QUANTIFYING VASCULAR REFILL USING COMBINED CONTINOUS SEGMENTAL BIOIMPEDANCE AND RELATIVE BLOOD VOLUME MONITORING

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BACKGROUND: More reliable and reproducible techniques are needed to accurately monitor fluid removal in haemodialysis patients. We have evaluated the potential role of combined continuous segmental bio impedance (CSBI) and relative blood volume (RBV) monitoring.

DESIGN: We studied 9 patients over two dialysis sessions, one using a constant ultrafiltration (uf) rate and the other using pulses of uf interspersed with periods of recovery (rebound). The first pulse removed 40% of interdialytic weight gain and three subsequent pulses 20% each. We used a Xitron 4200 Multifrequency Bioimpedance Spectrometer to measure changes in resistivity continuously in the lower leg, as a surrogate for ECF, and determined RBV continuously by an ultrasonic method.

FINDINGS: UF volume and overall changes in blood pressure, ECF resistivity and RBV were similar in both UF modes. There were marked differences in RBV and ECF relative resistance traces in the rebound period following the first and third 20% UF pulses, as dry weight approached. In the first rebound, the RBV trace and the ECF relative resistance trace converged (RBV rising and ECF relative resistance continuing to fall, reflecting adequate refill). In the third rebound period, both RBV and ECF relative resistance traces plateaued, and the traces tended towards parallel. This implies critically reduced vascular refill. As an index of how parallel the traces were, we compared the ratio of the difference between the value of the traces at the beginning and end of each rebound period. This ratio (which we termed the parallelity) will approach unity when the traces are perfectly parallel. All patients had a lower parallelity in the third rebound period than in the first. Parallelity approached unity in the third rebound period and was significantly lower than in the first (1.81 ± 0.48 vs 1.39 ± 0.22 ; $p<0.02$).

CONCLUSION: We have shown that ECF volume changes can be tracked during dialysis using CSBI and combination with RBV monitoring during pulse UF may provide useful insights into vascular refill. The relationship between these traces changes as dry weight is approached reflecting reduced vascular refill.

RELEVANCE: Quantification of these differences eg using the parallelity ratio may be a useful clinical tool and aid optimal fluid removal.