Treatment of Hypomagnesaemia in Adults
Clinical Guideline

V3.0

March 2021
Summary

Key:

- General Notes
- GP/SWASFT
- ED/MAU/SRU/Acute GP/Amb-Care
- In-patient wards

Start

Identify and treat the cause where appropriate

- <0.4mmol/L or >0.4mmol/L with symptoms
  - IV supplementation
    - See section 3.2
    - Monitor magnesium levels daily

- 0.4 to 0.7mmol/L and asymptomatic
  - Oral supplementation
    - See section 3.3
  - Recheck magnesium levels in 3-5 days

End
1. **Aim/Purpose of this Guideline**

1.1. For the treatment of hypomagnesaemia in adults in all clinical areas.

1.2. This version supersedes any previous versions of this document.

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DPA18 is applicable to all staff; this includes those working as contractors and providers of services.

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rch-tr.infogov@nhs.net

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2. **The Guidance**

2.1. **Background**

Magnesium (Mg) is the second most abundant intracellular cation. It is an essential body electrolyte and a cofactor in numerous enzyme systems. The average daily magnesium intake is 15mmol. One-third of this magnesium is absorbed, mainly in the small bowel; however, this fraction may be increased in patients with low magnesium levels. The kidney is the principal organ for magnesium regulation, the major site being the distal tubule.

2.2. **Definition of hypomagnesaemia**

2.2.1. The reference range for serum magnesium used in the Royal Cornwall Hospitals Trust is 0.7 – 1.0 mmol/L.

2.2.2. For the purposes of this guideline, hypomagnesaemia is defined as a serum blood magnesium concentration of less than 0.7 mmol/L.

2.3. **Causes of hypomagnesaemia**

2.3.1. Decreased magnesium absorption  
*Severe malabsorption, malnutrition, excess alcohol intake*  
*Drugs: proton pump inhibitors*
2.3.2. Increased renal excretion/loss
Drugs: loop and thiazide diuretics, digoxin, alcohol
Conditions: SIADH
Drug toxicity: aminoglycosides, ciclosporin, amphotericin

2.3.3. Endocrine
Hyperthyroidism, hyperaldosteronism, diabetes mellitus, diabetic ketoacidosis, vitamin D deficiency

2.3.4. Gut losses
Acute and chronic diarrhoea, excessive purgation, GI/biliary fistula, extensive bowel resection, prolonged nasogastric suction

2.3.5. Miscellaneous
Acute pancreatitis, excessive lactation

2.4. Signs and Symptoms

2.4.1. Many of the symptoms of moderate to severe hypomagnesaemia are non-specific. Symptomatic magnesium depletion is often associated with multiple biochemical abnormalities such as hypokalaemia and hypocalcaemia. Correction of magnesium may aid the correction of other electrolytes.

2.4.2. Symptoms may include:
- Neuromuscular: ataxia, carpopedal syndrome, confusion, depression, hallucination, muscle weakness, psychosis, seizures, tremor
- Metabolic: altered glucose homeostasis (carbohydrate intolerance, hyperinsulinism), atherosclerosis
- Cardiovascular: ECG abnormalities (widening of QRS complex, prolongation of PR interval), severe ventricular arrhythmias, sensitivity to cardiac glycosides
- Bone: osteoporosis, osteomalacia
- Calcium and potassium: refractory or unexplained hypocalcaemia, refractory hypokalaemia
- GI: anorexia, nausea

2.4. Treatment

2.4.1. Points to consider

2.4.2.1. Sub sub paragraph.

2.4.2.2. The specific regime for magnesium replacement is dependent on the clinical presentation of the patient. Although this document offers guidance, the dose of magnesium to correct hypomagnesaemia should be determined on an individual patient basis.

2.4.2.3. Precipitating agents should be withdrawn if possible, and the underlying cause treated.
2.4.2.4. Serum magnesium concentrations do not reflect the total body store. A clinical assessment is therefore more useful in guiding treatment approach.

2.4.2.5. Serum magnesium concentration may return to within a normal range within the first 24-hour period of replacement. However, total replenishment of body stores may take several days, and as approximately 50% of the administered IV dose of magnesium will be excreted in the urine, replacement must be done slowly. In resistant cases, please seek specialist advice.

2.4.2.6. Magnesium is also administered for therapeutic reasons in the absence of hypomagnesaemia such as acute asthma, which are not the subject of this guideline.

