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Role of bioelectrical impedance analysis for estimating body water content in hypernatremia patients

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Objectives: Hypernatremia is associated with poor outcomes in critically ill patients. Estimating body water content is a crucial step in correcting hypernatremia. Recently, bioelectrical impedance analysis (BIA) has been used as a new, noninvasive, and easy tool to measure volume status. We investigated whether body water measurement using BIA could help reducing blood sampling frequency and determining the amount of fluid to be administered.

Methods: This study included 51 patients with hypernatremia (serum sodium ≥ 150) in a laboratory test among hospitalized patients. Laboratory and BIA measurements were performed simultaneously to determine whether there was a correlation between the amount of water deficiency measured by the conventional formula (sodium corrected Watson formula) and BIA (BCM, Fresenius Medical Care, Germany). The same test was performed again on the third day to confirm whether the change of water content by each method was correlated.

Results: There was no correlation between the calculated absolute fluid overload (AFO equivalent to over hydration [OH]) value from BCM and water deficit from classic equation. Total body water (TBW) estimated with conventional formula and BIA showed significant correlation ($r=0.861$, $p<0.001$). While the Bland –Altman plot indicated that proportional bias was present ($r=0.617$, $p<0.001$). Intracellular water (ICW) measured by BCM showed significant correlation with TBW calculated with conventional formula ($r= 0.679$, $p <0.001$). ICW measured with BCM underestimated TBW calculated with conventional formula about 14.06 ± 4.0 L in the Bland-Altman analysis ($r=0.32$, $p=0.84$).

Conclusions: Mean OH value of BCM was inaccurate in hypernatremia patients. Although TBW of BCM showed the correlation with water deficit equation, there was significant proportional bias. It seems that ICW measured by BCM represents TBW obtained by sodium corrected Watson formula more precisely in hypernatremia patients.