

How is acute hypomagnesaemia treated in adults?

Prepared by UK Medicines Information ([UKMi](http://www.ukmi.nhs.uk)) pharmacists for NHS healthcare professionals
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Background

There are no national guidelines for the treatment of acute hypomagnesaemia, and practice varies widely across hospital Trusts. Following a thorough search of the literature, this guidance has been prepared and adopted in Leeds Teaching Hospitals NHS Trust. The use of magnesium for other indications has not been considered.

Reference ranges for serum magnesium vary between laboratories. For the purpose of this document, the reference range used for magnesium is 0.7-1.0 mmol/L. Serum magnesium concentrations are a poor indicator of total active ionised magnesium levels. The plasma contains only approximately 0.5% of total body magnesium and the relationship between serum magnesium levels and total magnesium stores has not been clearly defined (1,2).

Most of the symptoms of hypomagnesaemia are non-specific, but may include (1,3,4):

- muscle weakness, ataxia, tremor, seizures, carpedal spasm
- ventricular arrhythmias, ECG abnormalities
- depression, psychosis
- vertigo
- hyperinsulinism

Symptomatic hypomagnesaemia is usually associated with additional electrolyte abnormalities (1-3).

Magnesium deficiency has been associated with the following conditions (1-7):

- Gastrointestinal loss; diarrhoea
- Malabsorption
- Malnutrition
- Acute pancreatitis
- Chronic alcoholism
- Renal tubular reabsorption defects
- Hyperaldosteronism
- Diabetic ketoacidosis
- Lactation
- Long-term IV nutrition or fluid therapy
- Drug therapy e.g. diuretics, gentamicin, omeprazole, ciclosporin, foscarnet, amphotericin B, pentamidine, cancer chemotherapy particularly cisplatin

Answer

Magnesium replacement should be prescribed for patients with a serum magnesium concentration of 0.4 mmol/L or less (8). For patients with a serum magnesium concentration of 0.4 - 0.7 mmol/L, magnesium replacement should be considered if the patient presents with symptoms of hypomagnesaemia or following a clinical risk/benefit decision (1,8). Although this document offers guidance, the dose of magnesium to correct hypomagnesaemia should be determined on an individual patient basis.

Magnesium is renally excreted and should be used with caution in patients with renal impairment as they are at a higher risk of adverse effects (1,9-11). Magnesium salts should be used with caution in patients with myasthenia gravis, patients with hepatic impairment at risk of developing renal impairment, and respiratory insufficiency (7, 9, 10,11).

Parenteral magnesium should be avoided in patients with heart block or myocardial damage (7,10,13). In patients with severe renal impairment, parenteral magnesium should be avoided if possible, or used with great caution, as they are at a higher risk of side effects (7,9-12).

Oral magnesium replacement

Oral magnesium replacement should be considered first, as a sudden rise in serum magnesium concentration (as seen following intravenous replacement) partially removes the stimulus for magnesium retention, and up to 50% of the infused magnesium is excreted in the urine (5).

The standard dose of oral magnesium to prevent recurrence of hypomagnesaemia is 24mmol daily in divided doses (9). Oral magnesium salts commonly cause diarrhoea (7,9,10) which may be reduced by administration with or after food (10).

Parenteral magnesium replacement

If oral magnesium replacement is not appropriate, intravenous magnesium therapy may be considered. Magnesium sulphate is the salt of choice (9,13). The licensed dose for severe or symptomatic hypomagnesaemia is 5 grams magnesium sulphate (20 mmol magnesium) in 1 litre of sodium chloride 0.9% or glucose 5% infused over three hours (7,10), but local practice may differ. It has been suggested that a longer infusion period may be more suitable for non-emergency situations (8). Up to 150mmol magnesium may be required over 5 days to correct the deficiency (9,10). After initial intravenous administration, it may be appropriate to give oral magnesium supplements to replenish the magnesium stores (8).

