MEASURING AND RECORDING BLOOD PRESSURE

INTRODUCTION

The blood pressure, along with the body temperature, pulse, and respirations, is one of the vital signs. These measurements are used to quickly, easily, and reliably assess a patient’s basic state of health. They are also used to detect the presence of illness or injury, to monitor the progress of a disease or medical condition, or to see if a patient is responding favorably to a medication or a treatment. The blood pressure, specifically, can give us valuable information about the condition of a patient’s heart, the condition of a patient’s blood vessels, and whether or not there is a derangement of the circulating blood volume.

Measuring and recording blood pressures is more difficult than measuring and recording the body temperature, pulse, and respirations. It is also easier to make mistakes when measuring the blood pressure. You have to learn the proper way to do it in order to avoid recording a blood pressure that might be higher or lower than the true reading. However, with a little practice and with conscientious effort, accurately measuring and recording a blood pressure soon becomes easy.

OBJECTIVES

When the student has finished this module, he/she will be able to:

1. Identify a basic definition of blood pressure.
2. Identify the three factors/components that work together to create blood pressure.
3. Identify two groups of people whose blood pressure would be higher than average.
4. Identify two signs/symptoms of hypertension and two for hypotension.

BLOOD PRESSURE: ANATOMY AND PHYSIOLOGY

Blood pressure can be defined very simply like this: blood pressure is a measurement of the amount of force that is being exerted against the walls of the blood vessels. However, there is much more to it than that, because that force, the blood pressure, is created by the three components of the circulatory system: the heart, the blood vessels, and the circulating blood volume.

- The heart: The heart is a muscular pump that is divided into four chambers. It beats rhythmically, with an equal amount of time between each beat. For the average adult, the normal heart rate is approximately 72 beats a minute. There are two phases to a heartbeat. In the first phase, diastole, the chambers of the heart fill with blood that is carrying oxygen. In the second phase, systole, the chambers forcefully contract and send a volume of blood out to the body through the blood vessels.
- The blood vessels: The arteries and the capillaries carry oxygenated blood to the organs and tissues. After the oxygen has been released to them, the veins...
carry metabolic byproducts – mostly carbon dioxide – back from the body to the lungs. The lungs deliver oxygen to the blood, that blood is delivered to the heart and the cycle starts again. It is important to know that the arteries, capillaries, and veins are strong and have muscular tone. When the heart pumps a wave of blood out to the circulation, the blood vessels expand to accommodate the increased volume, but they also contract down in response, and that moves the blood along and out through the body.

- The blood: The blood volume for an average adult is approximately five liters. (It’s a little more for men, a little less for women). As explained above, blood carries oxygen to the body and carbon dioxide from the body to the lungs.

If you think of the circulatory system – the heart, the blood vessels, and the blood – as a closed system, a closed loop, it is easy to see how all three of these components are needed for the blood pressure. Without a strong, functioning heart, there would be no initial movement of the blood out through the circulation. Without healthy, functioning arteries, etc., that wave of pressure could not continue and the blood would never reach the more distant parts of the body or return back to the heart. And without a normal blood volume, the closed system would obviously be empty and there would be no pressure at all.

In the beginning of this section, blood pressure was defined as the measurement of the amount of force that is being exerted against the walls of the blood vessels. You can see however that this force/pressure varies. It rises when the heart pushes out a volume of blood (imagine squeezing on a tube of toothpaste with the cap closed; the pressure inside the tube will go up) and then it goes back down to a steady state that represents the pressure inside the blood vessels between each heartbeat.

**Learning Break:** Blood pressure is defined as the measurement of the force pressure exerted against the walls of the blood vessels. But the blood pressure is actually more complex than that. As mentioned above, blood pressure rises sharply during each heartbeat and there is also a steady state of pressure in the blood vessels between each heartbeat. The first of those two pressures – the pressure in the blood vessels as the heart is contracting – called the systolic pressure and the second – the steady state pressure in the blood vessels between heartbeats – is called the diastolic pressure. When you measure someone’s blood pressure you are checking the systolic and diastolic pressures.

**MEASURING AND RECORDING BLOOD PRESSURE**

In order to measure a blood pressure, you will need a stethoscope and a blood pressure monitor. (Note: The systolic blood pressure can be measured without a stethoscope by a method called palpation, but that will not be covered in this module). The technical term for a blood pressure monitor is *sphygmomanometer*, but they are more commonly called *blood pressure cuffs*. They can use mercury or they can be mechanical (the mechanical ones are also called *aneroid cuffs*). You may also see digital blood pressure cuffs. These simply require that the blood pressure monitor be attached to the person; the machine does all the measuring.
Both the mercury and the mechanical sphygmomanometers have an inflatable cuff. The cuff is attached (with a rubber tube) to a vertical glass tube that is filled with mercury and has gradations imprinted on it: in an aneroid sphygmomanometer, the tube from the cuff is attached to a gauge with a moveable needle, much like the face of a clock. With both the mercury and the aneroid sphygmomanometer, another rubber tube is also attached to the cuff and at the end of that tube is a rubber bulb which is squeezed repeatedly to inflate the cuff. Once you have your stethoscope and a sphygmomanometer, you are ready to begin, but in order to make the blood pressure you record is accurate, keep these points in mind:

- The patient should be lying down or sitting. If the blood pressure is taken when the patient is standing, the measurement will be too low (Note: You may see someone measuring blood pressure – and pulse – when the patient is lying down, then when sitting, then when standing. This procedure is called checking postural vital signs; it will not be discussed in this module).
- Choose either arm to use, but do not measure the blood pressure in an arm in which there is an intravenous needle or a hemodialysis shunt. Do not take the blood pressure in an arm that has been injured. A woman who has had a breast removed should have her blood pressure taken in the arm opposite the side of the surgery.
- Make sure the arm is level with the heart; this is very important. If the arm is above the level of the heart, the blood pressure reading will be falsely low. If the arm is below the level of the heart, the blood pressure reading will be falsely high.
- Have the patient move his/her clothing up the arm, towards the shoulder, until there is room for the blood pressure cuff. Do not take someone’s blood pressure with the cuff placed over a shirt, sweater, etc.
- The patient should be relaxed and ideally, he/she should be in the sitting or lying position for at least two minutes before the blood pressure is checked.
- The cuff should be the proper size. A cuff too big will result in a reading that is falsely low, and a cuff that is too small will result in a reading that is falsely high. The cuffs have demarcations on them that will help you determine which size to use. For the majority of patients, there is a standard sized cuff that will be appropriate. There should be several different sizes of cuffs available so that people who are very thin or who are obese can be accommodated.
- Try and measure the blood pressure in a place where there is a minimum of background noise.

Now you are ready to measure the blood pressure. Have the patient hold his/her arm out straight with the palm of the hand facing upward. Wrap the cuff around the patient’s arm securely. It should be placed so that the edge of the cuff is one inch above the bend of the elbow. Next, find the brachial artery: this is the blood vessel that will be used to determine the blood pressure. The brachial artery is located on the arm, left (toward the center of the patient’s body) of the fold of the elbow. Use your fingers (not your thumb) to palpate the area until you can feel the pulse. When you have found the pulse, put your stethoscope over the area.
After that, close the valve that is attached to the rubber bulb and begin squeezing. You will see the column of mercury rise in the tube or the needle of the aneroid sphygmomanometer move. Keep inflating the cuff until the mercury level or the needle on the aneroid gauge is at 160. At that point, the brachial artery will be completely occluded, and you should not hear anything through the stethoscope.

Slowly open the valve. The mercury column or the needle will start to drop. Remember to open the valve slowly: if the air is let out of the cuff too quickly, you won’t be able to measure the blood pressure correctly. Keep your eyes focused closely on the mercury or the needle on the aneroid sphygmomanometer move back and forth at the same time as they are dropping. That point is the systolic blood pressure. In a few more seconds, there will be a point at which you will no longer hear the pulse or see the mercury column or the needle moving back and forth; that point is the diastolic blood pressure. Let the cuff deflate completely, remove it and you are done.

If you notice from the patient’s chart that the systolic pressure when last measured was over 160, inflate the cuff a bit higher. Also, if you inflate the cuff to 160, but you immediately hear the patient’s pulse, deflate the cuff, wait a bit, and then inflate the cuff a bit higher.

By convention, blood pressure is recorded using units called millimeters of mercury: this is often recorded using the abbreviation mm Hg (mm stands for millimeters, and Hg is the chemical symbol for mercury). You should record the blood pressure immediately after you have measure it and preferably, make a notation that indicates whether the patient was lying or sitting at the time. By tradition, the blood pressure is recorded with the systolic pressure first, a forward slash, and then the diastolic pressure.

**BLOOD PRESSURE: HYPERTENSION AND HYPOTENSION**

There have been many attempts to determine a definition of a normal blood pressure. But it is not really possible to provide a single number that can be considered normal; there are simply too many variations in blood pressure among the general population for this to be practical and accurate. The blood pressure of many women, some elderly people, people who are very thin, and people who are very athletic is typically at the lower end of the normal range. The blood pressure of children and infants is lower than the blood pressure of adults. The blood pressure of people who are obese, people of certain ethnic groups (African-Americans), and many elderly people is likely to be at the higher end of the normal range. And blood pressure, like temperature and pulse, varies depending on the time of day: it is typically higher during the day and lower during the evening hours and the early morning.

**Learning Break:** Although there is no single number that can be considered normal when it comes to blood pressure, and there is some controversy about what a normal blood pressure is, most experts agree that a normal blood pressure can be defined as a systolic pressure less 120 mm Hg and/or a diastolic pressure less than 80 mm Hg.
You should be aware that you will often be measuring blood pressures that will be outside these parameters. There are many conditions can cause blood pressure to be too high or too low.

