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## Introduction and Aims

Bioimpedance techniques are widely employed to assess fluid status. Whole body bioimpedance spectroscopy (wBIS) is used to estimate total body extracellular (wECV) and intracellular volumes (wICV) in healthy subjects and dialysis patients. Calf bioimpedance spectroscopy (cBIS) is used to assess fluid status in dialysis patients.

The aim of the study was to investigate whether calf ECV measured by cBIS reflects wECV in a cohort of adult non-dialysis subjects.

## Methods

We performed a cross sectional study in a group of adult non-dialysis subjects using wBIS (Hydra 4200; Xitron Technologies, Inc, San Diego, CA) with frequencies between 5 and 1000 kHz. We measured 1) whole body (wrist to ankle) extracellular (wRe) and intracellular (wRi) resistance and 2) calf extracellular (cRe) and intracellular (cRi) resistance. Calf circumferences were measured exactly 10 cm apart, and based on the respective cross sectional areas, the calf volume was calculated. Body mass (BM) and height were recorded. Using a proprietary Xitron program, wECV, wICV, cECV and cICV were calculated based on wRe, wRi, cRe and cRi, respectively. Total body water was defined as the sum of wECV and wICV, and calf total water (cTW) as the sum of cECV and cICV.

## Results

Sixty three adult non-dialysis subjects (age 53.5±10 years, 38 females, body weight 79±15 kg) were studied.

wECV ( $r^2=0.62$ ) and wICV ( $r^2=0.73$ ) were highly correlated with cECV and cICV, respectively (Figure 1, upper panel).

## Results (continued)

Ratios of wECV/wTBW ( $r^2=0.57$ ) and wECV/BM ( $r^2=0.44$ ) were correlated with the respective calf measures, cECV/cTW and cECV/BM (Fig 1, lower panel).

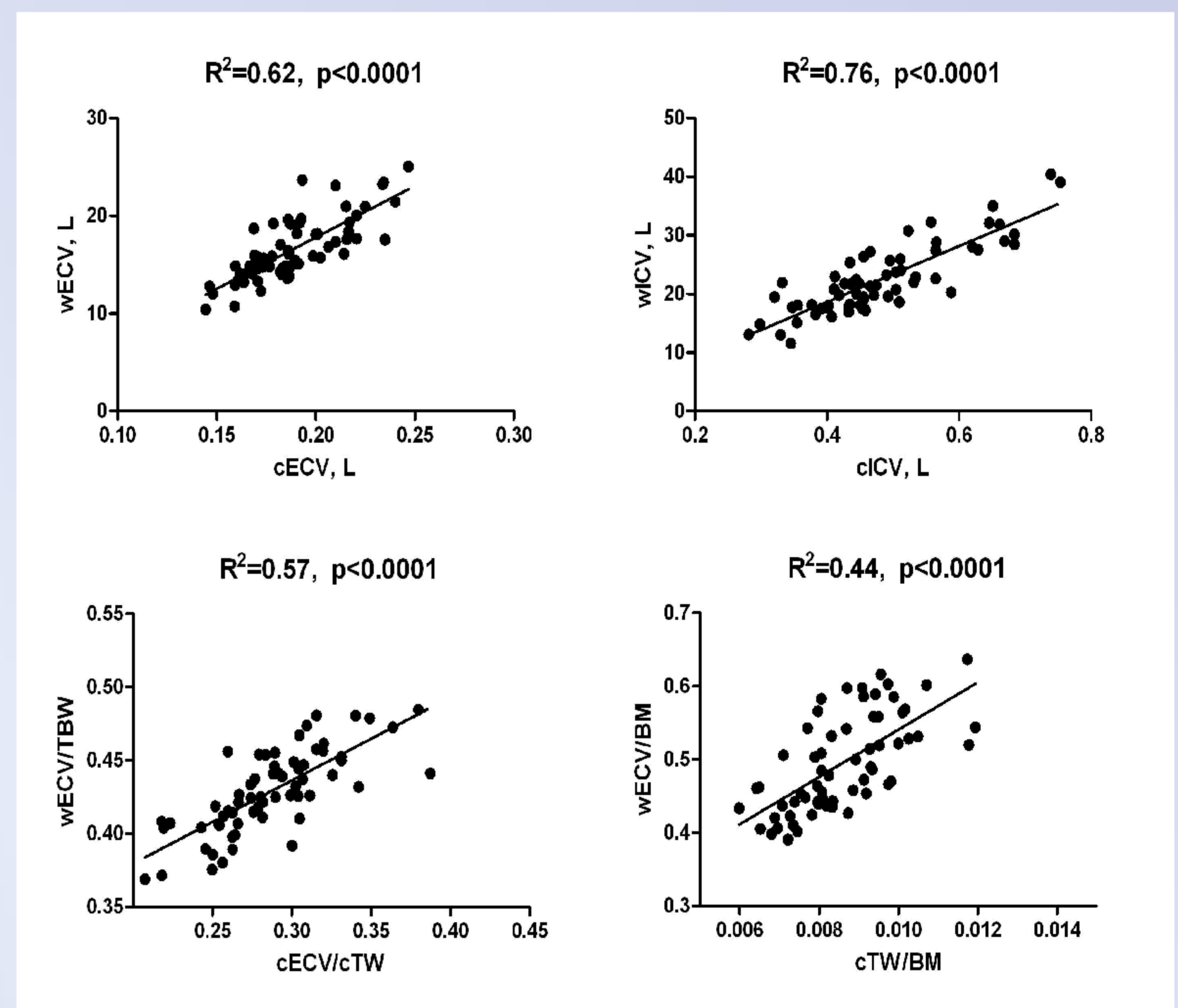


Fig1: Regression plots of cECV and wECV; cICV and wICV (upper panel); ratios of cECV/cTW and cECV/BM (lower panel), using wBIS and cBIS, respectively.

## Conclusion

Our study shows that fluid volumes (ECV; ICV) as estimated by wBIS are correlated with the respective fluid volumes, as determined by cBIS. An advantage of cBIS over wBIS is that the shape of the calf closely resembles a cylinder, and that the distribution of the electric alternate current in the calf is likely to be more isotropic compared to the whole body.

Taken together, cBIS provides accurate information about fluid status. In contrast to wBIS, cBIS can be used in patients with metal implants (e.g. pacemakers).

### References:

- Fansan Zhu et al. Estimation of normal hydration in dialysis patients using whole body and calf bioimpedance analysis. *Physiol. Meas.* 32 (2011) 887–902
- Paul W. Chamney et al. A new technique for establishing dry weight in hemodialysis patients via whole body bioimpedance. *Kidney International*, Vol. 61 (2002), pp. 2250–2258

