

# A RISE IN DIALYSATE MAGNESIUM CONCENTRATION: SAFETY AND EFFECTS ON BONE METABOLISM MARKERS IN HEMODIALYSIS PATIENTS

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## Background and Aim

Metabolic bone disease is a common complication of chronic kidney disease and is part of a broad spectrum of disorders of mineral metabolism that occur in this clinical setting. The role of magnesium (Mg) in bone metabolism and in the pathogenesis of renal bone disease has been a matter of debate. At present, in hemodialysis (HD) patients, the relationship of serum Mg and parathormone levels remains controversial. We conducted a prospective study to determine the influence of an increase in dialysate Mg on serum Mg and bone metabolism biochemical parameters.

## Methods

- In 29 stable HD patients, dialysate Mg concentration was increased from 0.5 to 0.75 mmol/l for a period of 4 months. All patients underwent dialysis three times weekly using dialyzers with polysulfone membranes. Patient characteristics are summarized in Table 1.
- Serum levels of Mg, intact PTH, calcium (Ca), phosphorus (P) alkaline phosphatase (ALP), albumin (Alb), were measured once monthly before midweek session 3 months before and 4 after Mg change in dialysate. Blood samples were obtained after an overnight fast and immediately before the dialysis session. Calcium dialysate concentration and secondary hyperparathyroidism treatment were kept unchanged during the study. Urea reduction ratio (URR) and Kt/V were maintained constant >65% and 1.2, respectively.
- Serum Mg, Ca, P, and ALP were measured by standard automated techniques and PTH by immunoradiometric assay. The normal ranges for serum Mg and PTH in our laboratory are 1.8 to 2.9 mg/dl and 15 to 65 pg/ml, respectively. Total Ca levels were corrected for serum albumin level.
- We compared the mean value of each parameter before and after dialysate Mg change using paired t-test, with statistical significance at  $P < 0.05$ . Possible relationships between serum levels of Mg and those of PTH, Ca, P, ALP and Alb were evaluated by linear correlation analysis.

Table 1. Patient characteristics

Age (median, range) years	65 (42-85)
Sex (Men/Women)	20/9
Hemodialysis duration (median, range) months	72 (12-348)
Diabetics/non diabetics	9/20
Dialysis modality	
Classic Hemodialysis/On line Hemodiafiltration	20/9
Primary nephropathy	
Glomerulonephritis	3
Nephrosclerosis	3
Diabetic nephropathy	6
Chronic pyelonephritis	2
Polycystic kidneys	2
Unknown	13

## Results

Mild hypermagnesemia (serum Mg > 2.9, to a maximum of 3.2 mg/dl) was observed in 4 (13.8%) patients at the 3<sup>rd</sup> and 8 (27.6%) at the 4<sup>th</sup> month, post dialysate change.

There was a significant increase in serum Mg and Alb with a decrease in serum Ca without significant change in serum iPTH, ALP and P levels (Table 2).

No significant correlations were found between Mg levels and PTH (Figure 1), Ca (Figure 2), Alb (Figure 3), ALP and P levels.

In the post dialysate Mg increase period, serum Mg levels were significantly lower in patients on proton pump inhibitors (PPIs, n=16) than in those without PPIs (2.49 0.24 vs 2.66 0.16 mg/dl, p=0.03).

Patients were classified into those with an initial PTH levels > 300 pg/ml (n=11) and < 300 pg/ml (n=18). Except for the values of PTH there was no difference in the other laboratory parameters.

The main results were not influenced by diabetic status or dialysis modality.

