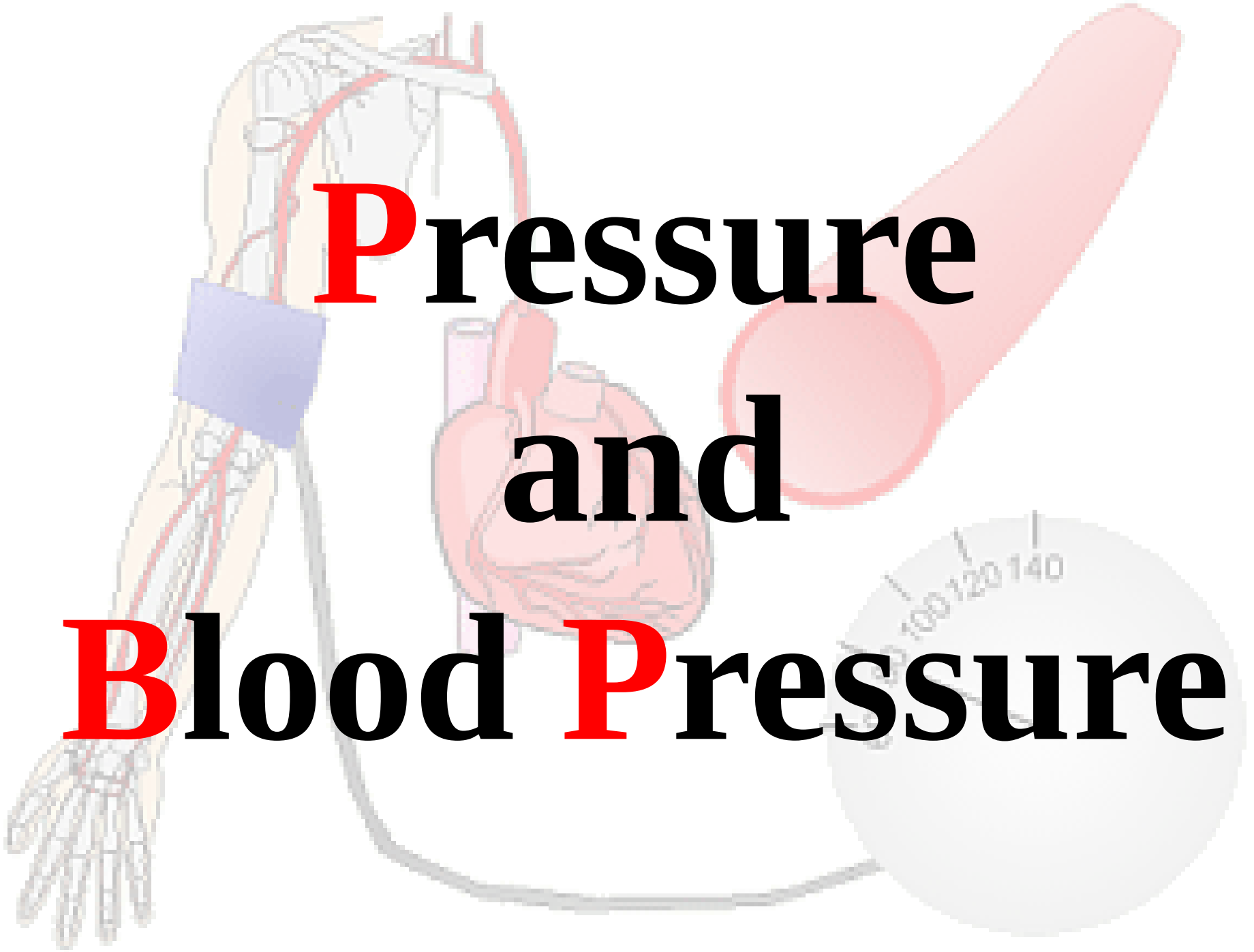


Pressure and Blood Pressure

Pressure

Is the force exerted per unit area (F/A).

