

# NOTES

## HYPERPARATHYROIDISM & HYPOPARATHYROIDISM

### GENERALLY, WHAT ARE THEY?

#### PATHOLOGY & CAUSES

- An imbalance of parathyroid hormone (PTH) due to overproduction or underproduction by the parathyroid gland resulting in impaired regulation of calcium and other electrolytes

##### Hyperparathyroidism

- $\uparrow$  PTH  $\rightarrow$   $\uparrow$  bone resorption and  $\uparrow$  renal reabsorption of calcium  $\rightarrow$   $\uparrow$  serum calcium levels  $\rightarrow$  asymptomatic or symptomatic hypercalcemia

##### Hypoparathyroidism

- $\downarrow$  PTH  $\rightarrow$   $\downarrow$  serum calcium  $\rightarrow$  symptomatic hypocalcemia

#### RISK FACTORS

- Hyperparathyroidism
  - Genetic mutations, chronic kidney disease,  $\downarrow$  vitamin D intake/absorption, hyperplasia of parathyroid glands
- Hypoparathyroidism
  - Most commonly iatrogenic cause due to accidental removal or damage to parathyroid blood supply during thyroid surgery

#### COMPLICATIONS

- Hyperparathyroidism
  - Osteoporosis, osteitis fibrosa cystica, nephrolithiasis, keratopathy, symptomatic hypercalcemia (e.g. hypertension, cardiac arrhythmias)
- Hypoparathyroidism
  - Symptomatic hypercalcemia (e.g. respiratory paralysis, cardiac arrhythmias)

#### SIGNS & SYMPTOMS

- See individual disorders

#### DIAGNOSIS

##### LAB RESULTS

- Measure serum PTH, calcium, phosphate, magnesium, 25-hydroxyvitamin D, urine calcium

##### OTHER DIAGNOSTICS

- Genetic testing

#### TREATMENT

##### MEDICATIONS

- Hyperparathyroidism
  - Vitamin D analogs, calcimimetics, bisphosphonates
- Hypoparathyroidism
  - IV calcium gluconate (acute), vitamin D analogs, synthetic PTH, thiazide diuretics ( $\downarrow$  renal calcium excretion)

##### SURGERY

- Hyperparathyroidism
  - Partial/complete parathyroidectomy; radiofrequency ablation

##### OTHER INTERVENTIONS

- Hyperparathyroidism
  - Physical activity to  $\downarrow$  bone resorption, maintain hydration to  $\downarrow$  nephrolithiasis, vitamin D supplements
- Hypoparathyroidism
  - Calcium, magnesium, and vitamin D supplements

# HYPERPARATHYROIDISM

osms.it/hyperparathyroidism

## PATHOLOGY & CAUSES

### TYPES

#### Primary

- Parathyroid gland creates PTH independently of calcium levels, does not respond to normal feedback mechanisms

#### Secondary

- Parathyroid gland hyperplasia, excess parathyroid hormone secreted in response to chronic hypocalcemia
- Impaired kidney function; kidneys do not filter phosphate properly into urine, make insufficient calcitriol
  - AKA renal osteodystrophy (bone pain, fracture)
- Altered calcium, phosphate levels → increased parathyroid hormone levels → bone resorption

#### Tertiary

- Develops in individuals with secondary hyperparathyroidism for many years, often due to hyperplasia of parathyroid glands
- Autonomous secretion of PTH separately from blood calcium levels
  - Even if causes of secondary hyperparathyroidism (e.g. renal transplant) corrected, increased PTH persists

## RISK FACTORS

#### Primary

- Genetic mutations
  - Multiple endocrine neoplasia (MEN) syndrome

## COMPLICATIONS

#### Primary

- Brown tumors, large bone cysts (due to high osteoclast activity)

## SIGNS & SYMPTOMS

- “Stones, thrones, bones, groans, and psychiatric overtones”; see mnemonic

#### Primary, tertiary

- Slower muscle contractions caused by less excitable neurons secondary to hypercalcemia

#### Secondary

- Bone resorption/renal osteodystrophy; calcification of blood vessels, soft tissues



### MNEMONIC

#### Signs and symptoms of hyperparathyroidism

**Stones:** calcium-based kidney stones, gallstones

**Thrones:** toilet; polyuria (frequent urination) from impaired sodium, water reabsorption

**Bones:** pain from chronic hormone-driven demineralization

**Groans:** constipation, muscle weakness

**Psychiatric overtones:** depressed mood, confusion

## DIAGNOSIS

### LAB RESULTS

#### Primary

- High total serum calcium (hypercalcemia), low phosphate (hypophosphatemia), high PTH value during diastole
- Hypercalciuria from excess calcium loss through urine, may cause dehydration
- Serum 25-hydroxyvitamin D
  - Determine type

