

Blood Pressure Measurement

Introduction

This module has been developed to assist members develop their skills in both taking and interpreting blood pressure readings. People of ages have varying blood pressure levels, so changes to the readings need to be assessed differently. Blood pressure can change because of physical stress on the body as well as emotional stresses, but know what to do if the reading is too high or too low can assist in knowing when to refer them on.

Definition

Blood pressure is a reading that relates to the pressure placed on vessels when the heart is pumping and when it is at rest.

As your heart pumps blood around the body your pulse can be felt. The peak of pressure (or pulse) is known as **systolic** blood pressure and the phase in between, when the heart is at rest is known as **diastolic** blood pressure.

Blood vessels require a level of pressure inside them, even when the heart is at rest. Otherwise the vessels would collapse. For the body to work effectively, an adequate amount of circulating blood must be present. The vessels need a minimum pressure of 60mm Hg to continue to supply the brain with oxygen. If the blood pressure drops the body will try and compensate. It does this by reducing the blood supply from the non-vital organs (such as your gut and limbs) and sends it to the vital organs such as your brain, heart, lungs and kidneys etc. As a result extremities may feel cool to touch. This action may occur when someone is going into shock. If an adults blood pressure drops below 90mm Hg, it may start to become life threatening.

Blood pressure is usually taken on an arm whilst listening or feeling for a brachial pulse. In certain situations this is not possible due to injury or for a medical reason where applying pressure to that limb may cause the patient harm. Patients who cannot have their blood pressure taken on a certain arm will usually tell you. Never take blood pressure on a person's arm if they have:

- An injured or broken limb
- A fistula inserted – which is used for dialysis
- Have had a mastectomy
- Cannula inserted

In some circumstances you may need to measure blood pressure on the leg (i.e. if the patient has had a bilateral mastectomy or has sustained injuries to both arms).

A sphygmomanometer (or blood pressure pump and cuff) is used to take a blood pressure and it is measured against the pressure of Mercury (Hg). Blood pressure is usually measured in the arm using the brachial artery. The cuff is wrapped around the arm and inflated until it exceeds systolic blood pressure. At this point, blood in the arm has ceased to flow and a brachial or radial pulse cannot be heard or felt. We then reduce the pressure slowly and listen with a stethoscope (auscultate) at the brachial artery and feel for a pulse.

Factors that may affect the blood pressure reading

Blood pressure is a very labile, everyone's is different. It can be elevated or lowered with physical activity, stress, medications, illness or injury. A person's blood pressure can be low (hypotensive) or high (hypertensive) or normal (normotensive).

A high blood pressure (hypertension) is very common in elderly people. Sudden causes of high blood pressure include fever, stress and physical activity. Long term causes include smoking, diet, obesity, ethnicity, and age.

Low blood pressure (hypotension) can be more life threatening in the first aid setting as one of the main causes is shock. However hypotension is one of the last signs of shock. Between 30-40% of blood volume needs to be lost before the systolic blood pressure will drop below 90mm Hg (ref 2). Some of the types of shock you may come across in a first aid situation:

<i>Volume Failure:</i>	Hypovolemia, caused by low circulating volume. E.g. blood loss, dehydration, severe nausea or vomiting, burns.
<i>Pump Failure:</i>	Cardiogenic Shock. Insufficient pumping of the heart. E.g. heart attack/ myocardial infarction, cardiac arrhythmia
<i>Container Failure:</i>	Sudden vasodilation. The "vascular container" enlarges without proportional increase in fluid volume. E.g. fainting, anaphylaxis, septic shock, spinal cord trauma

Medications also play a factor in elevating or lowering blood pressure. It is important to ask patients if they take any medications that affect or control their blood pressure, and when they last took them as this may affect the way you interpret their reading.

Ranges of blood pressure

Normal BP Adult Ranges:

- Systolic 100 - 160mmHg
- Diastolic 60 - 90mmHg

In Children & Infants:

- Systolic blood pressure is calculated as:
$$80 + (\text{age} \times 2)$$
- Examples:
 - 1 year old = $80 + (1 \times 2) = 82$ mmHg
 - 3 year old = $80 + (3 \times 2) = 86$ mmHg
 - 8 year old = $80 + (8 \times 2) = 96$ mmHg
 - 10 year old = $80 + (10 \times 2) = 100$ mmHg

Equipment

Stethoscope

Sphygmomanometer (pump and gauge)

Cuff (note different sizes are available)



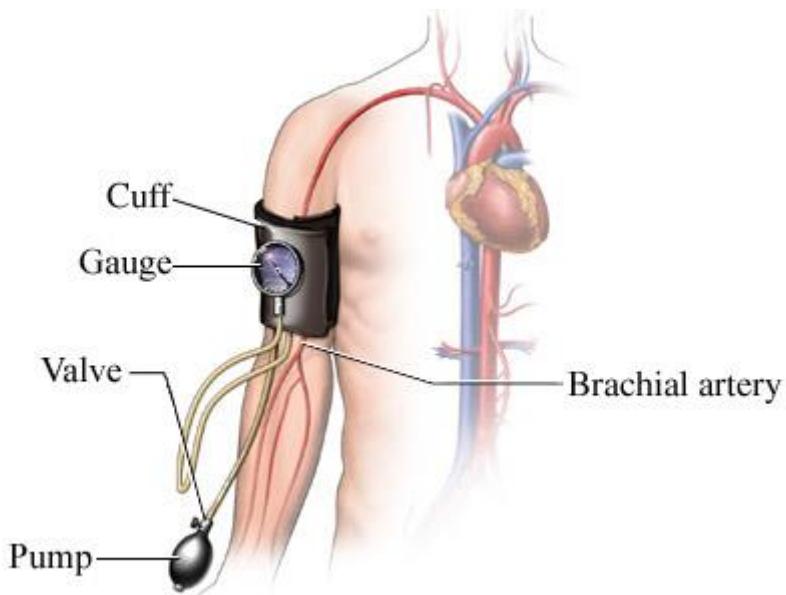
Cuff size selection

Ensure you select the correct cuff as choosing a cuff too small or too large may result in an incorrect reading. The cuff should fit comfortably around the arm without putting strain on the Velcro pieces. Two fingers should be able to slide underneath the cuff after it has been applied.

