The Heart and Blood Pressure Measurements

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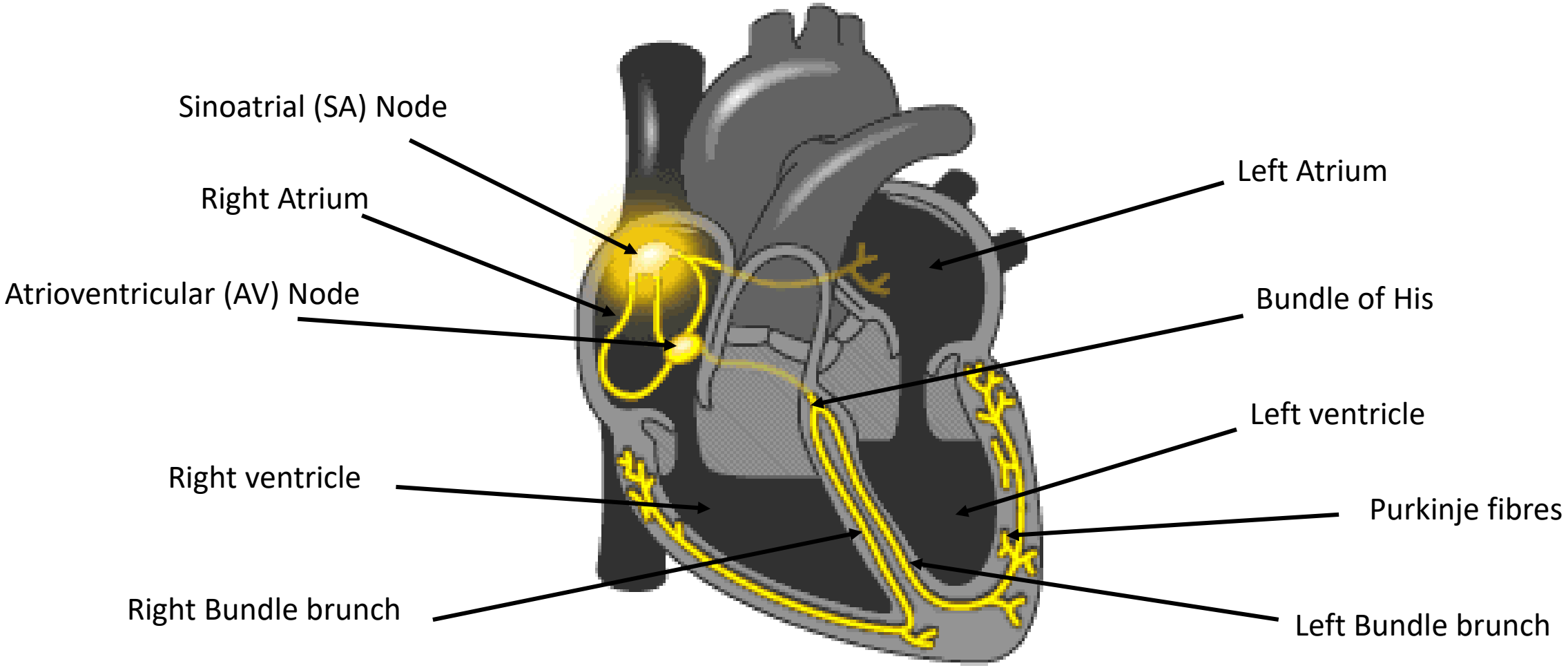
LAB_03

Outline

- How the heart works
- What is blood pressure
- BP terminologies
- How to measure blood pressure
- Factors affecting BP measurements

How the heart works



Blood pressure

Blood pressure

- Blood pressure is defined as the lateral pressure exerted by the blood on the elastic vessel walls of the arteries.
- It fluctuates during systole and diastole of the heart.
- It does not stay all the times
- It changes to meet the bodies needs
- Its affected by various factors such as breathing, emotional state, exercise and sleep.

