



# BLOOD PRESSURE

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# Learning Objectives

- Define sphygmomanometer and identify its parts.
- Describe the palpatory and auscultatory methods for ABP measurement.
- Differentiate between the palpatory and auscultatory methods in measuring ABP.
- Perform ABP measurement for a fellow student using the sphygmomanometer.
- Identify Korotkoff sounds and describe their use in ABP determination.
- Enumerate the precautions considered before and during ABP measurement.

# DEFINITIONS

➤ **Blood pressure means the force applied by blood against any unit area of blood vessel as it passes through it.**

- **Unit of Measurement----- mmHg**
- **Normal BP:**

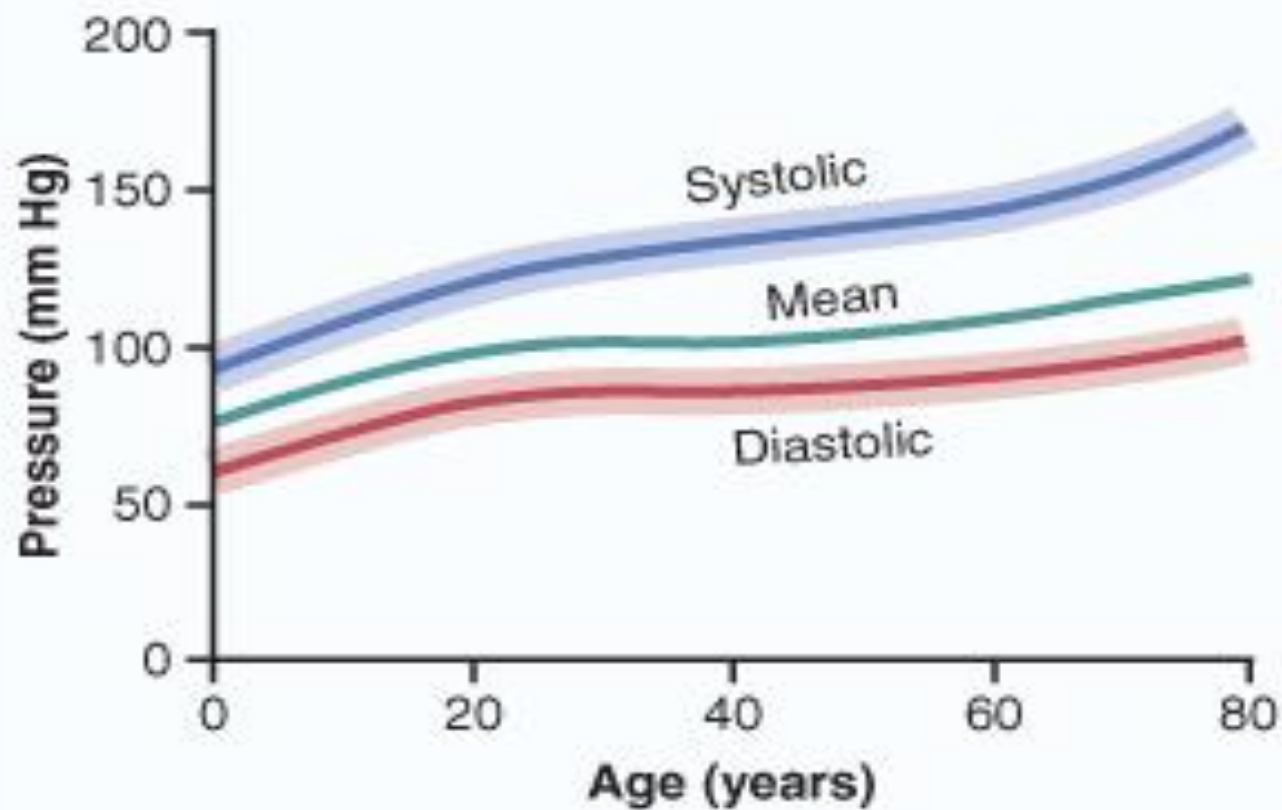
<b>BP category</b>	<b>Systolic BP</b>		<b>Diastolic BP</b>
<b>Average Values</b>	<b>120 mmHg</b>	<b>and</b>	<b>80 mmHg</b>
<b>Normal Range</b>	<b>100-140mmHg</b>	<b>and</b>	<b>60-90 mmHg</b>
<b>Hypertension</b>	<b>≥ 140mmHg</b>	<b>or</b>	<b>≥ 90mmHg</b>

