

PULSE RATE AND BLOOD PRESSURE

MATERIALS NEEDED

Textbook
 Clock with second hand
 Sphygmomanometer
 Stethoscope
 70% alcohol
 Absorbent cotton

For Demonstration:

Pulse pickup transducer or plethysmogram
 Physiological recording apparatus

The surge of blood that enters the arteries each time the ventricles of the heart contract causes the elastic walls of these vessels to swell. Then, as the ventricles relax, the walls recoil. This alternate expanding and recoiling of an arterial wall can be felt as a pulse in vessels that run close to the surface of the body.

The force exerted by the blood pressing against the inner walls of arteries also creates blood pressure. This pressure reaches a maximum during ventricular contraction and then drops to its lowest level while the ventricles are relaxed.

PURPOSE OF THE EXERCISE

To examine the pulse, determine the pulse rate, measure blood pressure, and investigate the effects of body position and exercise on pulse rate and blood pressure.

LEARNING OBJECTIVES

After completing this exercise, you should be able to

1. Determine pulse rate.
2. Test the effects of various factors on pulse rate.
3. Measure blood pressure using a sphygmomanometer.
4. Test the effects of various factors on blood pressure.
5. Calculate pulse pressure and mean arterial pressure from blood pressure readings.

PROCEDURE A—PULSE RATE

1. Review the sections entitled “Arterial Blood Pressure” and “Measurement of Arterial Blood Pressure—Clinical Application” in chapter 15 of the textbook.
2. Complete Part A of Laboratory Report 45.
3. Examine your laboratory partner’s radial pulse. To do this, follow these steps:
 - a. Have your partner sit quietly, remaining as relaxed as possible.
 - b. Locate the pulse by placing your index and middle fingers over the radial artery on the anterior surface of the wrist. Do not use your thumb for sensing the pulse because you may feel a pulse coming from an artery in the thumb itself.
 - c. Note the characteristics of the pulse. That is, could it be described as regular or irregular, strong or weak, hard or soft?
 - d. To determine the pulse rate, count the number of pulses that occur in 1 minute. This can be accomplished by counting pulses in 30 seconds and multiplying that number by 2.
4. Repeat the procedure and determine the pulse rate in each of the following conditions:
 - a. immediately after lying down;
 - b. 5 minutes after lying down;
 - c. immediately after standing;
 - d. 5 minutes after standing quietly;
 - e. immediately after 3 minutes of moderate exercise (*omit if the person has health problems*);
 - f. 5 minutes after exercise has ended.
5. Complete Part B of the laboratory report.

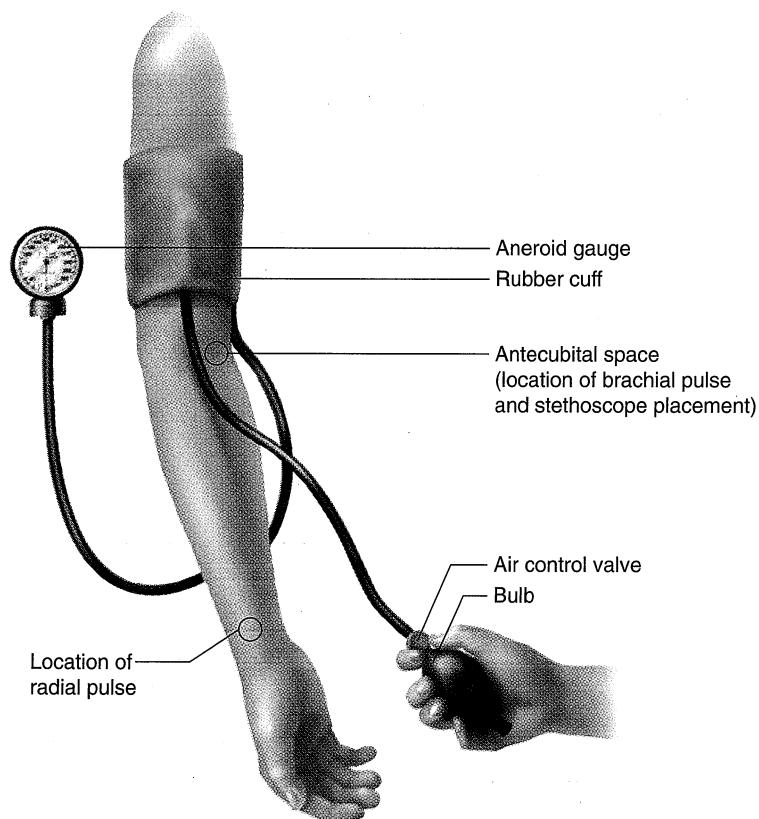
DEMONSTRATION

If the equipment is available, the laboratory instructor will demonstrate how a photoelectric pulse pickup transducer or plethysmogram can be used together with a physiological recording apparatus to record the pulse. Such a recording allows an investigator to analyze certain characteristics of the pulse more precisely than is possible using a finger to examine the pulse. For example, the pulse rate can be determined very accurately from a recording, and the heights of the pulse waves provide information about the blood pressure.