Blood pressure related terms

- Systolic Blood Pressure
- Diastolic Blood Pressure
- Pulse Pressure
- Mean Arterial Pressure
- Casual Blood Pressure
- Basal Blood Pressure

Systolic Blood Pressure

- It is defined as the maximum pressure produced during the cardiac cycle.
- Systolic pressure is recorded during systole (Ventricular contraction).
- It depends on cardiac output.
- Thus systolic blood pressure increases in conditions in which cardiac output increases.

Diastolic Blood Pressure

- It is defined as the minimum pressure recorded during the cardiac cycle.
- It is recorded during diastole (Ventricular relaxation).
- It depends mainly on the peripheral resistance.
- Peripheral resistance depends mainly on “the diameter of the blood vessel and viscosity of the blood.

Pulse Pressure

- It is the difference between the systolic and the diastolic blood pressure.
- This is the pressure that maintains the normal pulsatile nature of the flow of blood in the blood vessel which is required for perfusion of the tissues.

Mean Arterial Pressure

- It is the average pressure produced during the cardiac cycle.
- It is calculated by adding one third of the pulse pressure to the diastolic pressure.
- **Mean arterial pressure = Diastolic Blood Pressure +1/3 pulse pressure.**
- Mean arterial pressure is less than the value half-way between systolic and diastolic pressure.

Casual Blood Pressure

- Is blood pressure measured at any time of the day is called the casual blood pressure

Basal Blood Pressure

- Is blood pressure recorded under the basal condition is called as basal blood pressure.
- It is recorded following complete physical and mental rest after 12 hrs of fasting.

Normal blood pressure range

In an healthy male adult:

- Systolic Blood Pressure: 100 – 140 mm Hg
- Diastolic Blood Pressure: 60 – 90 mm Hg
- Pulse Pressure: 30 – 50 mm Hg.
- Mean Arterial Pressure : 75 – 105 mm Hg.

Factors affecting blood pressure

Blood Pressure = Cardiac Output x Peripheral Resistance.

- Thus factors affecting cardiac output will affect systolic blood pressure and factors affecting peripheral resistance will affect diastolic blood pressure.

