PHYSIOLOGY

Q4 – Short-Term Regulation of Blood Pressure

Ans : 1 – Answer

Introduction

Blood pressure must be continuously regulated to ensure adequate perfusion of vital organs such as the brain, heart, and kidneys. Short-term regulation of blood pressure refers to rapid mechanisms that act within seconds to minutes to correct sudden changes in arterial pressure. These mechanisms are predominantly neural in nature and are essential for moment-to-moment cardiovascular stability.

Definition

Short-term regulation of blood pressure is defined as the rapid adjustment of arterial blood pressure by neural reflex mechanisms acting within a short duration, without involving changes in blood volume.

Baroreceptor Reflex

The baroreceptor reflex is the most important mechanism for short-term regulation of blood pressure. Baroreceptors are stretch-sensitive receptors located in the carotid sinus and aortic arch. An increase in blood pressure increases baroreceptor firing, leading to inhibition of sympathetic activity and stimulation of parasympathetic activity. This results in decreased heart rate, reduced cardiac output, vasodilation, and a fall in blood pressure. A decrease in blood pressure produces the opposite effects.

Chemoreceptor Reflex

Chemoreceptors located in the carotid and aortic bodies respond to hypoxia, hypercapnia, and increased hydrogen ion concentration. Their stimulation activates the vasomotor center, increasing sympathetic outflow, causing vasoconstriction and elevation of blood pressure. This reflex becomes important during severe hypotension.

CNS Ischemic Response

The central nervous system ischemic response occurs when cerebral blood flow is markedly reduced. Ischemia directly stimulates the vasomotor center, producing intense sympathetic discharge. This leads to extreme vasoconstriction and a powerful rise in blood pressure. It is considered a last-resort or emergency mechanism.

Bainbridge Reflex

The Bainbridge reflex originates from stretch receptors in the right atrium and is stimulated by increased venous return. It results in an increase in heart rate and indirectly contributes to short-term regulation of blood pressure.

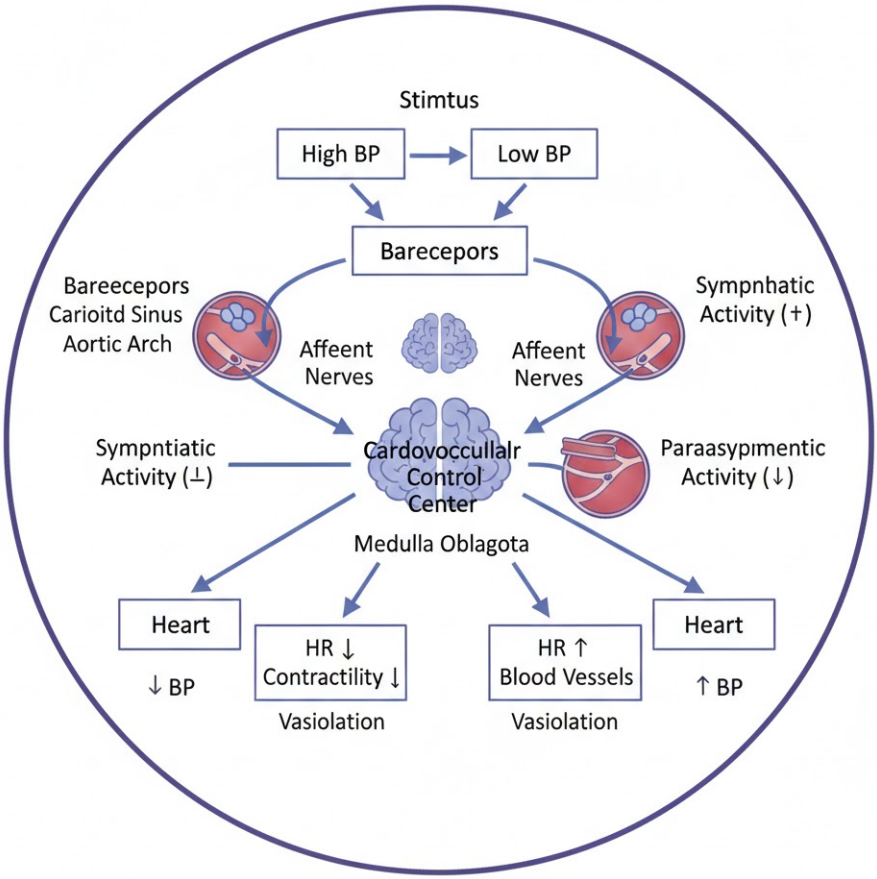
Characteristics of Short-Term Regulation

Short-term regulatory mechanisms act rapidly within seconds to minutes, are mainly neural in nature, do not involve alteration in blood volume, and provide immediate correction of sudden changes in arterial pressure.

Clinical Importance

Short-term regulation of blood pressure prevents postural hypotension and helps maintain circulatory stability during hemorrhage, shock, and sudden changes in body position. Failure of these mechanisms results in blood pressure instability.

Diagram – Short-Term Regulation of Blood Pressure (Baroreceptor Reflex)



Conclusion

Short-term regulation of blood pressure is primarily mediated by neural reflexes such as the baroreceptor reflex, chemoreceptor reflex, CNS ischemic response, and Bainbridge reflex. These mechanisms provide rapid, moment-to-moment control of arterial pressure and are essential for maintaining cardiovascular homeostasis during daily activities.