

Conversely, hypercalcaemia results in closure of voltage gated ion channels and consequent depressed nervous system function. Hypercalcaemia can also result in renal calculus due to the combination of calcium ions with phosphate ions.

Parathyroid hormone

In the blood, the sensitive process of calcium and phosphate homeostasis is maintained primarily by the parathyroid gland. The parathyroid gland consists of four small glands located posteriorly to the thyroid in the middle aspect of the anterior neck. The two parathyroid glands on each side that are positioned higher are called the left and right superior parathyroid glands, while the lower two are called the left and right inferior parathyroid glands. The chief cells of the parathyroid glands secrete parathyroid hormone (PTH). PTH is a polypeptide that is synthesized and cleaved into an active form within the parathyroid gland. When blood calcium levels drop below a certain point, calcium-sensing receptors in the parathyroid gland are activated, and the parathyroid gland secretes PTH. as serum calcium levels drop, PTH secretion increases. Increased serum calcium levels serve as a negative feedback loop signaling the parathyroid glands to stop the release of PTH. in the bones, PTH stimulates the release of calcium in an indirect process through osteoclasts which ultimately results in bone resorption. PTH directly stimulates osteoblasts which increases their expression of RANKL, a receptor activator for nuclear factor kappa-beta ligand, allowing for the differentiation of osteoblasts and osteoclasts. PTH also inhibits the secretion of osteoprotegerin, allowing for preferential differentiation into osteoclasts. Osteoprotegerin normally competitively binds with RANKL diminishing the ability to form osteoclasts. Osteoclasts possess the ability to remodel the bones by dissolution and degradation of hydroxyapatite and other organic material releasing calcium into the blood.

Circulating PTH targets the distal convoluted tubule and collecting ducts of the kidney directing increasing calcium reabsorption. PTH decreases phosphate reabsorption at the proximal convoluted tubule of the kidney. Phosphate ions in serum form salts with calcium that are insoluble, resulting in a decreased plasma calcium. The reduction of phosphate ions, therefore, results in more ionized calcium in the blood.

PTH stimulates the production of the enzyme 1-alpha-hydroxylase in the proximal convoluted tubule. 1-alpha-hydroxylase catalyses the synthesis of active vitamin D-1, 25-dihydroxycholecalciferol from the inactive form, 25-hydroxycholecalciferol. Active vitamin D plays a role in calcium reabsorption in the distal convoluted tubule via calbindin D, a cytosolic vitamin D allows the absorption of calcium through an active transcellular pathway and a passive paracellular pathway.

calcitonin , a hormone produced by the parafollicular cells of the thyroid, acts in opposition to PTH by inhibiting osteoclasts, stimulating osteoblasts, and increasing excretion of calcium in the urine by the kidneys.

Secondary hyperparathyroidism

Secondary hyperparathyroidism is the medical condition of excessive secretion of PTH by the parathyroid glands in response to hypoglycemia, with resultant hyperplasia of these glands. Secondary hyperparathyroidism is primarily seen in patients with chronic kidney