Select the correct cuff as indicated on the equipment you are using. This may be indicated (adult or paediatric) as a picture (large adult, small adult, child) or by measuring the width of the arm against the indicator arrow along the side of the cuff. The width across the arm should fit in between the arrows on the cuff size indicator.

Sphygmomanometer:

- Cuff should be at least 2/3 size of Casualty's upper arm
- Place cuff around arm, 2-3 cm above site of brachial artery
- Ensure arrows on cuff are in line with brachial artery



Cleaning:

Wipe over with detergent and water. If contaminated with blood or body fluids, after cleaning, wipe over with sodium hypochlorite solution [500 ppm] or an alcohol wipe (impregnated with 70% isopropyl alcohol) and allow to dry (p 22, Infection Control Guidelines, 2007).

Taking a Blood Pressure

In certain circumstances, you may not be able to take a blood pressure to determine the systolic and diastolic reading. This may be because you do not have a stethoscope, there is too much background noise to determine the reading, or because the assessment is time critical and you're only wanting to know the systolic reading for perfusion purposes. In all cases, gaining both the systolic and diastolic readings is desirable. Always use caution when taking a blood pressure on children.

1. Primary assessment DRABCD Action Plan
2. Positioning and reassurance
 - a. Explain to the casualty what you are going to do.
 - b. Ask the casualty to sit or lie comfortably and relax – remove bulky or thick clothing if necessary.
 - c. Arm should not be held higher than the heart (this may cause an incorrect/lower reading).
3. Standard Precautions
 - a. Wash your hands and apply gloves.
4. Prepare to take blood pressure
 - a. Gain permission from the patient to take a BP.
 - b. Ask the patient to roll or push their sleeve up to expose above the elbow.
 - c. Remember not to take a BP on a patient on the side they have:
 - i. An injured or broken limb,
 - ii. A fistula inserted – which is used for dialysis,
 - iii. Have had a mastectomy,
 - iv. Where a cannula is inserted (if possible).
 - d. Select appropriate sized cuff.
 - e. Wrap the deflated cuff around the patient's arm just above the elbow and secure it with the Velcro, ensuring the bladder of the cuff is sitting over the brachial artery. The cuff should sit two fingers width (3cm) above the crease of the elbow.
 - f. Ensure there is enough room to slide two fingers underneath the cuff.
 - g. Extend the arm and support it at heart level.
 - h. Position the gauge where you can see it.

5. Taking a blood pressure

Taking a Systolic Only

- a. Locate the radial pulse on the same arm
- b. Ensure valve on bulb is closed (either with a thumb screw, knob or trigger, test before you begin)
- c. Rapidly inflate the cuff until there is no radial pulse is felt – then continue to inflate 10-12mm Hg above where the pulse disappeared.
- d. Continue to feel the radial pulse
- e. Slowly deflate the cuff (approximately 2mm Hg per second)
- f. Note the reading when the radial pulse returns, this is the systolic pressure.
- g. Once felt, rapidly deflate the cuff of remaining pressure
- h. Wait one minute before repeating a blood pressure on the same arm.
- i. Interpret the reading based on the patient's presentation and medical history.
- j. Remove your gloves and wash your hands when you have finished.

Systolic and Diastolic

- a. Locate the radial pulse on the same arm
- b. Ensure valve on bulb is closed (either with a thumb screw, knob or trigger, test before you begin).
- c. Rapidly inflate the cuff until no radial pulse is felt – then continue to inflate 10-20mm Hg above where the pulse disappeared.
- d. Place the bell of the stethoscope over the brachial artery and listen for the return of arterial pressure as you deflate the cuff.
- e. Slowly deflate the cuff (approximately 2mm Hg per second)
- f. Note the reading when the first sound of the pulse returns. You should hear a “dub, dub, dub” noise, this is the systolic pressure.
- g. Continue to listen until the noise disappears you may hear a slight “whooshing noise”, note the reading, this is the diastolic pressure.
- h. Then rapidly deflate the cuff of remaining pressure.
- i. Wait one minute before repeating a blood pressure on the same arm.
- j. Interpret the reading based on the patient's presentation and medical history.
- k. Remove your gloves and wash your hands when you have finished.

6. Documentation

- a. Record your findings on an OB12.
- b. Establish any actions necessary.

When to Refer

Refer to a health care professional when the reading falls outside the normal parameters of the above.

References

Occupational First Aid, St John Ambulance, 2007

PHTLS Basic and Advanced Prehospital Trauma Life Support, 4th Edition, Mosby, 1999

Mireb, E. N, *Human Anatomy and Physiology*, 4th Edition. 1998, Benjamin/Cummings Science Publishing, California.

St John Ambulance Infection Control Guidelines,