

## Supplement Sampler

### Magnesium

#### Best Indications

Intravenous: IV magnesium sulfate is used for pre-eclampsia, pre-term labor, torsade de pointes, +/- asthma exacerbation.

Oral: Hypertension, bone strength, insulin sensitivity (*note: the DASH and Mediterranean diets, rich in Mg have been found to be beneficial for all these conditions as well*), constipation, fatigue, cardiac arrhythmias (a fib, PAC, PVC) and migraine HA prevention.

#### Mechanism of Action

Magnesium is involved in every metabolic process in the body including the production of energy and the production of proteins. It is responsible for the electrical stability of cells, particularly of cardiac tissue. It has a love/hate relationship with calcium. For some metabolic processes such as protein production, magnesium is a promoter while calcium is an inhibitor. Magnesium and calcium cooperate in the production of energy (ATP). Magnesium is nature's "calcium channel blocker" since it regulates the intracellular flow of calcium ions which likely helps explain its blood pressure lowering effects. The total magnesium content in the adult is about 25 gms with 50-60% found in bone.

#### Assessing Levels

Take a nutritional history: Magnesium is found in nuts, grains, fish (Halibut=most) and green leafy vegetables. If these foods (Mediterranean Diet) are consumed regularly, deficiency is unlikely. If your patients consume the standard American diet (S.A.D.) rich in dairy, red meat and white foods (potatoes, white breads, pasta) which are low in magnesium, consider supplementing with the foods above or with a pill if they are unwilling to change their diet. Magnesium, zinc and calcium are the most prevalent mineral deficiencies in the American diet.

Serum (extra-cellular) blood tests of magnesium are not sensitive enough to check for deficiency since magnesium is the second most prevalent intracellular ion (Potassium being the first). Checking a red blood cell magnesium is better. You can get this test if you speak with your lab personnel. An RBC Magnesium level is not available in the Epic 'orders' system in the EHR in Madison, WI.

Diuretics (Thiazides and Loop) result in magnesium losses. Heart patients on these meds at risk for cardiac arrhythmias may benefit from supplementation. Magnesium is universally cleared through the kidneys so be careful in those with renal failure.



## Magnesium

### Best Studies

*Research costs money and there is little incentive to research a mineral that can not be patented. Thus the best studies are often part of larger NIH studies such as the Nurses Health Study and the Framingham Study.*

HTN: Honolulu Heart Study and the Nurses Health study found HTN to be associated with low magnesium levels.<sup>1</sup> Foods rich in magnesium (and potassium) lower systolic BP by about 8 points and diastolic by about 5 points.<sup>2,3</sup>

PVCs: The Framingham Heart Study showed that those patients with low magnesium levels were 20% more likely to have symptomatic PVCs.<sup>4</sup> Have patients with PVCs cut back on their caffeine, increase aerobic exercise and eat Mg rich foods. If PVCs continue, consider supplementing with Mg (and fish oil 1 gm) before prescribing the beta-blocker to see if this helps reduce the cardiac excitability.

HA Prevention: High dose oral magnesium (600 mg/day) after 9-12 weeks reduced the attack frequency of migraine headaches by 41.6% in the magnesium group and by 15.8% in the placebo group compared to the baseline ( $p < 0.05$ ). The number of days with migraine and the drug consumption for symptomatic treatment per patient also decreased significantly in the magnesium group.<sup>5</sup>

### Dose

Note: A pearl to keep in mind is that most nutrients and minerals are best absorbed in small doses ingested frequently throughout the day (i.e.: 3-5 meals a day in forms that were recently alive!) vs. high amounts all at once (6 capsules with your morning diet coke and Hydrochlorothiazide).

#### Would the patient benefit from loosening the stools?

Use a non-chelated form of magnesium such as Magnesium citrate, oxide, hydroxide (*Hydroxide=Milk of Magnesia®*) or chloride. *Slow-Mag®* is Magnesium chloride that is absorbed slower and may cause less diarrhea. To loosen stools and replenish stores consider having patients take 150 mg Mg Citrate, 4 tablets in the evening and 2 tablets in the morning until they have a regular BM by 10 am the next morning. Titrate evening dose up every day until BM is stimulated. (Method of Pat Udelhofen, FNP). Excessive diarrhea results in magnesium loss so don't over do it.

The nurses in the family medicine floor at UW Hospital use a "Tootsie Roll" for constipation. The recipe: warm 7-up, prune juice and 30 cc of Milk of Magnesia to make one 8-10 oz glass at bedtime. (A tootsie roll will never taste the same! ☺)

#### Do you want to avoid loose stools?

Chelated (meaning 'bound to') forms cause the least diarrhea. They are bound to an amino acid and are absorbed earlier in the small intestine (vs. non-chelated forms that are absorbed in the small and large intestine). Magnesium Glycinate, Aspartate or Taurate are examples of chelated magnesium. Direct patients to look for the bottle that says "Chelated Magnesium." Taking magnesium with food is less likely to cause diarrhea.



## Magnesium

Magnesium Malate (combined with Malic Acid) is thought to be the best form used for treating fatigue since malic acid is also needed for energy production within the Krebs cycle.

If patients are getting very little magnesium through their diet, they will need about 320 mg of elemental magnesium daily. The total dosage on the bottle includes the binder. For example, 400 mg of Magnesium Glycinate will generally have 300 mg of glycinate and 100 mg of elemental magnesium. You would prescribe one tablet three times a day to get near 300 mg daily.

### Side Effects

Diarrhea, nausea and abdominal cramping. Generally diarrhea will prevent over-dosing that can result in dangerous levels of Mg. The exception is in those with renal failure who have difficulty secreting magnesium. Toxic levels cause muscle relaxation (e.g. uterine in pre-term labor) and loss of deep tendon reflexes.

### Cost

You can get a whole box of regionally grown magnesium from your local community supported agriculture (CSA) farm for about \$18.

200 capsules of magnesium will run around \$10.

### Disclaimer

*The health benefits from multi-colored whole food eaten with a smile with family and friends significantly trumps any product found in a bottle, be it a supplement or drug!*

*Brought to you by your colleagues in the UW Department of Family Medicine Integrative Medicine Program.*

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### References

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4. Tsuji H, Venditti FJ, Jr, Evans JC, Larson MG, Levy D. The associations of levels of serum potassium and magnesium with ventricular premature complexes (the Framingham heart study). *Am J Cardiol*. 1994; 74(3):232-235.
5. Peikert A, Wilimzig C, Kohne-Volland R. Prophylaxis of migraine with oral magnesium: Results from a prospective, multi-center, placebo-controlled and double-blind randomized study. *Cephalalgia*. 1996; 16(4):257-263.