Calcium Alginate versus Aluminum Hydroxide in Patients on Hemodialysis

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Dear Sir,

Calcium alginate is a natural polyuronic acid charged with calcium which has been used successfully as a phosphate binder in patients on peritoneal [1] and hemodialysis [2, 3] in Germany. In addition to being aluminum-free, it has the potential advantage of causing less hypercalcemia than other calcium-containing phosphate binders. No other clinical studies of calcium alginate have been published, although another group reported it to be less effective than the initial studies suggested [4]. Therefore, we compared the efficacy of calcium alginate to that of aluminum hydroxide in patients on hospital hemodialysis.

Seventeen patients (9 males), aged 56.3 ± 2.9 years and on hemodialysis in hospital for 4.1 ± 0.9 years, were enrolled in the study. There were 4 dropouts [due to death from ischemic heart disease (2), transplantation (1) and transfer to home hemodialysis (1)]. Twelve patients completed the study, and in another patient who died of ischemic heart disease, data are available from the first 2 months of each arm. Patients were randomized to receive aluminum hydroxide ('Alutabs', Riker Labs Aust., 600-mg tablet) for 6 months followed by calcium alginate ('Phospholok', Fisons Pty. Ltd., elemental Ca^{2+} 102 mg/g) in divided doses with meals (7 patients), or calcium alginate followed by aluminum hydroxide (6 patients). Dose was titrated each month to keep predialysis serum phosphate below 2 mmol/l (6.2 mg/dl) 3 days after the previous dialysis, to a maximum of 5.4 g $[\text{Al}(\text{OH})_3]$ and 8.4 g (calcium alginate) per day. If phosphate was not controlled on maximum dose, Mylanta II [400 mg $\text{Al}(\text{OH})_3$, 400 mg $\text{Mg}(\text{OH})_2$ per tablet, Parke Davis Pty. Ltd.] was added. Magnesium aspartate (not with meals) was used to keep serum magnesium normal in patients not requiring Mylanta. Diet and dialysis time (4.2 ± 0.1 h 3 times per week) and dialysis calcium [1.5 mmol/l, (6 mg/dl)] were kept constant. No patients received vitamin D. For simplicity, and as results for each binder were not altered by the order of administration, data for each arm have been combined.

Serum phosphate was not different between the 2 treatment arms after 4 months, but prior to this, during the period of dose titration, it was significantly higher with calcium alginate (fig. 1). One patient developed hypercalcemia at 3 months while receiving calcium alginate (8.4 g/day), which persisted despite reduction of calcium alginate to 6 g/day [peak serum calcium 2.83 mmol/l (11.3 mg/dl)]. Otherwise, serum calcium was not different. Serum electrolytes, urea, creatinine, magnesium, alkaline phosphatase (measured monthly) and parathyroid hormone (whole molecule, RIA) were not different (table 1). Plasma aluminum was significantly higher during

treatment with aluminum hydroxide (fig. 2), and although plasma aluminum after desferrioxamine (40 mg/kg intravenously) was also higher, the apparent difference was not statistically significant (table 1). Side effects were minor with both treatments, pruritis and occasional worsening of bone pain (during periods of poor phosphate control) and minor bowel disturbance (constipation with aluminum hydroxide, mild diarrhea in 1 patient with calcium alginate). Five patients preferred to take aluminum hydroxide, 5 calcium alginate and 2 had no preference.

Although this study confirms previous reports [2, 3] of the effectiveness of calcium alginate as a single agent in some hemodialysis patients, adequate phosphate control was achieved in 60% of patients only after another phosphate binder was added. However, an extra phosphate binder was also needed in 30% of patients while on aluminum hydroxide, even though the maximum dose of aluminum hydroxide was more than 2 times that currently recommended [5]. As might be expected, evidence of aluminum accumulation improved during treatment with calcium alginate. The previous claims that hypercalcemia is rare with calcium alginate [2, 3] are not substantiated as the incidence of hypercalcemia was similar to that reported with other calcium-containing phosphate binders in which the dose of elemental calcium was higher [6, 7].

Table 1. Serum and plasma values and drug doses during treatment with aluminium hydroxide (A) and calcium alginate (C)

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E

α to

1 2 3

Months

Fig. 1. Serum phosphate during treatment with aluminum hydroxide (O) or calcium alginate (D).

*p < 0.05; **p < 0.01. To convert to mg/dl, multiply by 3.1.

§ 5

E 3

Values are mean ± SEM. Normal values: calcium 2.13-2.63 mmol/l, magnesium 0.65-1.05 mmol/l, alkaline phosphatase 30-115 U/l, parathyroid hormone < 0.4 µg/ml. There were no statistically significant differences between A and C at either 3 or 6 months. Conversion: for calcium in mg/dl multiply by 4; for magnesium in mg/dl multiply by 2.4.

- 1 -

2 3

Months

Fig. 2. Plasma aluminum during treatment with aluminum hydroxide (O) and calcium alginate (□). *p < 0.05; **p = 0.01.

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