CLINICAL GUIDELINE FOR TREATMENT OF HYPOMAGNESAEMIA

1. **Aim/Purpose of this Guideline**
   1.1. For the treatment of hypomagnesaemia in adults in all clinical areas

2. **The Guidance**

2.1. **Background**
Magnesium is the second most abundant intracellular cation. It is an essential body electrolyte, which is 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. The kidney is the principal organ for magnesium regulation, the major site being the distal tubule.

2.2. **Causes**

2.2.1. Decreased magnesium absorption
Severe malabsorption, malnutrition, excess alcohol intake
Drugs: proton pump inhibitors

2.2.2. Increased renal excretion/loss
Drugs: loop and thiazide diuretics, digoxin, alcohol
Conditions: SIADH
Drug toxicity: aminoglycosides, ciclosporin, amphotericin

2.2.3. Endocrine
Hypothyroidism, hyperthyroidism, hyperaldosteronism, diabetes mellitus, diabetic ketoacidosis

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

2.2.5. Miscellaneous
Acute pancreatitis, excessive lactation, acute intermittent porphyria

2.3. **Signs and Symptoms**
Magnesium depletion may result in abnormal function of the neurological, neuromuscular and cardiovascular systems. 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, hypocalcaemia and metabolic alkalosis. Correction of magnesium may aid the correction of other electrolytes.

- Neuromuscular
  Seizures, muscle weakness, Trousseau and Chvostek signs, depression, psychosis

- Metabolic
  Carbohydrate intolerance, hyperinsulinism, atherosclerosis
• Cardiovascular
  Widening of QRS complex, prolongation of PR interval, severe ventricular
  arrhythmias, sensitivity to cardiac glycosides
• Bone
  Osteoporosis, osteomalacia
• Calcium and potassium
  Refractory hypocalcaemia, refractory hypokalaemia

2.4. Guideline

The specific regime for magnesium replacement is dependent on the clinical
presentation of the patient.
Since serum magnesium concentrations do not reflect the total body store, the
presence of symptoms related to magnesium depletion is more important in
determining the urgency and aggressiveness of treatment.
Serum magnesium concentration may return to within a normal range within the
first 24-hour period during 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, seek specialist endocrinology advice.

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

Routes of administration
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.

Oral
Magnesium supplements should be given orally whenever possible and is
indicated for asymptomatic patients with mild depletion. Diarrhoea tends to limit
the amount of magnesium that can be given orally. If diarrhoea develops, the
dose should be reduced. Other formulations of oral magnesium are available
upon request.

IV
The IV route is the preferred mode of parenteral administration. It may be used in
patients who cannot tolerate or are unlikely to absorb oral magnesium. The
magnesium infusion should not be mixed with any other drugs being infused
peripherally and no other drugs should be added to the infusion bag.

IM
Magnesium may be given intramuscularly in alternate buttocks at a dose of 1g
every 6 hours for 4 doses, where adult doses may be diluted to 25%. However,
the injections are painful, potentially sclerosing and require multiple
administrations. There is no therapeutic advantage over the IV route and so IM
administration should be reserved for those patients where peripheral venous
access is not readily available.
Concentration and rate
Each 10ml vial of magnesium sulphate 50% solution = 20mmol (5g)
For peripheral administration, the concentration should be no greater than 10%.
Therefore, each 1g (4mmol) should be diluted to at least 10ml with sodium chloride 0.9% or glucose 5%.
Depending on the patient’s fluid status, the volume of infusion fluid may range from as little as 50mL to 1L as an alternative IV regime.
A rate of infusion should be no more than 8mmol/hour.

2.5. Monitoring
Plasma magnesium, other electrolytes, e.g. K+, Ca2+, renal function, signs of magnesium toxicity (especially if given parenterally) should be monitored.
Rapid administration may cause flushing and hypotension.
When used as an intravenous infusion for replacement therapy blood pressure and respiratory rate should be monitored.

2.6. Further information/Special instructions
Renal impairment
In patients with renal dysfunction, magnesium excretion is reduced; hence there is an increased risk of hypermagnesaemia.
Patients should therefore be treated with lower doses of magnesium and their serum magnesium levels measured frequently.
It has been suggested that approximately half the normal dose or less should be administered, depending on the extent of renal impairment and whether the patient is symptomatic.
It may be prudent to administer a single dose of magnesium and using the serum magnesium levels to reassess further treatment.

Refeeding Syndrome
When initiating patients on enteral or parenteral nutrition it is important to check electrolyte levels prior to commencing feed.
A low magnesium must be corrected before feeding is initiated to minimise the risk of refeeding syndrome.

2.7. References


3. Monitoring compliance and effectiveness

<table>
<thead>
<tr>
<th>Element to be monitored</th>
<th>Prescribing and therapeutic drug monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead</td>
<td>The Lead Pharmacist for Patient Safety</td>
</tr>
<tr>
<td>Tool</td>
<td>Audit</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>The audit results will be reported to the Medication Practice Committee (MPC) and the individual areas audited 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>The MPC will co-ordinate the actions to the audit results. 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, Diversity & 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. Magnesium Guideline – Mobile Summary
Summary guidance published separately – available via Document Library (search for Magnesium or click here) Treatment of Hypomagnesaemia - Guideline Summary
### Appendix 2. Governance Information

