New strategies in haemodialfiltration (HDF)—prospective comparative analysis between online mixed HDF and mid-dilution HDF

Sir,

The report by Feliciani et al. [1] on the comparison of online mixed haemodialfiltration (HDF) and mid-dilution HDF caused several concerns as to the validity of their results. Their decision, which was based on a misinterpretation of our own, earlier published work [2], not attempting to optimize anti-coagulation for mid-dilution HDF, may have resulted in insufficient heparin dosing and, subsequently, in very high pressures and reduced clearances, due to increasingly clotting of fibres. The nearly instantaneous pressure rise suggests significant clotting at the outset of treatment. As a consequence of the unique blood flow-path configuration of the Nephros MD 190 filter, which is very sensitive to clotted fibres, and the procoagulatory effect of intense convection [3], it is highly advisable to comply with current recommendations for anti-coagulation in HDF to keep the device patent [4]. Therefore, it would be important to learn more about the applied heparin doses and the achieved effects on coagulation during HDF treatments performed within the study of Feliciani et al.

In our own tests, in four patients on mid-dilution HDF with the larger Nephros MD220 filter (surface area 2.2 m²), considerably lower pressures (maximum 767 mmHg) were observed at the arterial port of the device, when more rigorous operating conditions were chosen (Figure 1). Compared to Feliciani et al., both blood and substitution flow rate were set higher, being 400 and 200 ml/min, respectively. The activated clotting time ranged between 254 s at 30 min and 190 s at the end of treatment (at baseline 123 s). We also confirmed the findings from a very recently published study [5], reversing the configuration of the blood tubing, i.e. the connection of the arterial line to the venous port of the MD filter and vice versa, leading to even lower filter inlet pressures with a peak of 649 mmHg, despite otherwise unchanged operating parameters (Figure 2). In case of pressure-related problems, the reverse configuration can be recommended without significantly lower β₂-microglobulin plasma clearances (at 30 and 220 min 119 ± 13 and 107 ± 14 ml/min in reverse vs 127 ± 11 and 121 ± 21 ml/min in standard configuration, respectively) at similar albumin loss (1.5 ± 0.5 vs 2.2 ± 0.7 g/4 h session, respectively). In addition, it is self-evident that the blood flow rate has an important effect on the most critical inlet blood pressure of the MD220 device, as demonstrated in Figure 2.

According to our findings and experience, mid-dilution HDF with the Nephros MD220 filter is a safe and highly effective therapy mode, provided that adequate operating conditions have been chosen.

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Sir,

In a comparative study of two online haemodiafiltration techniques, published in NDT [1], we reported that, in mid-dilution HDF, impressive high hydraulic pressures were recorded in the first section of the blood dialyser compartment, where post-dilution takes place. Skepticism on the validity of these findings, recently expressed by Krieter and Canaud in NDT [2], lies on the feeling that insufficient anti-coagulation caused partial fibre clotting and compromised the efficiency of our experimental sessions. This may actually occur and, in fact, complete clotting of the blood circuit was reported in a mid-dilution HDF session of the study by Krieter et al. [3]. It was not the case in our study, in which the mean activated clotting time ranged between 210% of the basal value after the initial unfractionated heparin bolus and 150% under continuous heparin administration. Inspection of used-up MD-190 dialysers and blood circuits never revealed coagulation. Instead, progressive resistance to blood entering the post-dilution section of the dialyser, where the overall surface area of the capillaries is relatively low. Progressive haemoconcentration along the fibres and the infusion flow at the middle port of the filter further increase resistance in spite of the pressure drop, caused by ultrafiltration. Very high TMP is set by the machine’s volumetric ultrafiltration control in an attempt to achieve the planned ultrafiltration. This hypothesis and our results have been recently confirmed by Santoro et al. [4], who reported a mean TMP of about 1000 mmHg in the first post-dilution section of the MD-190 dialysers, even in sessions performed with a substantially lower infusion rate than ours (6 l/h). In this study, the safety of the technique (lower pressures) was ameliorated by reversing the dialyser. The same expedient was used by Krieter and Canaud [2], who employed larger dialysers in addition, according to a suggestion already expressed in our paper. We are happy that our criticism was productive. However, in our opinion, the main remaining drawback of this technique is the absence of an effective feedback control system, as that working in mixed HDF, which limits the negative effects of the excessive TMP by modulating the infusion rate.

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