Standard Units of Pressure

N/m^2 = Pascal

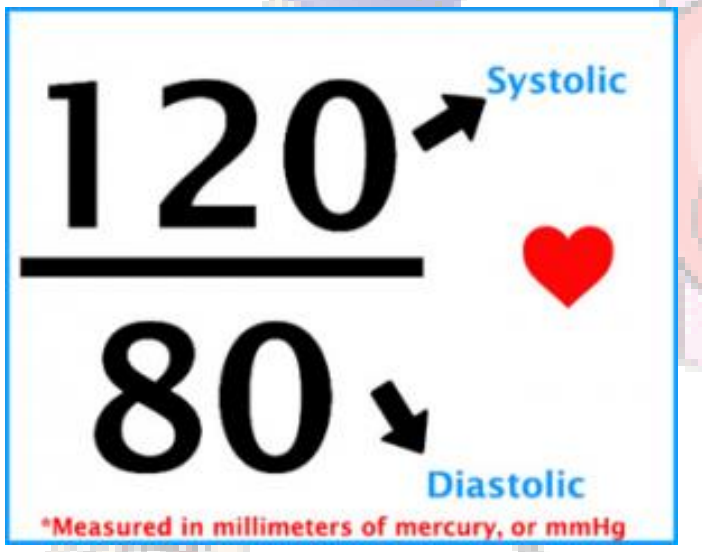
Blood Pressure

Is the force exerted by the blood against any unit area of the vessel wall.

The classical method of measuring pressure is to determine the height of a column of liquid that produces a pressure equal to the pressure being measured.

Standard Units of Blood Pressure

Blood pressure is almost always measured in **millimeters of mercury** (mmHg) because the mercury manometer has been used since antiquity as the standard reference for measuring blood pressure.

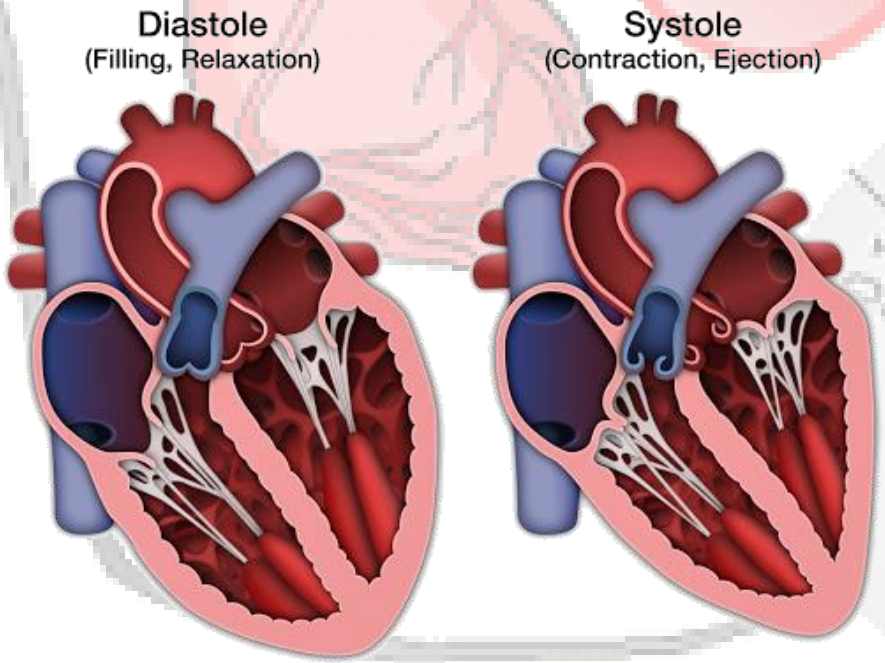


Systolic Pressure : force exerted by the blood against any unit area of the vessel wall at heart contraction.

Diastolic Pressure :force exerted by the blood against any unit area of the vessel wall at heart relaxation.

Systolic and Diastolic Pressure

Turbulence is used to make common blood pressure measurements. The cardiac cycle consists of a period of relaxation called "**Diastole**", during which the heart fills with blood, followed by a period of contraction called "**Systole**"", during which the heart empty from blood.



Systolic Pressure is measured by monitoring the cuff pressure when flow first resumes as the pressure in the cuff is lowered. The first flow is turbulent. The cuff pressure is then reduced until there is flow during all parts of the cycle. Flow remains turbulent because the artery is partially constricted. The turbulent sounds made by blood flow in this measurement are called "**Korotkoff Sounds**". The pressure at which flow occurs during all parts of the cycle but remains turbulent is called the **Diastolic Pressure** and is normally recorded.

Clinical Method for Measuring Systolic and Diastolic Pressures

It is impossible to use the various pressure records that require needle insertion into an artery for making routine pressure measurements in human patients, although they are used on occasion when special studies are necessary. Instead, the clinician determines **systolic** and **diastolic** pressures by indirect means, usually by the **auscultatory** method.

