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PEARLS OF LABORATORY MEDICINE

Hypoparathyroidism

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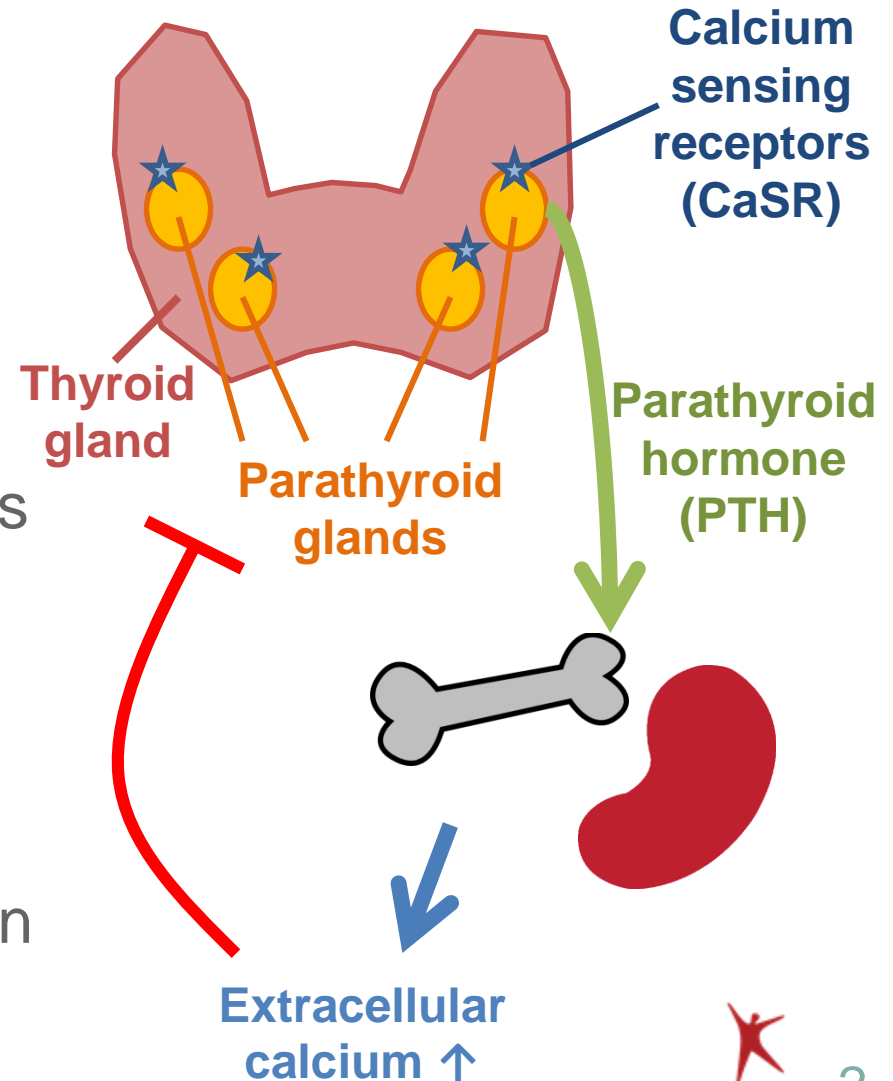
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Parathyroid Hormone Secretion

- 1) CaSR on parathyroid glands sense low blood calcium
- 2) PTH is secreted from parathyroid glands
- 3) PTH binds the PTH receptors on bone and kidney
- 4) Calcium released into cytoplasm
- 5) High calcium in blood downregulates PTH secretion



PTH Action in the Kidney and Bone

- In the kidney:
 - Increases calcium reabsorption
 - Inhibits phosphate reabsorption
 - Increases urinary phosphate wasting
 - Activates the conversion of inactive vitamin D to active vitamin D
- In the bone:
 - Increases the resorption of calcium and phosphate
- **Overall, PTH secretion = \uparrow Calcium & \downarrow Phosphate in blood**



