



# Determination of the Blood Pressure

## Physiology lab-2

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# Blood Pressure Determinations

## DEFINITION

Blood pressure (BP) is the lateral pressure exerted by the column of blood on the wall of the artery.

## AIM

To determine the blood pressure of the given subject at rest and after moderate exercise.

## APPARATUS

Sphygmomanometer and stethoscope.

## PRINCIPLE

The pressure of blood in the artery (brachial artery) is balanced against the pressure of air in a rubber cuff surrounding the artery. The pressure of air in the cuff is then measured by means of a mercury manometer.



# Blood Pressure Determinations

**Systolic pressure** is the maximum pressure in the arteries during systole. It indicates:

- a. The extent of work done by the heart
- b. The force with which the heart is working
- c. The degree of pressure which the arterial walls have to withstand.

**Diastolic pressure** is the minimum pressure at the end of ventricular diastole. It is the measure of constant stretch to which walls of the arteries are subjected. It is more important than systolic pressure because:

- a. It is less fluctuating
- b. It is the constant load against which the heart has to work
- c. It is the pressure of peripheral resistance and depends mainly on the tone of the arteries.

**Pulse pressure** is the difference between the systolic and diastolic pressures. It is the rise in pressure caused by the ejection of blood into the aorta by ventricular contraction. It is a measure of stroke volume and compliance of arteries.

**Mean arterial pressure** is the average pressure present throughout the cardiac cycle. It is responsible for pushing the blood through the systemic circulatory system. It is equal to diastolic pressure +  $\frac{1}{3}$  pulse pressure

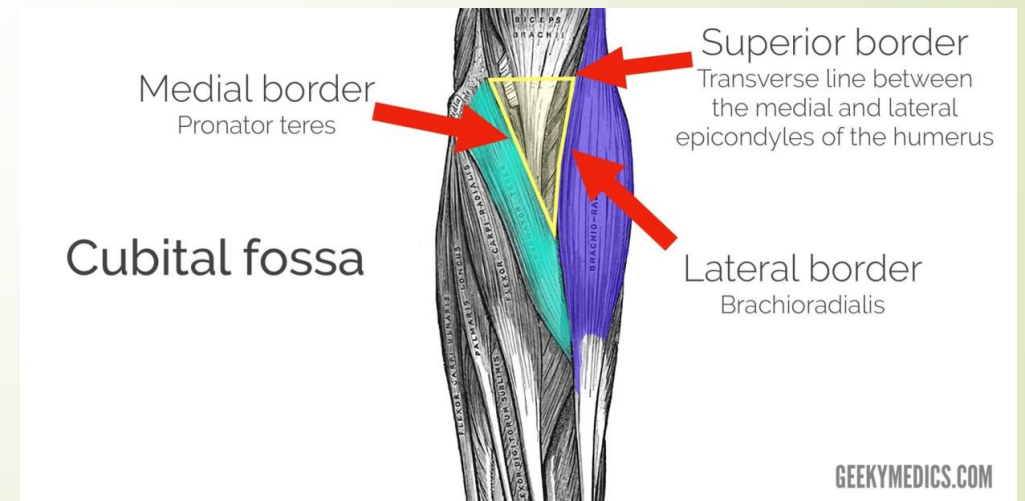
# Blood Pressure Determinations

## **METHODS:**

1. Palpatory method
2. Auscultatory method
3. Oscillatory method.

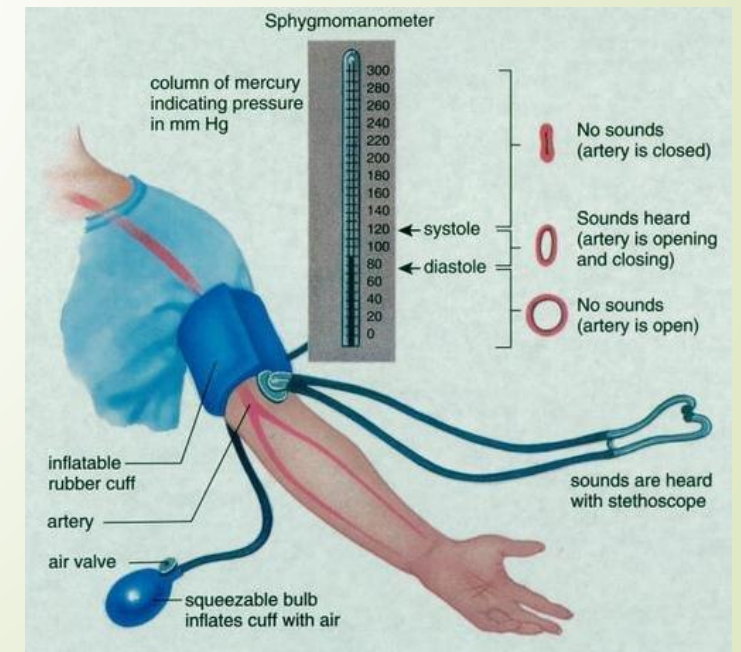
# Procedure:

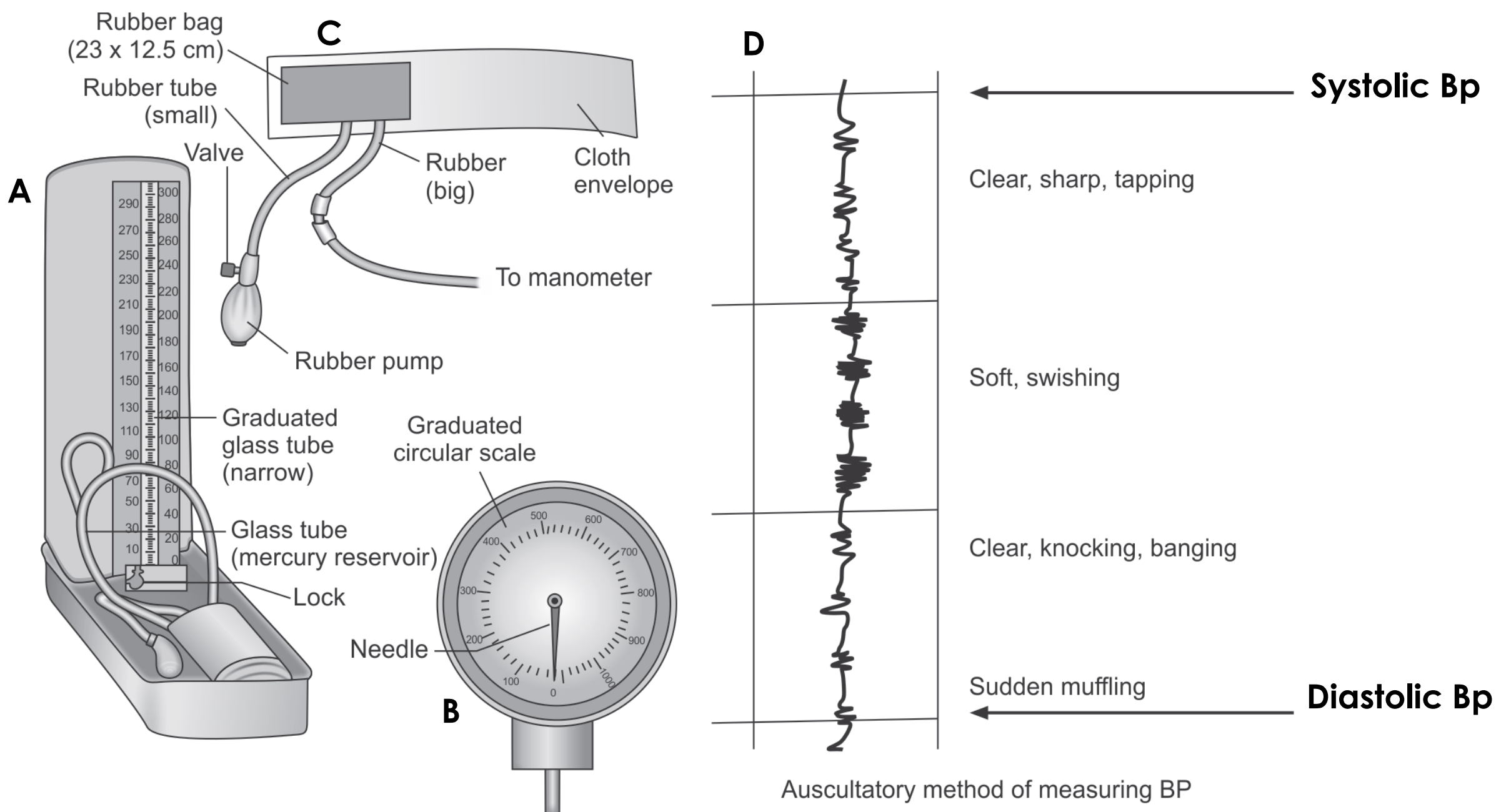
- 1. Palpatory method:** The subject is asked to sit on a stool. The cuff is tied around the upper arm with the lower border of the cuff not less than 2.5 cm above the cubital fossa. The outlet valve of the bulb is closed. The radial pulse is palpated while the cuff is being inflated to a pressure slightly above the level at which the radial pulsation is no longer felt. The pressure at which the pulsation was obliterated is read in the mercury manometer. The outlet valve is opened. The manometric reading is noted at the point where the pulsation reappears. The average of the two readings gives the systolic pressure. The diastolic pressure cannot be determined by this method.



# Procedure:

**2. Auscultatory method:** By palpatory method, only the systolic blood pressure could be measured. By auscultatory method, both the systolic and diastolic blood pressure can be measured. The chest piece of the stethoscope is placed over the brachial artery. The pressure in the cuff is raised above the systolic pressure (by about 30 mm Hg) previously determined by the palpatory method. The pressure is then lowered gradually (2–3 mm per second). The sounds that are heard are the Korotkoff's sounds. The first sound that occurs is a sharp tapping sound, indicates the peak systolic pressure. The diastolic pressure is measured by disappearing of the sound.





