrium joins the body of the sternum; at the level of the 2 <sup>nd</sup> rib and <b>T4/T5</b> IV disc (p99-100)
<b>Transverse Plane</b>	Plane through the sternal angle, bisecting rib 2 and T4/5 along a transverse/axial plane; between superior and inferior mediastinum (p128)
<b>Xiphisternal Joint</b>	Palpable and often seen as a ridge at vertebral level <b>T9</b> (p78)
<b>Costal Margin</b>	Extends from the xiphisternal junction at the 7 <sup>th</sup> rib, down the lip formed by the costal cartilage to the most inferior point on the 10 <sup>th</sup> rib, includes a step at the 9 <sup>th</sup> costal cartilage (p76)

**Other Notes**

1. In males, the nipple demarcates the **4<sup>th</sup> intercostal space** (p106)
2. Costal level is **NOT** the same as vertebral level – i.e. the angle of the 2<sup>nd</sup> rib is at T4/5



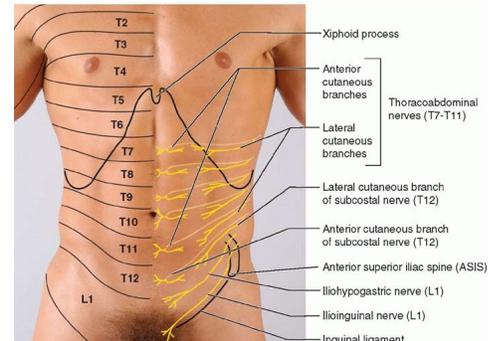
## Important Structures of the Transverse Thoracic Plane

Marks the transition between the ascending aorta to the arch of the aorta, and arch of the aorta to the descending aorta (p163)

- The merging of the brachiocephalic veins into the superior vena cava (p100)
- The bifurcation of the trachea into the mainstem bronchi (p114)
- The thoracic duct may cross from the right to the left posterior to the esophagus at either T4, T5, or T6 (p169)

## Dermatomes of Thorax and Referred Pain:

- **Visceral referred pain** – Pain referred to somatic structures (i.e. to a limb) that have afferent fibers with cell bodies in the same spinal ganglion, and central processes that enter the spinal cord via the same dorsal roots (p159)
- **T4:** Nipple
- **T10:** Umbilicus
- **L1:** Inguinal ligament



## Heart Margins

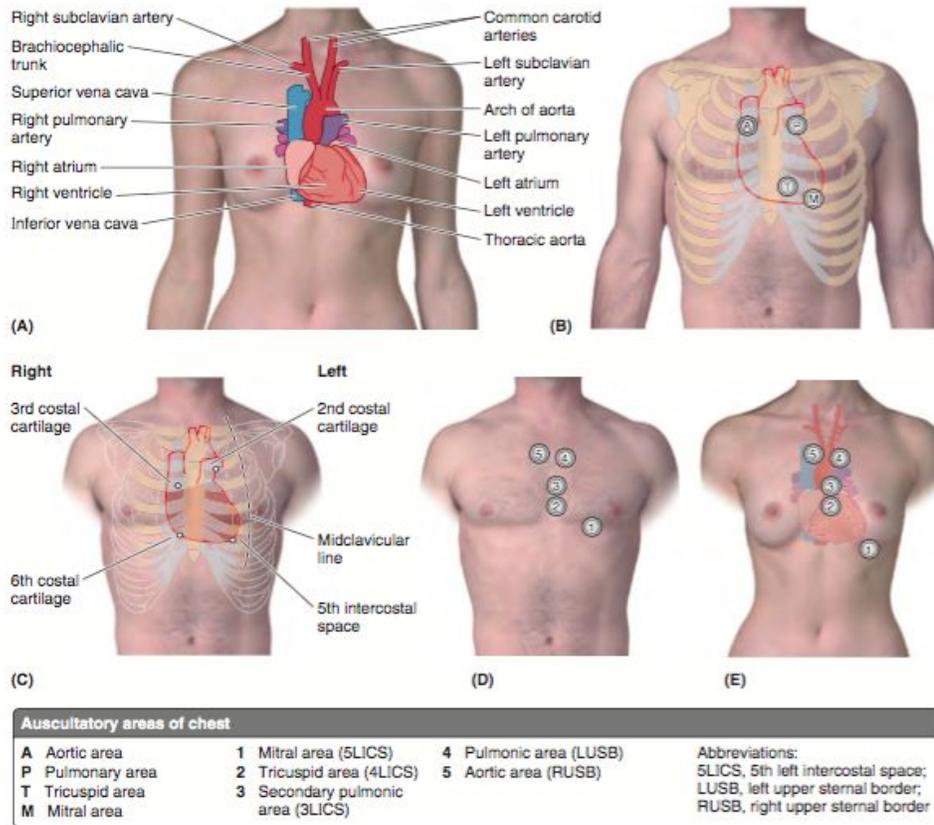
- Superior Border** Line connecting superior border of 3<sup>rd</sup> costal cartilage on right to the inferior border of the 2<sup>nd</sup> costal cartilage (left)
- Right Border** Line drawn from 3<sup>rd</sup> costal cartilage to 6<sup>th</sup> costal cartilage
- Left Border** Inferior border of 2<sup>nd</sup> costal cartilage to 5<sup>th</sup> ICS medial to the MCL (apex)
- Inferior Border** Line connecting 6<sup>th</sup> costal cartilage (right), to the 5<sup>th</sup> ICS medial to left MCL (apex)

