

HYPOPHOSPHATEMIA

DEFINITION: Total serum phosphate levels less than 3.0 mg/dL.

- **Mild hypophosphatemia:** 2.5-3.0 mg/dL.
- **Moderate hypophosphatemia:** 1.0-2.5 mg/dL.
- **Severe hypophosphatemia:** < 1.0 mg/dL.

INCIDENCE IN CRITICAL ILLNESS: Common.

ETIOLOGY:

- **Transcellular shift:** **Refeeding syndrome** (abrupt initiation of carbohydrate causes an insulin spike, which increases cellular phosphate uptake); exogenous administration of insulin; respiratory alkalosis.
- **Renal loss:** Diuretics; osmotic diuresis in diabetic ketoacidosis; hyperparathyroidism (primary and secondary; decreases urinary resorption of phosphate); proximal renal tubular dysfunction (Fanconi's syndrome).
- **Insufficient intestinal absorption:** Malnutrition; phosphate-binding antacids; vitamin D deficiency; chronic diarrhea; nasogastric tube suction; malabsorption.
- **Extreme catabolic states:** Burns; trauma; sepsis.

CLINICAL MANIFESTATIONS:

- **Cardiovascular:** Acute left ventricular dysfunction; reversible dilated cardiomyopathy.
- **Hematologic:** Acute hemolytic anemia; leukocyte dysfunction.
- **Neuromuscular:** Diffuse skeletal muscle weakness; rhabdomyolysis; bone demineralization; **acute and chronic respiratory failure secondary to diaphragmatic weakness (impaired ventilator weaning)**; confusion and lethargy; gait disturbance; paresthesias.

TREATMENT:

- **It is impossible to accurately predict the exact quantity of phosphate repletion required because most phosphate is intracellular.**
- **Moderate hypophosphatemia:** Oral supplementation is usually adequate (provided the gastrointestinal tract is functional).
- **Severe hypophosphatemia:** Intravenous repletion (sodium phosphate or potassium phosphate). However, IV repletion should be avoided in patients who have renal failure or hypercalcemia (risk of metastatic calcification).

KEY REFERENCES:

- Knochel JP. The pathophysiology and clinical characteristics of severe hypophosphatemia. *Arch Intern Med* 1977;137:203-220.
- Marinella MA. The refeeding syndrome and hypophosphatemia. *Nutr Rev* 2003;61:320-323.
- Aubier M, Murciano D, Lecocguic Y, et al. Effect of hypophosphatemia on diaphragmatic contractility in patients with acute respiratory failure. *N Engl J Med* 1985;313:420-424.