Table 2. The laboratory parameters before and after dialysate Mg increase

	Before	After	P
Mg (mg/dl)	2.30 0.27	2.57 0.22	<0.001
iPTH (pg/ml)	331.8 243.6	382.2 271.5	NS
Ca (mg/dl)	9.7 0.40	9.1 0.5	<0.001
P (mg/dl)	5.0 1.4	4.9 1.3	NS
ALP (U/l)	255.1 119.8	241.0 91.8	NS
Alb (mg/dl)	3.8 0.5	3.9 0.4	0.025

Figure 2. Correlation of serum Calcium (Ca) and Magnesium (Mg) values after dialysate Mg increase

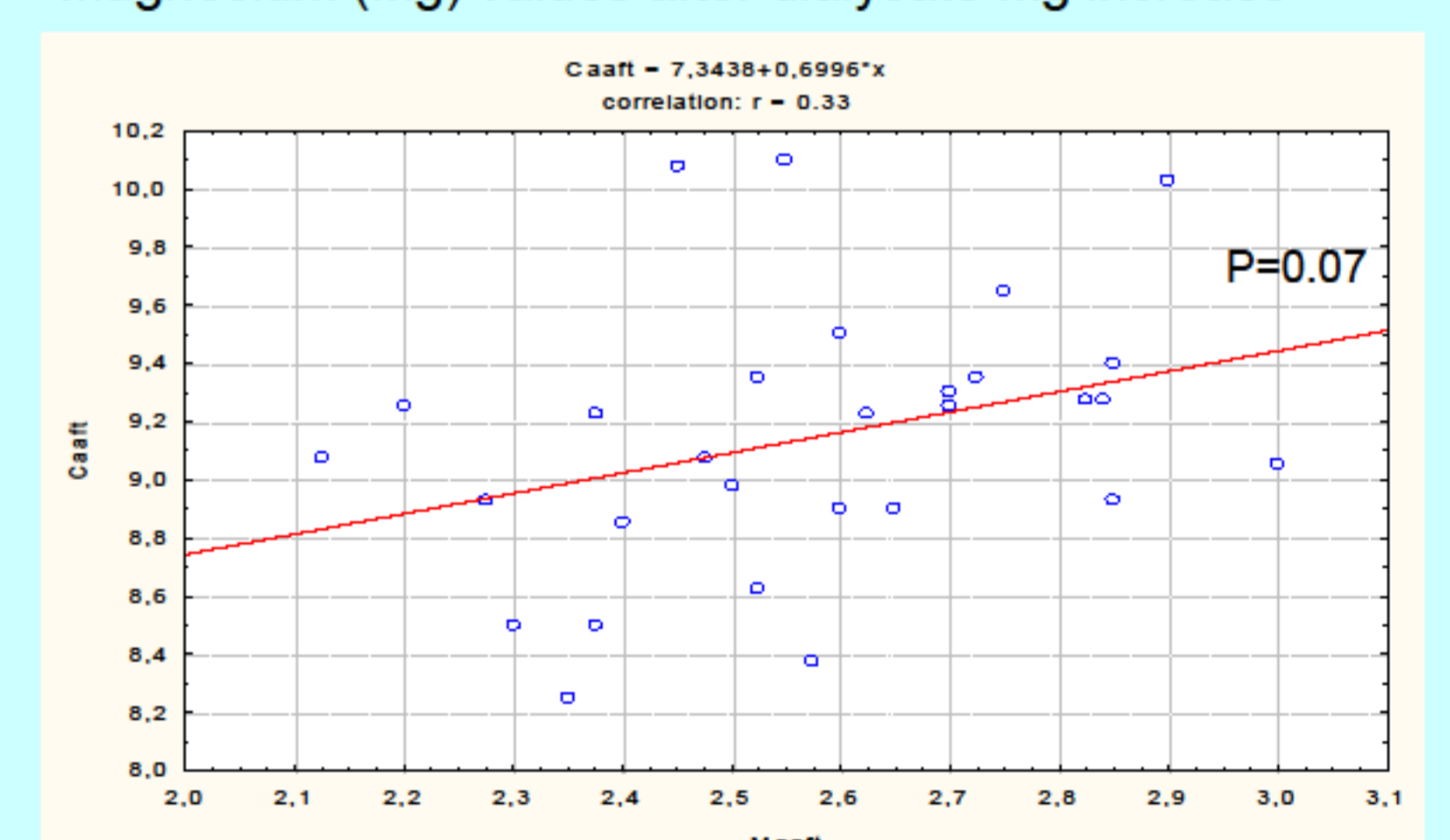


Figure 1. Correlation of serum parathormone (PTH) and Magnesium (Mg) values after dialysate Mg increase

