UNIT 8 - BLOOD / LYMPHATIC / CARDIOVASCULAR SYSTEMS

ACTIVITY - Blood Pressure Lab

Name _____ Period _____

OBJECTIVE:
To understand what happens to the control of blood pressure during strenuous exercise.

MATERIALS:
- Stethoscope
- Sphygmomanometer
- Ruler
- Staircase
- Athletic shoes
- Graph paper

BACKGROUND INFORMATION:

Many factors affect arterial blood pressure, but three of the most important are cardiac output, blood volume, and peripheral resistance. Cardiac output is the volume of blood ejected by the left ventricle into the aorta every minute. The volume of each beat, the stroke volume, multiplied by the heart rate equals cardiac output. SV X HR = CO. A slow, beating heart with a large capacity can actually pump more blood per minute than a smaller, fast beating heart which has a smaller capacity. So, one cannot assume that a slow beating heart always tends to decrease cardiac output.

Blood volume is also a major determinant for blood pressure. It makes sense that if a patient loses a large volume of blood that blood pressure must drop or if the patient retains fluids the blood pressure will rise. For our purposes, we will assume that the student is completely healthy and has a constant blood volume.

Peripheral resistance is more difficult to understand as it varies with activity, hormones, kidney function, age, weight, and probably many other factors. Peripheral resistance largely means the resistance produced by friction between the flowing blood and the walls of the blood vessel. A small vessel with a smaller diameter offers more resistance to flow or creates more pressure than a large vessel with a large diameter. Arterioles and capillaries have a small diameter and offer a greater resistance to blood flow than do large arteries or veins. In fact, arterioles account for almost half the total resistance in the systemic circulation resulting in significant pressure changes. Arterioles, with their muscular walls, constrict or dilate and are able to effectively change the resistance to blood flow and thus modify blood pressure. Arteriole constriction slows blood from flowing quickly out of the arteries, thus maintaining an elevated arterial blood pressure, while arteriole dilation enables the blood to dissipate rapidly and tends to reduce the blood pressure.

Capillaries are able to regulate most of the blood flow through their capillary bed by means of the sphincter muscles and the autonomic nervous system. This action is termed autoregulation. By means of autoregulation, sphincter muscles dilate or constrict, depending on the needs of the capillary bed. In the skeletal muscles, the exact mechanism of autoregulation is unclear. Vasodilation may occur because of a lack of oxygen or a buildup of some metabolic waste. It is known that a muscle that is being exercised produces vasodilator substances at a higher level than a muscle that is not being exercised. For example, carbon dioxide, adenosine, histamine, and lactic acid are always released from very active or hypoxic cells. All of these substances are known to cause at least some arteriole dilation and/or relaxation of the capillary sphincter muscles. Dilation of arteriole muscles or capillary sphincter muscles increases blood flow through the capillary bed bringing more oxygen or carrying away the waste products of energy production. You can imagine that if you exercise large muscle in the legs, the level of oxygen falls and more waste products are produced which in turn causes dilation of the arterioles. This action leads to a drop in the diastolic pressure.

Please note: If any student has high blood pressure, heart problems, respiratory problems such as asthma, or any other medical condition, they should not participate in the exercise portion of this lab.

PROCEDURE:

1. The students should work in pairs.

2. One student will serve as the test subject. The blood pressure of the test subject should be taken under resting conditions. Record the information in the data table.

3. The students should then go to the staircase. The subject will step up and down the stairs, while standing in place, for a total of two minutes. This rate should be sufficient to create strenuous exercise for the average student. After two minutes of exercise, the subject should sit down. The lab partner should measure the blood pressure immediately and each minute thereafter for a total of four minutes.

Blood Pressure Trial	Blood Pressure Measurement
Resting Blood Pressure	
BP immediately after exercise	
BP 1 minute after exercise	
BP 2 minutes after exercise	
BP 3 minutes after exercise	
BP 4 minutes after exercise	

4. Graph the information from the table.

5. What is the average systolic measurement after exercise?

_____

6. What is the average diastolic measurement after exercise?

_____

7. How do the systolic and the diastolic measurements after exercise compare with the resting blood pressure?

_____
_____
_____

8. Was there a change in the systolic blood pressure?

_____

If yes, give at least two reasons why that change occurred.

1._____

2._____

9. Was there a change in the diastolic blood pressure?

_____

If yes, give at least two reasons why that change occurred.

1._____

2._____

10. List and describe the three main factors that affect arterial blood pressure

1. _____

2. _____

3. _____