GUIDELINES FOR THE ACUTE TREATMENT OF HYPOMAGNESAEMIA IN ADULTS

This guidance does not override the individual responsibility of health professionals to make appropriate decision according to the circumstances of the individual patient in consultation with the patient and / or carer. Health care professionals must be prepared to justify any deviation from this guidance.

INTRODUCTION

This guideline covers the treatment of hypomagnesaemia for adult inpatients.

THIS GUIDELINE IS FOR USE BY THE FOLLOWING STAFF GROUPS:

All qualified healthcare professionals involved in prescribing or administering magnesium supplements for adult patients.

Lead Clinician(s)

Keith Hinton	Clinical Team Lead Pharmacist Critical Care and Surgery WAHT
Approved by Pharmacy Governance committee:	7th July 2022
Approved by Medicines Safety Committee:	13th July 2022
Review Date:	13th July 2025
This is the most current document and is to be used until a revised version is available	

Key amendments to this Document:

Date	Amendment	By:
October 2010	Addition oral therapy guidance. Replaces WAHT-CRI-012 as applies to all patients not just ITU	See list
December 2012	No changes – Approved by Nick Hubbard	Keith Hinton
January 2014	Additional monitoring information Updated serum range as per biochemistry	Keith Hinton
December 2015	Addition of magnesium aspartate dehydrate (licensed oral preparation)	Natalie Messer
December 2017	Sentence added in at the request of the Coroner	
March 2018	Document extended for 3 months as approved by TLG	TLG
May 2018	Minor change in formatting to improve clarity of magnesium sulfate dose. No change to clinical content required based on literature review	Ruth Buczko
June 2020	Document extended for 6 months during Covid-19 period	
February 2021	Document extended as per Trust agreement 11/02/2021	

June 2021	Additions made to drug causes Additional directions and contraindications for oral administration Risk of extravasation added for IV administration	Hassan Yasin
June 2022	Inclusion of additional licensed oral magnesium supplement	Keith Hinton

GUIDELINES FOR THE ACUTE TREATMENT OF HYPOMAGNESAEMIA IN ADULTS

INTRODUCTION

This guideline covers the treatment of hypomagnesaemia for adult inpatients.

DETAILS OF GUIDELINE

Classification	Magnesium serum range (mmol/l)
Normal	0.7-1.1
Mild hypomagnesaemia	0.50-0.69
Moderate/severe hypomagnesaemia	< 0.5

NB: Magnesium is mainly an intracellular ion and the serum level may be normal despite significant deficiency.

Signs and symptoms of hypomagnesaemia (Most commonly occur <0.5mmol/L)	
Musculoskeletal	Muscle twitching, tremor, tetany, cramps, seizures
CNS	Apathy, depression, hallucinations, agitation, confusion
Cardiovascular	Tachycardia, hypertension, arrhythmias, increased digoxin toxicity
Biochemical*	Hypokalaemia, hypocalcaemia, hypophosphataemia, hyponatraemia

* All signs and symptoms are generally non specific and could be attributed to other electrolyte abnormalities. Hypomagnesaemia rarely occurs alone and other electrolyte levels must be checked. In any hypokalaemia not responding to supplementation a decreased magnesium level should be suspected.

Causes of hypomagnesaemia:
Common causes include:

- Vomiting and diarrhoea
- Small bowel resection
- Malabsorption states
- Alcoholism
- Chronic renal failure
- Drainage from fistula
- Refeeding syndrome
- Drugs (see below)

Drug induced hypomagnesaemia:
This is not an exhaustive list. Contact your ward pharmacist or Medicines Information (ext 45776) for more details.

- Aminoglycosides (e.g. gentamicin)
- Amphotericin
- Bisphosphonates (e.g. pamidronate)
- Carboplatin
- Ciclosporin
- Cisplatin
- Diuretics (Loop & Thiazides)
- Foscarnet
- Proton pump inhibitors (PPIs)
- Salbutamol
- Tacrolimus
- Theophylline

NB: Potassium sparing diuretics are considered to be magnesium sparing.

TREATMENT:

In acute, severe or symptomatic hypomagnesaemia, cardiac monitoring is advised and magnesium should be given parenterally. Oral magnesium supplementation should be reserved to prevent recurrence of the deficit or to treat non-symptomatic hypomagnesaemia. Oral magnesium supplements can cause diarrhoea and therefore parenteral therapy may be preferred in patients with poor gastrointestinal absorption of magnesium or who are unable to tolerate oral supplements.

For patients at risk of refeeding syndrome, please refer to Trust guideline WAHT-NUT-006. For patients receiving parenteral nutrition please liaise with pharmacy to review the magnesium supplementation within the feed regimen.

