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# Sensitivity of Blood Volume Monitoring for Fluid Status Assessment in Hemodialysis Patients

F. Maduell, M. Arias, E. Massó, N. Fontsere, M. Carrera, M. Vera, A. Cases, J.M. Campistol

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## Commentary

By Professor Richard Glassock

Awareness of the critical role of chronic, indolent expansion of the extra-cellular fluid volume (ECFV), including blood volume, on short- and long-term outcomes of dialysis treatment of ESRD has been rising rapidly in recent years. This represents a sort of 'rediscovery' of precepts evident at the very start of the dialysis era. The major stumbling block in wider adoption of this concept is the difficulty in reliably, repetitively and inexpensively quantifying the excess ECFV. The use of 'dry weight' probing is widely practiced but it is well known to be insensitive, inaccurate, uncomfortable (for the patient) and possibly dangerous. Many alternative approaches have been suggested, but none have been consistently validated or achieved widespread use. At present on-line monitoring of relative blood volume (RBVM) during dialysis and bioelectrical impedance analysis (BIA) of whole body or segmental (e.g. calf) extra-cellular and intra-cellular water content have received the greatest attention. The RBVM technique was mainly devised to avoid unneeded intra-dialytic hypotension, which can be part and parcel of the 'dry weight' probing method. The BIA approach was designed to address the overall fluid overloaded status of the patients, for example at the beginning of each dialysis session. The two methods are complementary to each other. The study of Maduell and colleagues is an important contribution to the ongoing search for valid and sensitive tools for the evaluation of the volume status of dialysis patients. They showed by comparison of fluid overload (FO) assessed by one-time measurements using BIA that the on-line RBVM (assessed by 4-hour slopes) was reasonably accurate (area under the curve [AUC] of 0.7-0.850 for detection of marked excess FO (FO ≥ +3 l) and somewhat less accurate (AUC = 0.65-0.7) for detection of euvolemia (FO = 0 to +1), but rather inaccurate AUC = <0.65) for detection of intermediate levels of FO (FO = 1-3 l). Interestingly pre-dialysis systolic blood pressure was highly correlated with FO (Δ SBP = 8-9 mm Hg per liter of FO). All patients were managed by thrice-weekly hemodiafiltration and were maintained on a rather constant ultra-filtration rate (UFR) averaging about 7.8 ml/h/kg. Whether these findings also apply to hemodialysis patients and those with higher average UFR remains to be determined. Nevertheless, they provide strong support, in my opinion, for future development and application on a routine basis of techniques that marry BIA and RBVM. Perhaps this technology will facilitate better volume control during and between dialysis treatment and improvements in short- and long-term outcomes (longer survival and reduced hospitalizations).

**Several key questions are unanswered by this study. These include:**

1) Will better control of time-averaged fluid overload directly result in improved outcomes?

2) Can bioelectrical impedance and RBVM monitoring be integrated into a single technique for routine monitoring of volume status?

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