How BP is measured

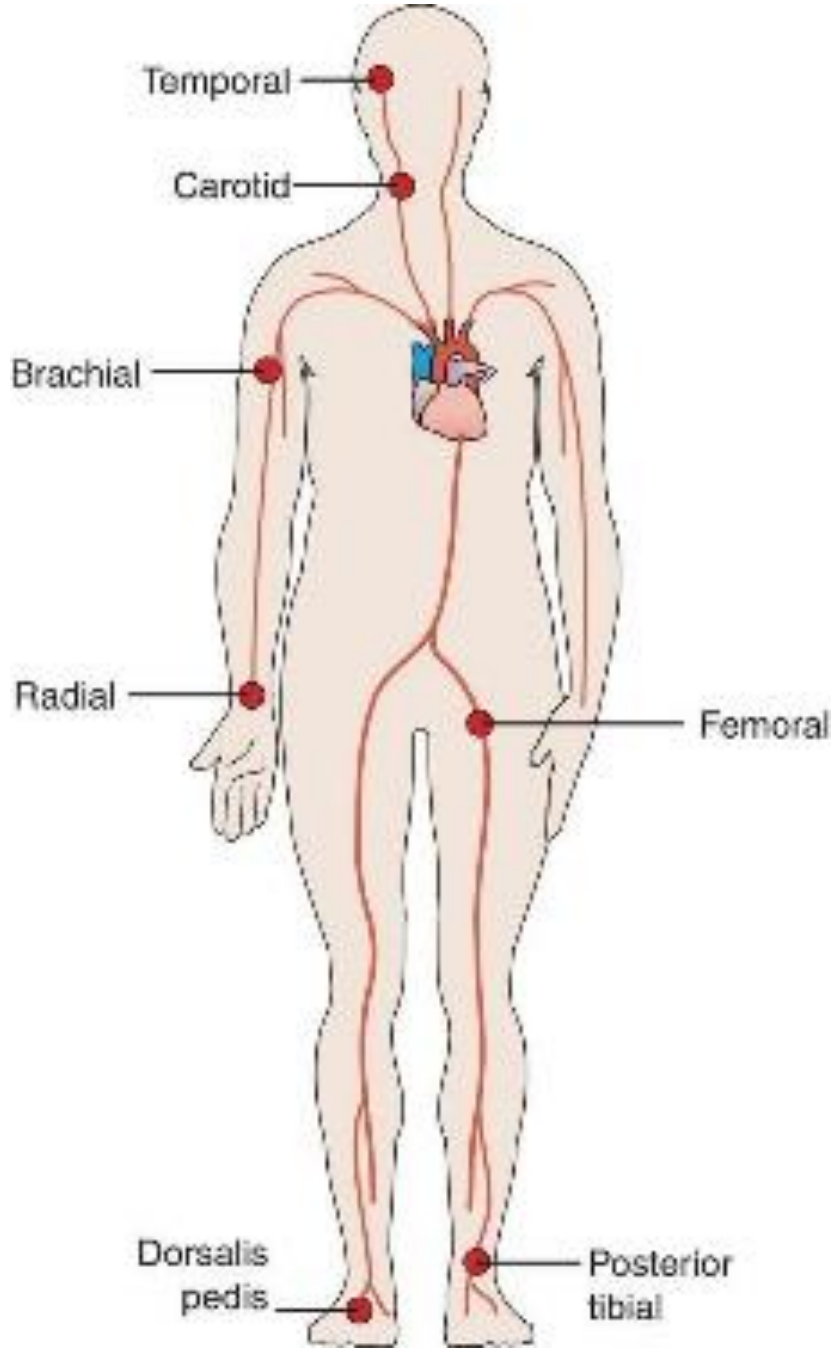
Methods of BP measurement

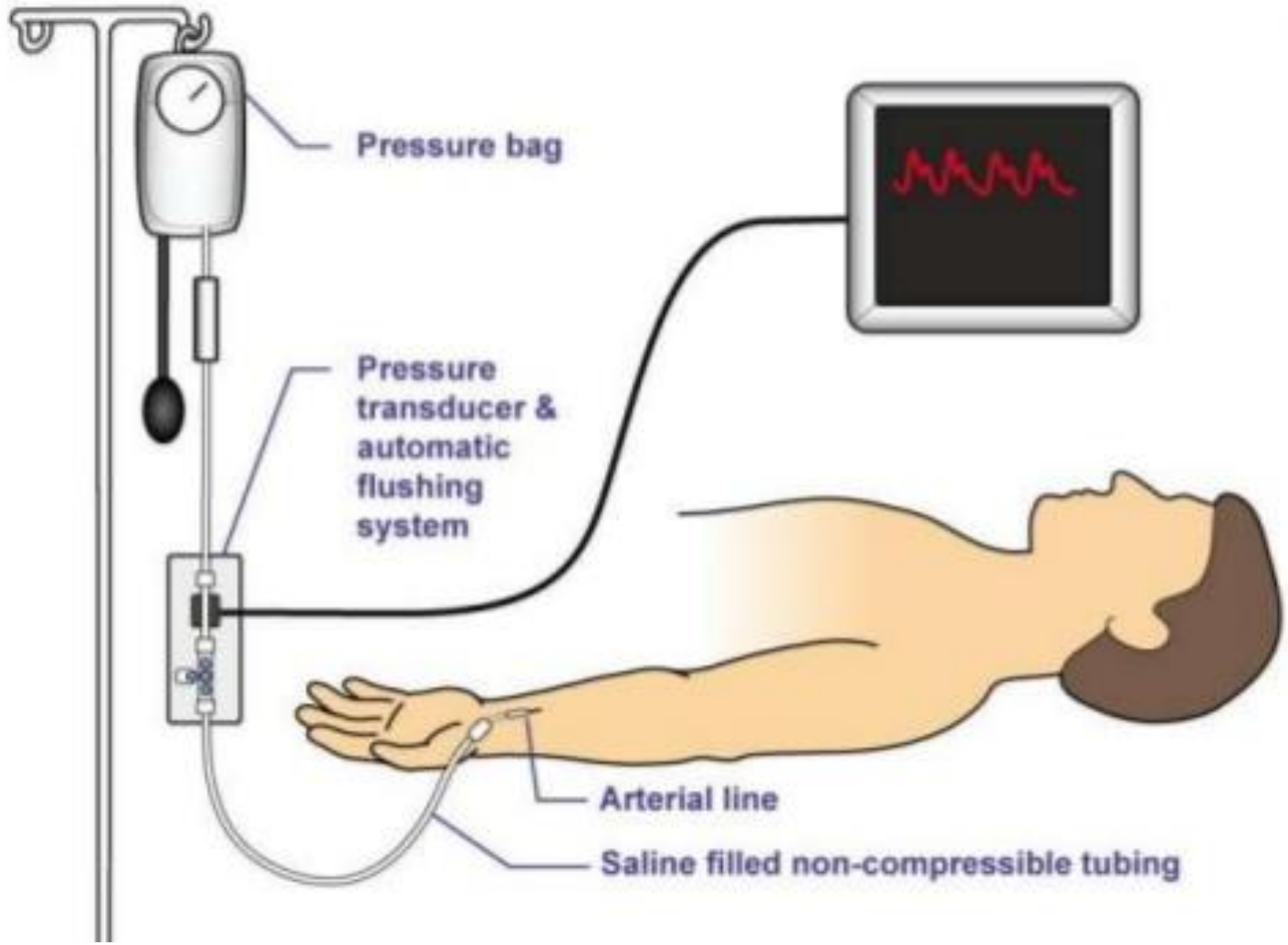
1. Direct method: By inserting a cannula in the vessel wall and connecting it to a mercury manometer.
2. Indirect methods: (Sphygmomanometry) – Three methods:

