

Body fluid volume determination via body composition spectroscopy in health and disease

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Abstract

The assessment of extra-, intracellular and total body water (ECW, ICW, TBW) is important in many clinical situations. Bioimpedance spectroscopy (BIS) has advantages over dilution methods in terms of usability and reproducibility, but a careful analysis reveals systematic deviations in extremes of body composition and morbid states. Recent publications stress the need to set up and validate BIS equations in a wide variety of healthy subjects and patients with fluid imbalance. This paper presents two new equations for determination of ECW and ICW (referred to as body composition spectroscopy, BCS) based on Hanai mixture theory but corrected for body mass index (BMI). The equations were set up by means of cross validation using data of 152 subjects (120 healthy subjects, 32 dialysis patients) from three different centers. Validation was performed against bromide/deuterium dilution (NaBr, D₂O) for ECW/TBW and total body potassium (TBK) for ICW. Agreement between BCS and the references (all subjects) was -0.4 ± 1.4 L (mean \pm SD) for ECW, 0.2 ± 2.0 L for ICW and -0.2 ± 2.3 L for TBW. The ECW agreement between three independent reference methods (NaBr versus D₂O–TBK) was -0.1 ± 1.8 L for 74 subjects from two centers. Comparing the new BCS equations with the standard Hanai approach revealed an improvement in SEE for ICW and TBW by 0.6 L (24%) for all subjects, and by 1.2 L (48%) for 24 subjects with extreme BMIs (<20 and >30). BCS may be an appropriate method for body

fluid volume determination over a wide range of body compositions in different states of health and disease.

Keywords: dilution, bioimpedance, total body water, body composition, extracellular volume

(Some figures in this article are in colour only in the electronic version)