Cardiovascular Module

Cardiovascular Physiology

Lect. Nine

Control of Blood Pressure

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Arterial blood pressure (BP)

- BP is the pressure exerted by the blood on the arterial walls during systole and diastole.
- Systolic BP normally averages 120 mmHg in young adult males (range 90 - 140 mmHg).
  - > 140 = systolic hypertension.
- The diastolic BP normally averages 80 mmHg (range 60 - 90 mmHg).
  - > 90 = diastolic hypertension.
- The BP is often reported as the systolic over the diastolic (e.g. 120/80).
  - < 90 systolic BP = hypotension.
Objectives:

1. Define the terms systemic arterial pressure, systolic pressure, diastolic pressure, pulse pressure, and mean arterial pressure.

1. State the influence of decreased aortic distensibility, increase in heart rate, and increase or decrease in peripheral resistance on systolic and diastolic systemic arterial pressures.
Arterial blood pressure

- **Pulse pressure (Pp)**: The difference between systolic and diastolic BP (normally averages 40 mmHg).
  \[ \text{systolic BP} - \text{diastolic BP} = 120 - 80 = 40 \text{ mmHg}. \]

- **Mean arterial blood pressure** (Tissue perfusion pressure)
  \[ \text{Diastolic BP} + \frac{1}{3} \text{ Pp} = 80 + 13 = 93 \text{ mmHg}. \]
Importance (function) of the arterial blood pressure:

- It maintains tissue perfusion (i.e. blood flow)
- It produces the capillary hydrostatic pressure (interstitial fluid).

**Diastolic blood pressure:**

- It maintains blood flow to the tissues during ventricular diastole (continuous, not intermittent).
- It is essential for the normal coronary blood flow.
blood pressure instruments
hypertension
Factors that determine the blood pressure:

1- Cardiac output (CO).
2- Total peripheral resistance (PR).
3- Elasticity of the aorta and large arteries.
4- Blood volume and circulatory capacity.
Factors that determine the blood pressure:

- The blood pressure is mainly determined by the cardiac output multiplied by the peripheral resistance.
  \[ \text{BP} = \text{CO} \times \text{PR} \]
- Mainly by HR, SV, & peripheral resistance
- An increase in any of these can result in increased BP
The arterial BP is directly proportionate to the CO.

\[
\text{CO} = \text{SV} \times \text{HR}.
\]

- With a constant HR, an increase in the SV raises systolic pressure with no significant change in diastolic pressure.

- With a constant venous return (SV), an increase in the HR raises mainly the diastolic pressure with no significant change in the systolic pressure due to shortened diastolic periods (blood accumulation in the arteries).
Total peripheral resistance & Blood pressure

- It is the sum of all the vascular resistances.
- The PR is essential for maintenance of the arterial B.P. particularly the diastolic BP.
- It is produced mainly in the arterioles.

It is determined by 3 factors:
(a) The radius (or diameter) of the vessel.
(b) Blood viscosity.
(c) The length of the vessel.

- Mainly and only the TPR can be determined by the arteriolar diameter.
Elasticity of the aorta and large arteries

- during cardiac diastole, elastic recoil of the walls of the vessels is essential for production and maintenance of diastolic BP.
- the elasticity of the aorta and large arteries also prevent excessive rise of the systolic BP (arteriosclerosis).
Blood volume and circulatory capacity

- When the blood volume increases, the systolic pressure rises. (diseases associated with excessive salt and water retention).
- When the blood volume decreases, the systolic BP falls. (after a severe haemorrhage).

venous return, EDV and SV.
In summary

BP = CO × PR
Thank you