PURPOSE
This chapter helps you learn the structure and function of the heart, valves, and great vessels; understand the cardiac cycle; describe the heart sounds; understand the rationale and methods of examination of the heart; and accurately record the assessment. At the end of this chapter you should be able to perform a complete assessment of the heart and neck vessels.

READING ASSIGNMENT

MEDIA ASSIGNMENT
Jarvis: *Physical Examination and Health Assessment* DVD Series: Cardiovascular System: Heart and Neck Vessels.

Google the Internet with the term *heart sounds*. Listen to several websites for a good sampling of the most common heart sounds you will encounter.

GLOSSARY
Study the following terms after completing the reading assignment. You should be able to cover the definition on the right and define the term out loud.

**Angina pectoris** ................. acute chest pain that occurs when myocardial demand exceeds its oxygen supply

**Aortic regurgitation** ............ (aortic insufficiency) incompetent aortic valve that allows backward flow of blood into left ventricle during diastole

**Aortic stenosis** ................. calcification of aortic valve cusps that restricts forward flow of blood during systole

**Aortic valve** ...................... the left semilunar valve separating the left ventricle and the aorta

**Apex of the heart** ............... tip of the heart pointing down toward the 5th left intercostal space
Apical impulse (point of maximal impulse, PMI) pulsation created as the left ventricle rotates against the chest wall during systole, normally at the 5th left intercostal space in the midclavicular line

Base of the heart broader area of heart's outline located at the 3rd right and left intercostal space

Bell (of the stethoscope) cup-shaped endpiece used for soft, low-pitched heart sounds

Bradycardia slow heart rate, <50 beats per minute in the adult

Clubbing bulbous enlargement of distal phalanges of fingers and toes that occurs with chronic cyanotic heart and lung conditions

Coarctation of aorta severe narrowing of the descending aorta, a congenital heart defect

Cor pulmonale right ventricular hypertrophy and heart failure due to pulmonary hypertension

Cyanosis dusky blue mottling of the skin and mucous membranes due to excessive amount of reduced hemoglobin in the blood

Diaphragm (of the stethoscope) flat endpiece of the stethoscope used for hearing relatively high-pitched heart sounds

Diastole the heart’s filling phase

Dyspnea difficult, labored breathing

Edema swelling of legs or dependent body part due to increased interstitial fluid

Erb’s point traditional auscultatory area in the 3rd left intercostal space

First heart sound (S₁) occurs with closure of the atroventricular (AV) valves signaling the beginning of systole

Fourth heart sound (S₄) (S₄ gallop; atrial gallop) very soft, low-pitched ventricular filling sound that occurs in late diastole

Gallop rhythm the addition of a 3rd or a 4th heart sound makes the rhythm sound like the cadence of a galloping horse

Inching technique of moving the stethoscope incrementally across the precordium through the auscultatory areas while listening to the heart sounds

LVH (left ventricular hypertrophy) increase in thickness of myocardial wall that occurs when the heart pumps against chronic outflow obstruction (e.g., aortic stenosis)

MCL (midclavicular line) imaginary vertical line bisecting the middle of the clavicle in each hemithorax

Mitral regurgitation (mitral insufficiency) incompetent mitral valve allows regurgitation of blood back into left atrium during systole

Mitral stenosis calcified mitral valve impedes forward flow of blood into left ventricle during diastole

Mitral valve left AV valve separating the left atria and ventricle

Palpitation uncomfortable awareness of rapid or irregular heart rate
Paradoxical splitting ............... opposite of a normal split $S_2$ so that the split is heard in expiration, and in inspiration the sounds fuse to one sound

Pericardial friction rub ............ high-pitched, scratchy extracardiac sound heard when the precordium is inflamed

Physiologic splitting .............. normal variation in $S_2$ heard as two separate components during inspiration

Precordium ....................... area of the chest wall overlying the heart and great vessels

Pulmonic regurgitation ............ (pulmonic insufficiency) backflow of blood through incompetent pulmonic valve into the right ventricle

Pulmonic stenosis ................. calcification of pulmonic valve that restricts forward flow of blood during systole

Pulmonic valve ..................... right semilunar valve separating the right ventricle and pulmonary artery

Second heart sound ($S_2$) ........ occurs with closure of the semilunar valves, aortic and pulmonic, and signals the end of systole

Summation gallop .................. abnormal mid-diastolic heart sound heard when both the pathologic $S_3$ and $S_4$ are present

Syncope ............................ temporary loss of consciousness due to decreased cerebral blood flow (fainting), caused by ventricular asystole, pronounced bradycardia, or ventricular fibrillation

Systole ............................. the heart’s pumping phase

Tachycardia ....................... rapid heart rate, >100 beats per minute in the adult

Third heart sound ($S_3$) .......... soft, low-pitched ventricular filling sound that occurs in early diastole ($S_3$ gallop) and may be an early sign of heart failure

Thrill ............................... palpable vibration on the chest wall accompanying severe heart murmur

Tricuspid valve ................. right AV valve separating the right atria and ventricle

**STUDY GUIDE**

After completing the reading assignment and the audio-visual assignment, you should be able to answer the following questions in the spaces provided.