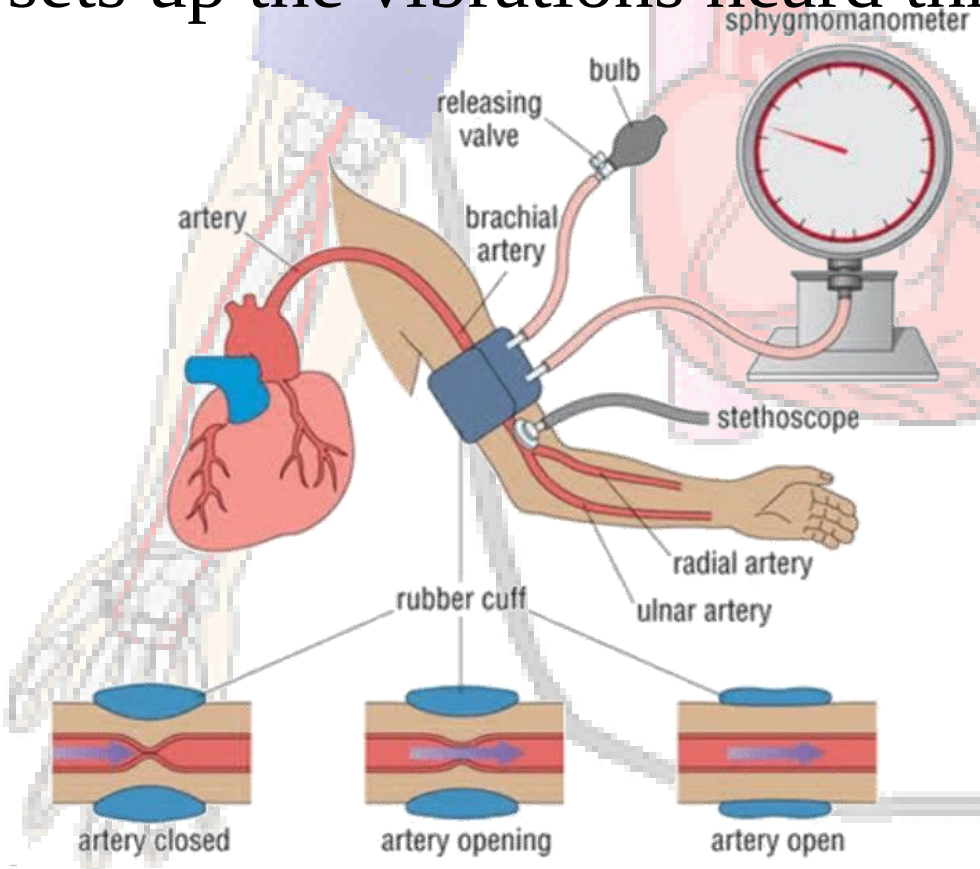
The **auscultatory** method for determining **systolic** and **diastolic** pressures is not entirely accurate, but it usually gives values within 10 percent of those determined by direct measurement from the arteries.

Sometimes we can measure the blood pressure without using the stethoscope this method called **palpatory** method. It is also consider indirect method but in this method we get the **systolic** pressure without the **diastolic** pressure.

Measuring the Blood Pressure by Indirect Method (Auscultatory Method)

A stethoscope is placed over the antecubital (brachial) artery and a blood pressure cuff is inflated around the upper arm. As long as the cuff compresses the arm with so little pressure that the artery remains distended with blood, no sounds are heard by the stethoscope., despite the fact that the blood within the artery is pulsating. When the cuff pressure is great enough to close the artery during part of the arterial pressure cycle, a sound is then heard with each pulsation. These sounds are called "**Korotkoff Sounds**".

The exact cause of korotkoff sounds is still debated, but they are believed to be caused mainly by blood jetting through the partly occluded vessel. The jet causes turbulence in the open vessel beyond the cuff, and this sets up the vibrations heard through the stethoscope.

