What is Circulation and How Do Blood Vessels Work?

Worksheet

Arteries carry blood away from the heart under high pressure with thick muscular walls; veins return blood to the heart at low pressure using one-way valves; capillaries are single-cell-thick vessels where gas and nutrient exchange actually happens.

Questions

1. Which vessel type has the thickest, most muscular walls to withstand high pressure?

A) Veins
B) Capillaries
C) Arteries
D) Venules

2. What structural feature lets capillaries carry out gas and nutrient exchange?

A) Walls just one cell (endothelium) thick
B) Thick layers of smooth muscle
C) Internal one-way valves
D) Being the widest vessels in the body

3. A patient has a blood pressure of 130/85 mmHg. What is their MAP (to the nearest whole number)?

A) 100 mmHg
B) 130 mmHg
C) 85 mmHg
D) 107 mmHg

4. What structure prevents backflow of blood in the veins of the legs?

A) Thick muscular walls
B) One-way valves
C) Constantly high blood pressure
D) Capillary beds

5. A patient's blood pressure reads 120/80 mmHg. Calculate their mean arterial pressure (MAP).

6. A patient with hypertension has a blood pressure of 140/90 mmHg. Find their MAP.

7. A patient in shock has a blood pressure of 90/60 mmHg. Is their MAP enough to perfuse vital organs (minimum ~60 mmHg needed)?

8. Define: What's the main structural difference between arteries and veins?

9. Define: What makes capillaries ideal for exchange?

10. Define: What is the mean arterial pressure (MAP) formula?

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Answer Key

1. C) Arteries - Arteries carry blood at high pressure straight from the heart's contractions, so they need thick, elastic, muscular walls.

2. A) Walls just one cell (endothelium) thick - A single-cell-thick wall minimizes diffusion distance, letting O2, CO2, and nutrients pass quickly between blood and tissue.

3. A) 100 mmHg - MAP = 85 + 1/3(13085) = 85 + 15 = 100 mmHg.

4. B) One-way valves - Veins contain one-way valves that close if blood tries to flow backward, aided by contraction of surrounding skeletal muscle.

5. MAP = DBP + 1/3(SBP DBP) MAP = 80 + 1/3(120 80) MAP = 80 + 13.33 = 93.33 mmHg

6. MAP = 90 + 1/3(140 90) MAP = 90 + 1/3(50) MAP = 90 + 16.67 = 106.67 mmHg (elevated)

7. MAP = 60 + 1/3(90 60) MAP = 60 + 10 = 70 mmHg 70 mmHg is above the 60 mmHg minimum, so organ perfusion is still adequate, though it should be monitored closely

8. Arteries have thick, muscular, elastic walls to handle high pressure; veins have thinner walls and rely on valves since pressure is low.

9. Their walls are just one cell thick (endothelium), allowing oxygen, CO2 and nutrients to diffuse easily between blood and tissue.

10. MAP = DBP + 1/3(SBP DBP) - the average pressure driving blood through the arteries over a cardiac cycle.

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