

DETERMINANTS OF CARDIAC OUTPUT



Terminology

- Cardiac output (CO): the volume of blood pumped by each ventricle in 1 min
- Heart rate: number of beats per minute
- EDV (preload): end diastolic volume; degree to which cardiac muscle is stretched before it contracts
- ESV: end systolic volume; volume of blood in ventricle at the end of contraction

- Stroke volume: volume of blood pumped by 1 ventricle with each beat; $SV = EDV - ESV$ (normal SV is 70 mL/beat)
- Afterload: pressure ventricles must overcome to eject blood
- Cardiac reserve: difference between resting CO and maximal CO
- Contractility: contractile strength at a given muscle length (independent of muscle stretch and EDV)

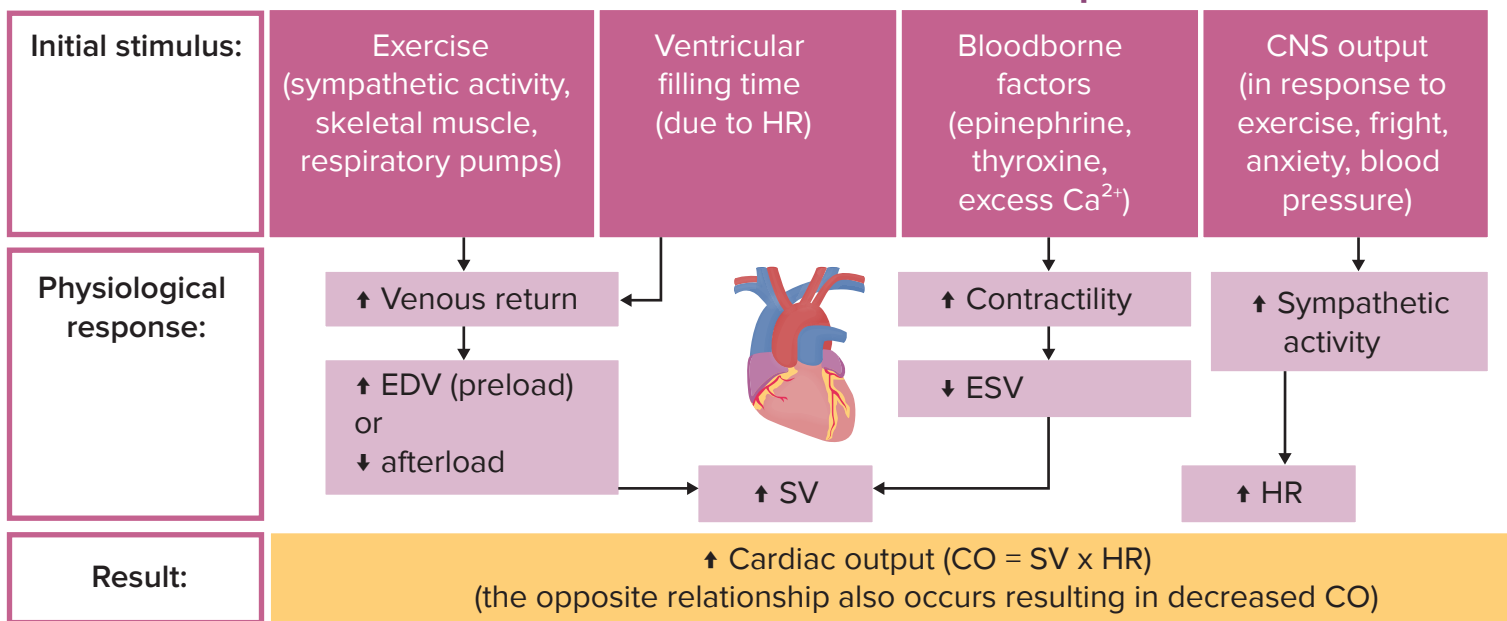
Cardiac Output Calculation

$$CO = \text{heart rate (HR)} \times \text{stroke volume (SV)}$$

Example

$$60 \text{ beats/min} \times 75 \text{ mL} = 4,500 \text{ mL/min} \rightarrow 4.5 \text{ L/min}$$

Factors That Affect Cardiac Output



Normal Values

- CO = 4–8 L/min
- SV = 50–100 ml
- HR = 60–100 beat/mins
- Maximum CO = 20–25 L/min in non-athletes
- Maximum CO = can reach 35 L/min in elite athletes

- EDV (preload) = 70–244 mL (dependent on age, sex, ventricle)
- ESV = 15–117 mL (dependent on age, sex, ventricle)
- Cardiac reserve = can be up to 4–5x greater than resting value

NOTES