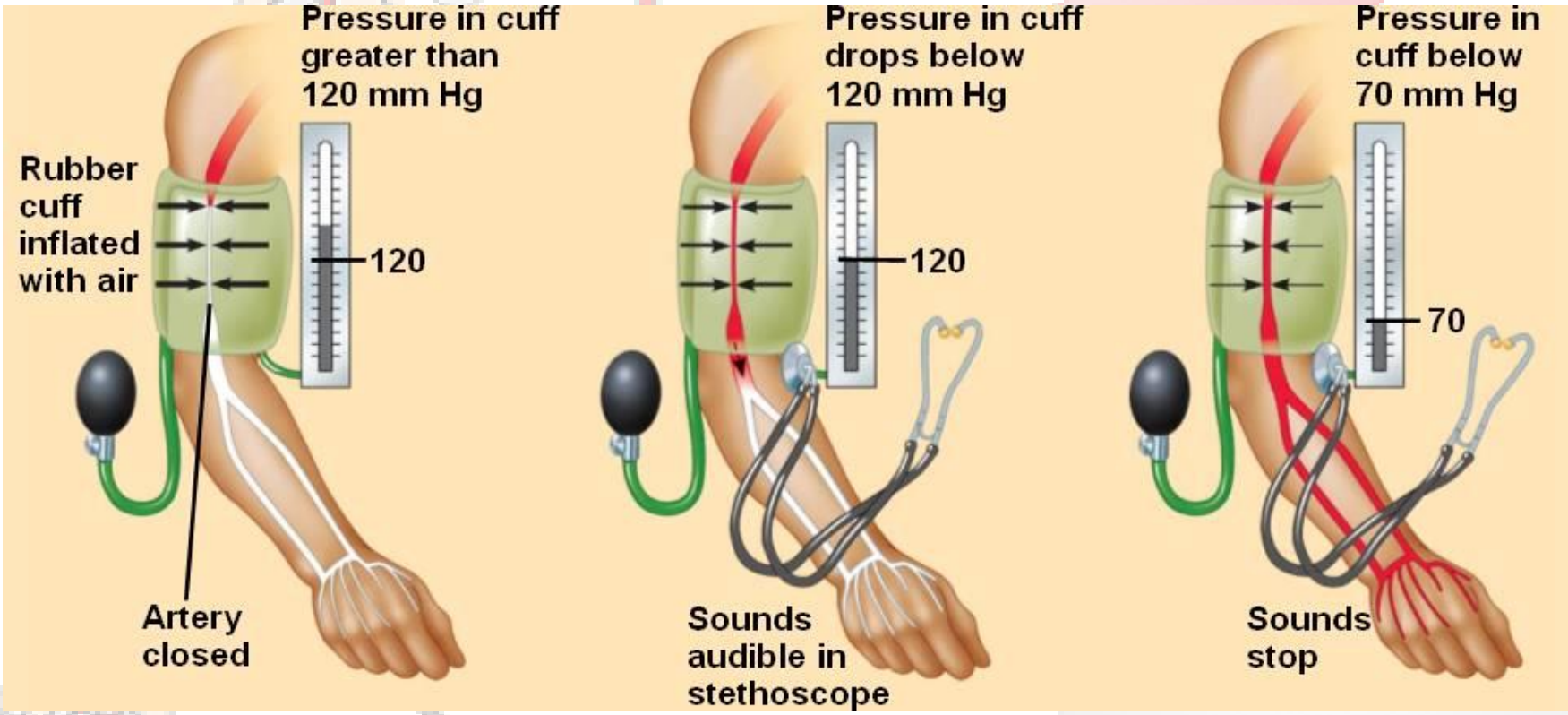


Korotkoff Sounds : sound heard with each pulsation During blood jetting through the partly occluded vessel.

1- Put cuff around the arm as shown in figure below.

2-Reduce pressure in cuff & monitoring blood jetting sound by stethoscope.