# PULSE PRESSURE

- What is pulse pressure ?
  - It is the difference between systolic and diastolic blood pressure.
- Normal Range-----30 to 60 mmHg

# MEAN ARTERIAL BLOOD PRESSURE

- What is Mean Arterial Blood Pressure ?
  - It is the average pressure which drives the blood forward in the tissues ( through blood vessels ) throughout the cardiac cycle.
- Mean Arterial B.P
  - =Diastolic B.P + 1/3 Pulse pressure
  - = 80+1/3 x 40=93mmHg



# PRACTICAL

## BLOOD PRESSURE MEASUREMENT

- Normal BP= 120/80 mmHg (In Adults)
- Range:
  - Systolic –100-140mmHg
  - Diastolic—60-90mmHg
- Equipment
  - Stethoscope
  - Sphygmomanometer

# FACTORS AFFECTING BP

- Age, Sex
- Posture
- Exercise
- Anxiety or Stress
- Gravity
- Sleep
- Pregnancy




# PRECAUTIONS

- Cuff Size
- Body Position (reading varies with position).
- Activity Level (at rest).
- Cuff should be at the level of the heart.
- Don't keep cuff inflated for too long.



# METHODS OF MEASUREMENTS

- Palpitory
  - Auscultatory
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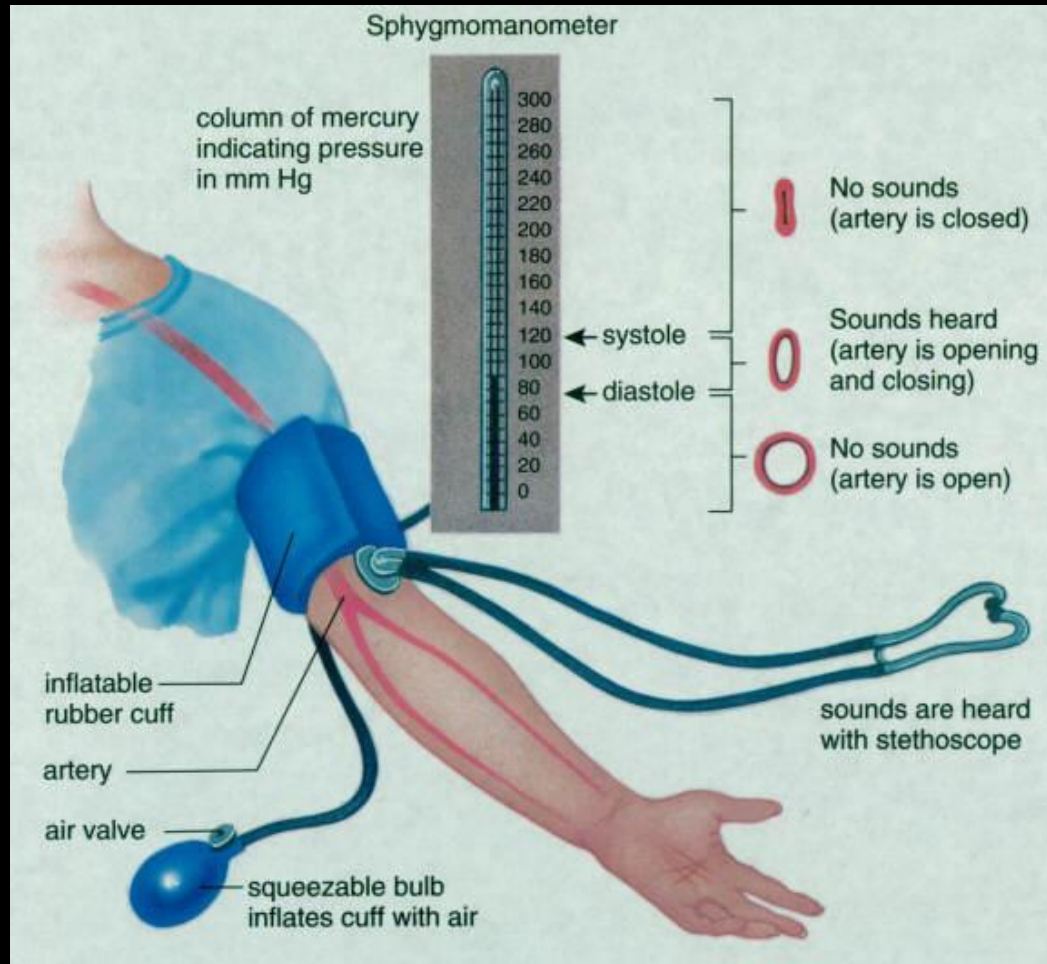
# PALPITORY METHOD