    a) Palpatory Method
    b) Oscillatory Method
    c) Auscultatory Method

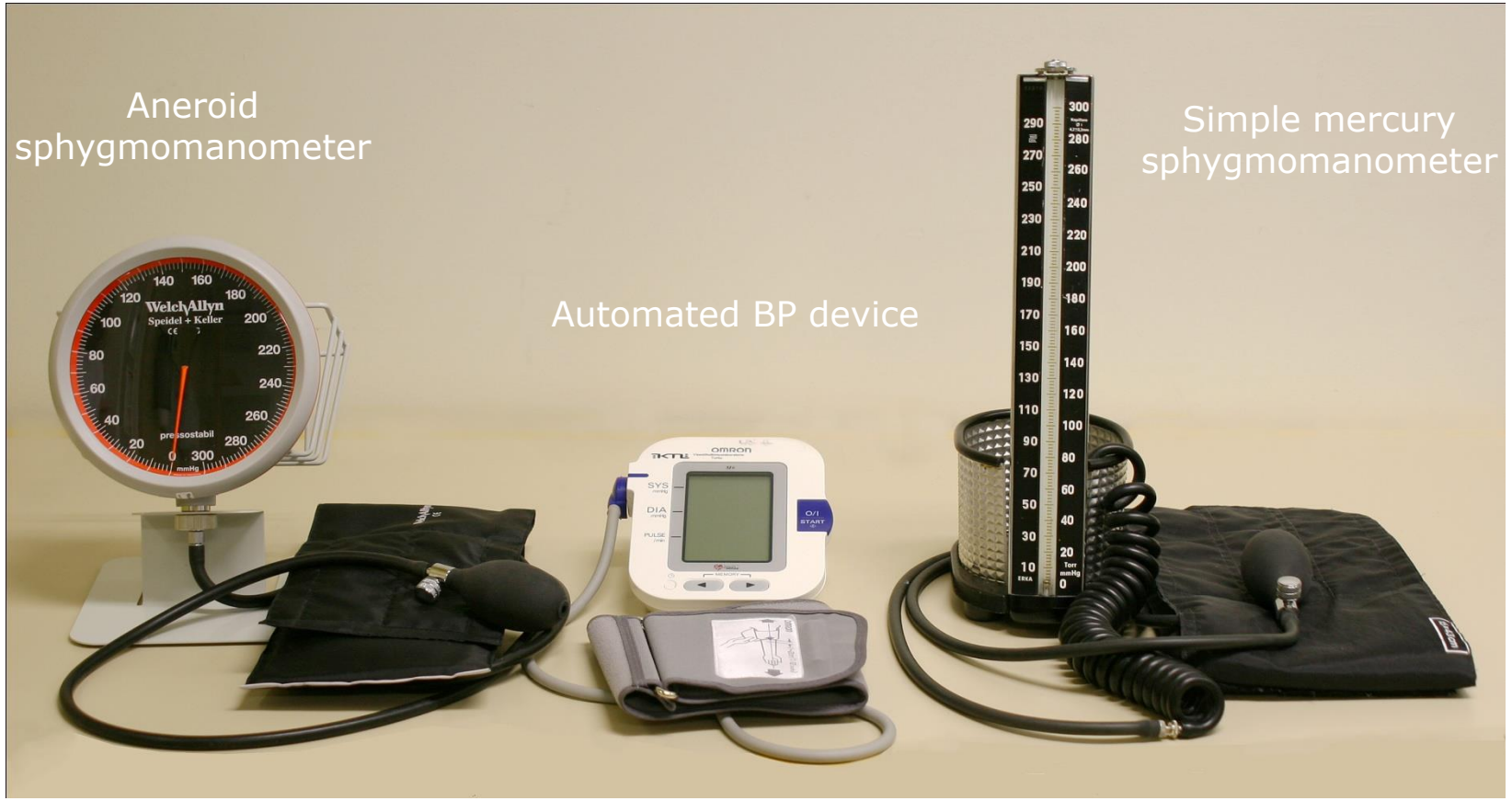
Direct BP measurement

- This is a direct measurement of the arterial pressure
- A cannula usually inserted into one of these arteries (radial, femoral, dorsalis pedis, and brachial)
- The cannula must be connected to a sterile fluid filled system and its connected to an electronic patient monitor system


Temporal
Carotid
Brachial
Radial
Femoral
Dorsalis pedis
Posterior tibial


Pressure bag
Pressure transducer & automatic flushing system
Arterial line
Saline filled non-compressible tubing