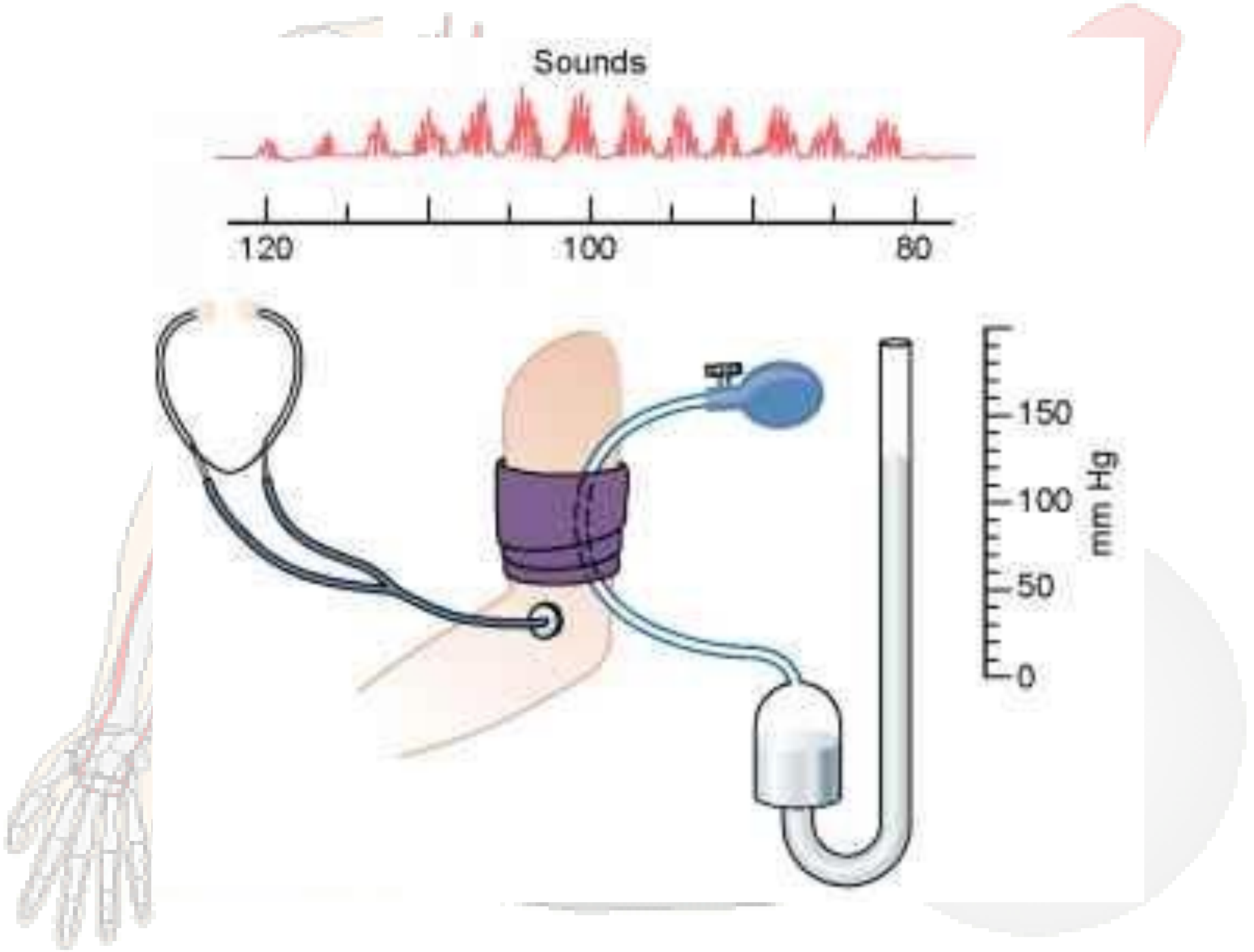
3 - 1st sound heard is when pressure in cuff equal to systolic pressure of heart.



4- The last sound heard when the cuff pressure is equal to the diastolic heart pressure.

In determining blood pressure by the auscultatory method, the pressure in the cuff is first elevated well above arterial systolic pressure. As long as this pressure is higher than systolic pressure, the brachial artery remains collapsed and no blood jets into the lower artery during any part of the pressure cycle. Therefore, no korotkoff sounds are heard in the lower artery. But then the cuff pressure is gradually reduced. Just as soon as the pressure in the cuff falls below systolic pressure, blood slips though the artery beneath the cuff during the peak of systolic pressure, and one being to hear tapping sounds in the antecubital artery in synchrony with the heartbeat. As soon as these sounds are heard, the pressure level indicated by the manometer connected to the cuff is about equal to the systolic pressure.

As the pressure in the cuff is lowered still more, the korotkoff sounds change in quality, having less of the tapping quality and more of a rhythmical, harsher quality. Then, finally, when the pressure in the cuff falls to equal diastolic pressure, the artery no longer closes during diastolic, which means that the basic factor causing the sounds (the jetting of blood through a squeezed artery) is no longer present. Therefore, the sounds suddenly change to a muffled quality and then usually disappear entirely after another 5 to 10 millimeter drop in cuff pressure. One notes the manometer pressure when the korotkoff sounds change to the muffled quality, and this pressure is about equal to the diastolic pressure.