## Heart Projections

- Sternocostal** Formed by the *right ventricle* (p138)
- Apex** Lies in the left 5<sup>th</sup> ICS (p137)
- Base** Heart's posterior aspect, formed mostly by the *left atrium* and some *right atrium*, faces toward vertebral bodies T6-T9 (p137)
- Maximal Impulse** Line connecting 6<sup>th</sup> costal cartilage (right), to the 5<sup>th</sup> ICS medial to left MCL (apex)

## Heart Sounds: helpful mnemonic: *APT-M 2245*

- Aortic Valve** Right 2nd intercostal space (ICS), inferior and right of the sternal angle
- Pulmonary Valve** Left 2nd ICS, immediately lateral to the sternum
- Tricuspid Valve** Left 4th ICS, inferior and left of the sternal angle
- Mitral Valve** Left 5th ICS at the midclavicular line



(p173)

## Heart Clinical Correlations

**Cardiac Tamponade** — Extra fluid in the pericardium can compress the heart, leading to heart failure (p133-134); can be treated with pericardiocentesis

**Pericardiocentesis** — Remove excess fluid within the pericardial sac (p134). Fluid can accumulate during pericarditis (pericardial inflammation), congestive heart failure, or stab/gunshot wounds (causes hemopericardium)

- Approach #1: Needle into the 5<sup>th</sup> or 6<sup>th</sup> left ICS near the sternum (“bare area” of pericardium)
- Approach #2: Needle enters superoposteriorly through the infrasternal angle

**“Bare Area” of the Heart** — Location where the pericardial sac contacts the thoracic wall without an intervening pleural sac. Is found at the level of the 4th costal cartilage, passes to the left margin of the sternum then inferior to the 6th costal cartilage.

**Cardiac Referred Pain** — Referred to the skin of the upper limb because the spinal cord segments of these cutaneous nerves (T1 – T3) are also the segments that the pain afferents for the coronary arteries arise from (p159)

**Valvular Heart Disease** — Valvular heart disease affects the pumping efficiency of the heart and is categorized as *stenosis* or *insufficiency (regurgitation)*. Stenosis is the failure of the valve to open fully. Insufficiency or regurgitation is failure of the valve to close completely due to misalignment of the cusps. Restriction of high-pressure blood flow (stenosis) or passage of blood through a narrow opening (stenosis and regurgitation) causes turbulence, which produces vibrations that are heard as *murmurs*.