1. Define the apical impulse and describe its normal location, size, and duration.
Which normal variations may affect the location of the apical impulse?

Which abnormal conditions may affect the location of the apical impulse?

2. Explain the mechanism producing normal first and second heart sounds.

3. Describe the effect of respiration on the heart sounds.

4. Describe the characteristics of the first heart sound and its intensity at the apex of the heart and at the base.

Which conditions increase the intensity of $S_1$?

Which conditions decrease the intensity of $S_1$?

5. Describe the characteristics of the second heart sound and its intensity at the apex of the heart and at the base.
Which conditions *increase* the intensity of S₂?

Which conditions *decrease* the intensity of S₂?

6. Explain the physiologic mechanism for normal splitting of S₂ in the pulmonic valve area.

7. Define the **third heart sound**. When in the cardiac cycle does it occur? Describe its intensity, quality, location in which it is heard, and method of auscultation.

8. Differentiate a physiologic S₃ from a pathologic S₃.

9. Define the **fourth heart sound**. When in the cardiac cycle does it occur? Describe its intensity, quality, location in which it is heard, and method of auscultation.

10. Explain the position of the valves during each phase of the cardiac cycle.
11. Define venous pressure and jugular venous pulse.

12. Differentiate between the carotid artery pulsation and the jugular vein pulsation.

13. List the areas of questioning to address during the health history of the cardiovascular system.

14. Define bruit, and discuss what it indicates.

15. Define heave or lift, and discuss what it indicates.

16. State 4 guidelines to distinguish S₁ from S₂.

1. ________________________________________________________________________________

2. ________________________________________________________________________________

3. ________________________________________________________________________________

4. ________________________________________________________________________________

17. Define pulse deficit, and discuss what it indicates.
18. Define preload and afterload.

19. List the characteristics to explore when you hear a murmur, including the grading scale of murmurs.

20. Discuss the characteristics of an innocent or functional murmur.

Fill in the labels indicated on the following illustrations.
REVIEW QUESTIONS

This test is for you to check your own mastery of the content. Answers are provided in Appendix A.

1. The precordium is:
   a. a synonym for the mediastinum.
   b. the area on the chest where the apical impulse is felt.
   c. the area on the anterior chest overlying the heart and great vessels.
   d. a synonym for the area where the superior and inferior venae cavae return unoxygenated venous blood to the right side of the heart.

2. Select the best description of the tricuspid valve.
   a. left semilunar valve
   b. right atrioventricular valve
   c. left atrioventricular valve
   d. right semilunar valve

3. The function of the pulmonic valve is to:
   a. divide the left atrium and left ventricle.
   b. guard the opening between the right atrium and right ventricle.
   c. protect the orifice between the right ventricle and the pulmonary artery.
   d. guard the entrance to the aorta from the left ventricle.

4. Atrial systole occurs:
   a. during ventricular systole.
   b. during ventricular diastole.
   c. concurrently with ventricular systole.
   d. independently of ventricular function.

5. The second heart sound is the result of:
   a. opening of the mitral and tricuspid valves.
   b. closing of the mitral and tricuspid valves.
   c. opening of the aortic and pulmonic valves.
   d. closing of the aortic and pulmonic valves.

6. The examiner has estimated the jugular venous pressure. Identify the finding that is abnormal.
   a. patient elevated to 30 degrees, internal jugular vein pulsation at 1 cm above sternal angle
   b. patient elevated to 30 degrees, internal jugular vein pulsation at 2 cm above sternal angle
   c. patient elevated to 40 degrees, internal jugular vein pulsation at 1 cm above sternal angle
   d. patient elevated to 45 degrees, internal jugular vein pulsation at 4 cm above sternal angle

7. The examiner is palpating the apical impulse. The normal size of this impulse:
   a. is less than 1 cm.
   b. is about 2 cm.
   c. is 3 cm.
   d. varies depending on the size of the person.

8. The examiner wishes to listen in the pulmonic valve area. To do this, the stethoscope would be placed at the:
   a. second right interspace.
   b. second left interspace.
   c. left lower sternal border.
   d. fifth interspace, left midclavicular line.

9. Select the statement that best differentiates a split S₂ from S₃:
   a. S₃ is lower pitched and is heard at the apex.
   b. S₂ is heard at the left lower sternal border.
   c. The timing of S₂ varies with respirations.
   d. S₃ is heard at the base; timing varies with respirations.
10. The examiner wishes to listen for a pericardial friction rub. Select the best method of listening.

a. with the diaphragm, patient sitting up and leaning forward, breath held in expiration
b. using the bell with the patient leaning forward
c. at the base during normal respiration
d. with the diaphragm, patient turned to the left side

11. When auscultating the heart, your first step is to:

a. identify S₁ and S₂.
b. listen for S₃ and S₄.
c. listen for murmurs.
d. identify all four sounds on the first round.