- After localizing the brachial pulse
- Inflate the BP cuff until a level which is about 20-30 mmHg above the point at which the pulse is no longer palpable.
- Now slowly deflate the cuff until the pulse is palpable again.
- **This is the systolic BP.**
- In this method only the systolic pressure can be measured, while the **diastolic pressure cannot be measured.**

# AUSCULTATORY METHOD

- The cuff pressure is inflated quickly to a pressure about 30 mm Hg higher than the systolic pressure determined by the Palpitory method. Then the air is let out of the cuff slowly.
- At some point the person listening with the stethoscope will begin to hear sounds with each heartbeat. This point marks the systolic pressure.
- The sounds are called Korotkoff sounds.

# METHODS OF MEASUREMENTS



Thank you



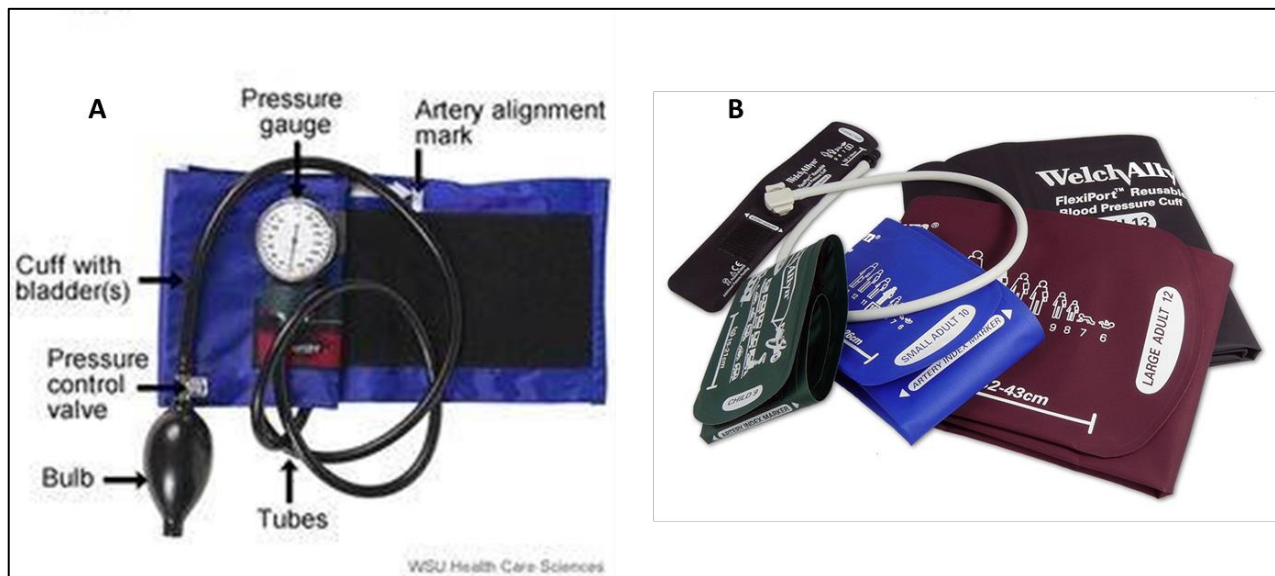
# Arterial Blood Pressure (ABP)

