

Measuring Blood Pressure

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Page 1. Introduction

- Blood pressure is an important indicator of cardiovascular health. It is influenced by the contractile activities of the heart and conditions and activities of the blood vessels.

Page 2. Goals

- To understand the terminology associated with measuring blood pressure.
- To understand the sounds heard during blood pressure measurement.

Page 3. Blood Pressure Defined

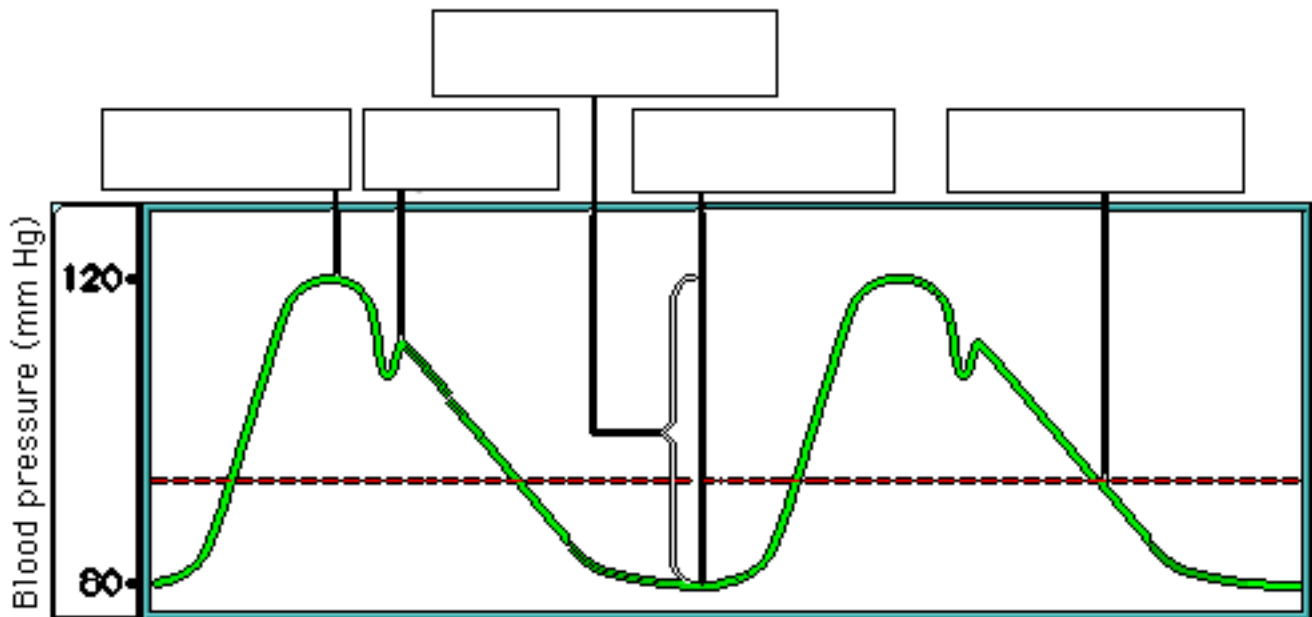
- Blood Pressure is the force that blood exerts against blood vessel walls.
- The pumping action of the heart generates blood flow.
- Blood pressure results when that flow is met by resistance from vessel walls.
- Blood pressure is expressed in millimeters of mercury (mm Hg). For example a blood pressure of 120 mm Hg is equivalent to a pressure exerted by a column of mercury 120 mm high.

Page 4. Laminar Flow

- Blood flows faster in the center of a vessel than near the sides, because the blood near the sides are hitting the walls of the vessels. This is called laminar flow and it is due to the friction (resistance) between the blood and the vessel walls.

Page 5. Blood Pressure Graph

- By taking your pulse, you can feel that blood pressure fluctuates with each heartbeat. The pulse which you feel is actually a pressure wave which travels from your heart throughout the arteries.
- We can use the graph created by this pressure wave to identify the component parts of blood pressure.
- Label the parts of this graph as you go through the next few pages:



Page 6. Systolic Pressure

- Systolic pressure is the maximum pressure exerted by the blood against the artery walls. It is the result of ventricular systole or contraction. It is normally about 120 mm Hg.

Page 7. Dicrotic Notch

- The aortic notch represents the interruption of smooth flow due to the brief backflow of blood that closes the aortic semilunar valve when the ventricles relax.

Page 8. Diastolic Pressure

- Diastolic pressure is the lowest pressure in the artery. It's a result of ventricular diastole (relaxation) and is usually around 80 mm Hg.