#### Secondary

- Low calcium, high phosphate, low vitamin D

#### Tertiary

- Normal-high calcium, high PTH, low vitamin D

## TREATMENT

### MEDICATIONS

#### Primary, tertiary

- Calcimimetics
  - Drugs that imitate calcium by attaching to CaSR on parathyroid cells
  - If surgery not an option

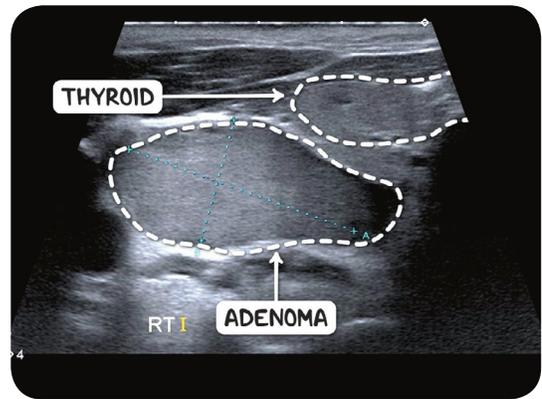
#### Secondary

- Hyperphosphatemia
  - Phosphate binders
- Vitamin D supplements
  - Increase calcium absorption, reduce PTH synthesis
- Calcitriol, vitamin D analogs (doxercalciferol, paricalcitol)
  - Suppress PTH levels
- Calcimimetics
  - Modulate CaSR → increase sensitivity of serum calcium → decrease PTH levels

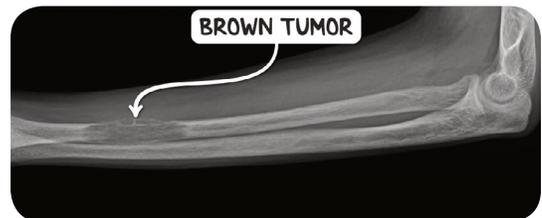
#### Tertiary

### SURGERY

- Remove abnormal parathyroid glands



**Figure 17.1** An ultrasound of the neck demonstrating a large parathyroid adenoma situated posteriorly and to the right of the right thyroid lobe. The skin surface is at the top of the image.



**Figure 17.2** A X-ray image of the forearm demonstrating a brown tumor of the distal radius in an individual with hyperparathyroidism.

## HYPERPARATHYROIDISM LABS

|                               | SERUM CALCIUM | SERUM PHOSPHATE | PARATHYROID HORMONE |
|-------------------------------|---------------|-----------------|---------------------|
| PRIMARY HYPERPARATHYROIDISM   | High          | Low             | High                |
| SECONDARY HYPERPARATHYROIDISM | Low           | High            | High                |
| TERTIARY HYPERPARATHYROIDISM  | High          | Varies          | High                |

## HYPOPARATHYROIDISM

[osms.it/hypoparathyroidism](https://osms.it/hypoparathyroidism)

### PATHOLOGY & CAUSES

- Underproduction of parathyroid hormone (PTH); hypo- = under/low
- No parathyroid hormone → ↓ bone resorption, ↓ renal calcium reabsorption, ↓ intestinal calcium reabsorption → hypocalcemia, hyperphosphatemia → ↑ cell excitability → tetany, paresthesias, seizures, arrhythmias

### CAUSES

#### Autoimmune disorders

#### Magnesium deficiencies

#### Latrogenic

- Most common
- Thyroid/parathyroid surgery/radiation

#### Hereditary abnormalities

- DiGeorge syndrome (DGS)
- Autosomal dominant hypoparathyroidism
- Albright hereditary osteodystrophy (pseudohypoparathyroidism)
  - Kidney resistance to PTH, increased PTH

### SIGNS & SYMPTOMS

- Asymptomatic/life-threatening
  - Degree, duration of hypocalcemia
  - Muscular dysfunction → respiratory paralysis → death
- ECG changes
  - Prolonged QT, ST
  - Torsades des pointes
  - Atrial fibrillation

#### Acute

- Muscular spasms/cramps → tetany → Chvostek, Trousseau signs
- Perioral numbness, paresthesias, seizures

#### Chronic

- Extraparasydrial movements → basal ganglia calcifications
  - Dystonias, parkinsonism, athetosis, hemiballismus, oculogyric crisis
- Cataracts
- Dermatologic manifestations
  - Dry, coarse skin; brittle nails; patchy alopecia



**Figure 17.3** Dry, brittle nails are a dermatologic manifestation of chronic hypoparathyroidism.

## DIAGNOSIS

### LAB RESULTS

- Hypocalcemia, low serum PTH
- Hypercalciuria

### OTHER DIAGNOSTICS

- Medical history of thyroid surgery/radiation

## TREATMENT

### MEDICATIONS

- IV calcium gluconate (severe cases)
- Oral calcium (mild-moderate cases)
- Vitamin D supplementation
- Synthetic PTH