Definition of Hypoparathyroidism

- A condition in which the body has low PTH secretion and/or action.
- PTH blood concentrations are inappropriately low for patients with hypocalcemia



Signs and Symptoms of Hypoparathyroidism

- Muscle involvement
 - Parasthesia
 - Muscle cramps
 - Muscle weakness
 - Twitching
 - Tetany
- CNS abnormalities
 - Depression
 - Altered mental status
 - Seizures
 - Coma
- Cardiac abnormalities
 - Arrhythmias
 - Hypotension
 - Heart failure
 - Respiratory failure
 - Cardiac abnormalities
- Respiratory Failure
 - Bronchospasm
 - Laryngospasm



Causes of Hypoparathyroidism

- 4 categories:
 - Parathyroid destruction
 - Genetic disorders
 - PTH resistance
 - Reversible impairment of PTH secretion



Hypoparathyroidism Caused by Parathyroid Destruction

- Parathyroidectomy
- Irradiation of parathyroid glands
- Autoimmune illness:
 - Autoimmune hypoparathyroidism
 - Type 1 autoimmune polyglandular syndrome
- Infiltration of parathyroid:
 - Wilson's disease
 - Iron overload
 - Aluminum toxicity
 - Metastatic tumor

Hypoparathyroidism Caused by Genetic Disorders

- Familial isolated hypoparathyroidism
 - Loss of function mutations in CaSR
 - Mutations in autoimmune regulator gene
 - Mutations in PTH gene
- Congenital hypoparathyroidism
- Autosomal dominant hypocalcemia
 - Gain of function mutations in CaSR
- DiGeorge syndrome
 - Deletion of Ch.22



Hypoparathyroidism Caused by PTH Resistance

- PTH resistance – when the body does not respond to increased PTH
- Pseudohypoparathyroidism (PHP) – increased PTH with hypoparathyroidism signs and symptoms
- Type 1 PHP – defective cAMP
 - Inject exogenous PTH = urine cAMP ↓, urine phosphate ↓
- Type 2 PHP – cAMP resistance
 - Inject exogenous PTH = urine cAMP ↑, urine phosphate ↓



Signs and symptoms of PHP

- Calcium ↓, Phosphate ↑, PTH ↑
- Heart-shaped or round face
- Shortened 4th and 5th metacarpals
- Obesity
- Short stature
- Developmental delay or mental retardation

- Pseudopseudohypoparathyroidism – PHP phenotype without calcium, phosphate, and PTH abnormalities



Hypoparathyroidism Caused by Reversible Impairment of PTH Secretion

- Hypomagnesemia impairs PTH secretion by causing PTH resistance
 - Renal resistance = urine cAMP ↓, urine phosphate ↓
 - Skeletal resistance = decreased calcium reabsorption from bone
- Magnesium administration will result in an immediate rise in serum PTH concentrations

