

HYPOMAGNESEMIA

(Last updated 07/25/2019; Reviewers: Alice Gallo de Moraes, MD)

IMMEDIATE CONSIDERATIONS

FINDINGS

- **Signs & Symptoms**
 - Neurological
 - Delirium
 - Nystagmus
 - Athetoid movements
 - Muscle cramps and weakness
 - Fasciculations and tremors
 - + Chvostek and Trousseau signs
 - Seizures
 - Coma
 - Cardiac
 - ECG changes
 - ST segment depression
 - Widened QRS complex
 - Flattened T waves
 - Prolonged PR and QT/QTc intervals
 - Arrhythmias
 - Premature atrial contractions
 - Atrial fibrillation
 - Multifocal atrial tachycardia

- Premature ventricular contractions
- Ventricular tachycardia and fibrillation
- *Torsades de pointes*

DIAGNOSTIC INTERVENTIONS

- **Labs**
 - Renal function
 - Phosphorous
 - Calcium
 - Potassium
 - Hypomagnesemia may cause refractory hypokalemia and hypocalcemia
- **Monitoring**
 - ECG
 - Serum magnesium concentrations

THERAPEUTIC INTERVENTIONS

- **Medications**
 - Ideally, intravenous magnesium replacement should be done under cardiac monitoring.
 - **Emergency conditions (in the presence of ECG abnormalities, cardiac arrhythmias, pre-eclampsia/eclampsia, serum magnesium < 1mg/dL)**
 - **Use IV route**
 - 8-16 mmol (1-2 grams) magnesium over 1-2 minutes
 - 40 mmol magnesium over the next 5 hours
 - **Severe Illness (serum magnesium < 1.5mg/dL)**
 - IV or IM route

- 40-48 mmol magnesium on the first day
- 16-25 mmol magnesium on day 2-5
- Empiric emergency IV administration often needed in emergencies before Mg level known
- Oral maintenance
 - 15-24 mmol magnesium per day

MANAGEMENT AFTER STABILIZATION

- Determine Renal vs. Extra-renal Magnesium Wasting
 - Fractional Excretion of Mg = $(U \text{ Mg} \times S \text{ Cr}) / (0.7 \times S \text{ Mg} \times U \text{ Cr})$
 - Multiply by 0.7, as only 70% of Mg is unbound and available for glomerular filtration
 - Spot urine acceptable if unable to obtain 24-hr collection
 - $\text{FeMg} < 4\%$ = Extrarenal Losses
 - Malnutrition
 - Especially in alcoholics
 - Small intestinal malabsorption
 - Crohn's
 - Gastric bypass
 - Acute and chronic diarrhea
 - Pancreatitis
 - Secondary to saponification
 - Cardiopulmonary bypass surgery
 - $\text{FeMg} > 4\%$ = Renal Losses
 - Inherited tubular defects
 - Bartter's
 - Gitelman's

- Familial Hypomagnesemia
 - Hypercalciuric Nephrolithiasis
- Electrolyte abnormalities
 - Hypercalcemia
 - Hypokalemia
- Diuretics
- Cisplatin and EGFR inhibitors
- Antimicrobials
 - Aminoglycosides
 - Amphotericin B
 - Foscarnet
- Immunosuppressants
 - Tacrolimus
 - Cyclosporine
- **Follow-Up**
 - Measure:
 - Renal function
 - Phosphorous
 - Calcium
 - Potassium
 - Magnesium

REFERENCES & ACKNOWLEDGEMENTS

Acknowledgement: Gina Iacovella, MD

- Touyz, RM. Magnesium in Clinical Medicine. *Frontiers in Bioscience*. 2004 (9): 1278-1293.
- Kraft, MD., Btaiche, IF., Sacks, GS., Kudsk, KA. Treatment of Electrolyte Disorders in Adult Patients in the Intensive Care Unit. *American Journal of Health-Syst Pharm*. 2005 (62): 1663-1682.
- Moe, SM. Disorders Involving Calcium, Phosphorous and Magnesium. *Primary Care*. 2008; 35(2): 215-vi.