2.4.2.7. Magnesium supplementation may be administered via the oral, intravenous or intramuscular route, depending on the severity of magnesium depletion, presence of symptoms, and patient tolerance.

2.4.2. Oral magnesium administration

2.4.2.1. For use in mild hypomagnesaemia (0.4 – 0.7 mmol/L) and in asymptomatic patients.

2.4.2.2. Magnesium supplements should be given orally whenever possible. Diarrhoea tends to limit the amount of magnesium that can be given orally; if diarrhoea develops, the dose should be reduced. Administering with or after food may help to reduce the incidence of diarrhoea.

Table 1: Oral magnesium preparation suitable for use at RCHT

<table>
<thead>
<tr>
<th>Preparation</th>
<th>Route</th>
<th>Contents of 1 sachet</th>
<th>Dose</th>
<th>Other instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnesium aspartate</td>
<td>Oral</td>
<td>10mmol (=243mg) magnes</td>
<td>1 sachet once or twice a day</td>
<td>Dissolve in 50-200mL water, tea or orange juice</td>
</tr>
</tbody>
</table>

2.4.2.3. Magnesium aspartate in 200mL water is licensed for administration via gastric, duodenal and nasal enteral feeding tubes.

2.4.3. Intravenous (IV) magnesium administration

2.4.3.1. For use in symptomatic or severe hypomagnesaemia (<0.4 mmol/L), or in patients who cannot tolerate, or are unlikely to absorb, oral magnesium.
2.4.3.2. The magnesium infusion should not be mixed with any other drugs, and no other drugs should be added to the infusion bag. For information on y-site compatibility, where there is a strict clinical necessity, please contact your ward pharmacist or Medicines Information for advice.

**Table 2: Intravenous magnesium preparation suitable for use at RCHT**

<table>
<thead>
<tr>
<th>Preparation</th>
<th>Route</th>
<th>Dose</th>
<th>Diluent</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnesium sulfate 50% (20mmol, or 5g, per 10mL)</td>
<td>IV</td>
<td>20mmol Mg (10mL)</td>
<td>$\geq$100mL sodium chloride 0.9% or glucose 5%</td>
<td>Give over 3 hours. (Do not exceed 8mmol/hour)</td>
</tr>
</tbody>
</table>

2.4.3.3. A maximum daily dose of 50mmol is recommended in 24 hours; a total of up to 160mmol may be required over 5 days to correct the deficiency.

2.4.3.4. A longer infusion period may be more suitable for non-emergency situations, for example, a rate of 4mmol/hour. The maximum recommended rate is 8mmol/hour.

2.4.3.5. Magnesium sulfate 50% injections must be diluted to a maximum concentration 5% (20mmol/100mL) for peripheral administration. (see Table 2 for dilution instructions)

2.4.4. **Intramuscular administration**

2.4.4.1. Undiluted magnesium sulfate 50% injections may be given intramuscularly in alternate buttocks at a dose of 1 or 2g (4 or 8mmol) every 6 hours for 24 hours (4 doses in total). However, the injections are painful, potentially sclerosing and require multiple administrations. There is no therapeutic advantage over the IV route, and intramuscular administration should thus be reserved for patients in whom peripheral venous access is not readily available.

2.4.4.2. In exceptional circumstances only, magnesium can be given subcutaneously on expert advice.

2.5. **Monitoring**

The following should be monitored daily when replacing magnesium:

2.5.1. **Urea and electrolytes, with special attention to the following:**

2.5.1.1. Magnesium – monitor for therapeutic outcome as well as magnesium toxicity (see section 5), especially if given parenterally.
2.5.1.2. Potassium and calcium – magnesium levels are closely linked to potassium and calcium; replacing one may affect levels of the others.

2.5.2. Renal function

2.5.2.1. Magnesium is renally cleared and can therefore accumulate in renal impairment, causing hypermagnesaemia. It has been suggested that approximately 50% of the normal dose or less should be administered, depending on the extent of renal impairment and whether the patient is symptomatic. Seek renal team input, especially in severe renal impairment (GFR <30ml/min).

2.5.2.2. Administer single doses of magnesium only and use resulting serum magnesium levels to reassess further treatment.

2.5.3. Cardiovascular

2.5.3.1. During intravenous infusion, blood pressure, respiratory rate and heart rate should be monitored. Rapid administration may cause flushing and hypotension.

2.5.3.2. In patients with underlying cardiac issues, ECG monitoring should also be in place.

2.5.3.3. If intravenous treatment is for symptomatic hypomagnesaemia with cardiovascular symptoms, continuous cardiac monitoring must be ensured.

