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EDITORIAL

Diffusion or convection: just a matter of taste?

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Since the first description of an arteriovenous haemofiltration technique by Kramer et al. in 1977, continuous renal replacement therapy (CRRT) has become the modality of choice for treating ICU patients with acute kidney injury (AKI), especially in the case of haemodynamically unstable AKI patients.[1] Nowadays, pump-driven venovenous systems have replaced arteriovenous techniques. Modern devices for CRRT are capable of providing different modes. Continuous venovenous haemofiltration (CVVH) is based on convection, whereas continuous venovenous haemodialysis (CVVHD) is based on diffusion. Continuous venovenous haemodiafiltration (CVVHDF) combines both methods. Due to the lack of comparative studies showing that one of these modalities is superior, the choice of the employed technique is mainly influenced by local experience, preference and availability. CVVHD is used relatively infrequently in comparison with the other modes. Based on published practice survey data in different countries and regions, it appears that CVVH and CVVHDF are, by far, the preferred modes of CCRT.[2] Apparently, physicians tend to use a mode with at least some haemofiltration, perhaps anticipating a benefit associated with haemofiltration.

Several theoretical differences between CVVH and CVVHD could be clinically relevant. During CVVH the ultrafiltrate produced is replaced by a sterile solution resulting in high ultrafiltrate rates, whereas ultrafiltrate rates during CVVHD are approximately equal to the set fluid loss. Consequently, CVVH requires more fluids and thus more bags need to be replaced. During CVVHD, solute removal depends on diffusive movement occurring via Brownian motion of the solute. Smaller molecules have greater kinetic energy and are preferentially removed based on the level of the concentration gradient. Thus, solute removal during CVVHD is proportional to the concentration gradient and size of each molecule. Dialysate flow is slower than the blood flow rate and is the limiting factor to solute removal. Therefore, small-molecular-weight solutes (<500 Dalton), such as blood urea nitrogen, potassium and creatinine, are more efficiently cleared by haemodialysis than by haemofiltration. During CVVH solute is removed by solvent drag, which is driven by hydrostatic pressure. CVVH provides better removal of medium and larger sized molecules than CVVHD. The question is to what extent these theoretical differences in solute clearance are relevant in clinical practice. It has been shown that the clearance of low-molecular-weight solutes is relatively equivalent for the two modalities.[3] Moreover, in a previous CVVH versus CVVHD study only a small difference in clearance of larger molecules was observed.[4]

Since the difference in efficacy between CVVH and CVVHD with respect to solute clearance might not be clinically important, it is reasonable to focus on other practical aspects such as filter survival, costs and ease of use. In this issue of the Netherlands Journal of Critical Care, Dalhuisen et al. report the results of a study comparing CVVH with CVVHD in a cohort of 15 patients with AKI.[5] The paper describes a comparison between these two CRRT protocols using an elegant cross-over study design that was adapted from an Italian study with the same subject.[4] The main difference between the two studies is the anticoagulation strategies that were used to prevent clotting of the haemofilter. In the study reported in this issue of the journal, regional citrate anticoagulation was used versus heparin in the Italian study. Moreover, in the latter study both CVVH and CVVHD were administered based on a similar prescription dose and using the same filters, whereas in the Dutch study dose and filters were different between the two modalities. Both studies demonstrate that removal of solutes during CVVH and CVVHD is more or less similar. Moreover, both studies show a better filter survival during CVVHD. In addition to aspects of efficacy, the study by Dalhuisen et al. also focused on user-friendliness and costs. The authors conclude that CVVHD is easier to handle and more cost-effective (24% cheaper) than standard CVVH. These are of course important aspects to take into consideration when choosing a mode of CCRT. It should be

noted that this study compares not only two CRRT modalities but also different filters, different citrate protocols and probably different CRRT equipment which is a shortcoming of the study. A well-designed and adequately powered trial would be necessary to establish the superiority of CVVHD. Yet, the study in this issue of the journal is a worthwhile read to anyone interested in CRRT and may aid in determining whether the method of CCRT that you apply in your unit is actually the most optimal.

Disclosures

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