The magnesium loading test: a multicentre audit

Centre I.D: Patient number:	Patient sticker Name: Hospital No:

Patient details		
Age	ECOG Performance Status	Diagnosis

Possible contributing factors to magnesium deficiency		Yes	No
Inadequate dietary intake	Anorexia		
	Dysphagia		
	Nausea and vomiting		
	Other (Please specify)		
Poor absorption	Pancreatic insufficiency		
	Cholestasis		
	Small bowel resection		
	Other (Please specify)		
Increased GI losses	Diarrhoea		
	Intestinal fistula		
	Other (Please specify)		
Increased Renal losses	Renal disease (e.g. ATN, interstitial nephritis) (Please specify:)		
	Medication (e.g. furosemide, previous cisplatin, cyclosporin, gentamicin) (Please specify)		
	Other (Please specify)		

Reason for magnesium loading test		
Symptoms considered possibly due to magnesium deficiency:		Tick all that apply
Pain		
Muscle weakness		
Tremor, twitching or cramps		
Lethargy		
Depression		
Serum electrolyte disturbance	Hypokalaemia	
	Hypocalcaemia	
	Hypophosphataemia	
Other reason (please specify)		

Confirming magnesium deficiency		
Patient group	**Action**	**Tick which applies**
Patients with a low serum magnesium	This is diagnostic of deficiency. A loading test is not needed. Proceed to magnesium replacement.	
Patients with impaired renal function	The loading test is not valid if renal function is impaired (creatinine>120micromol/l and urea>12mmol/l). Discuss further investigation with a clinical biochemist	
All other patients	Loading test required to confirm magnesium deficiency. Magnesium is a predominantly intracellular ion and a normal serum magnesium result does not exclude magnesium deficiency.	

Conducting the magnesium loading test	
Prior to starting the test you will need	• patients weight • 24 hour urine collection bottle (no additive, as used for creatinine clearance) • magnesium sulphate injection (50% solution is equivalent to 2mmol/ml).
Conducting the test	Prior to giving magnesium collect the pre-infusion urine • collect in a normal urine tube (as used for urine bacteriology) • send to biochemistry requesting 'urinary magnesium and creatinine'.
	Commence the intravenous magnesium infusion • give magnesium 0.1mmol/Kg in 100ml of glucose 5% over 4 hours (e.g. 60Kg person requires 6mmol, i.e. 3ml of the 2mmol/ml solution) • simultaneously start the 24 hour urine collection when the infusion starts **Record magnesium dose given**: • when completed send the 24 hour collection to biochemistry requesting '24 hour urinary magnesium and creatinine'.
Notes	• patients sometimes experience a warm flushing sensation in the cannulated arm during the infusion.

Interpreting results of the loading test		
Results required for calculating '%magnesium retention'	Pre-infusion urine magnesium concentration (mmol/l)	Please record here
	Pre-infusion urine creatinine concentration (mmol/l)	
	24 hour urine magnesium (mmol) [Total, *not* concentration]	
	24 hour urine creatinine (mmol) [Total, *not* concentration]	
	Dose of magnesium infused (mmol)	
Calculating the % retention $\left[1 - \frac{\text{24hr urinary Mg} - (\text{preinfusion urinary Mg / Cre ratio} \times \text{24hr urinary creatinine})}{\text{Dose of Mg infused}}\right] \times 100$		
Interpreting the result (record % here)	Patients retaining >50% (likely to be magnesium deficient).	Please tick which applies
	Patients retaining <50% (unlikely to be deficient).	
Notes	The % retention may be greater than 100%. This still indicates deficiency.	

Prescribing magnesium replacement

Initial magnesium replacement is given as daily intravenous magnesium infusions over 3 days:

- **Day 1**: **50mmol** of magnesium in 250 ml of glucose 5% or saline 0.9% over 2 hours
- **Day 2**: **25mmol** of magnesium in 250 ml of glucose 5% or saline 0.9% over 2 hours
- **Day 3**: **25mmol** of magnesium in 250 ml of glucose 5% or saline 0.9% over 2 hours.

Patients commonly experience transient flushing and a sensation of warmth during the infusions. If unpleasant, slow rate of infusion to 4 hours.

Because the degree of deficiency is difficult to determine, further replacement is empirical, guided by symptoms, serum magnesium and renal function. Options include:

- intermittent intravenous magnesium (e.g. once weekly outpatient infusions)
- oral magnesium supplementation (generally poorly absorbed). For further information on preparations see palliative care formulary (page 256-259 of 2nd edition).

Symptom record

Baseline symptoms (complete before replacement)	**If magnesium replaced:** (complete between 7 and 14 days after completing replacement. **Please record number of days:)**
1. Pain	
a. Cause (e.g. 'neuropathic due to tumour infiltration of brachial plexus')	**c. Outcome**. Please ask the patient if their pain is much worse / slightly worse / same / slightly better / much better
b. Severity. Please ask the patient to rate their pain as none slight moderate severe	**d. Potential additional contributors to outcome** (e.g. 'gabapentin added')
2. Muscle weakness	
a. Potential contributors (e.g. 'long term corticosteroids')	**c. Outcome**. Please ask the patient if their weakness is much worse / slightly worse / same / slightly better / much better
b. Severity. Please ask the patient to rate their weakness as none slight moderate severe	**d. Potential additional contributors to outcome** (e.g. 'blood transfusion')

3. Low mood

a. Potential contributors (e.g. 'long term corticosteroids')

b. Severity. Please ask the patient to rate their mood as

very low | fairly low | normal | fairly good | very good

Please also provide your own assessment of their mood as

very low | fairly low | normal | fairly good | very good

c. Outcome. Please ask the patient if their mood is

much worse | slightly worse | same | slightly better | much better

d. Potential additional contributors to outcome (e.g. 'methylphenidate added')

4. Other symptoms considered possibly due to magnesium deficiency

a. Symptom

b. Potential causes/contributors

c. Severity. Please ask the patient to rate the symptom as

none | slight | moderate | severe

d. Outcome. Please ask the patient if the symptom is

much worse | slightly worse | same | slightly better | much better

e. Potential additional contributors to outcome

5. Other symptoms considered possibly due to magnesium deficiency

a. Symptom

b. Potential causes/contributors

c. Severity. Please ask the patient to rate the symptom as

none | slight | moderate | severe

d. Outcome. Please ask the patient if the symptom is

much worse | slightly worse | same | slightly better | much better

e. Potential additional contributors to outcome

Please send a patient anonymised copy of completed forms to Dr Andrew Wilcock, Hayward House, City Hospital, Hucknall Road, Nottingham, NG5 1PB, United Kingdom.

Thank you for helping with this audit