

Sinclair Community College, Division of Allied Health Technologies

Health Promotion for Community Health Workers – Cardiovascular disease, stroke, and cancer

Class #4 Measurement of Blood Pressure

(date)

Course Objectives:

Know and demonstrate the correct method for taking blood pressure measurements

Class/Learning Objectives: By the end of this session, students will be able to:

1. Describe the Korotkoff sounds
2. Relate the importance of standardized training for taking blood pressure
3. Demonstrate the proper technique for taking blood pressure
4. Identify potential sources of error in measuring blood pressure and suggest techniques to minimize them

Participants:

Instructor(s)

Students

Materials/Resources Needed:

Sphygmomanometers, stethoscopes

Handouts:

- 4-1 Korotkoff Sounds
- 4-2 Chart of Acceptable Bladder Dimensions for Arms of Different Sizes
- 4-3 Common problems in measuring blood pressure and recommendations for avoiding them
- 4-4 Step by Step Technique for Measuring Blood Pressure

Class Outline

I. Overview

II. Lesson

- A. Indirect vs. direct measurement of blood pressure
- B. Importance of standardized protocol for measurement
- C. What are Korotkoff sounds and what do they mean?
- D. Procedure, demonstration, and practice of blood pressure measurement

III. Blood pressure measurement in special situations

IV. Summary

Plan for the Class:

I. Overview

When we talk about “blood pressure,” we mean the pressure of the blood against the arteries, so it is really “arterial blood pressure.” When the flow of blood through the arteries is stopped temporarily (or **occluded**) and then allowed to flow again, it makes sounds that can be heard through a stethoscope or sensed by an automatic blood pressure machine. In this class we’ll talk about those sounds and learn and practice the correct way to take a blood pressure measurement.

II. Lesson

A. Indirect vs. direct measurement of blood pressure

Listening to blood pressure using a cuff is an **indirect** way of measuring blood pressure. The gold standard for really accurate blood pressure measurement is through a catheter or tube inserted directly into an artery. This technique is not practical or appropriate for non-hospitalized patients or for large scale screenings. Direct and indirect measurements are similar but rarely identical. Indirect measurement is accurate enough and is used because it is practical, simple, low-cost, and non-invasive.

B. Importance of standardized protocol for measurement

Because blood pressure measurement is used so much to diagnose high blood pressure and to monitor treatment, it is very important that these measurements be as accurate as possible. It is also important that everyone who may be involved in taking a person’s blood pressure does it the same way so an accurate pressure is obtained each time. While the technique is simple and easy to learn, there are ways that errors that errors can be made. Therefore it is important that the method for taking blood pressure should be standardized. This class will teach you the American Heart Association’s recommendation for blood pressure measurement protocol.

C. What are Korotkoff sounds and what do they mean?

Indirect measurement of blood pressure is done by wrapping an inflatable cuff around the upper arm and inflating the cuff until the flow of blood through the brachial artery is stopped. When the artery is occluded (blocked) by the pressure of the cuff, arterial pulsations can no longer be felt or heard through a stethoscope. As the pressure of the cuff is reduced, blood flow reappears through the partially compressed artery, producing repetitive sounds. These “Korotkoff” sounds are named for a Russian physician who first described the procedure for listening to blood pressure (**auscultatory** method) in 1905.

Handout 4-1: Korotkoff Sounds. Refer students to this handout as the next section is discussed.

The level of the pressure in the cuff, as measured by the manometer to which it is connected, at the appearance of the first Korotkoff sound corresponds to the systolic blood pressure. The level of the pressure at which the sounds disappear completely (Korotkoff sound V) corresponds to the diastolic pressure. There has been some debate over whether the point where the sounds become muffled (Korotkoff IV) or the point where the sounds disappear (Korotkoff V) is the best indication of diastolic pressure. Disappearance of sound correlates better with intra-arterial pressure than does muffling, so the disappearance of sound is used and recorded as the bottom number (or diastolic) blood pressure in adults. Phase V is operationally defined as the level of the pressure at which the last sound is heard.

In children less than 13 years old, pregnant women, and adults with high cardiac output, sounds are often heard at levels far below that which muffling occurs, even sometimes at levels close to zero. In these cases, muffling of the sounds should be used as the diastolic pressure, but both muffling (phase IV) and disappearance of sound (phase V) should be recorded.

Occasionally, especially in older and hypertensive patients, the sounds disappear during Phase II or III, only to reappear when the pressure in the cuff is reduced further. This period of silence is called the auscultatory gap.

