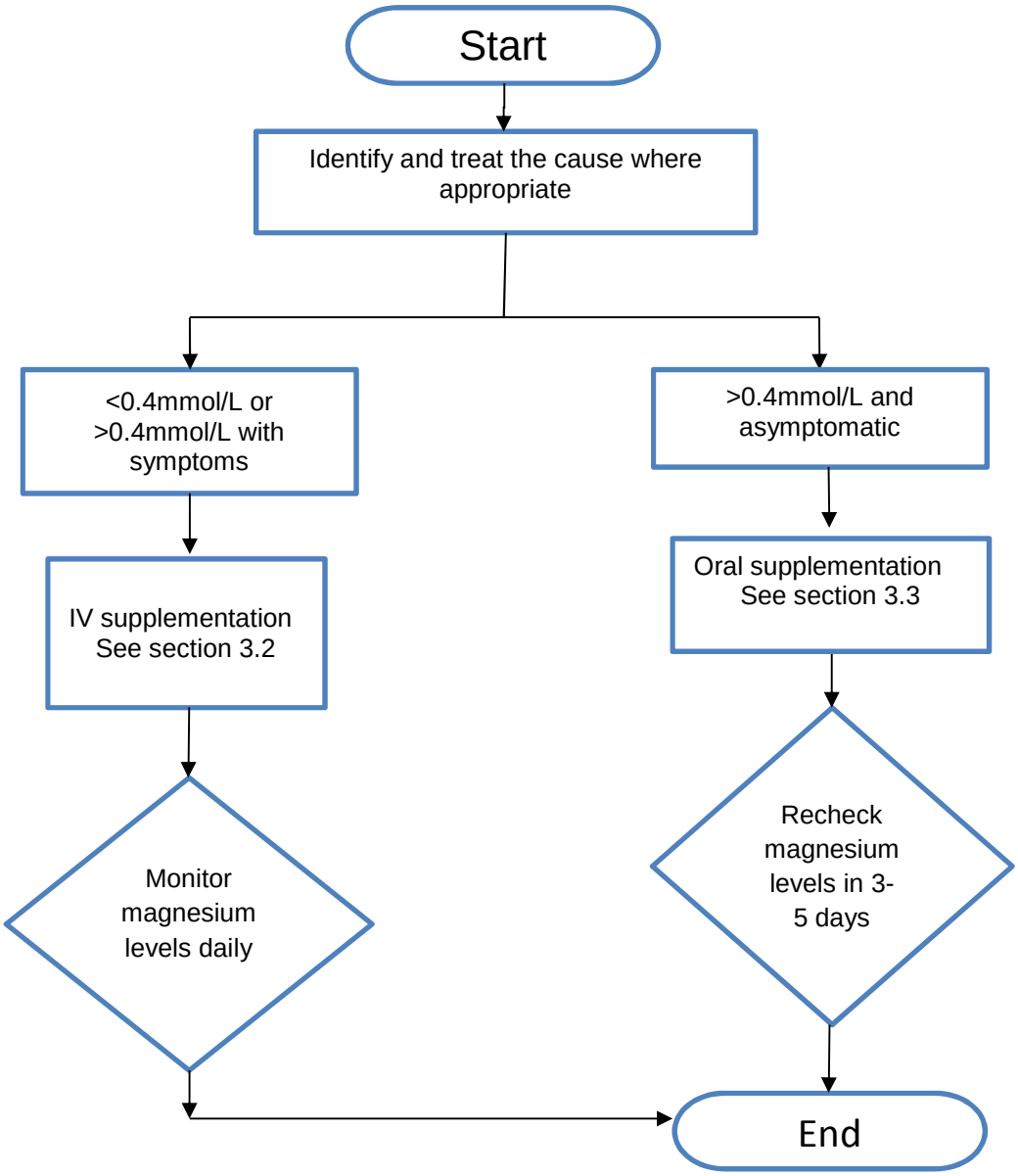
CLINICAL GUIDELINE FOR TREATMENT OF HYPOMAGNESAEMIA IN ADULTS

Summary.