PROCEDURE B—BLOOD PRESSURE

1. Measure your laboratory partner's arterial blood pressure. To do this, follow these steps:
 - a. Obtain a sphygmomanometer and a stethoscope.
 - b. Clean the earpieces and the diaphragm of the stethoscope with cotton moistened with 70% alcohol.
 - c. Have your partner sit quietly with bare upper limb resting on a table at heart level. Have the person remain as relaxed as possible.
 - d. Locate the brachial artery at the antecubital space. Wrap the cuff of the sphygmomanometer around the arm so that its lower border is about 2.5 cm above the bend of the elbow. Center the bladder of the cuff in line with the *brachial pulse* (fig. 45.1).
 - e. Palpate the *radial pulse*. Close the valve on the neck of the rubber bulb connected to the cuff, and pump air from the bulb into the cuff. Inflate the cuff while watching the sphygmomanometer, and note the pressure when the pulse disappears. (This is a rough estimate of the systolic pressure.) Immediately deflate the cuff.
 - f. Position the stethoscope over the brachial artery. Reinflate the cuff to a level 30 mm Hg higher than the point where the pulse disappeared during palpation.
 - g. Slowly open the valve of the bulb until the pressure in the cuff drops at a rate of about 2 or 3 mm Hg per second.
 - h. Listen for sounds (Korotkoff sounds) from the brachial artery. When the first loud tapping sound is heard, record the reading as the systolic pressure. This indicates the pressure exerted against the arterial wall during systole.
 - i. Continue to listen to the sounds as the pressure drops, and note the level when the last sound is heard. Record this reading as the diastolic pressure, which measures the constant arterial resistance.
 - j. Release all of the pressure from the cuff.
 - k. Repeat the procedure until you have two blood pressure measurements from each arm, allowing 2-3 minutes of rest between readings.
 - l. Average your readings and enter them in the table in Part C of the laboratory report.
2. Measure your partner's blood pressure in each of the following conditions:
 - a. immediately after lying down;
 - b. 5 minutes after lying down;
 - c. immediately after standing;
 - d. 5 minutes after standing quietly;
 - e. immediately after 3 minutes of moderate exercise (*omit if the person has health problems*);
 - f. 5 minutes after exercise has ended.
3. Complete Part C of the laboratory report.

Figure 45.1 Blood pressure is commonly measured by using a sphygmomanometer (blood pressure cuff).



PULSE RATE AND BLOOD PRESSURE

PART A

Complete the following statements:

1. The term *blood pressure* most commonly is used to refer to systemic _____ pressure.
2. The maximum pressure achieved during ventricular contraction is called _____ pressure.
3. The lowest pressure that remains in the arterial system during ventricular relaxation is called _____ pressure.
4. The pulse rate is equal to the _____ rate.
5. A pulse that feels full and is not easily compressed is produced by an elevated _____.
6. The instrument commonly used to measure systemic arterial blood pressure is called a (an) _____.
7. Blood pressure is expressed in units of _____.
8. The upper number of the fraction used to record blood pressure indicates the _____ pressure.
9. The difference between the systolic and diastolic pressure is called the _____.
10. The mean arterial pressure is approximated by adding the _____ pressure to one-third of the pulse pressure.
11. The _____ artery in the arm is the standard systemic artery in which blood pressure is measured.

PART B

1. Enter your observations of pulse characteristics and pulse rates in the table.

| Test Subject | Pulse Characteristics | Pulse Rate |
|-----------------|-----------------------|------------|
| Sitting | | |
| Lying down | | |
| 5 minutes later | | |
| Standing | | |
| 5 minutes later | | |
| After exercise | | |
| 5 minutes later | | |

2. Summarize the effects of body position and exercise on the characteristics and rates of the pulse. _____

PART C

1. Enter the initial measurements of blood pressure in the table.

| Reading | Blood Pressure in Right Arm | Blood Pressure in Left Arm |
|---------|-----------------------------|----------------------------|
| First | | |
| Second | | |
| Average | | |

2. Enter your test results in the table.

| Test Subject | Blood Pressure |
|-----------------|----------------|
| Lying down | |
| 5 minutes later | |
| Standing | |
| 5 minutes later | |
| After exercise | |
| 5 minutes later | |

3. Summarize the effects of body position and exercise on blood pressure. _____

4. Summarize any correlations between pulse rate and blood pressure from any of the experimental conditions.



Critical Thinking Application

When a pulse is palpated and counted, which blood pressure (systolic or diastolic) would be characteristic at that moment? Explain your answer.
