A case of hypomagnesaemia due to malabsorption, unresponsive to oral administration of magnesium glycerophosphate, but responsive to oral magnesium oxide supplementation

Introduction—Oral and intravenous replacement of minerals such as magnesium and calcium are usually straightforward in clinical practice, the choice generally being governed by the preparation most readily available. There are very few data comparing efficacy and absorption profiles of different magnesium salts. This case report highlights the importance of considering alternative preparations of oral magnesium salts in patients who appear unresponsive to one preparation, rather than moving on to chronic intravenous therapy via a Hickman line. In the case of patients with small bowel shortening, the use of magnesium oxide should be considered.

Case report—A 39 year old Jamaican woman presented on the ward that the patient ingested all the tablets on three 95 mg tablets nine times a day, equivalent to 108 mmol/day of magnesium. This failed to maintain adequate serum magnesium concentrations, despite observation by staff on the ward that the patient ingested all the tablets each day. She required intravenous magnesium “top ups” on days 1, 6, 10, 16, 18, 23, 36, and 40 as a result of repeated episodes of symptomatic hypomagnesaemia. Six weeks after admission there was concern that she may require lifelong intravenous magnesium supplementations. However, a different magnesium preparation, magnesium oxide, was then substituted as there have been anecdotal reports of its efficacy. The patient’s serum magnesium subsequently stabilised at 0.58 mmol/l with a dose of three 100 mg tablets nine times a day of magnesium oxide, equivalent to 67.5 mmol of magnesium per day. She was then discharged home on this regimen.

After discharge from hospital, her serum magnesium initially remained stable between 0.58 and 0.62 mmol/l, and she was asymptomatic. However, 14 weeks later she decided to reduce her magnesium oxide intake to two tablets four times a day and her serum magnesium fell to 0.42 mmol/l (fig 1); this prompted her to restart the original dose of three tablets nine times a day. Figure 1 demonstrates changes in serum magnesium concentration with time, together with her corresponding doses and preparations of oral magnesium.

Discussion—Magnesium is an essential element and deficiency is rarely encountered in normal individuals but its presence usually indicates underlying disease such as short bowel syndrome. Magnesium deficiency is a known complication of extensive bowel resection and this was the most likely cause in our patient as renal loss was found to be minimal. The daily requirement for magnesium has been estimated to be up to 15 mmol/day. Only one third to a half of ingested magnesium is absorbed, and the site of maximal absorption appears to be the small intestine, mainly the distal part of the ileum. The fraction of magnesium absorbed increases as magnesium intake decreases.

Our patient failed to maintain serum magnesium levels when taking 108 mmol/day of a standard magnesium preparation, magnesium glycerophosphate. However, she stabilised on 67.5 mmol/day of the magnesium oxide supplement. The ability of the patient to absorb and/or retain magnesium seems to have been dependant on the preparation.

The most common magnesium salts used to maintain magnesium levels, after intravenous replacement has been given, are the glycerophosphate, oxide, acetate, citrate, phosphate, aspartate, hydroxide, and lactate salts. There is little evidence comparing the relative bioavailability of...
these different preparations. The British National Formu-
lar currently recommends magnesium glycerophosphate
tables in a dose of 24 mmol daily in divided doses, but this
preparation is not licensed. Administration of magnesium
sulphate leads to diarrhoea and magnesium chloride is very
hygroscopic and therefore difficult to formulate. Magnes-
imium aspartate and acetate are used elsewhere in Europe.
Magnesium hydroxide and oxide have anecdotally been
reported to be efficacious in case reports, magnesium oxide
was used in 12 patients who had undergone intesti-
nal shunts for obesity, and magnesium hydroxide was
effective in patients with renal calculi.

Three studies have attempted to estimate the absorption
of magnesium oxide using urinary excretion data, but none
in patients with short bowel syndrome. Lindberg and
colleagues10 studied 18 male volunteers who were given
three oral loading tests in random order: magnesium citrate
(25 mmol), magnesium oxide (25 mmol), or distilled
water. The increment in serum magnesium over four hours
following loading was higher with the citrate than the
oxide: 0.063 (0.135) versus 0.014 (0.007) mmol/l. Muhlbauer and colleagues, using a similar technique,
found magnesium oxide capsules had lower cumulative
magnesium urinary excretion than L-aspartate HCL
tables in eight healthy volunteers but plasma magnesium
levels remained unchanged after treatment. Altura and
colleagues10 studied 18 male volunteers who were given
magnesium enriched diets and then 12.34 mmol of
magnesium as oxide or phosphate plus oxide, and found
that the magnesium oxide preparation improved serum
magnesium in those with low basal serum levels but not in
those with normal/high serum levels, although again total
magnesium remained the same.

We do not know why magnesium oxide was much better
absorbed than magnesium glycerophosphate in our patient.
It may be that magnesium oxide is better absorbed
than magnesium glycerophosphate in patients with a
shortened small bowel and hence malabsorption, but the
cumulative absorption kinetics have never been studied in
such patients. However, switching magnesium prepa-
ration in this patient and subsequent stabilisation of her
serum magnesium level enabled her to avoid insertion of a
permanent Hickman line for lifelong intravenous magne-
sium, and all the associated complications. Until the
absorption kinetics are further elucidated we would
recommend consideration of magnesium oxide for supple-
mentation in patients, particularly those with short bowel
syndrome and limited absorption, who fail to respond to
magnesium glycerophosphate or indeed other prepara-
tions. Clearly, compliance is a potential issue but we do not
believe this to be the reason for the apparently different
efficacy of the magnesium preparations given to our
patient.

J R ROSS
P I DARGAN
A L JONES

Department of Medicine, Guy’s and St Thomas’ Hospital Trust,
Guy’s Hospital, London SE1 9RT, UK

A KOSTRZEWSKI

Department of Pharmacy, Guy’s and St Thomas’ Hospital Trust,
Guy’s Hospital, London SE1 9RT, UK

Correspondence to: Dr J R Ross, SpR Palliative Medicine, St. Joseph’s Hospice,
Marc Street, London E18 4SA, UK; joy.ross@talk21.com

1 Hallberg D. Magnesium problems in gastroenterology. Acta Med
55.
3 Seeling MS. The requirement of magnesium by normal adults summary and
4 Wester PO, Dycrner T. The importance of the magnesium ion. Magnesium
5 Rude KR. Magnesium metabolism and deficiency. Endocrinol Metab Clin
6 Parfitt K, ed. Martindale, the complete drug reference, 32nd edn. London:
7 British National Formulary, 38th edn. London: BMA and Royal Pharmaceu-
9 Muhlbauer B, Schwenk M, Coram WM, et al. Magnesium-L-aspartate-
HCL and magnesium-oxide: bioavailability in healthy volunteers. Eur J
Mg-enriched diet and different orally administered magnesium oxide
preparations on ionized Mg, Mg metabolism and electrolytes in serum of
among patients receiving home intravenous therapy with peripheral, central
100S.
A case of hypomagnesaemia due to malabsorption, unresponsive to oral administration of magnesium glycerophosphate, but responsive to oral magnesium oxide supplementation

J R ROSS, P I DARGAN, A L JONES and A KOSTRZEWSKI

Gut 2001 48: 857-858
doi: 10.1136/gut.48.6.857