NOTES
HYPERMAGNESEMIA & HYPOMAGNESEMIA

GENERALLY, WHAT ARE THEY?

PATHOLOGY & CAUSES

- Abnormal levels of magnesium in the blood
- *Hypomagnesemia:* < 1.7mg/dL
- *Hypermagnesemia:* > 2.4mg/dL

SIGNS & SYMPTOMS

- Mild variations are usually asymptomatic, severe imbalances may result in potentially fatal arrhythmias and neurological complications

DIAGNOSIS

LAB RESULTS

- Assessment of blood magnesium levels
- Further tests are useful to establish underlying cause

TREATMENT

MEDICATIONS

- Identify and treat any underlying causes
- Hypermagnesemia
  - Administer calcium gluconate → competes for magnesium binding sites
- Hypomagnesemia
  - Supplemental magnesium

HYPERMAGNESEMIA

osms.it/hypermagnesemia

PATHOLOGY & CAUSES

- Blood magnesium levels above 2.4mg/dL

CAUSES

- Renal failure
  - Kidneys unable to efficiently excrete magnesium (most common cause)
- Excessive intake
  - Ingesting larger amounts of magnesium than the kidneys are able to excrete (supplements or medication e.g. magnesium hydroxide, often used for heartburn or constipation)
  - Excessive IV administration (e.g. treatment of preeclampsia)
- Cellular breakdown (excessive release)
  - Tumour lysis syndrome, rhabdomyolysis

COMPLICATIONS

- Impaired signal transmission across neuromuscular junction → muscle weakness (magnesium inhibits calcium influx at neuromuscular junction), inhibition of parathyroid hormone release, hypocalcemia, cardiac bradyarrhythmias

SIGNS & SYMPTOMS

- Nausea
- Drowsiness
- Tingling sensation in the face (facial paresthesia)
- Progressive loss of deep tendon reflexes (earliest sign)
- Coma
- Muscular paralysis
- Respiratory failure
- Cardiac arrest

DIAGNOSIS

- ECG changes similar to those of hyperkalemia, increased PR interval, widened QRS complex, bradyarrhythmias

LAB RESULTS

- Blood free magnesium level > 2.4mg/dL
- Renal function testing
  - Urea, creatinine clearance test (levels increase with renal failure)

OTHER DIAGNOSTICS

- Thorough examination of individual's history often reveals cause

TREATMENT

MEDICATIONS

- Calcium gluconate injection
  - Calcium and magnesium compete for binding sites
  - Reserved for severe, symptomatic hypermagnesemia
- Loop diuretics increases the urinary excretion of magnesium

OTHER INTERVENTIONS

- Identify and stop the source of excessive intake
  - If normal renal function, with relevant history or possible iatrogenic cause, cessation of excessive intake sufficient treatment
- Hemodialysis
  - In severe cases magnesium can be externally filtered from the blood

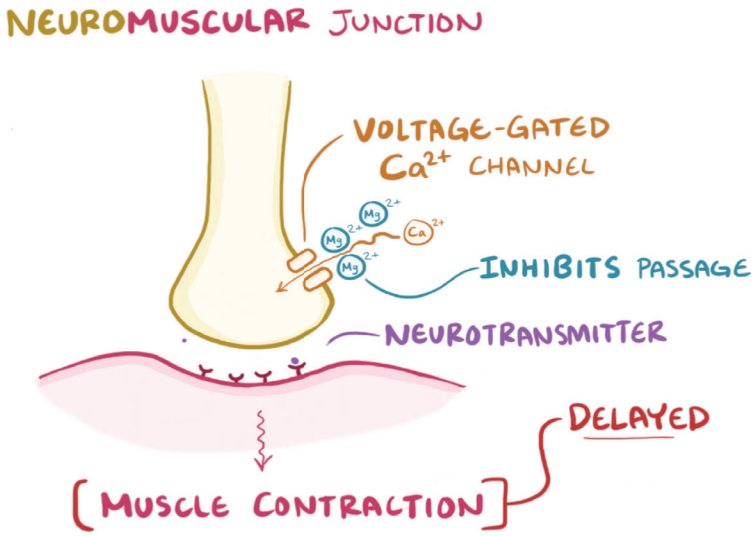

Figure 113.1 Illustration depicting calcium channel inhibition due to hypermagnesemia, causing delayed muscle contraction.

HYPOMAGNESEMIA

osms.it/hypomagnesemia

PATHOLOGY & CAUSES

- Low levels of magnesium in the blood, <1.7mg/dL

CAUSES

- Insufficient renal reabsorption
  - Loop and thiazide diuretics
  - Nephrotoxic drugs (amphotericin B, calcineurin inhibitors, cisplatin)
  - Hypercalcemia
  - Channelopathies (genetic mutations that affect the ion channels through which electrolytes like magnesium are reabsorbed)
  - Diabetes (osmotic diuresis carries electrolytes along with water)
- Insufficient gastrointestinal absorption
  - *Malnutrition:* dietary insufficiency
  - *Malabsorption:* sufficient quantities are consumed, but insufficient amounts are absorbed because of rapid gastrointestinal transit time (e.g., chronic diarrhea) or medications (e.g., proton pump inhibitors)
- Hungry bone syndrome
  - Surgical removal of the thyroid or parathyroid

RISK FACTORS

- Alcohol use disorder (causes a mixed hypomagnesemia, poor diet and alcohol increases excretion)

COMPLICATIONS

- *Hypokalemia:* magnesium interferes with excretion of potassium
- *Hypocalcemia:* parathyroid gland is dependent on magnesium to function

SIGNS & SYMPTOMS

- Neuromuscular
  - Without magnesium, calcium more readily enters neuron, exits sarcoplasmic reticulum → more excitable nerves, muscles
- Cardiac arrhythmias
  - Premature atrial contractions
  - Premature ventricular contractions
  - Increased risk of torsades de pointes (particularly with concurrent class III antiarrhythmics)
  - Increased risk of arrhythmias associated with digoxin toxicity
- ECG changes
  - PR prolongation
  - QT prolongation
  - T wave flattening
- Hypocalcemia often occurs alongside hypomagnesemia. Either/both conditions may cause
  - Tetany (intermittent muscle spasms throughout the body)
  - Hyperreflexia
  - 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 makes nerve fire → muscle spasm makes wrist and metacarpophalangeal joints flex)
  - Seizures

DIAGNOSIS

LAB RESULTS

- Measure free unbound magnesium in the serum, <1.7mg/dl

TREATMENT

MEDICATIONS

- Treat underlying cause
- *Mild asymptomatic:* oral supplementation usually sufficient
- *Severe and/or symptomatic:* magnesium sulphate may be administered intravenously