Page 9. Pulse Pressure

- Pulse Pressure is the difference between systolic and diastolic pressure.
- It's the throb you feel when you take your pulse.

$$\begin{array}{rcl} \text{Pulse Pressure} & = & \text{Systolic Pressure} - \text{Diastolic Pressure} \\ \sim 40 \text{ mm Hg} & & \sim 120 \text{ mm Hg} - \sim 80 \text{ mm Hg} \end{array}$$

Page 10. Mean Arterial Pressure (MAP)

- Mean Arterial Pressure (MAP) is a calculated "average" pressure in the arteries.

$$\begin{array}{rcl} \text{Mean Arterial Pressure (MAP)} & = & \text{Diastolic Pressure} + \frac{1}{3} \text{ Pulse Pressure} \\ \sim 93 \text{ mm Hg} & = & \sim 80 \text{ mm Hg} + \frac{\sim 40 \text{ mm Hg}}{3} \end{array}$$

- MAP is closer to the diastolic pressure than systolic pressure because the heart stays longer in diastole.
- MAP is the force that propels the blood through the arteries.

Page 11. Blood Pressure Sounds

- When blood pressure is measured, a cuff is inflated to constrict an artery so that no blood flows through. Since the pressure in the cuff is greater than the pressure in the artery, the artery is closed off and no blood flows through.
- As the cuff pressure is gradually released, but the artery is still partially constricted, blood flow resumes. Sounds can be heard with a stethoscope because the blood flows turbulently, causing audible sounds.
- When enough pressure is released to fully open the artery, the blood flows freely and the sounds disappear because smooth flowing blood does not create sounds.

Page 12. Checking Blood Pressure

- The first sounds that are heard indicate systolic pressure. When the sounds stop, diastolic pressure has been reached.

Page 13. Summary

- Systolic pressure = highest pressure in an artery; result of ventricular contraction
- Diastolic pressure = lowest pressure in an artery; result of ventricular relaxation
- Pulse pressure = systolic pressure - Diastolic Pressure
- Mean Arterial Pressure (MAP) = Diastolic pressure + $\frac{1}{3}$ Pulse pressure
- When blood pressure is measured, first sounds indicate systolic pressure; end of sounds indicates diastolic pressure.

** Now is a good time to go to quiz questions 1-2:

- Click the Quiz button on the left side of the screen.
- Work through quiz questions 1-2.

Notes on Quiz Questions:

Quiz Question #1. Blood Pressure Measurement

- This question asks you to determine a blood pressure.

Quiz Question #2. Pulse Pressure Calculation

- This question asks you to determine a pulse pressure.

Study Questions on Measuring Blood Pressure:

1. (Page 3.) What is the term used to express the force that blood exerts against the walls of blood vessels?

2. (Page 3.) How is blood pressure generated?
3. (Page 3.) In what units is blood pressure expressed?
4. (Page 4.) Does blood flow at the same rate in the exact center of a vessel compared to at the sides of the vessel?
5. (Page 4.) What is laminar flow and what causes it?
6. (Page 5.) What is a pulse?
7. (Page 6.) What is systolic pressure and what causes it?
8. (Page 6.) What is ventricular systole?
9. (Page 6.) What is a typical normal value for systolic pressure?
10. (Page 7.) What does the aortic notch represent?
11. (Page 8.) What is diastolic pressure and what causes it?
12. (Page 8.) What is ventricular diastole?
13. (Page 8.) What is a typical normal value for diastolic pressure?
14. (Page 9.) What is pulse pressure?
15. (Page 9.) If the systolic pressure is 120 mm Hg and the diastolic pressure is 80 mm Hg, what would the pulse pressure be?
16. (Page 6-10). Match these terms to their characteristic:

<ol style="list-style-type: none"> 1. Systolic Pressure 2. Aortic Notch 3. Diastolic Pressure 4. Pulse Pressure 5. Mean Arterial Pressure 	<ol style="list-style-type: none"> a. the throb you feel when you take your pulse b. interruption of smooth flow due to the brief backflow of blood c. result of ventricular diastole d. the force that propels the blood through the arteries e. the result of ventricular systole
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17. (Page 9.) Why is mean arterial pressure closer to diastolic pressure than systolic pressure?
18. (Page 10.) Calculate the mean arterial pressure when systolic pressure is 120 mm Hg and the diastolic pressure is 80 mm Hg.
19. (Pages 10, 11.) What do the sounds correspond to when a blood pressure is taken?