- Mitral Valve Insufficiency (Mitral Valve Prolapse):** One or both leaflets extend into the left atrium during systole. Blood regurgitates into the left atrium during contraction of the left ventricle, producing a murmur.
- Aortic Valve Stenosis:** Aortic valve stenosis is the most frequent valve abnormality and most frequently the result of degenerative calcification. Aortic stenosis results in left ventricular hypertrophy.

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**USMLE STEP 1** — A 48 year old woman was being treated for pericarditis (inflammation of the pericardial sac) that produced an exudate. The fluid accumulated within the pericardial sac and is now impeding the motion of the heart. The physician decides to remove the fluid from the pericardial cavity. Where would the wide-bore needle most likely be inserted to enter the pericardial sac?

- a. To the left of the xiphoid process at a 45-degree angle.
- b. A subxiphoid approach on the right side at an acute angle.
- c. through the right fifth intercostal space adjacent to the body of the sternum.
- d. through the left third intercostals space close to the body of the sternum.

### Other Practice Questions

1. The Sternal Angle of Louis is clinically significant and formed by the junction of the manubrium and the body of the sternum - which costal cartilage articulates with the sternum at the level of this angle?

- a. 1st
- b. 2nd
- c. 3rd
- d. 4th

2. The imaginary line that extends from the xiphisternal junction at the 7<sup>th</sup> rib, down the lip formed by the costal cartilage to the most inferior point on the 10<sup>th</sup> rib is the \_\_\_\_\_.

- a. costal margin
- b. midclavicular line
- c. supracristal plane
- d. subcostal plane

3. Which of the following heart sounds is heard at the left 2<sup>nd</sup> ICS, immediately lateral to the sternum?

- a. aortic valve
- b. pulmonary valve
- c. mitral valve
- d. tricuspid valve

4. A 37-year old patient with palpitation was examined by her physician, and one the diagnostic records included a posterior/anterior chest radiograph. Which of the following comprises the largest portion of the sternocostal surface of the heart seen on the radiograph?

- a. Left Atrium
- b. Right Atrium
- c. Left Ventricle
- d. Right Ventricle
- e. Base of the heart

5. A 32 year old patient who weighs 275 lbs comes to the doctors office. On the surface of the chest the physician is able to locate the apex of the heart:

- a. At the level of the sternal angle
- b. Left fourth intercostal space
- c. Left fifth intercostal space
- d. Right fifth intercostal space
- e. At the level of the xiphoid process of the sternum

6. A 27 year old cardiac patient with an irregular heartbeat visits her doctor's office for examination. Where should the physician place the stethoscope to listen to the sound of the mitral valve?
- Over the medial end of the second left intercostal space
  - Over the medial end of the second right intercostal space
  - In the left fourth intercostal space at the midclavicular line
  - In the left fifth intercostal space at the midclavicular line
  - Over the right half of the lower end of the body of the sternum
7. A radiologist examines posterior-anterior chest radiographs of a 27-year-old victim of a car accident. Which of the following structures forms the right border of the cardiovascular silhouette?
- Arch of the aorta
  - Pulmonary trunk
  - SVC
  - Ascending aorta
  - Left ventricle
8. A 37-year-old house painter fell from a ladder and fractured his left third rib and the structures with which it articulated. Which of the following structures would most likely be damaged?
- Manubrium of the sternum
  - Body of the second thoracic vertebra
  - Spinous process of the third thoracic vertebra
  - Body of the fourth thoracic vertebra
  - Transverse process of the second thoracic vertebra
- 

## Answers

USMLE Question — A

- |      |      |      |
|------|------|------|
| 1. D | 4. D | 7. C |
| 2. A | 5. C | 8. B |
| 3. B | 6. D |      |
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**Disclaimer** — *This is not intended to serve as a primary study guide for Anatomy or Clinical Skills exams. Surface Anatomy is a peer-taught mentoring program overseen by Dr. Spudich; however, the review sessions are primarily designed by MS2 Coordinators. The goal of review sessions is to highlight clinically relevant anatomical landmarks in order to reinforce lecture material. All review topics have been discussed in lecture; no new testable material will be introduced in these sessions.*

## MS2 Coordinators

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