- Hypertension (Abnormally high)
- Blood loss (Abnormally low)
- Infection (Abnormally low: the blood vessels have dilated in response)
- Myocardial infarction (Heart attack: abnormally low)
- Drug overdose (Abnormally high as with cocaine, or abnormally low, as with narcotics)
- Adverse drug reaction (Abnormally high or low)
- Dehydration (Abnormally low)

**Learning Break:** If the blood pressure it abnormally high or abnormally low, there is damage to, or a malfunction of: a) the heart, b) the blood vessels or, c) the blood volume – it is that simple.

Most commonly, you will be measuring the blood pressures of people with chronic hypertension or you will measure a blood pressure that is considered to be abnormally high and the patient is unaware of the condition. Hypertension is one of the most common diseases in the United States: it is estimated that at least 58 million American adults have hypertension. Hypertension directly contributes to the development of heart disease, hemorrhage, strokes, blindness, and kidney disease.

**Learning Break:** Hypertension is most often defined as being a chronic condition in which the systolic pressure in adults is above 140 mm Hg and/or the diastolic pressure is above 90 mm Hg.

The higher the blood pressure, the greater the risk of developing complications. Unfortunately, for many people with hypertension, there are no signs and symptoms unless the blood pressure gets dangerously high or the complications have already developed. However, people who have a blood pressure that is abnormally high may complain of dizziness, headaches, blurred vision, or chest pain.

**Learning Break:** If the patient’s systolic blood pressure is greater than 140 mm Hg or the diastolic blood pressure is greater than 80 mm Hg, report this immediately to the R.N. or your immediate supervisor. Also, ask the person if he/she is experiencing any dizziness, headaches, blurred vision, or chest pain.

**Learning Break:** If a person with hypertension is complaining of blurred vision, chest pain, dizziness, or headache, report this immediately to the R.N. or your immediate supervisor, regardless of what the blood pressure measurement might be.

You also remember that what might be a normal blood pressure for one person would be considered abnormally high or low for someone else. For example, a young, slender,
athletic woman may have a blood pressure of 102/50 mm Hg. This reading is on the lower end of the normal range – but it is still normal. However, a reading of 102/50 mm Hg may indicate that something is wrong if the patient normally has a blood pressure of 139/78 mm Hg. And the opposite is certainly true, also. If someone normally has a blood pressure of 102/50 mm Hg and now has a pressure of 139/78 mm Hg, that may be a cause for concern.

**Learning Break:** If the patient’s blood pressure is unusually high or low when compared what it has been before, make sure you tell the R.N. or your immediate supervisor know immediately.

Low blood pressure can also be a cause for concern. If the pressure in the circulatory system is too low, vital organs such as the brain, the kidneys and the heart do not receive enough oxygen. Low blood pressure – like high blood pressure – is caused by a problem in the functioning of the heart (the heart may be damaged and cannot pump strongly enough) or the blood vessels (the blood vessels may be abnormally dilated due to an overwhelming infection), or loss of circulating blood volume (hemorrhage or dehydration). Signs and symptoms of low blood pressure include dizziness, lack of energy, pale skin, weakness, fainting, difficulty breathing, and feeling lightheaded when changing positions from sitting to standing or when exercising.

**Learning Break:** Low blood pressure – hypotension – is defined in adults as a systolic blood pressure below 90 mm Hg and/or a diastolic blood that is below 60 mm Hg

**SUMMARY**

Measuring and recording blood pressure quickly and correctly takes more time to learn than measuring the other vitals signs, but it is not highly difficult to learn. The important points to remember are:

- Blood pressure represents the force exerted against the walls of the blood vessel during each heart beat and the steady state pressure that is exerted against the walls of the blood vessels between each heart beat.
- A normal blood pressure is defined as a systolic pressure less than 120 mm Hg and a diastolic pressure less than 80 mm Hg.
- Hypertension is defined as a systolic pressure greater than over 140 mm Hg and/or a diastolic pressure greater than 90 mm Hg.
- Hypotension is defined as a systolic pressure less than 90 mm Hg and/or a diastolic pressure less than 60 mm Hg.
- An abnormally high or low blood pressure would be caused by a derangement in the heart, the blood vessels or the circulating blood volume.
- In order to measure the blood pressure accurately, the patient should be sitting or lying, should be at rest for at least two minutes, and the patient’s arm must be level with the heart.
• You should notify someone immediately if the patient’s blood pressure is abnormally high or low, if it is abnormally high or low compared to previous readings.

• You should also notify someone immediately if the patient has hypertension and is complaining of blurred vision, chest pain, dizziness, or headache, regardless of whether or not the blood pressure at the time is normal.