2.6. Cautions and contraindications

2.6.1. Avoid use in patients with heart block or bradycardia.

2.6.2. Caution in patients with myasthenia gravis.

2.6.3. Caution in patients with severe renal impairment (higher risk of adverse effects).

2.6.4. Caution in patients with hepatic impairment at risk of developing renal impairment.

2.7. Adverse effects of magnesium replacement

2.7.1. Oral magnesium can cause gastro-intestinal irritation and watery diarrhea. The latter may be avoided by administering with or after food.

2.7.2. Intravenous magnesium replacement can cause hypermagnesaemia (particularly in patients with renal failure), hypocalcaemia, hypotension (due to peripheral vasodilatation) and injection site reactions, such as phlebitis.
2.7.3. Symptoms of hypermagnesaemia include respiratory depression, loss of deep tendon reflexes due to neuromuscular blockade, nausea, vomiting, flushing of the skin, thirst, muscle weakness, ECG changes/arrhythmias (e.g. bradycardia), double vision, slurred speech, confusion, coma and cardiac arrest.

2.8. Of note

2.8.1. Magnesium sulphate has a high osmolarity and may cause tissue damage if it extravasates into the surrounding tissue following IV administration.

2.8.2. Refeeding Syndrome

2.8.2.1. When initiating patients on enteral or parenteral nutrition, it is important to check electrolyte levels prior to commencing feed.

2.8.2.2. Low magnesium levels must be corrected before feeding is initiated to minimise the risk of refeeding syndrome.

3. Monitoring compliance and effectiveness

<table>
<thead>
<tr>
<th>Element to be monitored</th>
<th>Clinical Guideline for the Management of Hypomagnesaemia in Adults.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead</td>
<td>Medications Safety Pharmacist.</td>
</tr>
<tr>
<td>Tool</td>
<td>Datix will be used to identify clinical incidents.</td>
</tr>
<tr>
<td>Frequency</td>
<td>The policy will be monitored every three years, or sooner as clinical incidents dictate.</td>
</tr>
<tr>
<td>Reporting arrangements</td>
<td>Clinical incidents on Datix will be reported to the senior nurse/manager in that area and will also be reported to the Medication Safety Group.</td>
</tr>
<tr>
<td>Acting on recommendations and Lead(s)</td>
<td>Actions from incident reports will be at a local level and may also resulting broader actions, co-ordinated by the Medication Safety Group.</td>
</tr>
<tr>
<td>Change in practice and lessons to be shared</td>
<td>Required changes to practice will be identified and actioned within the time frame specified in the action plan.</td>
</tr>
</tbody>
</table>

4. Equality and Diversity

4.1. This document complies with the Royal Cornwall Hospitals NHS Trust service Equality and Diversity statement which can be found in the 'Equality, Inclusion & Human Rights Policy' or the Equality and Diversity website.

4.2. Equality Impact Assessment

The Initial Equality Impact Assessment Screening Form is at Appendix 2.
### Appendix 1. Governance Information

<table>
<thead>
<tr>
<th>Document Title</th>
<th>Treatment of Hypomagnesaemia in Adults Clinical Guideline V3.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>This document replaces (exact title of previous version):</td>
<td>Clinical Guideline for Treatment of Hypomagnesaemia in Adults V2.0</td>
</tr>
<tr>
<td>Date Issued/Approved:</td>
<td>January 2021</td>
</tr>
<tr>
<td>Date Valid From:</td>
<td>March 2021</td>
</tr>
<tr>
<td>Date Valid To:</td>
<td>March 2024</td>
</tr>
<tr>
<td>Contact details:</td>
<td>01872 252587</td>
</tr>
<tr>
<td>Brief summary of contents</td>
<td>Guideline on the diagnosis and treatment of Hypomagnesaemia.</td>
</tr>
<tr>
<td>Suggested Keywords:</td>
<td>hypomagnesaemia, magnesium, electrolyte, electrolytes, replacement, refeeding</td>
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<tr>
<td>Target Audience</td>
<td>RCHT</td>
</tr>
<tr>
<td>Executive Director responsible for Policy:</td>
<td>Medical Director</td>
</tr>
<tr>
<td>Approval route for consultation and ratification:</td>
<td>Medication Practice Committee, Pharmacy, Biochemistry</td>
</tr>
<tr>
<td>General Manager confirming approval processes</td>
<td>Richard Andrezjuk</td>
</tr>
<tr>
<td>Name of Governance Lead confirming approval by specialty and care group management meetings</td>
<td>Kevin Wright</td>
</tr>
<tr>
<td>Links to key external standards</td>
<td>None required</td>
</tr>
<tr>
<td>Related Documents:</td>
<td>None required</td>
</tr>
<tr>
<td>Training Need Identified?</td>
<td>No</td>
</tr>
<tr>
<td>Publication Location (refer to Policy on Policies – Approvals and Ratification):</td>
<td>Internet &amp; Intranet</td>
</tr>
<tr>
<td>Document Library Folder/Sub Folder</td>
<td>Clinical / Pharmacy</td>
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</table>
## Version Control Table

