NOTES
HYPERPHOSPHATEMIA & HYPOPHOSPHATEMIA

GENERALLY, WHAT ARE THEY?

PATHOLOGY & CAUSES

- Phosphate imbalances in blood
  - *Hyperphosphatemia:* > 4.5mg/dL
  - *Hypophosphatemia:* < 2.5mg/dL
- Phosphate intake; absorption through gastrointestinal (GI) tract; kidney excretion; transcellular shift; balance between uptake, release by bone tissue

SIGNS & SYMPTOMS

- *Mild:* usually asymptomatic
- *Severe:* may be fatal

DIAGNOSIS

LAB RESULTS

- Assess blood phosphate levels

TREATMENT

- See individual disorders

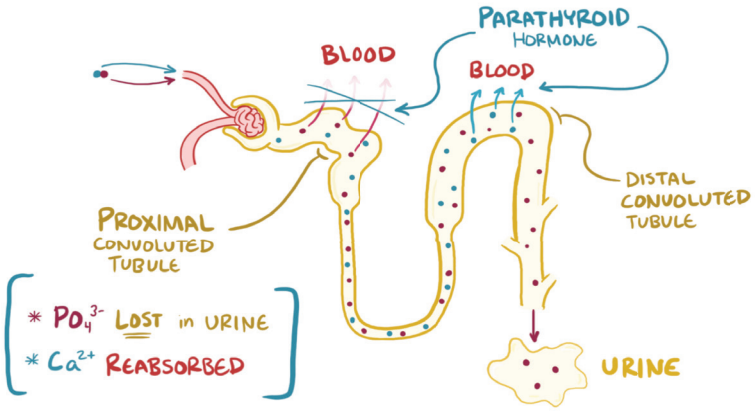

Figure 115.1 Illustration depicting parathyroid hormone preventing reabsorption of phosphate and promoting reabsorption of calcium.

HYPERPHOSPHATEMIA

osms.it/hyperphosphatemia

PATHOLOGY & CAUSES

- High phosphate levels in blood > 4.5mg/dL
- 70% of individuals with advanced chronic kidney disease
  - Individuals with chronic kidney disease, hyperphosphatemia → secondary hyperparathyroidism, renal osteodystrophy → bones thin, weak
- Risk of metastatic calcification (e.g. kidney stones, nephrocalcinosis)

CAUSES

- Decreased kidney excretion
  - Decreased glomerular filtration rate in acute/chronic kidney disease
  - Hypoparathyroidism
  - Pseudohypoparathyroidism
  - *Vitamin D intoxication:* increased phosphate absorption through GI tract
- Increased phosphate intake
  - Only acute phosphate load (e.g. too much phosphate-based laxative)
- Transcellular shift
  - Massive cell death (e.g. tumor lysis syndrome, rhabdomyolysis, crush injuries, massive hemolysis—intracellular phosphate released into bloodstream)
  - Acidosis

COMPLICATIONS

- Metastatic calcification
- Renal calcinosis

SIGNS & SYMPTOMS

- *Mild:* asymptomatic
- *Severe:* hypocalcemia
  - Tetany
  - Chvostek's sign (facial muscles twitch after facial nerve lightly finger tapped 1cm/0.39in below zygomatic process)
  - Trousseau's sign (blood pressure cuff occludes brachial artery, pressure on nerve leads to muscle spasm, flexing wrist, metacarpophalangeal joints)
  - Hyperreflexia
  - Tingling around mouth
  - Seizures
  - Bone pain

DIAGNOSIS

LAB RESULTS

- ↑ phosphate
- ↓ calcium
- ↑ vitamin D
- ↓ parathyroid hormone
- ↑ urinary phosphate excretion

OTHER DIAGNOSTICS

- History, physical examination

TREATMENT

MEDICATIONS

- Decrease phosphate absorbed from GI tract
  - Phosphate binders (e.g. aluminium salts, calcium carbonate)
- Increase phosphate excretion
  - *Healthy kidneys:* forced diuresis, intravenous (IV) saline, loop diuretic (furosemide) → overwhelm proximal convoluted tubule of nephron → unable to effectively reabsorb solutes (e.g. phosphates)
  - *Life-threatening hyperphosphatemia:* dialysis

OTHER INTERVENTIONS

- Decrease phosphate intake; avoid high-phosphate foods (e.g. dairy, meat, soda)

HYPOPHOSPHATEMIA

osms.it/hypophosphatemia

PATHOLOGY & CAUSES

- Low phosphate levels in blood < 2.5mg/dL

CAUSES

- Increased kidney excretion
  - Primary hyperparathyroidism
  - *Fanconi syndrome:* proximal convoluted tubule loses capacity to reabsorb solutes (e.g. phosphates)
- Decreased intake, absorption through GI tract
  - Low intake dietary phosphate (unusual)
  - Medications impair absorption (e.g. antacids with aluminum/calcium/magnesium)
  - Alcohol use disorder → low dietary phosphate intake, vitamin D deficiency
- Transcellular shift
  - Refeeding syndrome in severely malnourished individuals → hypokalemia, cardiac arrhythmias, neurologic problems
  - Insulin treatment in diabetic ketoacidosis; insulin makes phosphate move from the bloodstream inside the cells
  - Respiratory alkalosis

RISK FACTORS

- Alcoholism, diabetes, sepsis

COMPLICATIONS

- Rhabdomyolysis, kidney damage
- Chronic hypophosphatemia
  - Osteomalacia (adults), rickets (children)

SIGNS & SYMPTOMS

- *Mild:* asymptomatic
- Severe:
  - Muscle weakness, respiratory/cardiac insufficiency
  - Altered mental status
  - Seizures

DIAGNOSIS

LAB RESULTS

- ↓ phosphate
- ↑ calcium
- ↓ vitamin D
- ↑ parathyroid hormone

OTHER DIAGNOSTICS

- History, physical examination

TREATMENT

MEDICATIONS

- Replenish phosphates
  - Oral administration, diet alone may suffice
  - IV for life-threatening hypophosphatemia

OTHER INTERVENTIONS

- Avoid refeeding syndrome by gradually increasing caloric intake, supplements over several days