## Objectives

- Define sphygmomanometer and identify its parts.
- Describe the palpatory and auscultatory methods for ABP measurement.
- Differentiate between the palpatory and auscultatory methods in measuring ABP.
- Perform ABP measurement for a fellow student using the sphygmomanometer.
- Identify Korotkov sounds and describe their use ABP determination.
- Enumerate the precautions considered before and during ABP measurement.
- Recognize the effect of exercise on the ABP.

## Equipment

- Sphygmomanometer, Fig-29.
- Stethoscope.
- Bicycle ergometer and/or treadmill.



**Figure 1. The sphygmomanometer.** (A) shows the parts of the sphygmomanometer. (B) shows the different cuff sizes available to match patient age, size and built.

## Procedure

### I. Palpatory method for ABP measurement

This method only gives an estimate of the systolic blood pressure.

1. Ask the subject to sit comfortably on a chair with their arm resting on the bench.
2. Apply the cuff around the arm and over the brachial artery about 2.5cm above the cubital crease. Make sure the arm is at heart level.
3. Inflate the cuff until the radial pulse disappears. By compressing the brachial artery, the pulse or pressure wave is prevented from being transmitted to the radial artery.
4. Deflate the cuff slowly (3-4 mmHg/second) and note the pressure at which the radial pulse returns. This will be the systolic blood pressure.

### II. Auscultatory method for ABP measurement

This method measures both systolic and diastolic blood pressures.

1. Inflate the sphygmomanometer cuff until there is no radial pulsation.
2. Place the diaphragm of the stethoscope over the brachial artery. The brachial artery is found in the cubital fossa 1/3 the way from the medial epicondyle (9).
3. Deflate the cuff (3-4 mmHg/second). As you deflate the cuff, five different sounds are heard, known as the “**Korotkoff**” sounds. The first sound heard is Korotkoff I (KI) and is heard as a tapping sound and represents “systolic pressure”. As the cuff continues to deflate, the sounds increase in intensity (KII), then decrease (KIII), become muffled (KIV) and finally disappears (KV). The pressure at which the sounds disappear represents “diastolic pressure”, Fig-30 (9).

### Further measurements

- Practice the above two methods while the subject is resting in a supine position and then in the sitting position.
- Repeat each measurement *at least three times* to establish reproducibility of the results.



- Ask the subject to perform a 10 minutes exercise on either a bicycle ergometer or a treadmill, then measure their ABP immediately after the end of the exercise and 5 minutes later.

### **Precautions for measuring ABP**

- The cuff should fit the patient's arm appropriately. Cuffs come in different sizes, Fig-29B. Ideally, the width of the inflatable bladder should cover 40% of the upper arm while its length should cover 80% of upper arm circumference (10).
- The cuff must be applied snugly (not too tight and not too loose) about 2.5 cm above the cubital fossa.
- Take care that the free margin of the cuff is not on the course of brachial artery i.e. make sure that the rubber bag within the cuff is on the medial side so that it can occlude the brachial artery when the cuff is inflated.
- It is important that the manometer is at the same level as the heart to exclude the effect of gravity while measuring the blood pressure.
- Mercury manometer should be in the vertical position.
- Check that there is adequate amount of mercury in the bulb of the instrument. This is done by checking the mercury level is at the zero position of the manometer.
- The subject must be physically and mentally relaxed and in a comfortable environment.