<table>
<thead>
<tr>
<th>Date</th>
<th>Version No</th>
<th>Summary of Changes</th>
<th>Changes Made by</th>
</tr>
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<tbody>
<tr>
<td>Dec 2017</td>
<td>V2.0</td>
<td>Update</td>
<td>Maggie Fitzgerald Pharmacist</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Medicines Information</td>
</tr>
<tr>
<td>January 2021</td>
<td>V3.0</td>
<td>Clinical update. Deletion of mention of giving doses up to 50mmol daily off license, if tolerated.</td>
<td>Lisa Thomas Medicines Information Pharmacist</td>
</tr>
</tbody>
</table>

**All or part of this document can be released under the Freedom of Information Act 2000**

*This document is to be retained for 10 years from the date of expiry.*

*This document is only valid on the day of printing*

**Controlled Document**

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## Appendix 2. Equality Impact Assessment

### Section 1: Equality Impact Assessment Form

<table>
<thead>
<tr>
<th>Name of the strategy / policy / proposal / service function to be assessed</th>
<th>Treatment of Hypomagnesaemia in Adults Clinical Guideline V3.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Directorate and service area: Pharmacy</td>
<td>Is this a new or existing Policy? Existing</td>
</tr>
<tr>
<td>Name of individual/group completing EIA</td>
<td>Lisa Thomas, Medicines Information Pharmacist</td>
</tr>
<tr>
<td>Contact details: 01872 252587</td>
<td></td>
</tr>
</tbody>
</table>

1. **Policy Aim**
   - Who is the strategy / policy / proposal / service function aimed at?
   - To provide guidance on the diagnosis and management of hypomagnesaemia.

2. **Policy Objectives**
   - To ensure the safe treatment of hypomagnesaemia

3. **Policy Intended Outcomes**
   - Treatment of hypomagnesaemia complies with the guidance set out in this document.

4. **How will you measure the outcome?**
   - Incidence reports

5. **Who is intended to benefit from the policy?**
   - Hypomagnesaemic patients and the clinical staff treating them.

6a). **Who did you consult with?**

   - Workforce
   - Patient
   - Local groups
   - External organisations
   - Other

   - X

b). **Please list any groups who have been consulted about this procedure.**

   - Medications Safety Group
   - Medicines Information
   - Biochemistry

c). **What was the outcome of the consultation?**

   - Approved
7. The Impact
Please complete the following table. If you are unsure/don't know if there is a negative impact you need to repeat the consultation step.

Are there concerns that the policy **could** have a positive/negative impact on:

<table>
<thead>
<tr>
<th>Protected Characteristic</th>
<th>Yes</th>
<th>No</th>
<th>Unsure</th>
<th>Rationale for Assessment / Existing Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex (male, female non-binary, asexual etc.)</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender reassignment</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Race/ethnic communities /groups</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disability (learning disability, physical disability, sensory impairment, mental health problems and some long term health conditions)</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Religion/other beliefs</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marriage and civil partnership</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pregnancy and maternity</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sexual orientation (bisexual, gay, heterosexual, lesbian)</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

If all characteristics are ticked ‘no’, and this is not a major working or service change, you can end the assessment here as long as you have a robust rationale in place.

I am confident that section 2 of this EIA does not need completing as there are no highlighted risks of negative impact occurring because of this policy.

Name of person confirming result of initial impact assessment: Lisa Thomas, Medicines Information Pharmacist

If you have ticked ‘yes’ to any characteristic above OR this is a major working or service change, you will need to complete section 2 of the EIA form available here: [Section 2. Full Equality Analysis](#)

For guidance please refer to the Equality Impact Assessments Policy (available from the document library) or contact the Human Rights, Equality and Inclusion Lead debby.lewis@nhs.net