

Regulation of Blood Pressure

Neural Controls of BP

1. Vasomotor Center and Cardioregulatory Centers of the Medulla Oblongata

- a. vasomotor center receives information from hypothalamus; and receives sensory information from organs. It controls constriction of arterioles via sympathetic fibers leaving the thoracolumbar region of the spinal cord.
 - i. If blood pressure is low, the vasomotor center causes sympathetic action potentials to constrict arterioles in the skin, kidneys, GI system and reproductive organs.
 - ii. If blood pressure is high, the vasomotor center causes sympathetic action potentials to dilate arterioles in the skin, kidneys, GI system and reproductive organs

2. Baroreceptor Reflexes

- a. high blood pressure stimulates stretch receptors found on aortic arch and carotid bodies send more frequent signals to medulla:
 - i. inhibits vasomotor center and cardioacceleratory center
 - ii. Stimulates cardioinhibitory center

3. Chemoreceptor reflexes

- a. low oxygen or pH; high carbon dioxide stimulate these receptors (also located on aortic arch and carotid bodies) to send signals to medulla:
 - i. stimulate cardioacceleratory center and vasomotor center

4. Hypothalamic controls always affect the Medulla's regulation of HR and BP, depending on body temperature, emotional state, and circadian rhythms.

Hormonal Controls of BP

1. Adrenal Medulla releases **Epinephrine** and **Norepinephrine** when stimulated by sympathetic fibers. These hormones directly increase vasoconstriction and heart rate and stroke volume, thus they Increase Blood Pressure.
2. **Natriuretic peptides (ANP and BNP)**: released from heart when pressure is high, these hormones block aldosterone to allow salt and water loss from kidney. Decrease Blood Pressure.
3. **ADH (vasopressin)**: stimulates water retention by kidneys—released by pituitary during dehydration or low BP. Increase Blood Pressure
4. **Renin-Angiotensin Aldosterone System (RAAS)**: When Blood Volume or Pressure through the kidneys is low, the kidneys release renin.
 - a. Renin converts Angiotensinogen to Angiotensin I.
 - b. Angiotensin Converting Enzyme (ACE) converts AI to AII.
 - c. AII causes:
 - i. **Potent vasoconstriction**—BP increases because TPR increases.
 - ii. **Stimulates the pituitary gland to release ADH**—targets kidneys and causes water reabsorption. Increase blood volume causes increased blood pressure.
 - iii. **Stimulates the adrenal cortex to release aldosterone**—targets kidneys and causes salt reabsorption. Water follows salt into the blood vessels and increases blood volume and thereby increases blood pressure.