NEUTROPHIL ACTIVATION DURING HEMODIALYSIS

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INTRODUCTION

Dialyzing membranes are often used in clinical circumstances and are an important factor in the consideration of biocompatibility with non-biological medical paraphernalia. Depending on the unique physical characteristics of the various filters employed, there are some significant side effects regard to cellular activation.

CHEMOTACTIC AND PHAGOCYTOTIC RESPONSIVENESS OF PMN

The chemotactic response of dialyzed polymorphonuclear neutrophils (PMNs) at maximum neutropenia was normal when cuprophan, cellulose acetate, and cellulose hydrate filters were used, whereas their random locomotion was decreased (1). However, the chemotactic response towards agonists was decreased after a single passage through a cuprophan filter (2). Similarly, chemotactic response toward formyl-methionyl-leucyl-phenylalanine (FMLP) was decreased when the cells has been exposed to cellulose membrane (3).

Phagocytotic responsiveness of PMN increased after exposure to cuprophan filter although exposure to polyacrylonitrile and polysulfone hemodialyzers did not affect phagocytotic activity (4). Furthermore, PMN activation of glycolysis was increased after passage through polymethylmethacrylate dialyzer filter that was indicated by an increase of phosphorylase a activity (5) as shown in figure 1; in addition, increases in the activities of glycolytic enzymes at the end of hemodialysis treatment have been reported by Metcoff et al. (6). Vanholder et al. (4) observed a dramatic fall in phagocytotic activity after 15 minutes of hemodialysis with cuprophan membranes. Reused cuprophan caused a minor decrease in phagocytotic activity, whereas hemodialysis with polyacrylonitrile and polysulfone produced no significant change in their population. There was a marked increase in the 14CO2 production from labeled glucose after 15 minutes of cuprophan hemodialysis but not with the polyacrylonitrile or polysulfone hemodialyzers (7).
Figure 1. Phosphorylase a activity in PMNs of healthy controls and of hemodialysis patients during hemodialysis. *p<0.05 before HD vs during and after HD.

DEGRANULATION

Hemodialysis with cuprophan filter membranes induced C3a and C5a formation, leucopenia, and the gradual release of lactoferrin by PMNs (8). Ivanovich et al. (9) reported an increase of lactoferrin levels during hemodialysis with cuprophan and, to a lesser extent, with cellulose acetate. Hållgren et al. (10) found increased levels of lactoferrin and eosinophilic cationic protein during hemodialysis with cuprophan membranes. However, there was an appreciable binding of lactoferrin and lysozyme to the membrane. Predialysis lysozyme levels were 3 to 4 times higher than in uremic patients (11). Patients dialyzed with cellulose hydrate, cuprophan, or ethylene vinyl alcohol copolymer dialyzers had no significant change in their plasma lysozyme concentration. There was, however, a significant decrease in the plasma lysozyme concentration immediately after hemodialysis when polyacrylonitrile or polymethylmethacrylate membranes were used (11); although others found that lysozyme levels in the afferent blood did not rise (10).

We observed a progressive elevation of plasma elastase in complex with alpha,-proteinase inhibitor (E-alpha,PI) during hemodialysis therapy using dialyzers made of cuprophan (12). Plasma E-alpha,PI levels were higher in diabetic compared with nondiabetic dialysis patients (13). When we studied the effect of different dialyzer membranes on the release of granulocyte elastase, marked differences were observed (11). Similar results were obtained by Knudsen et al. (14). The modified cellulosic membrane (Hemophan) caused lower release of granulocyte elastase and less leukopenia than the regenerated cellulose (Cuprophan) (15). If we compare the results with