Aluminum and Parathyroid Hormone Concentrations in Insulin-Dependent Diabetics on Long-Term Hemodialysis

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1 1.50 ■

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0.75

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0

1.67 + 0.28

Dear Sir,

It has been found recently that secondary hyperparathyroidism develops more slowly in diabetics when compared with non-diabetic patients on long-term hemodialysis [1]. These data are in agreement with the results reported in other studies [2–4], indicating that serum parathyroid hormone (PTH) levels are significantly lower in diabetics than in non-diabetics undergoing long-term hemodialysis. Vincenti et al. [5] showed that a low rate of bone formation is a prominent finding in dialysis-treated diabetics, and Andress et al. [6] suggested that the low rate of bone formation may be due to the increased rate of accumulation of aluminum in bones of diabetics on long-term hemodialysis. Factors responsible for reduced PTH secretion in diabetics on hemodialysis remain to be clarified because insulin-dependent diabetes mellitus is associated with a low rate of bone formation (and osteopenia) in patients with normal renal function [7], and certain observations indicated that aluminum can inhibit the PTH secretion [8, 9].

We report on the investigation of secondary hyperparathyroidism and aluminum concentration in patients with insulin-dependent diabetes and non-diabetic patients undergoing a long-term hemodialysis.

Serum calcium, phosphate, PTH and aluminum levels were measured and radiological investigation of the bone status was performed in 20 insulin-dependent diabetics (12 females and

8 males) and 20 (10 females and 10 males) age-matched non-diabetics (mean age 44.4 vs. 40.1 years) on long-term hemodialysis (mean 4.5 vs. 3.5 years). Hemodialysis was performed three times a week with a dialysate containing 1.75 mmol/L calcium and less than 0.37 $\mu\text{mol/L}$ aluminum in both groups. The mean dose ($\pm$ SD) of calcitriol was not significantly different in diabetics when compared with the non-diabetic group (0.25 ± 0.08 vs. 0.30 ± 0.14 $\mu\text{g/day}$) as well as the

Fig. 1. Serum aluminum levels (a) and PTH concentrations (b) in the diabetic (■) and non-diabetic (□) groups (mean $\pm$ SD).

duration of the therapy (3.0 ± 0.4 vs. 2.86 ± 1.06 years). The oral intake of aluminum hydroxide was significantly higher in the non-diabetic group (0.45 ± 0.05 vs. 0.25 ± 0.04 kg/year, $p < 0.01$). None of the patients had undergone previous parathyroidectomy, and no exogenous blood was administered for 2 months prior to the study. The aluminum concentration in serum was determined by graphite-furnace atomic-absorptiometry [10] and PTH was measured with a commercial radioimmunoassay kit (Byk Sangtec, Dietzenbach, FRG). The radiological investigations included conventional views of lumbosacral spine, pelvis, hands and feet. Our findings demonstrated that PTH levels were significantly lower ($1,106 \pm 540$ vs. $5,360 \pm 1,658$ pmol/L, $p < 0.01$, fig. 1b) in insulin-dependent diabetics in comparison to non-diabetic uremics. Serum aluminum concentrations, however, were significantly higher in insulin-dependent diabetics versus non-diabetic uremics on long-term hemodialysis (1.67 ± 0.28 vs. 0.54 ± 0.31 $\mu\text{mol/L}$, fig. 1a, $p < 0.01$).

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503
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Phalangeal subperiosteal erosions were absent in diabetics, but were found in 35% of non-diabetics. Rugger-Jersey appearance of the spine was seen in 4% of diabetics and in 20% of non-diabetic uremics. ³

The results of this investigation are in accordance with recent reports [1, 2] indicating that secondary hyperparathyroidism develops more slowly in diabetics than in ⁴ non-diabetics undergoing long-term hemodialysis.

Data from this study demonstrated that the serum ⁵ aluminum level is significantly elevated in insulin-dependent diabetic patients in comparison to non-diabetic uremics. The differences in aluminum concentration cannot be explained with different aluminum load since both groups of patients were on the same therapy regimen with ⁶ the identical exposure to aluminum contaminated dialysate. However, the oral intake of elemental aluminum ⁸ was even lower in diabetic patients. This may indicate that elevated aluminum concentrations in diabetics is eventually related to diabetic gastroenteropathy and/or other factors promoting the enhanced rate of aluminum ¹⁰ absorption. Also, it should be emphasized that because of the low aluminum loading none of the patients have had an aluminum level compatible to that associated with a considerable risk of aluminum toxicity.