The magnesium loading test: a multicentre audit

Example

Centre I.D: **Nottingham** Patient number: **1**	Patient sticker Name: ********** Hospital No: **N********

Patient details		
Age **78**	ECOG Performance Status **3**	Diagnosis **Colon with bone mets**

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) **Furosemide 40mg each morning**	√	
	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**: **7mmol** • 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 **4.3**
	Pre-infusion urine creatinine concentration (mmol/l)	**7.6**
	24 hour urine magnesium (mmol) [Total, *not* concentration]	**3.7**
	24 hour urine creatinine (mmol) [Total, *not* concentration]	**5.5**
	Dose of magnesium infused (mmol)	**7mmol**
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) **92%**	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') **Bone pain due to lumbar and rib mets**	**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') **Radiotherapy to mets 3 weeks prior to Mg replacement**
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')

Recent confirmation of cancer recurrence

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

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

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

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

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

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

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

none | slight | moderate | severe

e. Potential additional contributors to outcome

5. Other symptoms considered possibly due to magnesium deficiency

a. Symptom

b. Potential causes/contributors

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

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

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

none | slight | moderate | severe

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