Protein C and Its Inhibitors during Hemodialysis

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Table 1. Mean values of PCA, PAI-3 and α -AT levels in hemodialysis patients and controls
Before dialysis After dialysis Controls

PCA, %

PAI-3, % α -AT, mg/dl

60.5 ± 9.9

84.2 ± 5.8 217.3 ± 8.8

Means ± SEM. 1 Corrected for changes in Hct.

Dear Sir,

Low anticoagulant activity of protein C in uremia has been reported previously, and it was suggested that this may contribute to the prethrombotic state observed in these patients [1]. On the other hand, Knudsen et al. [2] had shown that protein C activity (PCA) increased acutely during hemodialysis, the underlying mechanism, however, was unclear, and they had speculated the presence of an unknown dialyzable inhibitor of protein C in uremic plasma. In order to clarify the role of protein C inhibitors in the genesis of protein C changes during hemodialysis, we studied the two well-known protein C inhibitors, namely, plasminogen activator inhibitor-3 (PAI-3) and antitrypsin (α -AT) [3, 4] besides PCA before and after hemodialysis in uremic patients on regular dialysis. 18 healthy controls and 20 patients with end-stage renal failure were studied. All patients were on regular hemodialysis performed for 4-6 h 2 or 3 times a week. Following dialysis, α -AT levels were corrected for the changes in Hct. Hct correction factor was calculated from the quotient $(100 - \text{Hct}_{\text{post}}) / (100 - \text{Hct}_{\text{pre}})$.

The mean values of PCA, PAI-3 and α -AT levels in 20 patients and 18 controls are presented in table 1. Mean PCA before dialysis was found to be lower in the uremic group than in the control group ($p < 0.05$) and increased significantly after dialysis compared with predialysis values ($p < 0.02$). Hemodialysis induced statistically significant increases in PAI-3 activity as well ($p < 0.02$). The observed significant increase in the mean α -AT level ($p < 0.05$) was considered to be due to volume contraction caused by the hemodialysis procedure

itself, because postdialysis α AT levels corrected for the changes in Hct were comparable with predialysis levels ($p > 0.05$).

In the present study, it is shown, as previously reported [1, 2], that PCA is low in uremic patients, and a single hemodialysis session restores this defect. The determined increase in PAI-3 by virtue of dialysis in this study was thought to be due to the ability of heparin, given as anticoagulant during dialysis, to accelerate protease inhibition by heparin-dependent protein C inhibitor (PAI-3) [5]. We also did not detect any decrease in α AT concentrations during hemodialysis. In spite of the fact that we did not demonstrate any decrease in protein C inhibitors, marked increase in PCA was observed during hemodialysis treatment, namely, alterations in protein C inhibitors do not account for the restoration of PCA during hemodialysis. Therefore, we conclude that the determined increases in PCA in the course of hemodialysis should be due to the presence of a hitherto unknown dialyzable inhibitor(s) of protein C in uremic plasma other than the known protein C inhibitors presently described.

+ 6.3

+ 5.3 207.4 + 8.5

115.6+12.0 131.0 + 14.1 238.5 + 12.5 229.6+10.61

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