

What is Blood Pressure (Hemodynamics)?

Worksheet

Mean arterial pressure equals cardiac output multiplied by total peripheral resistance: $MAP = CO \times TPR$. Raising either the heart's output or vessel resistance raises blood pressure.

$$P = Q \times R$$

Questions

1. $CO = 6 \text{ L/min}$, $TPR = 15 \text{ mmHgmin/L}$. What is the MAP?

- A) 21 mmHg
- B) 90 mmHg
- C) 2.5 mmHg
- D) 9 mmHg

2. If TPR increases while CO stays constant, blood pressure will

- A) Decrease
- B) Stay the same
- C) Increase
- D) Become zero

3. What is the unit of total peripheral resistance in this formula?

- A) mmHg
- B) L/min
- C) mmHgmin/L
- D) mmHg

4. Vasodilation of arterioles primarily affects blood pressure by

- A) Increasing cardiac output
- B) Decreasing total peripheral resistance
- C) Increasing heart rate
- D) Decreasing blood volume

5. A patient has a cardiac output of 5 L/min and total peripheral resistance of 18 mmHgmin/L . Find their mean arterial pressure.

6. During exercise, cardiac output rises to 8 L/min while resistance drops to 10 mmHgmin/L (vessels dilate). Find the new MAP.

7. A patient in shock has TPR fall sharply to 6 mmHgmin/L while CO stays at 5 L/min . What happens to MAP, and why is this dangerous?

8. Define: What is the hemodynamics formula for mean arterial pressure?

9. Define: What is cardiac output?

10. Define: What is total peripheral resistance?

Answer Key

1. B) 90 mmHg - $MAP = CO \cdot TPR = 6 \cdot 15 = 90$ mmHg.
2. C) Increase - MAP is directly proportional to TPR when CO is fixed, so higher resistance raises pressure.
3. C) mmHgmin/L - TPR is expressed in mmHgmin/L so that CO (L/min) TPR gives pressure in mmHg.
4. B) Decreasing total peripheral resistance - Wider arterioles reduce resistance to flow, lowering TPR and thus MAP.
5. $MAP = CO \cdot TPR$ $MAP = 5 \cdot 18$ $MAP = 90$ mmHg
6. $MAP = CO \cdot TPR$ $MAP = 8 \cdot 10$ $MAP = 80$ mmHg (Even though CO rose, vasodilation kept MAP from rising too much.)
7. $MAP = CO \cdot TPR$ $MAP = 5 \cdot 6$ $MAP = 30$ mmHg This is far below the normal range (~70-100 mmHg), so organs may not get enough blood flow - a hallmark of circulatory shock.
8. $MAP = CO \cdot TPR$ - cardiac output multiplied by total peripheral resistance.
9. The volume of blood the heart pumps per minute, in L/min (CO = heart rate stroke volume).
10. The overall resistance blood vessels offer to blood flow, mainly controlled by arteriole diameter.

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