Key:

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



1. Aim/Purpose of this Guideline

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

2. Introduction

2.1. Background

Magnesium (Mg) 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; 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.

2.1.1 Definition of hypomagnaesaemia

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

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

2.2. Causes of hypomagnaesaemia

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
Hyperthyroidism, hyperaldosteronism, diabetes mellitus, diabetic ketoacidosis, vitamin D deficiency

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

2.3. Signs and Symptoms

2.3.1 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.

2.3.2 Symptoms may include:

2.3.2.1 Neuromuscular – *ataxia, carpopedal syndrome, confusion, depression, hallucination, muscle weakness, psychosis, seizures, tremor*

2.3.2.2 Metabolic – *altered glucose homeostasis (carbohydrate intolerance, hyperinsulinism), atherosclerosis*

2.3.2.3 Cardiovascular – *ECG abnormalities (widening of QRS complex, prolongation of PR interval), severe ventricular arrhythmias, sensitivity to cardiac glycosides*

2.3.2.4 Bone - *osteoporosis, osteomalacia*

2.3.2.5 Calcium and potassium - *refractory or unexplained hypocalcaemia, refractory hypokalaemia*

2.3.2.6 GI – a*norexia, nausea*

3. Treatment

3.1 Points to consider

3.1.1 The specific regime for magnesium replacement is dependent on the clinical presentation of the patient. Precipitating agents should be withdrawn if possible, and the underlying cause treated.

3.1.2 Serum magnesium concentrations do not reflect the total body store. A clinical assessment is therefore more useful in guiding treatment approach.

3.1.3 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.

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

3.1.5 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.

3.2 Oral magnesium administration

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

3.2.2 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.

Table 1: Oral magnesium preparation suitable for use at RCHT

Preparation	Route	Contents of 1 sachet	Dose	Other instructions
Magnesium aspartate	Oral	10mmol (=243mg) magnesium	1 sachet once or twice a day	Dissolve in 50-200mL water, tea or orange juice

3.2.2 Doses up to 50mmol daily may be given off license, if tolerated.

3.2.3 Magnesium aspartate is licensed for administration via enteral feeding tubes.

3.3 Intravenous (IV) magnesium administration

3.3.1 For use in symptomatic or severe hypomagnesaemia (<0.4 mmol/L), or in patients who cannot tolerate, or are unlikely to absorb, oral magnesium.

3.3.2 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 Medicines Information for advice.

Table 2: Intravenous magnesium preparation suitable for use at RCHT

Preparation	Route	Dose	Diluent	Rate
Magnesium sulphate 50% (20mmol, or 5g, per 10mLs)	IV	20mmol Mg	≥100mL sodium chloride 0.9% or glucose 5%	Give over 3 hours.

3.3.3 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.

3.3.4 A longer infusion period may be more suitable for non-emergency situations. The usual maximum rate recommended is 8mmol/hour.

3.3.5 Magnesium sulphate 50% injections must be diluted to a concentration of less than 5% (20mmol/100mL) for peripheral administration.

3.4 Intramuscular administration

3.4.1 Magnesium may be given intramuscularly in alternate buttocks at a dose of 1g (4mmol) every 6 hours for 4 doses. 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.

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

4. Monitoring

The following should be monitored daily when replacing magnesium:

4.1 Urea and electrolytes, with special attention to the following:

4.1.1 Magnesium – monitor for therapeutic outcome as well as magnesium toxicity (see section 5), especially if given parenterally.

4.1.2 Potassium and calcium – magnesium levels are closely linked to potassium and calcium; replacing one may affect levels of the others.

4.2 Renal function

4.2.1 Magnesium is renally cleared and can therefore accumulate in renal impairment, causing hypermagnesaemia. 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. Seek renal team input.

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

4.3 Cardiovascular

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

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

5. Cautions and contraindications

5.1 Avoid use in patients with heart block or bradycardia.

5.2 Use with caution in patients with myasthenia gravis.

6. Adverse effects of magnesium replacement

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

6.2 Intravenous magnesium replacement can cause hypermagnesaemia, hypocalcaemia, hypotension and injection site reactions such as phlebitis.

