SERUM MAGNESIUM TESTING

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INSTRUCTIONS FOR USE
This Medical Policy provides assistance in interpreting UnitedHealthcare benefit plans. When deciding coverage, the enrollee specific document must be referenced. The terms of an enrollee's document (e.g., Certificate of Coverage (COC) or Summary Plan Description (SPD)) may differ greatly. In the event of a conflict, the enrollee's specific benefit document supersedes this Medical Policy. All reviewers must first identify enrollee eligibility, any federal or state regulatory requirements and the plan benefit coverage prior to use of this Medical Policy. Other Policies and Coverage Determination Guidelines may apply. UnitedHealthcare reserves the right, in its sole discretion, to modify its Policies and Guidelines as necessary. This Medical Policy is provided for informational purposes. It does not constitute medical advice.

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BACKGROUND

Magnesium is a dietary mineral essential to hundreds of metabolic reactions in the body including carbohydrate and energy metabolism, DNA and protein synthesis, nerve and muscle function, and ion channel regulation. Magnesium homeostasis requires the healthy functioning of numerous organs. Absorption occurs throughout the intestine, and renal secretion or reabsorption balances the store of magnesium when plasma levels wax and wane, respectively. Magnesium is primarily an intracellular cation, and bone houses over half of the body’s stores. Redistribution of magnesium can occur in states of hypomagnesemia, and skeletal stores of magnesium are released when plasma levels fall.

Endocrine function and magnesium homeostasis are linked. Hypoparathyroidism, hyperthyroidism and aldosteronism increase renal loss of magnesium. In acute hypomagnesemia, parathyroid hormone (PTH) is
released, but in severe, chronic hypomagnesemia, release of PTH is decreased and contributes to the hypocalcemia of magnesium deficiency. In such cases, hypocalcemia cannot be corrected without correcting the magnesium deficiency.¹

Knowledge of the subcellular mechanisms of magnesium absorption and secretion continues to grow through advances in the field of molecular genetics. One channel, TRPM6, allows epithelial absorption of magnesium in the intestine and epithelial reabsorption in the kidney. Perturbations of acid-base status, monogenetic disorders such as Gitelman Syndrome, and drugs including FK 506 and cyclosporine alter the expression of TRPM6 and subsequently impair magnesium homeostasis.²

Hypomagnesemia is common in patients with acute and chronic illness, and it causes additional morbidity when present. It has been estimated that 7% to 11% of hospitalized patients have some degree of hypomagnesemia, but in critically ill patients, the prevalence is much higher.³ One study reported 61% of adult patients had abnormally low serum magnesium on admission to the surgical intensive care unit.⁴ The prevalence of hypomagnesemia in pediatric intensive care unit patients has been reported to be as high as 70%, with the lowest magnesium levels in patients treated with diuretics and aminoglycoside antibiotics.⁵ Another study found a higher incidence in pediatric intensive care unit patients undergoing corrective surgery for scoliosis and craniofacial anomalies.⁴

Hypomagnesemia can be caused by dietary deficiency, decreased absorption, increased loss, metabolic diseases, shifts into cells, iatrogenic artifact, electrolyte imbalance, and alcohol abuse. Most Western diets do not meet the recommended daily allowance of magnesium.³ Dietary sources including leafy greens, nuts, grains, seafood, and meat. Patients with eating disorders and protein-energy malnutrition often have magnesium deficiency and pregnant patients have an increased requirement of 360-400 mg daily.⁶ Reduced absorption occurs in patients with genetic disorders, pancreatic insufficiency, cholestatic liver disease and intestinal pathology including infection, gluten enteropathy, intestinal obstruction, and inflammatory bowel disease. Increased loss of magnesium can occur via non-renal and renal mechanisms. In diseases causing diarrhea, magnesium is secreted into the bowel lumen. Pathology of the kidney and ureter can cause increased renal secretion of magnesium. Extrarenal factors, such as primary and secondary hyperaldosteronism, also increase renal secretion. Diabetes mellitus type I and II increase renal secretion and are the most common causes of magnesium deficiency.³ Shifts of magnesium stores can cause hypomagnesemia. Magnesium enters cells when catecholamine levels increase, which may explain hypomagnesemia following subarachnoid hemorrhage.⁷ Magnesium forms insoluble soaps around areas of fat necrosis in acute pancreatitis. In patients with osteoblastic metastases, magnesium shifts into bone. Hypomagnesemia can occur as an iatrogenic artifact of chemotherapy, immunotherapy and radiotherapy. Hungry bone syndrome occurs after parathyroidectomy. Correction of acidosis in renal failure drives magnesium into cells as does the administration of glucose and insulin. Some diuretics, particularly loop diuretics such as furosemide, cause magnesium wasting. Hypomagnesemia can follow transfusion, dialysis, and hyperalimentation. Low phosphate levels and hypercalcemia cause hypomagnesemia. Patients with chronic alcoholism generally have more than one mechanism causing hypomagnesemia; dietary intake can be decreased and intestinal losses occur with vomiting and diarrhea. Also, liver disease and pancreatitis can interfere with absorption in this patient population.