IV Administration

- Up to 160mmol magnesium over 5 days may be required to replace the deficit in acute or severe hypomagnesaemia
- Magnesium is given by IV infusion of magnesium sulfate.
- Patients should be treated according to symptoms and serum levels. **A reduced dosage and additional monitoring should be considered in renal impairment.**
- Infusion fluid: Sodium chloride 0.9% or glucose 5%.

Dosing is largely empirical and depends on severity.

Mild (plasma level 0.5 – 0.69mmol/L) or asymptomatic
Magnesium sulfate 5g (20mmol Magnesium) in 250ml infusion fluid usually over 4 hours intravenously (can be given over 2 to 6 hours and 100ml if patient fluid restricted) Reduce the rate of infusion if patient becomes bradycardic.

Moderate/Severe hypomagnesaemia (plasma level <0.5mmol/L) or Symptomatic emergencies e.g. in critical care.
Magnesium sulfate 10g (40mmol Magnesium) in 250ml infusion fluid over 4 hours intravenously For patients with renal impairment, consider reducing the dose to 20mmol and repeating as necessary depending on repeat plasma level and/or patient symptoms.

Dilution:

- Magnesium sulfate 50% must ALWAYS be diluted before use
- A maximum concentration of magnesium sulfate 5% (50mg/mL) is recommended for peripheral administration (20mmol in 100ml) and should ideally be given centrally due to high osmolarity and risk of phlebitis.
- Suggested practice is to dilute up to 5g magnesium sulfate (20mmol magnesium) in 250mL of diluent
- Maximum rate is 150mg/min (20mmol over 33mins)
- Magnesium sulphate has a high osmolarity and may cause tissue damage if it extravasates into the surrounding tissue

Oral Administration

- To prevent recurrence of the deficit or to treat non-symptomatic hypomagnesaemia, magnesium may be given orally as a dose of 10-20mmol magnesium daily (10mmol once daily or 10mmol twice daily).
- This can be given as **1 sachet once daily** or **1 sachet twice daily of magnesium L-Aspartate as Magnaspartate® sachets** depending on severity of deficiency.
- Magnaspartate® sachets contain 243mg (10mmol) of magnesium.
- The contents of the sachet should be reconstituted and given immediately. (It can be reconstituted in 50-200mls of water, orange juice or tea).
- Oral magnesium salts commonly cause diarrhoea which may be reduced by administration with or after food. Therefore, consider IV supplementation for patients with diarrhoea or high output stomas.
- Note that Magnaspartate® sachets are **contraindicated in patients with severe renal impairment (i.e. GFR < 30 ml/min)**
- If this is insufficient in maintaining serum magnesium level within normal range, or for patients who are intolerant to magnaspartate, switching to an alternative magnesium salt may be appropriate e.g. **magnesium chewable tablets 4mmol** at a dose of 1 to 2 tablets three times a day. Please contact your ward pharmacist or Pharmacy department for more information.
- In prolonged deficiency states e.g. short bowel syndrome, high ileostomy output please refer the patient to the dietitian for assessment and optimisation of dietary intake.
- Contact your ward pharmacist for more information on the use of Magnaspartate in pregnancy, breastfeeding and patients with feeding tubes.

MONITORING:

Magnesium levels should be checked daily as plasma levels may be artificially high whilst magnesium equilibrates with the intracellular compartment. Monitor calcium and other electrolyte plasma levels in patients with hypomagnesaemia.

However if toxicity is suspected treatment should be discontinued.
Patients at risk of hypermagnesaemia include the elderly and patients with renal insufficiency.
Clinical signs include:

- Hypotension
- Bradycardia
- Respiratory depression
- Depressed mental state
- Nausea and vomiting
- ECG abnormalities

During intravenous magnesium supplementation, monitor blood pressure, respiratory rate, heart rate, signs of hypermagnesaemia.

Monitoring Tool

Page/ Section of Key Document	Key control:	Checks to be carried out to confirm compliance with the policy:	How often the check will be carried out:	Responsible for carrying out the check:	Results of check reported to: *(Responsible for also ensuring actions are developed to address any areas of non-compliance)*	Frequency of reporting:
Page 4	All patients identified as acute hypomagnesaemia will have their plasma levels monitored daily until plasma concentration is in range and stable	Audit	Every 12 months	Nutrition and hydration committee	To directorates as appropriate	Annually

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CONTRIBUTION LIST

Key individuals involved in developing the document

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Circulated to the following CD's / Heads of dept for comments from their directorates / departments

Name	Directorate / Department
Dr Edwin Mitchell	Clinical Director, ICCU WAHT

Circulated to the chair of the following committee's / groups for comments

Name	Committee / Group
Steve Graystone	Chair of the Medicines Optimisation Committee
Alison Smith	Principal Pharmacist Medical Safety

Supporting Document 1 - Equality Impact Assessment Tool

To be completed by the key document author and included as an appendix to key document when submitted to the appropriate committee for consideration and approval.