12. You will hear a split S₂ most clearly in what area?

a. apical
b. pulmonic
c. tricuspid
d. aortic

13. The stethoscope bell should be pressed lightly against the skin so that:

a. chest hair doesn’t simulate crackles.
b. high-pitched sounds can be heard better.
c. it does not act as a diaphragm.
d. it does not interfere with amplification of heart sounds.

14. A murmur heard after S₁ and before S₂ is classified as:

a. diastolic (possibly benign).
b. diastolic (always pathologic).
c. systolic (possibly benign).
d. systolic (always pathologic).

15. When assessing the carotid artery, the examiner should palpate:

a. bilaterally at the same time, while standing behind the patient.
b. medial to the sternomastoid muscle, one side at a time.
c. for a bruit while asking the patient to hold his or her breath briefly.
d. for unilateral distention while turning the patient’s head to one side.

16. Fill in the following blanks:

S₁ is best heard at the _______ of the heart, whereas S₂ is loudest at the _______ of the heart. S₁ coincides with the pulse in the _______ and coincides with the _______ wave if the patient is on an ECG monitor.

Match column A to column B

Column A

17. ______ tough, fibrous, double-walled sac that surrounds and protects the heart
18. ______ thin layer of endothelial tissue that lines the inner surface of the heart chambers and valves
19. ______ reservoir for holding blood
20. ______ ensures smooth, friction-free movement of the heart muscle
21. ______ muscular pumping chamber
22. ______ muscular wall of the heart

Column B

a. pericardial fluid
b. ventricle
c. endocardium
d. myocardium
e. pericardium
f. atrium
23. Briefly relate the route of a blood cell from the liver to tissue in the body.

24. List the major risk factors for heart disease and stroke identified in the text.

**SKILLS LABORATORY/CLINICAL SETTING**

You are now ready for the clinical component of the cardiovascular system. The purpose of the clinical component is to practice the regional examination on a peer in the skills laboratory or a patient in the clinical setting and to achieve the following.

**Clinical Objectives**

1. Demonstrate knowledge of the symptoms related to the cardiovascular system by obtaining a regional health history from a peer or patient.

2. Correctly locate anatomic landmarks on the chest wall of a peer.

3. Using a grease pencil and with peer’s permission, outline borders of the heart and label auscultatory areas on a peer’s chest wall.

4. Demonstrate correct technique for inspection and palpation of the neck vessels.

5. Demonstrate correct techniques for inspection, palpation, and auscultation of the precordium.

6. Record the history and physical examination findings accurately, reach an assessment of the health state, and develop a plan of care.

**Instructions**

Gather your equipment. Wash your hands. Clean the stethoscope endpiece with an alcohol wipe. Practice the steps of the examination of the cardiovascular system on a peer or on a patient in the clinical area. Record your findings using the regional write-up sheet that follows. The front of the page is intended as a worksheet; the back of the page is intended for your narrative recording using the SOAP format.
REGIONAL WRITE-UP—CARDIOVASCULAR SYSTEM

Date _____________________
Examiner ___________________

Patient ___________________________ Age ______ Gender _______

Reason for visit _____________________________________________________________

I. Health History

1. Any chest pain or tightness? _____________________________
2. Any shortness of breath? _____________________________
3. Use more than one pillow to sleep? _____________________________
4. Do you have a cough? _____________________________
5. Do you seem to tire easily? _____________________________
6. Facial skin ever turn blue or ashen? _____________________________
7. Any swelling of feet or legs? _____________________________
8. Awaken at night to urinate? _____________________________
9. Any past history of heart disease? _____________________________
10. Any family history of heart disease? _____________________________
11. Assess cardiac risk factors: _____________________________

II. Physical Examination
A. Carotid arteries
   Inspect and palpate
   Grade R ________ L ________
   (0 = absent, 1+ weak, 2+ normal, 3+ increased, 4+ bounding)

B. Jugular venous system
   External jugular veins (circle one): collapsed supine
   meniscus visible at ____________________ bed elevated
   Internal jugular venous pulsations (circle one):
   not visible
   visible at ____________________________ bed elevated

C. Precordium
   Inspect and palpate
   1. Skin color and condition _____________________________
   2. Chest wall pulsations _____________________________
   3. Heave or lift _____________________________
   4. Apical impulse in the _________ at _____________________________
      Size ________________ Amplitude _____________________________

D. Auscultation
   1. Identify anatomic areas where you will listen.
   2. Rate and rhythm _____________________________
   3. Identify S1 and S2 in diagram at right and note any variation.
      Fill in any murmur below:
      \[ S_1 \quad S_2 \quad S_1 \quad S_2 \]
      \[ S_1 \quad S_2 \quad S_1 \quad S_2 \]
4. Listen in systole and diastole:
   Extra heart sounds ________________________________
   Systolic murmur _________________________________
   Diastolic murmur _________________________________

**REGIONAL WRITE-UP—CARDIOVASCULAR SYSTEM**

Summarize your findings using the SOAP format.

**Subjective** (Reason for seeking care, health history)

**Objective** (Physical examination findings) Record findings using diagram

**Assessment** (Assessment of health state or problem, diagnosis)

**Plan** (Diagnostic evaluation, follow-up care, patient teaching)