**Magnesium sulfate**

**(mag-NEE-see-um SUL-fayt)**

**CLASSIFICATION(S):**  
Anticonvulsant, miscellaneous; and laxative, saline

**PREGNANCY CATEGORY: A**

Rx: Epsom Salts.

SEE ALSO ANTICONVULSANTS AND LAXATIVES, BOTH IN CHAPTER 2.

**USES**

Parenteral. (1) Prevention and treatment of seizures in severe pre-eclampsia or eclampsia without producing deleterious CNS depression in mother or infant. (2) To control hypertension, encephalopathy, and convulsions associated with acute nephritis in children. (3) Replacement therapy in Mg deficiency, especially in acute hypomagnesemia accompanied by signs of tetany similar to those seen in hypocalcemia. (4) Added to total parenteral nutrition therapy to correct or prevent hypomagnesemia that may occur during the course of therapy. 

Investigational: (1) As a tocolytic agent to manage premature labor (not a first-line agent). (2) IV use as an adjunct to treat acute exacerbations of moderate to severe asthma in clients who respond poorly to beta agonists. (3) In adults to prevent recurrences of torsades de pointes by suppressing early-after depolarizations.

Oral. Laxative.

**ACTION/KINETICS**

**Action**

Magnesium (Mg) is an essential element for muscle contraction, certain enzyme systems, and nerve transmission. Extracellular fluid levels: 1.5–2.5 mEq/L. Mg depresses the CNS and controls convulsions by blocking release of acetylcholine at the myoneural junction. Also, Mg decreases the sensitivity of the motor end plate to acetylcholine and decreases the excitability of the motor membrane. As a laxative, it acts in the small and large intestine to attract and retain water in the intestinal lumen, increasing intraluminal pressure; also releases cholecystokinin.

**Pharmacokinetics**

**Therapeutic anticonvulsant serum levels:** 2.5 or 3–7.5 mEq/L (normal Mg levels: 1.5–2.5 mEq/L). Onset, IM: 1 hr; IV: immediate. **Duration, IM:** 3–4 hr; IV: 30 min. Excreted by the kidneys at a rate proportional to the serum concentration and GFR. **Plasma protein binding:** 30% bound to albumin.

**CONTRAINDICATIONS**

In the presence of heart block or myocardial damage. In toxemia of pregnancy during the 2 hr prior to delivery.

**SPECIAL CONCERNS**

- Use with caution in clients with renal disease because Mg is removed from the body solely by the kidneys; use in renal disease may cause magnesium intoxication.
- The elderly may require reduced dosage due to impaired renal function.
- Magnesium sulfate is compatible with breast feeding.

**SIDE EFFECTS**

**Most Common**

Magnesium intoxication when used parenterally (see below for symptoms).

**Magnesium intoxication:** Cardiac and CNS depression preceding respiratory paralysis, circulatory collapse, depressed reflexes, flaccid paralysis, flushing, hypotension, hypothermia, sweating. **CNS:** Depression. **CV:** Flushing, hypotension, circulatory collapse, depression of the myocardium. **Miscellaneous:** Sweating, hypothermia, muscle/flaccid paralysis, CNS depression, **respiratory paralysis.** Suppression of knee jerk reflex can be used to determine toxicity. **Respiratory failure may occur if given after knee jerk reflex disappears.** Hypocalcemia with signs of tetany secondary to Mg sulfate when used for eclampsia.

**NOTE:** Magnesium toxicity may occur in the newborn especially if the mother has received an IV infusion for more than 24 hr prior to delivery. Elevated Mg levels may persist for up to 7 days in the newborn.

**OD**

**OVERDOSE MANAGEMENT**

**Symptoms:** Sharp drop in BP and respiratory paralysis. Disappearance of patellar reflex indicates onset of magnesium toxicity. ECG changes include increased PR interval, increased QRS complex, and
prolonged QT interval. Heart block and asystole may occur. Other symptoms depend on serum levels with respiratory arrest, asystole, and death possible if serum levels exceed 14 mEq/L. Hypermagnesemia in the newborn, including neuromuscular or respiratory depression. Treatment: Artificial respiration and IV calcium salt to antagonize the effects of magnesium. A dose of 5–10 mEq calcium gluconate will usually reverse respiratory depression and heart block. In extreme cases, may need peritoneal dialysis or hemodialysis. Hypermagnesemia in the newborn may require resuscitation and assisted ventilation via endotracheal intubation or intermittent positive pressure ventilation, as well as IV calcium.

**DRUG INTERACTIONS**

CNS depressants (general anesthetics, sedative-hypnotics, narcotics) / Additive CNS depression

Neuromuscular blocking agents / Possible potentiation of neuromuscular blockade

Streptomycin / ↓ Streptomycin antibiotic activity

Tetracycline / ↓ Tetracycline antibiotic activity

Tobramycin / ↓ Tobramycin antibiotic activity

**HOW SUPPLIED**

Oral Solutions (various strengths): Injection: 4% (0.325 mEq/mL), 8% (0.65 mEq/mL), 12.5% (1 mEq/mL), 50% (4 mEq/mL).