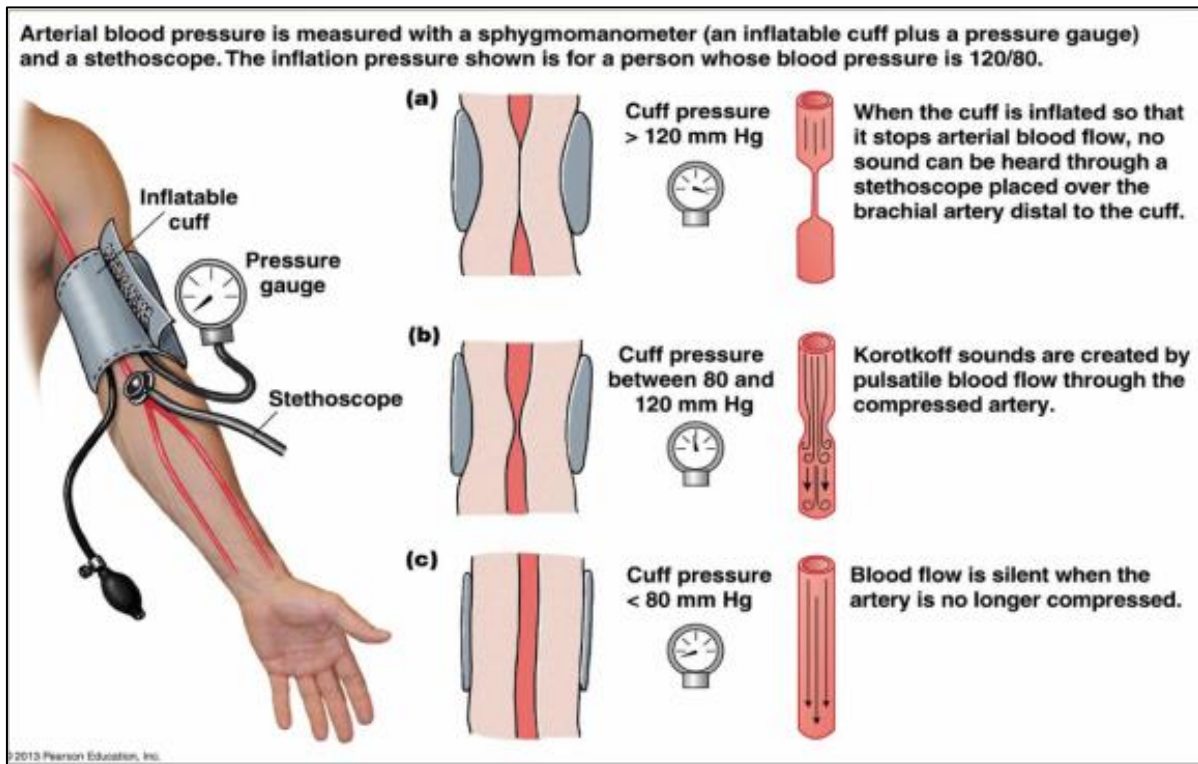


Figure 2. Arterial blood pressure measurement.

## ABP values

Ranges for normal and abnormal blood pressure (BP) measurement are shown in table-10.

Table 1. AHA guidelines for hypertension.

BP category	Systolic BP		Diastolic BP
Average Values	120 mmHg	and	80 mmHg
Normal Range	100-140mmHg	and	60-90 mmHg
Hypertension	$\geq 140$ mmHg	or	$\geq 90$ mmHg

Table-11 shows an example of BP changes with exercise.

**Table 2. BP changes with exercise.**

<b>Conditions</b>	<b>Blood pressure</b>
Before exercise	120/80 mmHg
After mild to moderate exercise	140/80 mmHg
After heavy exercise	160/60 mmHg

In the above example, we can observe that after mild exercise, systolic blood pressure increases while diastolic blood pressure remains more or less the same. Following heavy exercise, the systolic pressure increases tremendously and the diastolic pressure drops.

## Practice questions

1. Explain how Korotkoff sounds are produced?

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2. What is pulse pressure and how is it calculated?

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3. What is mean arterial blood pressure? What is its significance? How is it calculated?

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4. What are the effects of exercise on systolic and diastolic blood pressure? What happens to pulse pressure during exercise? Explain your answer.

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*Good  
Luck!*