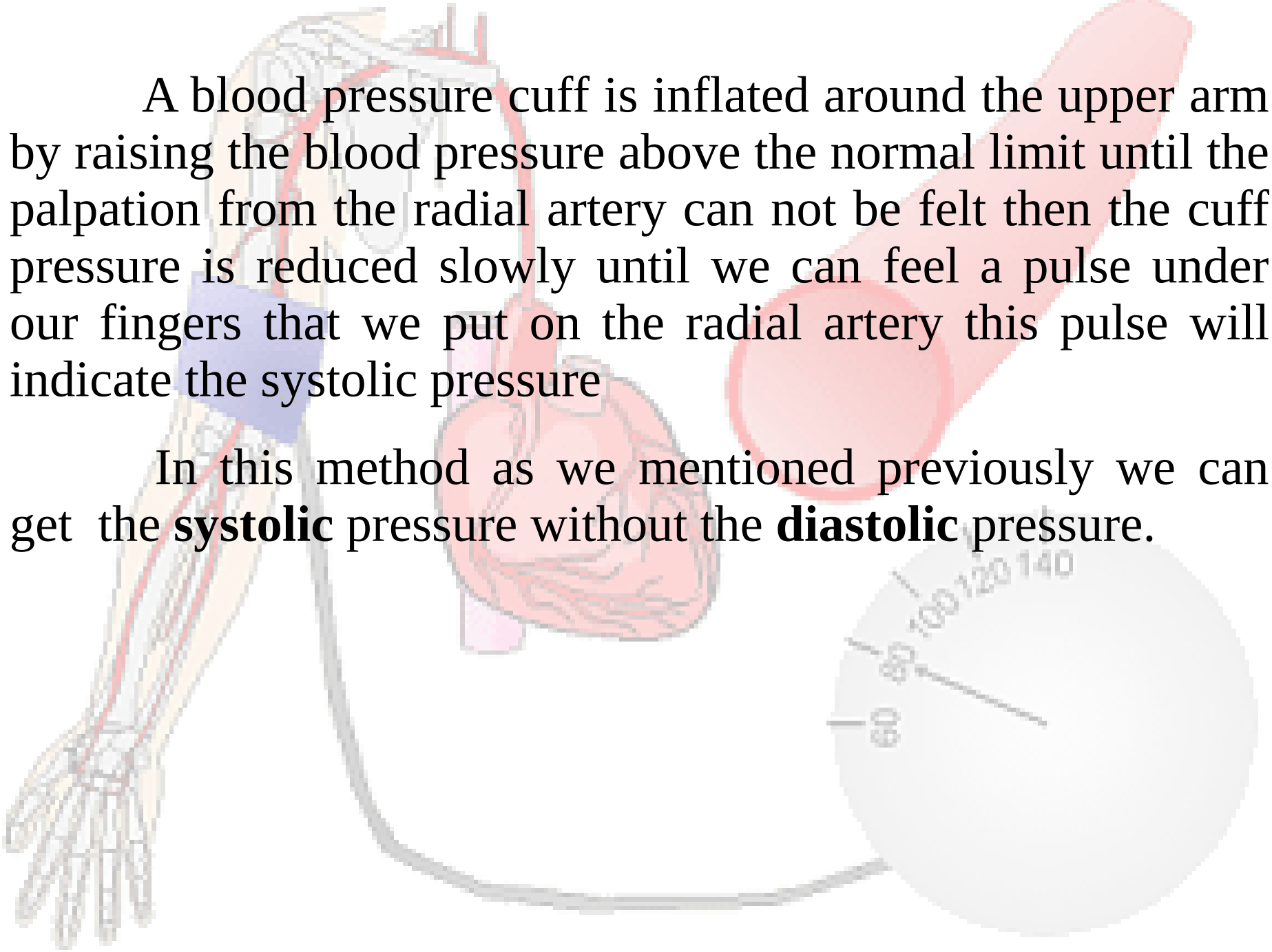

Sounds
120
100
80
150
100
50
0
mm Hg

Measuring the Blood Pressure by Indirect Method (Palpatory Method)

In **palpatory** method feel the radial pulse by putting the three middle fingers of the right hand along the course of the radial artery at the wrist with the index finger towards the subject, and then follow the same steps of **auscultatory** method.

A blood pressure cuff is inflated around the upper arm by raising the blood pressure above the normal limit until the palpation from the radial artery can not be felt then the cuff pressure is reduced slowly until we can feel a pulse under our fingers that we put on the radial artery this pulse will indicate the systolic pressure

In this method as we mentioned previously we can get the **systolic** pressure without the **diastolic** pressure.



The Needs for Measuring the Blood Pressure by Indirect Method

To measure the blood pressure by indirect method we need: -

1. Stethoscope: -

Clinical instruments consists of chest-piece with two functions and convertible axis, latex tubes, binaural head frame and ear plugs. It is used for ausculatating various sounds of heart, lung and other organs in human body.

2. Sphygmomanometer: -

clinical instruments used in measuring blood pressure. It found in tow types: 1-Mercury 2-Aneroid 3-electronic.

- **A Mercury Type: -**

In this type the pressure is indicated by the height of a column of mercury inside a glass tube.