6.2.1 Symptoms of hypermagnesaemia include respiratory depression, loss of deep tendon reflexes due to neuromuscular blockade, thirst, muscle weakness, ECG changes/arrhythmias, double vision, slurred speech, confusion and coma.

7. Of note

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

7.2 Refeeding Syndrome

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

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

1. Monitoring compliance and effectiveness

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

2. Equality and Diversity

2.1. 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.

2.2. Equality Impact Assessment

The Initial Equality Impact Assessment Screening Form is at Appendix 2.

Appendix 1. Governance Information

Document Title	Clinical Guideline for the Management of Hypomagnesaemia in Adults.			
Date Issued/Approved:	January 2018.			
Date Valid From:	January 2018.			
Date Valid To:	January 2021.			
Directorate / Department responsible (author/owner):	Maggie Fitzgerald, Medicines Information. Bronwin Staple, Medicines Information. Simon Fleming, Consultant Biochemist. Ann Cardell, Medication Safety.			
Contact details:	01872 252587			
Brief summary of contents	Guideline on the diagnosis and treatment of Hypomagnesaemia.			
Suggested Keywords:	hypomagnesaemia, magnesium, electrolyte, electrolytes, replacement, refeeding			
Target Audience	RCHT	PCH	CFT	KCCG
	✓			
Executive Director responsible for Policy:	Medical Director.			
Date revised:	N/A			
This document replaces (exact title of previous version):	N/A			
Approval route (names of committees)/consultation:	Medication Practice Committee, Pharmacy, Biochemistry.			
Divisional Manager confirming approval processes	*Head of relevant Division*			
Name and Post Title of additional signatories	Not Required.			
Name and Signature of Divisional/Directorate Governance Lead confirming approval by specialty and divisional management meetings	{Original Copy Signed}			
	Name:			
Signature of Executive Director giving approval	{Original Copy Signed}			
Publication Location (refer to Policy	Internet & Intranet		Intranet Only	✓

on Policies – Approvals and Ratification):				
Document Library Folder/Sub Folder	Clinical / Pharmacy.			
Links to key external standards	None.			
Related Documents:				
Training Need Identified?	No.			

Version Control Table

Date	Version No	Summary of Changes	Changes Made by *(Name and Job Title)*
Dec 2017	V2.0	Update	Maggie Fitzgerald Pharmacist Medicines Information

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

This document has been created following the Royal Cornwall Hospitals NHS Trust Policy on Document Production. It should not be altered in any way without the express permission of the author or their Line Manager.

Appendix 2. Initial Equality Impact Assessment Form

Name of Name of the strategy / policy /proposal / service function to be assessed (hereafter referred to as *policy*) (Provide brief description):	
Directorate and service area: All clinical areas	Is this a new or existing *Policy?* existing policy
Name of individual completing assessment: Maggie Fitzgerald	Telephone: **01872 252587**
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) Is consultation required with the workforce, equality groups, local interest groups etc. around this policy? b) If yes, have these *groups been consulted? C). Please list any groups who have been consulted about this procedure.	No. Medications Safety Group, Medicines Information, Biochemistry.

7. The Impact
Please complete the following table.

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

Equality Strands:	Yes	No	Rationale for Assessment / Existing Evidence
Age		✓	Policy for all patients
Sex (male, female, trans-gender / gender reassignment)		✓	Policy for all patients
Race / Ethnic communities /groups		✓	Policy for all patients
Disability - learning disability, physical disability, sensory impairment and mental health problems		✓	Policy for all patients
Religion / other beliefs		✓	Policy for all patients
Marriage and civil partnership		✓	Policy for all patients
Pregnancy and maternity		✓	Policy for all patients
Sexual Orientation, Bisexual, Gay, heterosexual, Lesbian		✓	Policy for all patients

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 e<u>xcludes</u> 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.	**Yes**	**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 December 2017

Names and signatures of members carrying out the Screening Assessment	1. Maggie Fitzgerald 2. Bronwin Staple 3. Simon Fleming	

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 _____