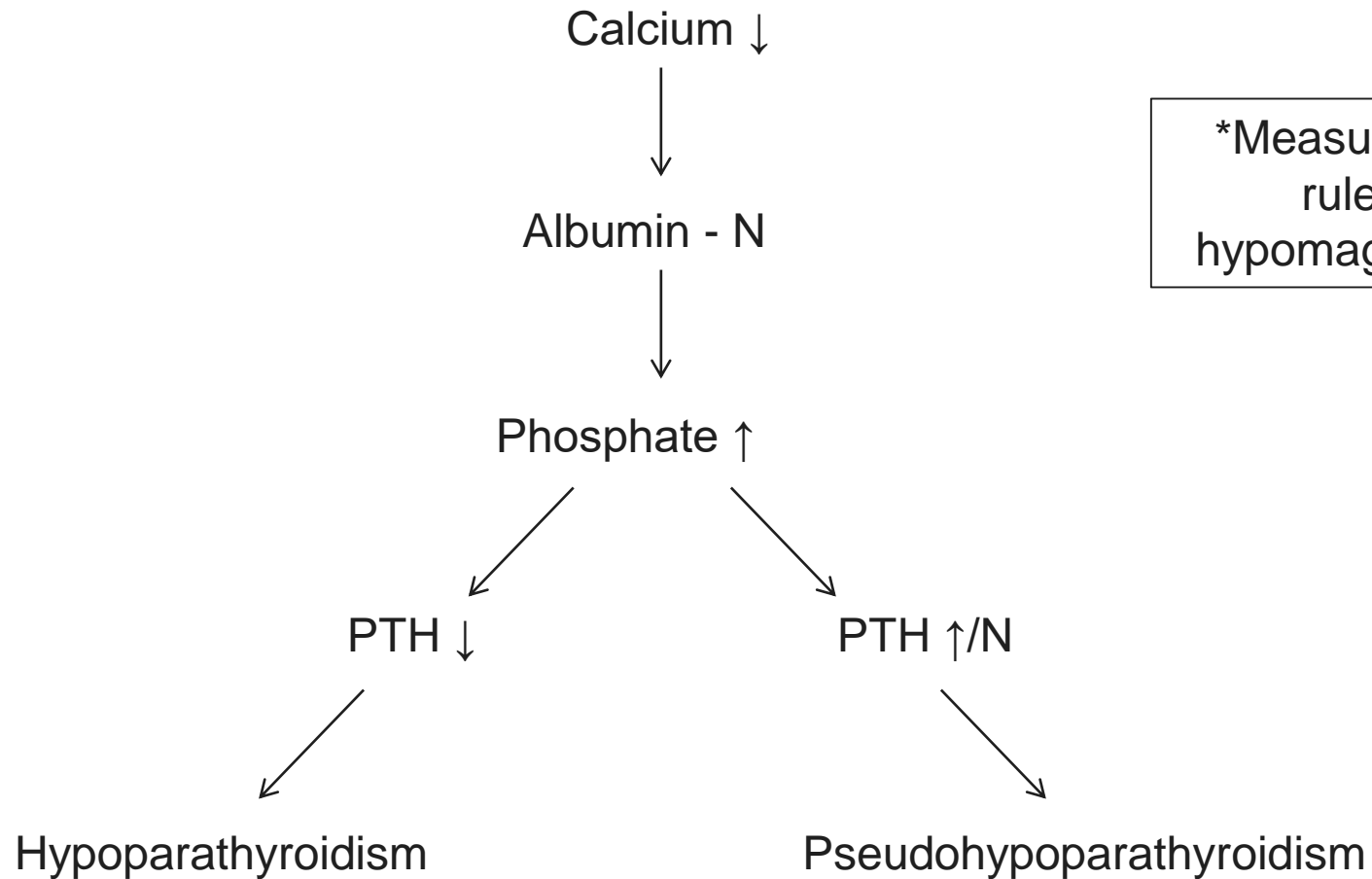


Transient hypoparathyroidism

- Immature newborns
- Infants of diabetic mothers
- Neonatal illnesses
- Kids and adults with severe illness, stress, sepsis, or surgery



Diagnosis of hypoparathyroidism



*Measure Mg to rule out hypomagnesemia



Treatment of Hypoparathyroidism

- Calcium supplements
- Vitamin D supplements
- Exogenous PTH
- Calcium-rich and phosphate-poor diet



Summary

- Hypoparathyroidism – deficiency in PTH secretion and action in the setting of hypocalcemia
- Causes:
 - Parathyroid destruction
 - Genetic disorders
 - PTH resistance
 - Reversible impairment of PTH secretion
- Signs and symptoms reflect the body's response to low calcium
- Diagnose and monitor with regular measurements of blood calcium, phosphate, and PTH



References

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Disclosures/Potential Conflicts of Interest

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