It consists of: -

1. Inflated Cuff (rubber bag enclosed in a cloth cuff with a cloth tail).
2. Rubber Tubes.
3. Inflated Rubber Bulb with two valves (one and two way valve).
4. Mercury Reservoir.
5. Graduated Cylinder

- **An Aneroid Type: -**

In this type the pressure changes the shape of a sealed flexible container, which causes a needle to move on a dial.

It consists of: -

1. Inflated Cuff (rubber bag enclosed in a cloth cuff with a cloth tail).
2. Rubber Tubes.
3. Inflated Rubber Bulb with two valves (one and two way valve).
4. Sealed Flexible container.
5. Dial with Needle.

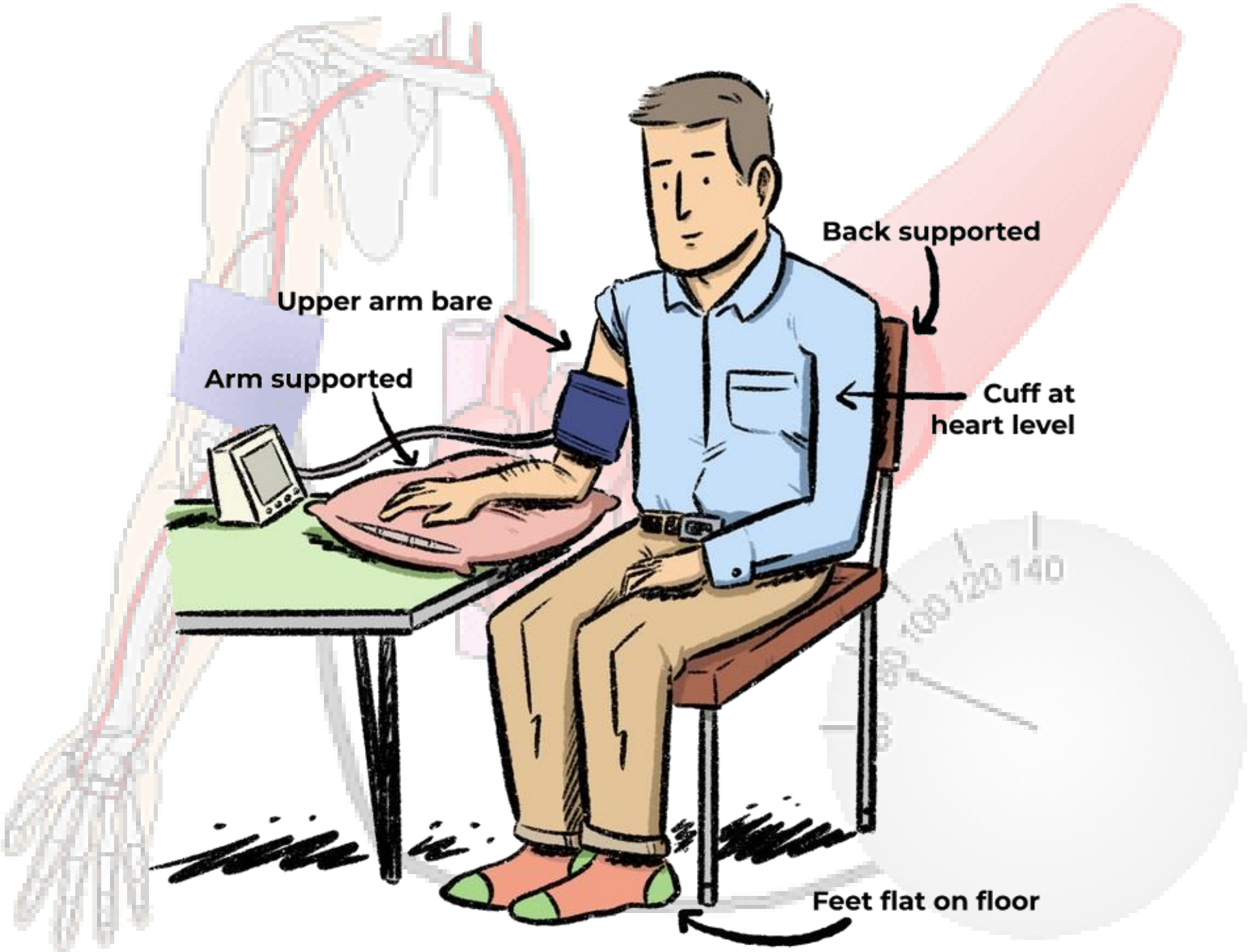
Precaution Taken During Measurement of Blood Pressure