Hypomagnesemia is common in hospitalized patients and the critically ill. Assessment of magnesium status is not straightforward. Since magnesium is an intracellular cation, serum levels reflect only 1% of body stores. Individuals with magnesium levels in the normal range of 0.75-1.0 mmol/L can suffer from magnesium
depletion. For this reason it has been recommended that if a patient with a predisposing factor for magnesium deficiency has signs and symptoms of magnesium deficiency, they should be treated even if the total serum magnesium level is normal. 8 Symptomatic patients are generally treated with intravenous magnesium sulfate. Reasons to suspect hypomagnesemia include electrolyte changes such as hypokalemia and hypocalcemia; neuromuscular compromise including tetany, seizures, vertigo, muscle weakness; mental status changes including depression and psychosis; and cardiac dysrhythmias. Some patients with magnesium deficiency are asymptomatic, and routine evaluation of serum magnesium is a consideration for alcoholics and patients treated with loop and thiazide diuretics, aminoglycosides, amphotericin, and cisplatin. 9 It has been suggested that calcium, magnesium and phosphorus should be monitored in critically ill geriatric patients. 10 The American Heart Association recommends that patients being treated pharmacologically for atrial fibrillation should have their magnesium levels checked periodically. 11

Evidence is mounting that low magnesium levels predispose individuals to many health problems. In patients with kidney disease, low serum magnesium levels are associated with vascular calcification and cardiovascular mortality, and in the general population, with the pathogenesis of cardiovascular disease, hypertension, and blood clots. 12 Animal models suggest that hypomagnesemia may predispose women to osteoporosis. 3 Magnesium deficiency in pregnancy has been linked to insulin resistance and diabetes of the newborn in animal studies. 13 Low serum magnesium increases the risk of atrial fibrillation after cardiovascular surgery; some studies have shown a decrease in relative risk with magnesium prophylaxis. 14 Magnesium has been used for the prophylaxis and treatment of migraine. 15 Hypomagnesemia increases insulin resistance, and magnesium supplementation can reduce the amount of insulin required for management of diabetes. 3 Despite the potential benefits of magnesium supplementation for many patients, consensus practice guidelines do not exist for these uses of magnesium.

Aside from its use to correct symptomatic magnesium depletion, there are a few evidence-based uses for magnesium therapy that are endorsed by advisory boards. Magnesium is recommended for use as a therapeutic agent for eclampsia, pre-eclampsia, torsade de pointes, and severe acute asthma. Magnesium sulfate is the drug of choice to prevent convulsions in pre-eclampsia and eclampsia. For this use, the target range is a serum concentration of 2-3.5 mmol/L. Deep tendon reflexes are monitored to avoid neuromuscular transmission block. During epidural analgesia and in the absence of tendon reflexes and normal renal function, serum concentrations are used to monitor magnesium therapy in obstetric patients. The use of magnesium in obstetric patients with myasthenia gravis, Eaton-Lambert syndrome and myotonic dystrophy can be problematic. 5 Torsade de pointes is a type of ventricular tachycardia with QT-interval prolongation on electrocardiogram; anti-arrhythmic drugs and methadone are known risk factors for the potentially lethal condition. Magnesium is the first line of therapy for cases that do not resolve spontaneously irrespective of serum magnesium. 16 Guidelines from the National Asthma Education and Prevention Program 17 recommend the use of intravenous magnesium sulfate for pediatric and adult patients who have life-threatening asthma or whose asthma remains severe after one hour of conventional therapy. Magnesium has been found to decrease the risk of intubation in this patient population. The guidelines further recommend measuring serum magnesium levels in patients with asthma exacerbation who take diuretics or have coexistent cardiovascular disease because therapy with short-acting beta2-agonists can decrease serum magnesium.

Magnesium is also used to correct electrolyte imbalances caused by hydrofluoric acid burns. In this clinical setting, intravenous calcium and magnesium are used to inactivate fluoride ions. 18 Magnesium sulfate has been also been used to treat organophosphorous pesticide poisoning. 19
Hypermagnesemia occurs far less commonly than hypomagnesemia but can be a serious complication of magnesium therapy in patients with renal failure. Patients with decreased renal function require daily monitoring of magnesium levels while undergoing therapy with magnesium. Patients with chronic kidney disease should be cautioned to avoid over-the-counter antacids and laxatives containing magnesium. Other etiologies of hypermagnesemia include lithium toxicity, hypothyroidism, and Addison’s disease. Signs of magnesium toxicity include hypotension, ECG changes, drowsiness, decreased deep tendon reflexes, and muscle paralysis.

**POLICY**

For the following CPT code(s) in Table 1, the patient should have a diagnosis (ICD-10-CM) code(s) listed in the attached table below.

**Table 1. HCPCS Codes (Alphanumeric, CPT® AMA)**

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<tr>
<th>HCPCS Code</th>
<th>Description</th>
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<tr>
<td>83735</td>
<td>Magnesium</td>
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**ICD-10 Diagnosis Codes (Proven)**

CMP-044 Serum Magnesium ICD10 v1
REFERENCES


POLICY HISTORY/REVISION HISTORY

<table>
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<tr>
<th>Date</th>
<th>Action/Description</th>
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<tbody>
<tr>
<td>01/21/2017</td>
<td>Updated ICD10 codes as per CMS recommendations. Removed ICD9 code file</td>
</tr>
<tr>
<td>10/01/2015</td>
<td>Removed ICD9 table. Embedded ICD9/ICD10 PDF files.</td>
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