

HYPOMAGNESEMIA

DEFINITION: Total serum Mg^{2+} levels less than the normal range (1.5-2.3 mg/dL).

INCIDENCE IN CRITICAL ILLNESS: 15-60%.

ETIOLOGY:

- **Inadequate intake of magnesium.**
- **Renal losses:** Diuretic use; alcohol abuse; diabetes; acute tubular necrosis; administration of aminoglycoside, amphotericin, cyclosporine, cisplatin, digoxin.
- **Gastrointestinal losses:** Vomiting; diarrhea; nasogastric suction; pancreatitis.
- **Acute intracellular shift of magnesium:** Refeeding; insulin administration; excessive catecholamines, metabolic acidosis.
- **Miscellaneous:** Burns; massive blood transfusion; cardiopulmonary bypass; hepatic transplantation; severe sepsis; large-volume plasma expansion.

CLINICAL MANIFESTATIONS:

- **Cardiovascular:** Atrial fibrillation/flutter; ventricular tachycardia (torsade de pointes).
- **Metabolic:** Frequently identified in conjunction with hypokalemia, hypocalcemia and hypophosphatemia.
- **Neuromuscular:** Seizures; bronchospasm (smooth muscle contraction).

TREATMENT:

- **Caution:** When renal dysfunction is present.
- **Recommendations:** Limited (lack of adequately controlled studies).
- **Intravenous:**
 - Preferred in symptomatic, critically ill patients.
 - $MgSO_4$ (1 gm = 4 mmol); $MgCl_2$ (1 gm = 4.5 mmol).
 - Torsade de pointes: 1-2 gm $MgSO_4$ bolus over 5 minutes.
 - Example of urgent treatment: Consider 2-3 gm $MgSO_4$ bolus followed by infusion of 10 gm $MgSO_4$ over 5 hours.
 - ICU sliding scale repletion regimens.
- **Enteric:**
 - Magnesium oxide (400 mg = 6 mmol); magnesium gluconate (500 mg = 1.2 mmol).
 - Chronic losses: Consider 800-1600 gm magnesium oxide per day.

KEY REFERENCES:

- Noronha JL, Matuschak GM. Magnesium in critical illness: metabolism, assessment, and treatment. *Intensive Care Med* 2002;28(6):667-679.
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- Khan MU, Komolafe BO, Weber KT. Cation interdependency in acute stressor states. *Am J Med Sci* 2013;345(5):401-404.