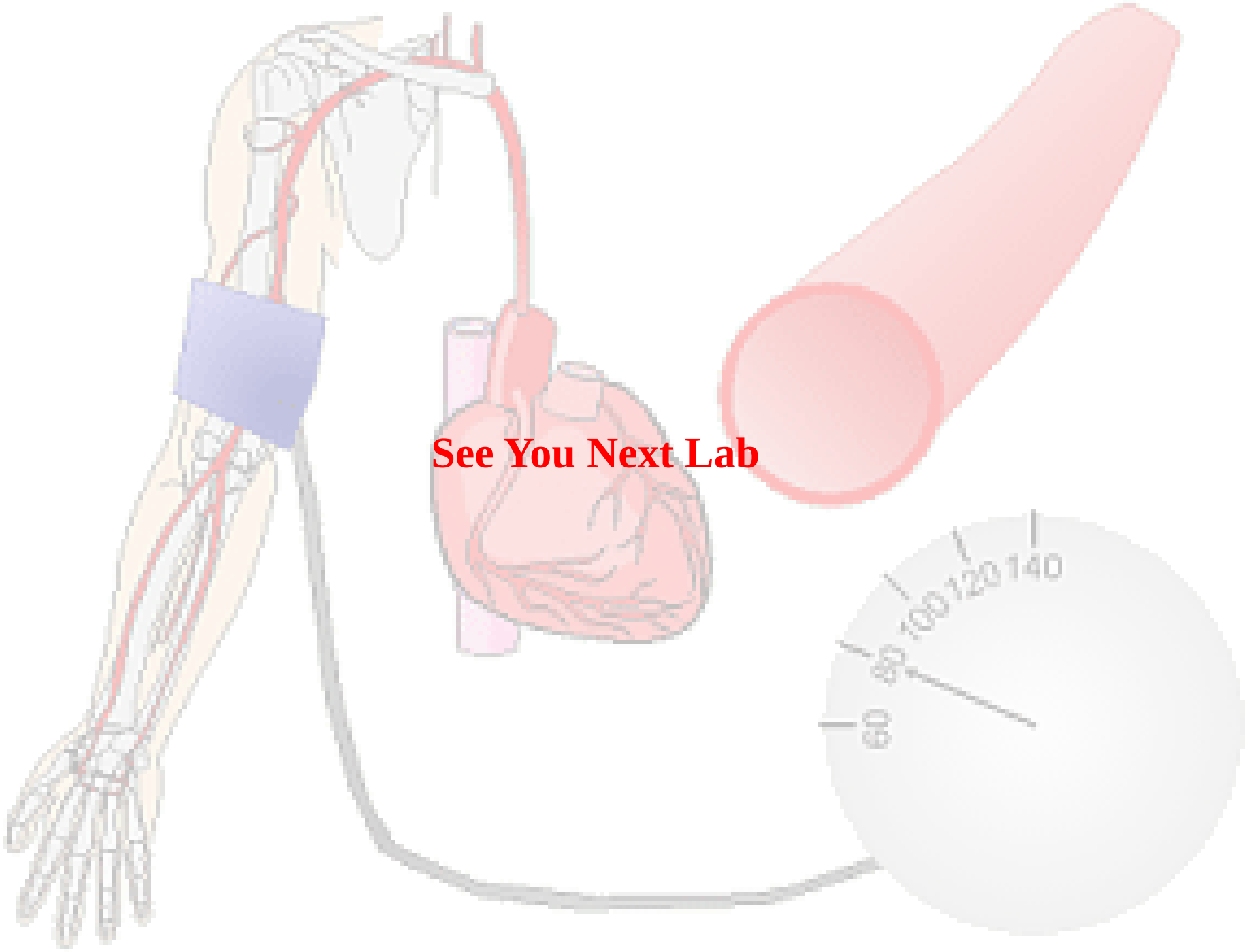
1. Before taking your blood pressure, plan to relax and rest for at least 15 minutes. This will reduce the error due to physical activity.

2. Whether sitting or lying, be sure that your arm rests at the same level as your heart to obtain a pressure that is uninfluenced by gravity.

3. Do not let tight clothes around the arm or the cuff is inflated for sometime, the discomfort may cause reflex vasoconstriction, raising the blood pressure.

4. Leaving the cuff partially inflated too long will fill the venous system and make sound difficult to hear.


Back supported
Upper arm bare
Arm supported
Cuff at
heart level
Feet flat on floor



See You Next Lab