<table>
<thead>
<tr>
<th><strong>Document Title</strong></th>
<th>Clinical guideline for treatment of hypomagnesaemia</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Date Issued/Approved:</strong></td>
<td>November 2014</td>
</tr>
<tr>
<td><strong>Date Valid From:</strong></td>
<td>November 2014</td>
</tr>
<tr>
<td><strong>Date Valid To:</strong></td>
<td>November 2017</td>
</tr>
<tr>
<td><strong>Directorate / Department responsible (author/owner):</strong></td>
<td>Maggie Fitzgerald Senior Pharmacist Medicines Information</td>
</tr>
<tr>
<td><strong>Contact details:</strong></td>
<td>01872 252587</td>
</tr>
<tr>
<td><strong>Brief summary of contents</strong></td>
<td>Safe effective prescribing and monitoring of magnesium</td>
</tr>
<tr>
<td><strong>Suggested Keywords:</strong></td>
<td>Magnesium, Hypomagnesaemia</td>
</tr>
<tr>
<td><strong>Target Audience</strong></td>
<td>RCHT ✓ PCH CFT KCCG</td>
</tr>
<tr>
<td><strong>Executive Director responsible for Policy:</strong></td>
<td>Medical Director</td>
</tr>
<tr>
<td><strong>Date revised:</strong></td>
<td>June 2014</td>
</tr>
<tr>
<td><strong>This document replaces (exact title of previous version):</strong></td>
<td>New Document</td>
</tr>
<tr>
<td><strong>Approval route (names of committees)/consultation:</strong></td>
<td>Medication Practice Committee (2.10.14) CSSC Governance DMB (18.11.14)</td>
</tr>
<tr>
<td><strong>Divisional Manager confirming approval processes</strong></td>
<td>Sally Rowe, Divisional Director</td>
</tr>
<tr>
<td><strong>Name and Post Title of additional signatories</strong></td>
<td>Janet Gardner, Governance Lead CSSC</td>
</tr>
<tr>
<td><strong>Signature of Executive Director giving approval</strong></td>
<td>{Original Copy Signed}</td>
</tr>
<tr>
<td><strong>Publication Location (refer to Policy on Policies – Approvals and Ratification):</strong></td>
<td>Internet &amp; Intranet ✓ Intranet Only</td>
</tr>
<tr>
<td><strong>Document Library Folder/Sub Folder</strong></td>
<td>Clinical / Pharmacy</td>
</tr>
<tr>
<td><strong>Links to key external standards</strong></td>
<td>None</td>
</tr>
<tr>
<td><strong>Related Documents:</strong></td>
<td>See references</td>
</tr>
<tr>
<td><strong>Training Need Identified?</strong></td>
<td>No</td>
</tr>
</tbody>
</table>
Appendix 3. Initial Equality Impact Assessment Form

<table>
<thead>
<tr>
<th>Name of the strategy / policy / proposal / service function to be assessed (hereafter referred to as <em>policy</em>) (Provide brief description):</th>
<th>Directorate and service area: All clinical areas</th>
<th>Is this a new or existing Policy? New</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name of individual completing assessment: Maggie Fitzgerald</td>
<td>Telephone: 01872 252587</td>
<td></td>
</tr>
<tr>
<td>1. Policy Aim* Who is the strategy / policy / proposal / service function aimed at?</td>
<td>To promote safer administration of magnesium supplements</td>
<td></td>
</tr>
<tr>
<td>2. Policy Objectives*</td>
<td>To foster safer prescribing of magnesium supplements</td>
<td></td>
</tr>
<tr>
<td>3. Policy – intended Outcomes*</td>
<td>Safer prescribing of magnesium supplements</td>
<td></td>
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<tr>
<td>4. *How will you measure the outcome?</td>
<td>Audit</td>
<td></td>
</tr>
<tr>
<td>5. Who is intended to benefit from the policy?</td>
<td>Patients receiving magnesium supplements</td>
<td></td>
</tr>
<tr>
<td>6a) Is consultation required with the workforce, equality groups, local interest groups etc. around this policy?</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>b) If yes, have these *groups been consulted?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C). Please list any groups who have been consulted about this procedure.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

7. The Impact
Please complete the following table.

Are there concerns that the policy **could** have differential impact on:

<table>
<thead>
<tr>
<th>Equality Strands:</th>
<th>Yes</th>
<th>No</th>
<th>Rationale for Assessment / Existing Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td>√</td>
<td></td>
<td></td>
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<tr>
<td><strong>Sex</strong> (male, female, trans-gender / gender reassignment)</td>
<td>√</td>
<td></td>
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<tr>
<td>Race / Ethnic communities /groups</td>
<td>✓</td>
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<tr>
<td>Disability - Learning disability, physical disability, sensory impairment and mental health problems</td>
<td>✓</td>
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<tr>
<td>Religion / other beliefs</td>
<td>✓</td>
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<tr>
<td>Marriage and civil partnership</td>
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<tr>
<td>Pregnancy and maternity</td>
<td>✓</td>
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<tr>
<td>Sexual Orientation, Bisexual, Gay, heterosexual, Lesbian</td>
<td>✓</td>
<td></td>
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</tbody>
</table>

You will need to continue to a full Equality Impact Assessment if the following have been highlighted:
- You have ticked “Yes” in any column above and
- No consultation or evidence of there being consultation - this excludes any policies which have been identified as not requiring consultation. or
- Major service redesign or development

8. Please indicate if a full equality analysis is recommended. No

9. If you are not recommending a Full Impact assessment please explain why.

Signature of policy developer / lead manager / director

Date of completion and submission

Names and signatures of members carrying out the Screening Assessment

1. Maggie Fitzgerald
2.

Keep one copy and send a copy to the Human Rights, Equality and Inclusion Lead, c/o Royal Cornwall Hospitals NHS Trust, Human Resources Department, Knowledge Spa, Truro, Cornwall, TR1 3HD

A summary of the results will be published on the Trust’s web site.

Signed ____________________

Date ____________________