

## Mid-Dilution: The Perfect Balance between Convection and Diffusion

Santoro A, Conz P, De Cristofaro V, Acquistapace I, Gaggi R, Ferramosca E, Renaux J, Rizzioli E, Wratten M

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### Abstract:

Although hemodiafiltration (HDF) offers the advantage of increased convective clearance for middle molecules, there is still controversy as to whether reinfusion should occur pre- or postfilter. Mid-dilution hemodiafiltration (MD HDF) is a new HDF technique that uses a special dialyzer, MD190, which allows both pre- and postreinfusion. While externally the dialyzer looks similar to conventional hemodialyzers, the internal fibers are divided into two bundles by a special annular header that first lets the blood pass through the peripheral bundle in 'postdilution', mix with the reinfusion fluid at the opposite end of the dialyzer and then proceed (after 'predilution') to the dialyzer blood exit. The dialyzer is able to support substantially higher reinfusion rates (10-12 l/h). We have compared the removal characteristics of several small solutes and larger middle-molecular-weight toxins by examining instantaneous clearance at 45 min, the dialysis reduction ratio and total mass removal (by spilling) in a three-center prospective cross-over study. Twenty patients were randomized to a treatment sequence of one-week high-flux bicarbonate hemodialysis (HD) followed by MD HDF, or vice versa. The parameters evaluated included urea, creatinine,  $\beta_2$ -microglobulin, angiogenin, leptin, retinol-binding protein, and the effects on sodium, potassium, bicarbonate and calcium. Blood flow rates ranged between 300-450 ml/min (mean  $359 \pm 44$  HD,  $367 \pm 35$  MD HDF). The mean reinfusion for MD HDF was  $166 \pm 17$  ml/min. MD HDF had a significantly better instantaneous clearance for urea ( $328 \pm 28$  vs  $277 \pm 40$ ); creatinine ( $292 \pm 32$  vs.  $212 \pm 66$ ); phosphate ( $324 \pm 38$  vs.  $242 \pm 63$ );  $\beta_2$ -microglobulin ( $249 \pm 27$  vs.  $100 \pm 24$ ); angiogenin ( $173 \pm 27$  vs.  $28 \pm 32$ ); and leptin ( $202 \pm 29$  vs.  $63 \pm 43$ ). Treatments were well tolerated with no adverse reactions occurring during any of the treatments. The MD HDF filter's unique configuration is designed to deliver high-efficiency HDF with a significant improvement in small and middle molecule removal. MD HDF supports substantially higher ultrafiltration rates, and as such, results in a higher removal of middle-molecular-weight toxins.