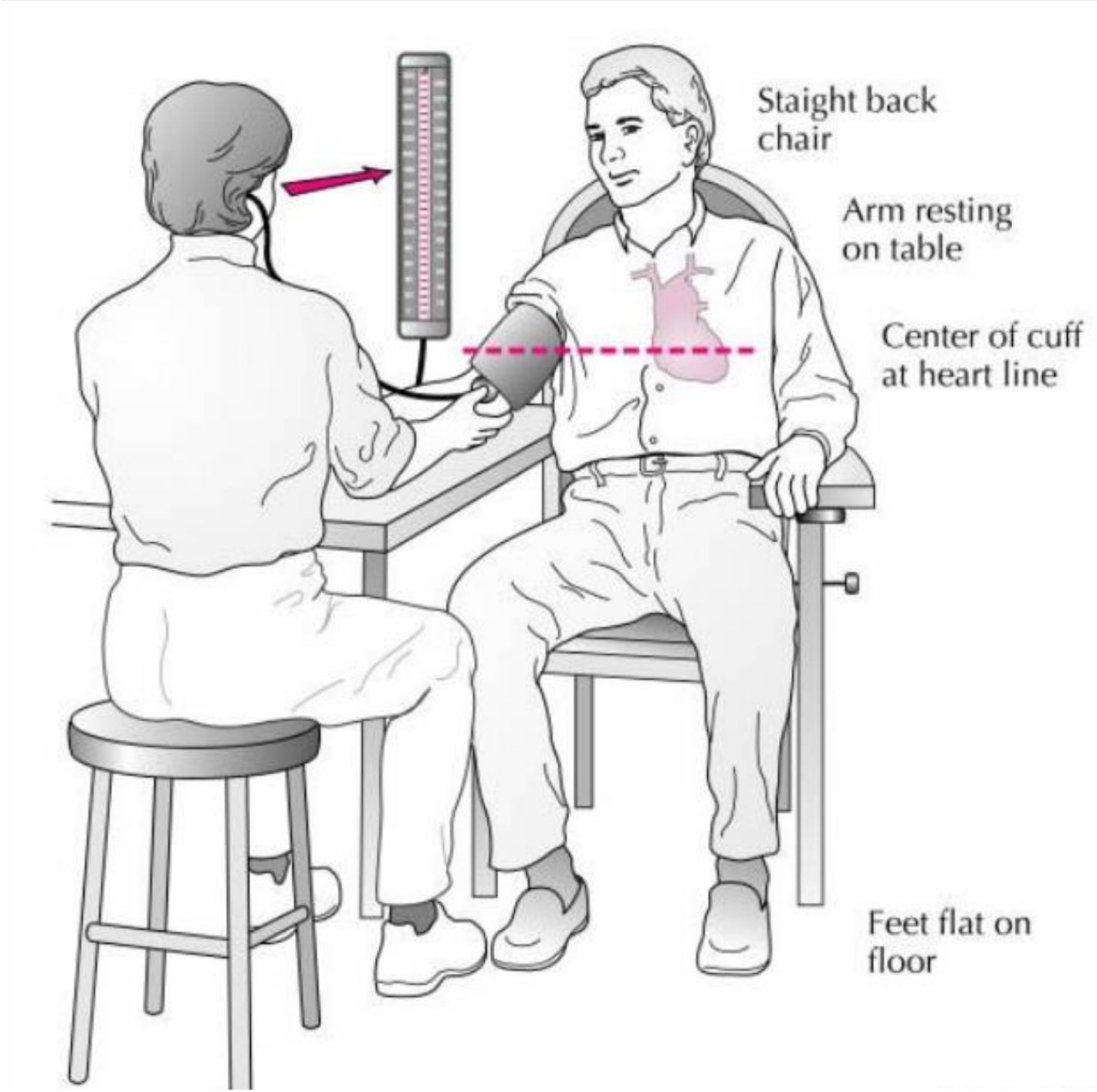
Some BP devices

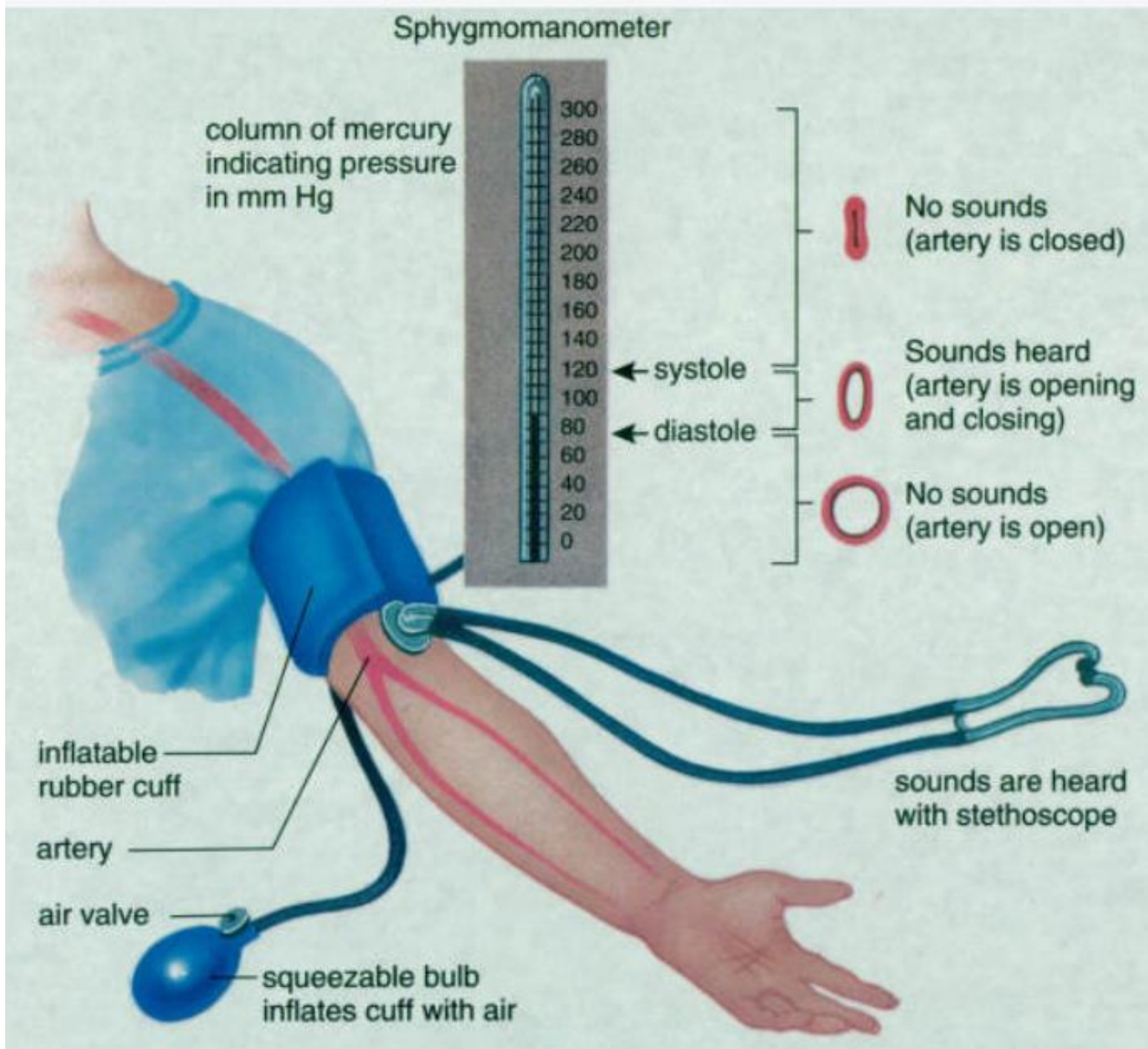


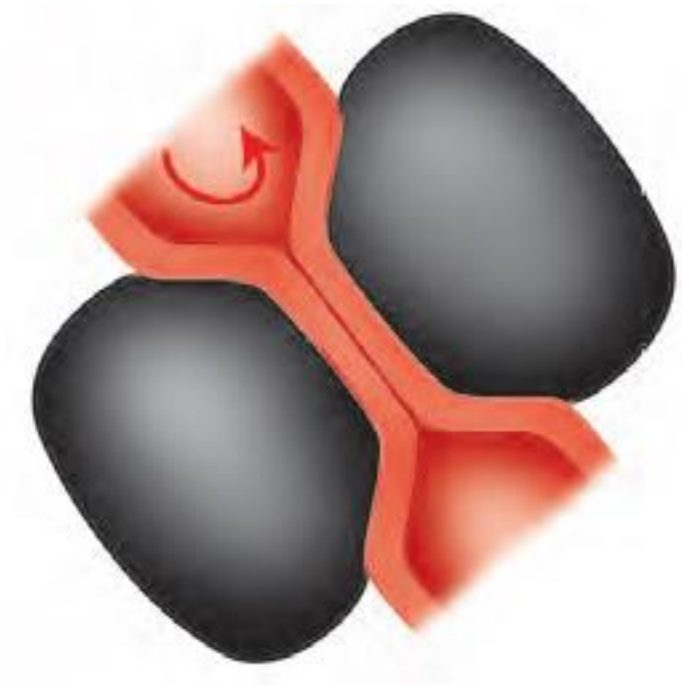
Indirect BP measurement

- In this method arterial wall is obliterated artificially by obstructing blood flow temporarily and blood flow is temporarily stopped.
- Then as the pressure is slowly released, sounds are produced due to entry of blood flow into the blood vessel which are studied to record blood flow by three methods:
    a) Feeling the pulse – Palpatory method.
    b) Observing the Oscillations of the mercury column – Oscillometric method.
    c) Listening to the sound (Korotkoff sound) produced in the part of the artery just below the obstructed segment the – Auscultator method.

