Does Lead Overload Develop in Hemodialysis Patients?

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Dear Sir,

Lead has been variously associated with gout, hypertension, and renal failure. Thomson et al. [1] described a significant but slight increase in concentrations of red blood cell lead in patients with chronic renal failure (CRF) and on hemodialysis. After EDTA chelation test, Batuman et al. [2] found higher levels of urinary lead in gouty patients with CRF than in gouty patients with normal renal function. The same author measured larger amounts of mobilizable lead in hypertensive patients with reduced renal function than in patients who had hypertension without renal impairment but suggested that this increase could not be due to the renal disease since normotensive CRF patients did not excrete such large amounts [3]. Among CRF patients, Colleoni and D'Amico [4] found a linear correlation between serum creatinine and mobilizable lead only in gouty patients. On the other hand, Behringer et al. [5] and Ritz et al. [6] observed elevated chelatable lead in patients with impaired renal function and lead exposure. Environmental pollution leads to an increasing body lead content in healthy subjects [7], which means that, as lead is mainly removed by urinary excretion [8], a lead overload could occur in patients affected by CRF even without a known or suspected exposure.

In a preliminary study, the erythrocyte zinc protopor-phylin IX (Zn PP IX) level (the increase of which may reflect a lead overload) was determined in 3 groups of patients: healthy subjects, mild to moderate chronic renal failure patients and hemodialysis patients. The results are shown in table I. The differences among the three groups were highly significant; moreover, a linear correlation between serum creatinine and Zn PP IX levels was observed ($p < 0.001$).

Fifteen dialysis patients without lead exposure and high Zn PP IX levels were tested for serum lead. The

Table I. Erythrocyte Zn PP IX levels in healthy subjects, CRF and hemodialysis patients determined by direct hematofluorimetric method (Model 4000; Experimental Sciences Associated)

Healthy subjects

CRF

patients

Hemodialysis patients

Patient number	84	52	97		
ZnPPiX, µg/dl	13.35 ± 10.41	22.82 ± 22.4	39.41 ± 22.67	p values (t test)	< 0.001 <

Values are given as mean ± SD.

distribution of values was within the normal ranges (114 ± 41 µg/l; mean ± SD). Then 5 of them were submitted to the EDTA chelation test. Their mean age was 64 years (range 58–74) and they had been receiving hemodialysis for an average of 77 months (range 48–156). In order to recover the EDTA-linked lead in such anuric subjects, the patients were converted to hemofiltration since the polyacrylonitrile membrane allows the EDTA to be filtrated. At the end of a standard hemofiltration session 1 g of Ca-EDTA was administered intravenously. Samples for lead content in blood and ultrafiltrate were taken before EDTA administration and during the following three sessions. The ultrafiltrate collected was 85 l, which is about half of the normal daily GFR. Analyses were carried out using a Perkin-Helmer 5000 with HGA 400, pyrolytically coated tubes and L'vov platform. Method accuracy was evaluated: intra assay CV – 4.2% at ultrafiltrate Pb 3.8 µg/l, 0.7% at 44.3 µg/l; inter assay CV – 17.9% at 3.8 µg/l, 5.7% at 44.3 µg/l, and mean recovery 96.7–103.5%. The results, summarized in table II, show that blood lead concentrations do not change, either before or after hemofiltration, but between start and end

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Table II. Blood lead in samples taken immediately before and at the end of each hemofiltration session performed; concentrations of lead in the ultrafiltrate (UF) and total lead removed

Basal

EDTA 1

EDTA 2

EDTA 3

of the first session after EDTA infusion (EDTA 1) ($p < 0.05$). It should be noted that a reliable amount of lead is extracted by hemofiltration after chelation and that nearly all of it is removed within the first two sessions (EDTA 1 and EDTA 2), the amount being more than 800 µg.

Urinary lead measurement after EDTA generally assesses an increased body lead burden when it exceeds 500–650 µg/24 h urine [9].

We suggest that the EDTA chelation test, followed by hemofiltration, can be a suitable diagnostic tool in anuric uremic patients too and that, although further studies on larger populations are required, the body lead burden in hemodialysis patients might be increased.

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