**Figs 1: (A) Mercury sphygmomanometer; (B) Aneroid sphygmomanometer; (C) Riva-Rocci cuff; (D) Korotkoff's sounds**

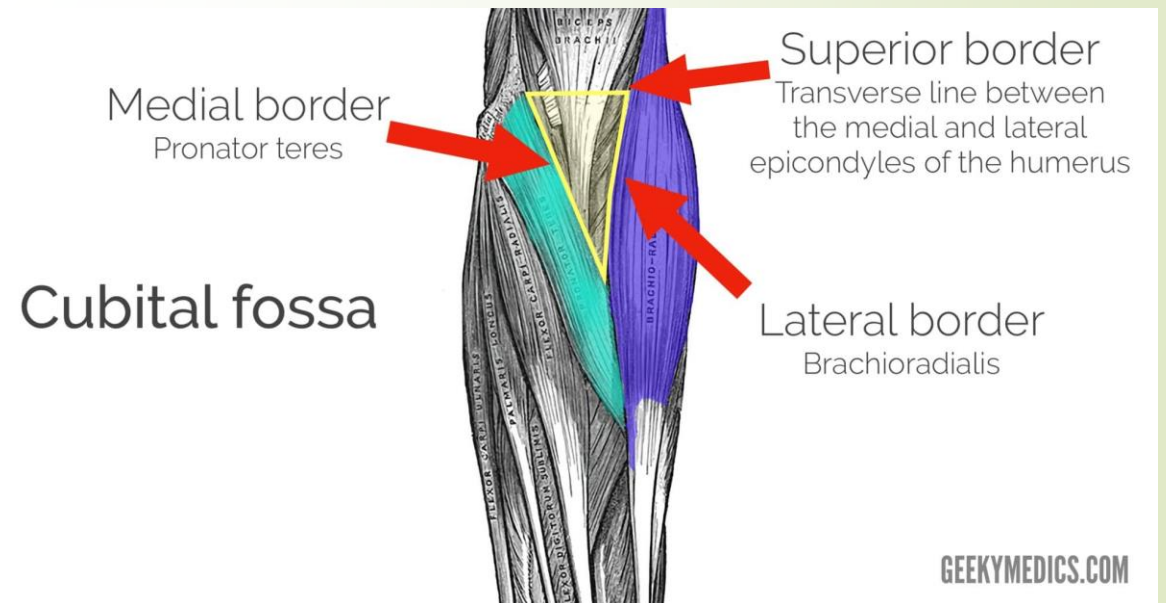


# Procedure:

**3. Oscillatory method:** This is another method of determining blood pressure. By this method, both the systolic and diastolic blood pressure are determined. The pressure at which **oscillations appear** in the mercury manometer gives the systolic pressure and the pressure at which it disappears give the diastolic blood pressure. However, this method is not accurate.

# Important precautions in the use of sphygmomanometer:

1. The manometer should be placed at the level of the heart.
2. The lower border of the cuff should be 2.5 cm above the cubital fossa. For children, a narrow cuff should be used.
3. Blood pressure should be preferably taken in the left arm.



## NORMAL VALUES

- The average systolic pressure in healthy adults is 100–140 mm Hg.
- The average diastolic pressure is 60–90 mm Hg.
- In children it is closer to the lower end of the scale and in the elderly, it reaches or even exceeds the higher figure.
- The difference between the systolic and diastolic pressure is the pulse pressure 30–60 mm Hg.

# Observing the Effect of Various Factors on Blood Pressure and Heart Rate

- Arterial blood pressure is directly proportional to cardiac output (CO, amount of blood pumped out of the left ventricle per unit time) and peripheral resistance (PR) to blood flow, that is,

$$BP = CO * PR$$

- Peripheral resistance is increased by blood vessel constriction (most importantly the arterioles), by an increase in blood viscosity, and by a loss of elasticity of the arteries (seen in arteriosclerosis). Any factor that increases either the cardiac output or the peripheral resistance causes an almost immediate reflex rise in blood pressure.

# Physiological Variations

1. Blood pressure is slightly lower in women than men.
2. Persons with slender build have got a lower blood pressure than those of heavy build.
3. During sleep, systolic pressure is less.
4. Emotional excitement and muscular exercise cause an increase in the blood pressure. It is also increased after meals.
5. The blood pressure especially the diastolic is highest in the standing position, lower in the sitting and lowest while the subject is lying down.

## **Pathological Increase in Blood Pressure**

1. Essential hypertension
2. Adrenal tumor
3. Hyperthyroidism
4. Pheochromocytoma.

## **Pathological Decrease in Blood Pressure**

1. Shock
2. Hypothyroidism
3. Adrenal insufficiency.

# Effect of moderate exercise on blood pressure

During exercise, there is a moderate increase in systolic blood pressure. This is due to an increase in cardiac output caused by an increased heart rate and myocardial contractility (stroke volume increases) due to increased sympathetic activity, and increased venous return.

The increase in blood pressure is not proportionate to the increase in cardiac output because there is a reduction in total peripheral resistance. The effects of vasoconstriction in inactive regions are overcome by vasodilatation in active muscles. Hence, the diastolic pressure at the pre-exercise level is slightly reduced. Pulse pressure is increased.

**Thank you**