Auscultator method


Staight back
chair
Arm resting
on table
Center of cuff
at heart line
Feet flat on
floor


Sphygmomanometer
column of mercury indicating pressure in mm Hg
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
systole
diastole
No sounds (artery is closed)
Sounds heard (artery is opening and closing)
No sounds (artery is open)
inflatable rubber cuff
artery
air valve
squeezable bulb inflates cuff with air
sounds are heard with stethoscope



Palpatory method

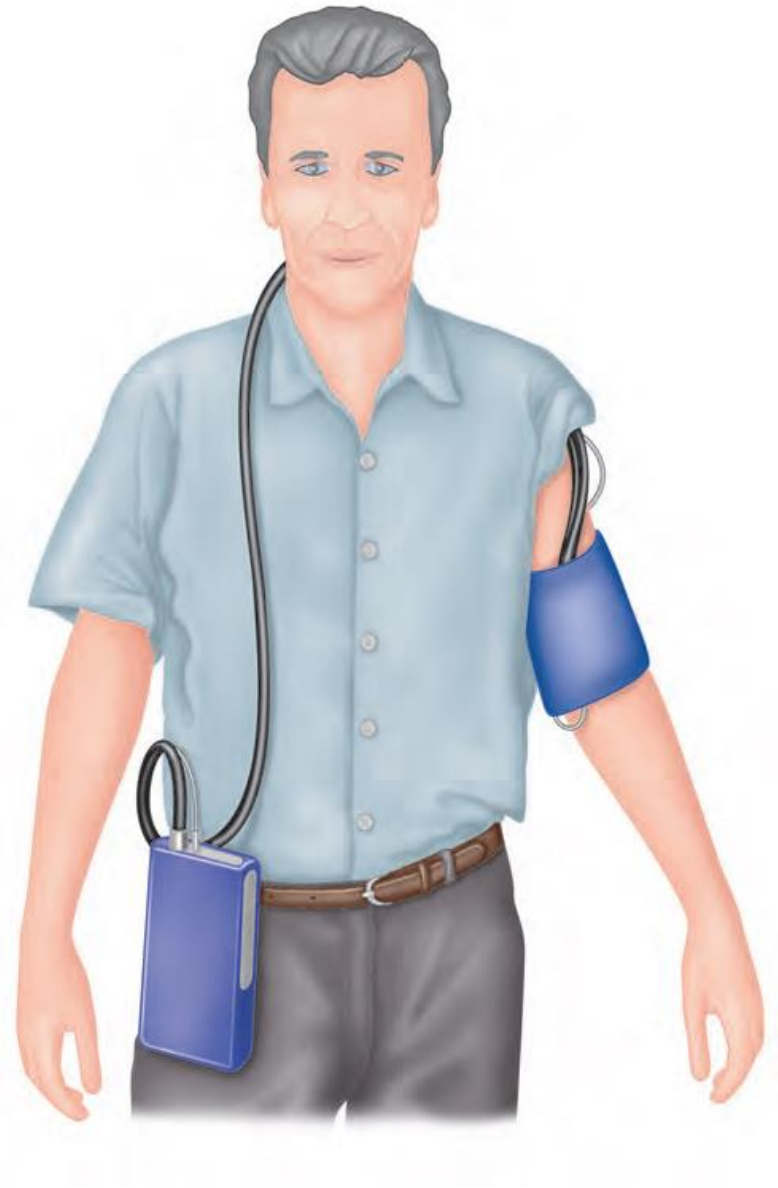
- Inflate the cuff rapidly to 70 mmHg, and increase by 10 mm Hg increments while palpating the radial pulse.
- Note the level of pressure at which the pulse disappears and subsequently reappears during deflation will be systolic blood pressure

BP physiological variations

- Age: at birth systolic BP is 40 mmHg, and its 120 mmHg in adult
- Sex: less in women than in men
- Less in morning and more in evening
- Increased after meal
- More in well built persons
- Minimum in lying down position
- Decreased during sleep
- Increased during exercise
- Increases in hot environment

Continuous monitoring of BP

- Wearing the system for a limited time
- The BP data is automatically recorded
- The date is analysed by the MD



Any Questions?

Thank you

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