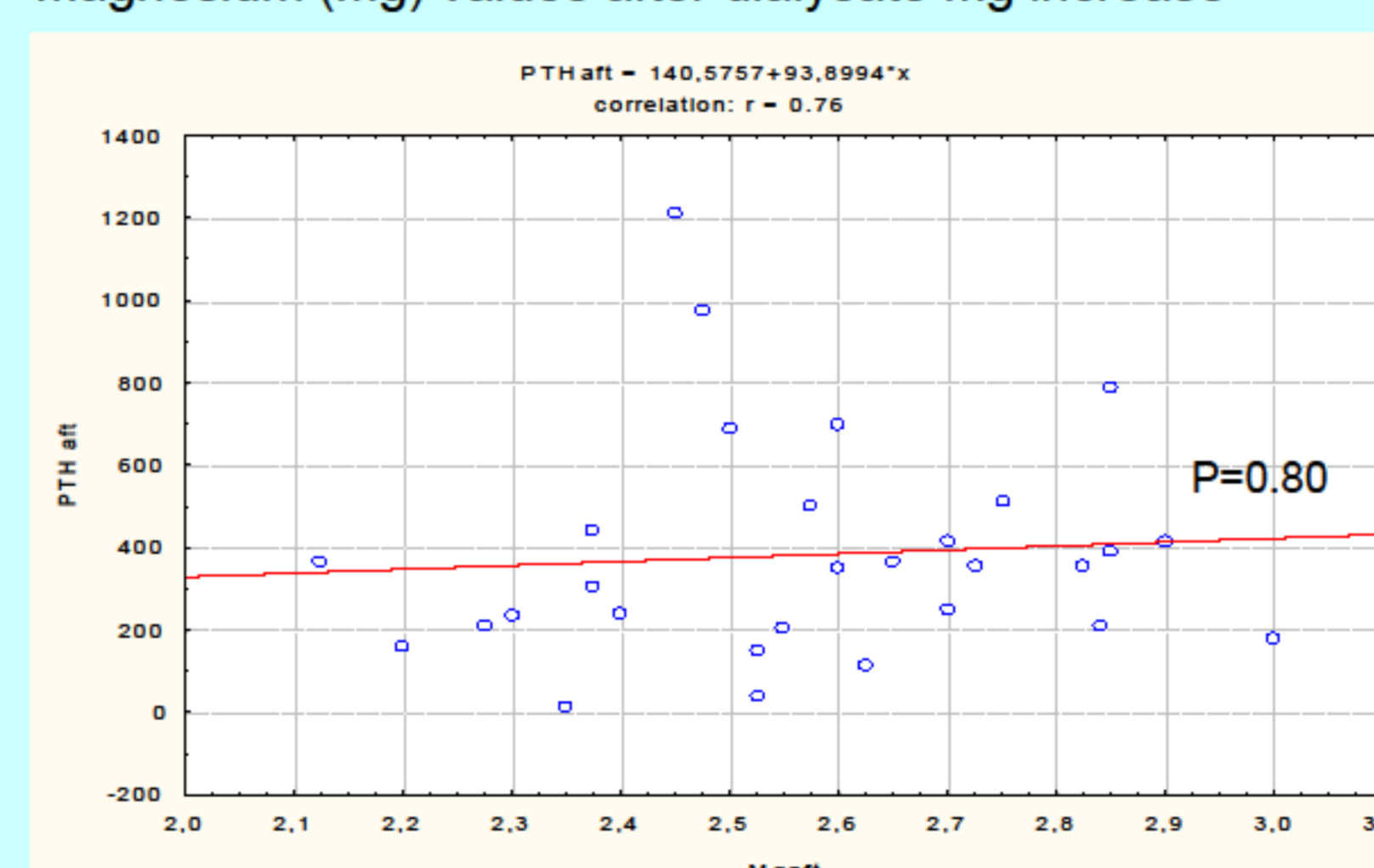
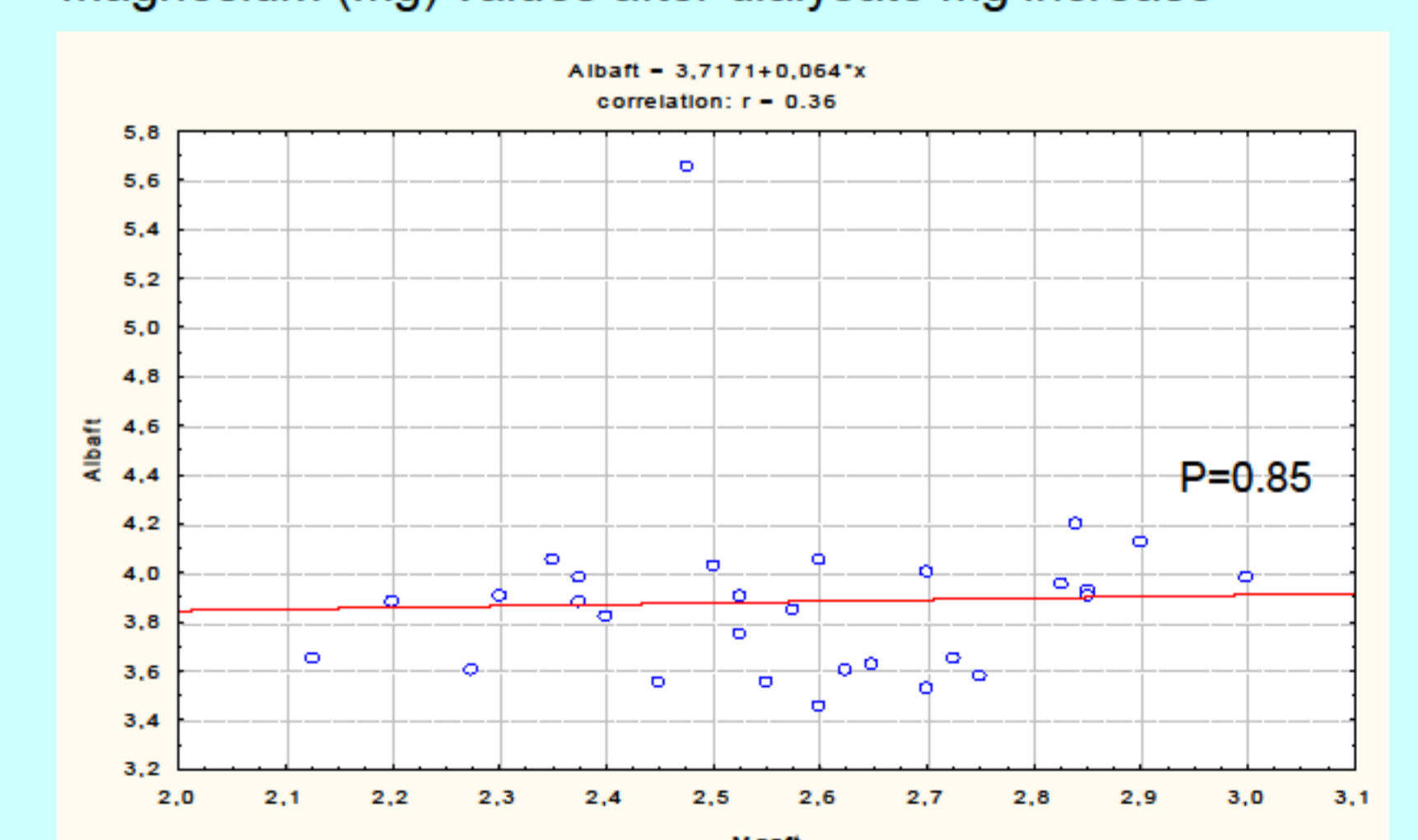


Figure 3. Correlation of serum Albumin (Alb) and Magnesium (Mg) values after dialysate Mg increase



## Conclusions

A 50% increase (from 0.5 to 0.75 mmol/l) of Mg dialysate concentration was safe, significantly increased serum Mg and decreased serum calcium, with no influence on intact parathormone, phosphorus or alkaline phosphatase levels.

After dialysate Mg increase the patients on proton pump inhibitors had lower serum Mg levels compared to those without proton pump inhibitors