D. Procedure, demonstration, and practice of blood pressure measurement

Equipment:

- 1) Stethoscope – The head of the stethoscope is placed over the occluded artery to amplify the Korotkoff sounds. The length of the tubing from the ear pieces to the head should be 12 to 15 inches; long enough so that a seated observer can conveniently place the head over the artery and listen for the sounds while observing the manometer at eye level.
- 2) Sphygmomanometer – which consists of a manometer (scale) calibrated for measuring pressure and an inflation system.

The manometer reflects the pressure in the occluding cuff by the height of a column of mercury (mercury manometer) or by the location of a rotating needle on a dial scale (aneroid manometer). Manometers should be calibrated from 0 to 300 millimeters of

mercury (abbreviated as mmHg), marked at 2 and 10 mmHg intervals.

The inflation system is a wide, flat bladder enclosed in a cuff that can be wrapped around the arm, with an inflation bulb and tubing. The bladder should not be too large or too small for the arm circumference. The width of the bladder should be 40% of the arm circumference, and long enough to encircle at least 80% of the arm circumference. Cuffs generally available are classified by the width of the bladder rather than its length and are labeled "newborn", "infant," "child," "small adult", "adult", "large adult", and "thigh".

Handout 4-2: Acceptable Bladder Dimensions for Arms of Different Sizes

Observer:

The observer must be comfortably positioned to be able to

- (1) inflate and deflate the bladder in the cuff gradually;
- (2) see the meniscus in the column of mercury or the indicator needle on an aneroid scale;
- (3) hear the Korotkoff sounds and differentiate them from extraneous noise;
- (4) make note of and remember the level of the pressure at the first appearance and at the disappearance of the Korotkoff sounds while continuing to deflate the cuff; and
- (5) remember and record the systolic and diastolic pressure accurately to the nearest 2 mmHg.

Subconscious biases of observers can result in errors such as terminal digit preference and direction or cut-off bias. Terminal digit preference is a tendency to round pressure off to numbers ending in zero instead of recording to the nearest 2mm Hg. (For example, recording a heard pressure of 124/86 as 120/90.) Direction or cut-off bias results in falsely recording pressures as being above or below a dividing line between "normal" and "hypertensive." The way to prevent these biases from causing errors is to be aware that they may exist and be careful to record the blood pressure accurately to the nearest 2 mm Hg.

Subject:

The blood pressure is measured in the upper arm, with the subject seated. Ideally, measurements should be made in a quiet area, after a period of rest, not immediately after exertion, drinking coffee, or conversation. The legs should be uncrossed and resting on the floor, and the back should be supported. The upper arm should be positioned at the level of the heart. The subject should be asked not to talk during the taking of the measurement.

Handout 4-3: Common Problems in Measuring Blood Pressure and Recommendations for Avoiding Them

Technique Demonstration and Practice

Refer to Handout 4-4: Step by Step Technique for Taking a Blood Pressure Measurement

Your instructor will demonstrate the technique step by step. You will then practice the technique with each other.

III. Blood pressure measurement in special situations

Persons who have recently undergone a mastectomy or other surgical procedure involving the arm or shoulder should have blood pressure taken from the opposite arm. In dialysis patients, blood pressure should not be measured in the arm with the arteriovenous fistula.

IV. Summary

Manual indirect measurement of blood pressure is an important tool in diagnosing high blood pressure and in monitoring treatment. Therefore, it is important that measurement be accurate, using calibrated equipment and trained observers.

Resources:

Perloff, D., Grim, C., Flack, J., Frohlich, E.D., Hill, M., McDonald, M., Morgenstern, B.Z. (1993). Human Blood Pressure Determination by Sphygmomanometry. *Circulation* 88: 2460-2470. Available at: <http://circ.ahajournals.org/cgi/reprint/88/5/2460.pdf>

Pickering, T., Hall, J.E., Appel, L. J., Falkner, B.E., Graves, J., Hill, M.N., Jones, D.W., Kurtz, T., Sheps, S.G., Roccella, E.J. (2004). Recommendations for Blood Pressure Measurement in Humans and Experimental Animals: Part 1: Blood pressure measurement in humans: a statement for professionals from the Subcommittee of Professional and Public Education of the American Heart Association Council on High Blood Pressure Research. *Hypertension* 45:142-161. Available at: <http://hyper.ahajournals.org/cgi/content/full/45/1/142>