Effect of Intra-abdominal Dialysate on Bioimpedance-Derived Fluid Volume Status and Body Composition Measurements in Peritoneal Dialysis Patients

After peritonitis (1), ultrafiltration failure with volume overload is the next major cause of treatment failure in peritoneal dialysis (PD) (2). Multi-frequency bioimpedance spectroscopy (MF-BIS) can be used to estimate extracellular water (ECW) and intracellular water (ICW) (3,4) and has been validated against isotopic dilution methods in both healthy subjects and dialysis patients (5). Multi-frequency BIS can also be used to assess body composition (6,7). Although it is much more convenient for PD patients and staff to measure MF-BIS with dialysate dwelling, some manufacturers recommend measurements be made with an empty bladder, and therefore the abdomen is always drained before measurements are taken.

To assess the effects of indwelling peritoneal dialysate on MF-BIS, 40 PD outpatients [57.5% men; 17.5% with diabetes; median age: 62 years (range: 24 – 72.5 years); PD vintage: 28 months (range: 4 – 44 months)] attending for peritoneal transport assessment using a standard 2-L exchange with 22.7 g/L dextrose were studied before and after the peritoneal dialysate was drained. Measurements were taken using an 8-tactile-electrode system (InBody 720: BioSpace, Seoul, Korea) (8,9).

Median net PD ultrafiltration volume was 200 mL (range: 100 – 300 mL); serum C-reactive protein, 3 mg/dL (range: 1 – 5.5 mg/dL); and glucose, 5.6 mmol/L (range: 4.6–6.9 mmol/L). Mean albumin was 39.2 ± 3.4 g/dL.

To confirm reliability, measurements of ECW divided by total body water (TBW) were repeated in 22 patients, and a Bland–Altman analysis showed no significant differences (bias: 0.0003; t-statistic: 0.47; 95% confidence limits: –0.0016, 0.001). In 6 patients chosen for a wide range of TBW (24 L – 51 L), 4 MF-BIS measurements were made during a period of 2 hours with dialysate dwelling, and no differences in ECW (mean bias: –0.2 ± 0.21) or ICW (mean bias: 0.097 ± 0.041) were observed.

Using the InBody MF-BIS device, differences in TBW, ICW, and ECW were observed depending on whether

TABLE 1
Volume Assessment and Body Composition Measurements Made With and Without 2.0 L of 22.7 g/L Glucose Peritoneal Dialysate Instilled

Measurement	Abdomen full	Abdomen empty
Weight (kg)	68.7±13.1	66.7±13.1[a]
Intracellular water (ICW)	21.78±5.0	21.07±4.84[a]
Extracellular water (ECW)	14.05±3.16	13.53±3.13[a]
Right arm ECW/TBW	0.379±0.008	0.379±0.008
Left arm ECW/TBW	0.379±0.007	0.379±0.007
Trunk ECW/TBW	0.395±0.013	0.393±0.012[a]
Right leg ECW/TBW	0.391±0.014	0.391±0.014
Left leg ECW/TBW	0.394±0.013	0.394±0.019
Fat-free mass (kg)	48.74±11.1	46.97±10.8[a]
Soft lean mass (kg)	45.8±10.41	44.3±10.2[a]
Body fat mass (kg)	19.96±8.06	19.67±7.77[b]
Body cell mass (kg)	31.2±7.16	29.98±7.48[a]

TBW = total body water.
[a] $p < 0.001$.
[b] $p < 0.01$.

dialysate was instilled or drained (Table 1). Not surprisingly, the greatest variation occurred in the truncal compartment; the ECW/TBW ratios did not vary for the limbs. Significant differences in body composition were noted depending on whether dialysate was instilled or drained (Table 1). Electrical resistance increased with fluid instilled, and the MF-BIS software algorithms overestimated muscle mass more than fat mass (10,11).

Thus, although it is much more convenient to take MF-BIS measurements with peritoneal dialysate *in situ*, my group also advocates drainage of the dialysate, in keeping with the InBody manufacturer's recommendation that measurements should be performed with an empty bladder. Further work is required to determine whether other MF-BIS devices are equally affected. The differences in measurements are probably not clinically significant provided they are made in a standardized and reproducible fashion (12) and are performed serially to document change rather than absolute values; however, single measurements of body composition may be prone to error with dialysate instilled.

DISCLOSURES

The author has no financial conflicts of interest.

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