Important points to consider for parenteral magnesium therapy:

- ◆ 10mL magnesium sulphate 50% solution contains 20mmol magnesium which must be diluted prior to administration (7,9,11,14,15).
- ◆ The maximum concentration for peripheral magnesium administration must not exceed 200mg/ml (0.8mmol/ml) (7,9,11,12,14,15). The maximum rate of administration must not exceed 140mg/minute (0.6mmol/minute) (11,12,14,15).
- ◆ Preferably administer concentrations over 50mg/ml (0.2mmol/ml) via a central venous access device to avoid venous irritation (15).
- ◆ Magnesium sulphate has a high osmolarity and may cause tissue damage if it extravasates into the surrounding tissue (14,15).
- ◆ Parenteral magnesium therapy should be avoided in patients with heart block or myocardial damage (7,10,13).

Intramuscular magnesium therapy should be only be used when there is no venous access and the oral route is inappropriate, as the injections are painful, require multiple punctures and have no therapeutic advantage over the intravenous route (11). Magnesium sulphate may be given by intramuscular administration for severe hypomagnesaemia at a dose of 250mg/kg (1mmol/kg) in divided doses over a four hour period (6,10-12). Magnesium sulphate preparations up to 50% may be used for intramuscular injection in adult patients (14).

Magnesium may be given by subcutaneous administration if the oral, intravenous and intramuscular routes are all unavailable. [See UKMi Q&A no. 14.6](#) for further guidance (16).

Monitor serum magnesium concentration regularly (7,10-13).

During intravenous magnesium administration monitor heart rate, blood pressure, respiratory rate, urine output and for signs of hypermagnesaemia (7,9). Signs of hypermagnesaemia are described below:

Adverse effects of magnesium therapy

Hypersensitivity, diarrhoea (following oral magnesium therapy) and hypermagnesaemia may all occur following magnesium replacement (5,6,9-12). Patients with renal impairment are at a higher risk of adverse effects (7,10).

Hypermagnesaemia is unlikely to occur following oral magnesium supplementation, except in patients with renal failure. Symptoms include respiratory depression, loss of deep tendon reflexes, nausea, vomiting, flushing of the skin, thirst, hypotension due to peripheral vasodilatation, drowsiness, confusion, slurred speech, double vision, muscle weakness, bradycardia, coma, and cardiac arrest (5,6,9-12).

Summary

There is no national guidance on the treatment of hypomagnesaemia, and practice varies widely between hospital Trusts. The guidance in this document reflects practice at Leeds Teaching Hospitals NHS Trust.

- Magnesium replacement should be prescribed for patients with a serum magnesium concentration of 0.4 mmol/L or less. Replacement should be considered for those with magnesium >0.4 mmol/L if they are symptomatic
- Oral magnesium therapy should be considered first-line. Most oral magnesium preparations are unlicensed. The standard dose of oral magnesium for hypomagnesaemia is 24mmol daily in divided doses, however oral magnesium salts frequently cause diarrhoea.
- If the oral route is not appropriate, intravenous magnesium therapy may be considered. Magnesium sulphate is the salt of choice. The licensed dose for the treatment of hypomagnesaemia is 5 grams magnesium sulphate in 1 litre sodium chloride 0.9% or glucose 5%, however local practice may vary.
- Intramuscular or subcutaneous magnesium replacement may be considered if the oral and intravenous route is not available. Subcutaneous magnesium administration is unlicensed.
- Magnesium is renally cleared. Magnesium (especially via the intravenous route) should be used with caution in patients with renal impairment.

Limitations

This Q&A is designed for adult patients only. This guidance is not suitable for chronic hypomagnesaemia, patients with complex medical problems, or those with renal impairment or re-feeding syndrome. The dose of magnesium to correct hypomagnesaemia should be determined on an individual patient basis. There are no national guidelines for the treatment of hypomagnesaemia, and practice varies widely across Hospital Trusts.

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Search strategy

- Embase [terms used: magnesium deficiency (exp), limited to English, Human and Adult, Publication year 2014-2017]

- Medline [terms used: magnesium deficiency (exp), limited to English, Human and Adult, Publication year 2014-2017]
- In-house Database/resources