Please complete assessment form on next page;

Herefordshire & Worcestershire STP - Equality Impact Assessment (EIA) Form
Please read EIA guidelines when completing this form

Section 1 - Name of Organisation (please tick)

Herefordshire & Worcestershire STP		Herefordshire Council		Herefordshire CCG	
Worcestershire Acute Hospitals NHS Trust	x	Worcestershire County Council		Worcestershire CCGs	
Worcestershire Health and Care NHS Trust		Wye Valley NHS Trust		Other (please state)	

Name of Lead for Activity	

Details of individuals completing this assessment	**Name**	**Job title**	**e-mail contact**
	Keith Hinton	**Clinical team lead Pharmacist**	**keith.hinton1@nhs.net**
Date assessment completed	**23.06.2022**		

Section 2

Activity being assessed (e.g. policy/procedure, document, service redesign, policy, strategy etc.)	**Title:** Guideline for the acute treatment of hypomagnesaemia			
What is the aim, purpose and/or intended outcomes of this Activity?	As per title			
Who will be affected by the development & implementation of this activity?	X X ❑ ❑	Service User Patient Carers Visitors	X ❑ ❑ ❑	Staff Communities Other _____
Is this:	X Review of an existing activity ❑ New activity ❑ Planning to withdraw or reduce a service, activity or presence?			

What information and evidence have you reviewed to help inform this assessment? (Please name sources, eg demographic information for patients / services / staff groups affected, complaints etc.	See references
Summary of engagement or consultation undertaken (e.g. who and how have you engaged with, or why do you believe this is not required)	Via MSC
Summary of relevant findings	

Section 3

Please consider the potential impact of this activity (during development & implementation) on each of the equality groups outlined below. **Please tick one or more impact box below for each Equality Group and explain your rationale**. Please note it is possible for the potential impact to be both positive and negative within the same equality group and this should be recorded. Remember to consider the impact on e.g. staff, public, patients, carers etc. in these equality groups.

Equality Group	Potential positive impact	Potential neutral impact	Potential negative impact	Please explain your reasons for any potential positive, neutral or negative impact identified
Age		X		
Disability		X		
Gender Reassignment		X		
Marriage & Civil Partnerships		X		
Pregnancy & Maternity		X		
Race including Traveling Communities		X		
Religion & Belief		X		
Sex		X		
Sexual Orientation		X		
Other Vulnerable and		x		

Equality Group	Potential positive impact	Potential neutral impact	Potential negative impact	Please explain your reasons for any potential positive, neutral or negative impact identified
Disadvantaged Groups (e.g. carers; care leavers; homeless; Social/Economic deprivation, travelling communities etc.)				
Health Inequalities (any preventable, unfair & unjust differences in health status between groups, populations or individuals that arise from the unequal distribution of social, environmental & economic conditions within societies)		x		

Section 4

What actions will you take to mitigate any potential negative impacts?	Risk identified	Actions required to reduce / eliminate negative impact	Who will lead on the action?	Timeframe
		.		
How will you monitor these actions?				
When will you review this EIA? (e.g in a service redesign, this EIA should be revisited regularly throughout the design & implementation)				

Section 5 - Please read and agree to the following Equality Statement

1. Equality Statement

1.1. All public bodies have a statutory duty under the Equality Act 2010 to set out arrangements to assess and consult on how their policies and functions impact on the 9 protected characteristics: Age; Disability; Gender Reassignment; Marriage & Civil Partnership; Pregnancy & Maternity; Race; Religion & Belief; Sex; Sexual Orientation
1.2. Our Organisations will challenge discrimination, promote equality, respect human rights, and aims to design and implement services, policies and measures that meet the diverse needs of our service, and population, ensuring that none are placed at a disadvantage over others.
1.3. All staff are expected to deliver services and provide services and care in a manner which respects the individuality of service users, patients, carer's etc, and as such treat them and members of the workforce respectfully, paying due regard to the 9 protected characteristics.

Signature of person completing EIA	Keith Hinton
Date signed	23/06/2022
Comments:	
Signature of person the Leader Person for this activity	
Date signed	
Comments:	

Supporting Document 2 – Financial Impact Assessment

To be completed by the key document author and attached to key document when submitted to the appropriate committee for consideration and approval.

	Title of document:	Yes/No
1.	Does the implementation of this document require any additional Capital resources	No
2.	Does the implementation of this document require additional revenue	No
3.	Does the implementation of this document require additional manpower	No
4.	Does the implementation of this document release any manpower costs through a change in practice	No
5.	Are there additional staff training costs associated with implementing this document which cannot be delivered through current training programmes or allocated training times for staff	No
	Other comments:	

If the response to any of the above is yes, please complete a business case and which is signed by your Finance Manager and Directorate Manager for consideration by the Accountable Director before progressing to the relevant committee for approval