**DOSEAGE**

- **IM**
  - Acute nephritis in children. 20–40 mg/kg as needed to control seizures. Dilute the 50% concentration to a 20% solution and give 0.1–0.2 mL/kg of the 20% solution.
  - Mild magnesium deficiency.
  - Adults: 1 gram (8.12 mEq; 2 mL of a 50% solution) IM q 6 hr for 4 doses (total of 32.5 mEq/24 hr).
  - Severe hypomagnesemia.
  - As much as 3 mEq/kg (0.5 mL of a 50% solution) within 4 hr, if necessary.
- **IV/IM**
  - Seizures associated with eclampsia.
  - Initial: 10–14 grams. To initiate therapy, 4 grams Mg sulfate in water for injection or 4–5 grams in 250 mL of DSW or 0.9% NaCl may be given IV. Simultaneously, 4–5 grams may be given IM into each buttock using undiluted 50% Mg sulfate. Alternatively, the initial IV dose of 4 grams may be given by diluting the 50% solution to a 10% or 20% concentration; the diluted solution (40 mEq of a 10% solution or 20 mL of a 20% solution) may be given IV over a period of 3–4 hr. After the initial IV dose, 1–2 grams/hr may be given by IV infusion. Subsequent IM doses of 4–5 grams may be injected into alternate buttocks q 4 hr, depending on the presence of the patellar reflex, adequate respiratory function, and absence of signs of Mg toxicity. A serum level of 3–6 mg/dL (2.5–5 mEq/L) is considered optimal for seizure control; do not exceed a total daily dose of 20–40 grams of magnesium sulfate. Continue therapy until paroxysms cease.
- **IV INFUSION**
  - Hypomagnesemia, severe.
  - Adults: 5 grams (40 mEq)/L of D5W injection or sodium chloride injection by slow infusion over period of 3 hr. Use caution to prevent exceeding renal excretory capacity.
  - Hypermagnesemia in the newborn may require resuscitation and assisted ventilation via endotracheal intubation or intermittent positive pressure ventilation, as well as IV calcium.
- **ORAL SOLUTION**
  - Laxative.
  - Adults and children 12 years and older: 5–10 mL in one-half glass of water.
  - Children, 6–12 years: 2.5–5 mL in one-half glass of water.

**NURSING CONSIDERATIONS**

**ADMINISTRATION/STORAGE**

1. When used as laxative, dissolve in a glassful of ice water or other chilled fluid to lessen the disagreeable taste.
2. Dilutions for IM: Deep injection of 50% concentrate for adults. Use a 20% solution for children.

**3. Reserve IV use in eclampsia for immediate control of life-threatening convulsions. Give slowly to avoid producing hypermagnesemia. When given by continuous IV infusion to toxemic mothers, the newborn may show signs of magnesium toxicity. Hypermagnesemia in the newborn may require resuscitation and assisted ventilation via en-
dotracheal intubation, as well as IV calcium.

4. For IV infusion, dilute to a concentration of 20% or less. Generally do not exceed an IV rate of 1.5 mL of a 10% concentration (or its equivalent) per min (150 mg/min), except in severe eclampsia with seizures.

5. Mg sulfate in solution may cause a precipitate when mixed with solutions containing the following: High concentrations of alcohol, alkali carbonates and bicarbonates, alkali hydroxides, arsenates, barium, calcium, clindamycin phosphate, heavy metals, hydrocortisone sodium succinate, phosphates, polymyxin B sulfate, procaine HCl, salicylates, strontium, and tartrates.

ASSESSMENT
1. List reasons for therapy, onset, characteristics of S&Gs, other agents trialed.
2. Evaluate cardiac status, respirations, ECG. Monitor I&O.
3. Note any kidney disease. Assess Mg levels (S&Gs of toxicity begin at 4 mEq/L) and renal function.
4. With premature labor, continually assess fetal heart rate, intensity and timing of contractions.

INTERVENTIONS
1. Parenteral administration by trained individuals in a monitored environment.
2. Before administering IV check for the following conditions:
   - Absent patellar reflexes
   - Respirations below 16/min
   - Urine output <100 mL in past 4 hr
   - Early signs of hypermagnesemia: flushing, sweating, hypotension, or hypothermia
   - Past history of heart block or myocardial damage; prolonged PR and widened QRS intervals
3. Adjust dose of CNS depressants.
4. Digitalis toxicity treated with calcium is extremely dangerous and may result in heart block.
5. Do not administer for 2 hr preceding delivery. If mother received continuous IV Mg therapy 24 hr prior to delivery, assess newborn constantly for neurologic and respiratory depression.

CLIENT/FAMILY TEACHING
1. Orally drug attracts/retains water in intestinal lumen. This increases intraluminal pressure and induces urge to defecate. Do not exceed prescribed dose.
2. Mix granules in at least a half-glass of water before swallowing; follow with a full glass of water. May mix with ice chips or flavor with lemon or OJ to enhance palatability.
3. Review other measures that may help prevent constipation (eg, dietary fiber, adequate fluid intake, well-balanced diet, and regular daily exercise to promote bowel motility).
4. Keep all F/U to assess response, labs, and for adverse SE.

OUTCOMES/EVALUATE
- Control of seizures
- Mg levels (1.8–3 mEq/L)
- Successful evacuation of stool