On – Line Dialysate Filtration: A Method of Dialysate Endotoxin Removal or Only Reduction?

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Patient

Dear Sir,

Microbially contaminated dialysate is a well-known risk in patients undergoing he-modialysis but today seems very infrequent. On the contrary, more attention is to take into consideration for the dialysate pyrogenic substances, or endotoxins, with the introduction of high-flux dialysis (hydraulic and molecular highly permeable membranes, dialysate retrofiltration phenomenon) and especially during hemodiafiltration with on-line dialysate filtration (production from the dialysate of substitution fluid or infusate for hemofiltration) [1].

Many authors have tested the permeability of highly permeable polysulfone membranes for pyrogens, mostly with highly sensitive methods (Limulus amoebocyte lysate assay, LAL, or interleukin 1, IL-1) [2-4].

Recently, Frinak et al. [5] have demonstrated the effectiveness of the on-line polysulfone filtration system for the removal of pyrogenic substances from dialysate with high microbial burden. But we feel that this dialysate purification method is only a reduction factor of contamination.

In this way, we have performed a study in vitro with on-line dialysate filtration (fig. 1). The dialysate, in recirculation use, is contaminated by high rates of free endotoxins (lipo-polysaccharide preparation, LPS, Escherichia coli 0111 B4 L 4130, Sigma France) to reach a 5,000-ng/ml concentration. On-line hemodiafiltration (infusate for hemofiltration flow rate 100 ml/min) is conducted during 180 min with samples on sites 1 and 2. Each sample (0, 10, 30, 90, 180 min) is analyzed (double determination) by two methods: firstly, the LAL test (sensitivity 0.03 ng/ml; Pyrotel, Amelabo), secondly, the polyacrylamide electrophoresis technique (sensitivity 25 ng/ml) described by Hitchcock [6].

Dialysate

Fig. 1. In vitro on-line hemodiafiltration. Patient: pyrogen-free physiological serum bag (1,000 ml), flow rate 150 ml/min. Dialysate: recirculation 5,000 ml, flow rate 600 ml/min. 1, 2 = Dialysate samples after 1 or 2 polysulfone membrane ultrafiltrations.

at each time of the study, but a crossing through the membrane was identified by an LAL test at 10 min.

Our results are in contrast to the results of Frinak's [5] study in which never crossing over for endotoxins was demonstrated in on-line dialysate filtration (double polysulfone filtration). One explanation for these differences could be the type (bacterial contamination of the dialysate with endotoxin release) and the concentration (30-300 ng/ml) of the endotoxin. Our results (table 1) demonstrate the crossing over 1 polysulfone membrane for endotoxins (site 1) with a highly sensitive method (LAL test) and with a highly specific method (electrophoresis). One filtration allows a progressive reduction in endotoxin concentration. In the same way, a double polysulfone filtration (site 2) achieves a high percentage reduction in the concentration of endotoxins; the samples were below the limit of sensitivity of the electrophoresis technique

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ins used. In our study, we have used a high rate of free endotoxin substances (lipopolysaccharides, 5,000 ng/ml endotoxins by LAL determination).

We feel that the on-line polysulfone filtration system is a very effective and reliable method only for reduction of endotoxin substances from the dialysate. But total removal is dependent from the initial level of dialysate contamination and the limit of detection of the test used. Table 1. Endotoxin determination after 1 (site 1) or 2 (site 2) polysulfone ultrafiltrations by LAL test (ng/ml, sensitivity 0.03 ng/ml) and electrophoresis (bands, sensitivity 25 ng/ml, +++, ++ or + decrease in band intensity)

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