

## Components of Parathyroid Glands and their Significance in Human Body

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### ABOUT THE STUDY

The parathyroid glands, a vital component of the endocrine system, play a crucial role in maintaining calcium homeostasis in the human body. Despite their small size and inconspicuous location, these four tiny glands located on the posterior surface of the thyroid gland are responsible for producing and secreting parathyroid hormone (PTH), which serves as the key regulator of calcium and phosphate levels in the bloodstream. This article aims to explore the anatomy, physiology, and clinical significance of the parathyroid glands, shedding light on their remarkable contributions to overall health.

### Anatomy of the parathyroid glands

The parathyroid glands consist of four small, oval-shaped structures measuring around 5-6 millimeters in length and weighing roughly 30-50 milligrams each. They are typically located on the posterior aspect of the thyroid gland, two on each side. However, their precise anatomical arrangement can vary among individuals, with some individuals possessing additional parathyroid glands located within the thymus or the thyroid gland itself.

#### Physiology of parathyroid hormone

Parathyroid hormone, the primary product of the parathyroid glands, exerts profound effects on calcium and phosphate metabolism. When blood calcium levels drop, specialized cells within the parathyroid glands called chief cells sense the change and respond by releasing Parathyroid Hormone (PTH). PTH then acts on target organs, including the bones, kidneys, and intestines, to restore calcium balance. It promotes bone resorption, liberating calcium from the skeletal system, and enhances the reabsorption of calcium in the kidneys while simultaneously inhibiting phosphate reabsorption. Furthermore, PTH stimulates the production of active vitamin D, which aids in the absorption of dietary calcium in the intestines.

### Regulation of parathyroid hormone secretion

The release of parathyroid hormone is tightly regulated by a negative feedback mechanism involving Calcium-Sensing Receptors (CaSR) located on the surface of parathyroid cells. When blood calcium levels rise, the CaSRs detect the increase and suppress PTH secretion. Conversely, a decline in blood calcium levels triggers the release of PTH. Other factors, such as magnesium levels, phosphate levels, and vitamin D levels, also influence the secretion of PTH to maintain calcium homeostasis.

# Clinical conditions associated with parathyroid dysfunction

Disorders of the parathyroid glands can result in dysregulation of calcium metabolism, leading to various clinical conditions. Hyperparathyroidism, characterized by excessive production of PTH, can lead to hypercalcemia, which manifests as symptoms like kidney stones, bone pain, muscle weakness, and gastrointestinal disturbances. On the other hand, hypoparathyroidism, a condition marked by insufficient production of PTH, causes hypocalcemia, resulting in symptoms such as numbness, muscle cramps, tetany, and seizures. Both hyper- and hypoparathyroidism require medical intervention to restore calcium balance and alleviate associated symptoms.

### Parathyroid disorders and diagnosis

The diagnosis of parathyroid disorders typically involves measuring blood calcium, phosphate, and PTH levels. Elevated blood calcium and PTH levels suggest primary hyperparathyroidism, whereas low calcium levels and high phosphate levels may indicate hypoparathyroidism. Additional imaging techniques such as ultrasound, scintigraphy, or Magnetic Resonance Imaging (MRI) may be employed to locate abnormal parathyroid glands or detect tumors that may be causing the dysfunction.

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#### **Treatment** options

The treatment of parathyroid disorders depends on the specific condition and its underlying cause. Surgical removal of the abnormal parathyroid gland, known as parathyroidectomy, is often the preferred treatment for primary hyperparathyroidism caused by parathyroid adenomas or hyperplasia. In cases of secondary hyperparathyroidism, the primary cause, such as renal failure or vitamin D deficiency, is addressed to correct the imbalance. Hypoparathyroidism is typically managed by administering calcium and vitamin D supplements to maintain appropriate calcium levels in the blood.

## Beyond calcium regulation: emerging roles of the parathyroid glands

While the parathyroid glands' primary function revolves around calcium and phosphate regulation, emerging research suggests that these tiny organs may have additional physiological roles. Recent studies have indicated potential links between parathyroid hormone and cardiovascular health, glucose metabolism, immune function, and even cancer development. However, further investigation is required to fully elucidate these connections and establish their clinical implications.

### CONCLUSION

The parathyroid glands, often overlooked due to their small size, are indispensable for maintaining calcium homeostasis in the body. Their production of parathyroid hormone, along with intricate feedback mechanisms, ensures the precise regulation of calcium and phosphate levels in the bloodstream. Dysfunction of these glands can lead to significant clinical disorders, emphasizing the importance of accurate diagnosis and appropriate management. Ongoing research aims to unravel the potential far-reaching effects of the parathyroid glands beyond calcium regulation, opening new avenues for understanding their comprehensive role in human health.