Reliable Estimation of Dry Weight in Hemodialysis Patients by the Bioelectrical Impedance Analysis

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Introduction

- Management of fluid in HD patients
  - Largely dependent on a clinical assessment of dry weight (DW)
  - Requires time consuming test and entry process

- Bioelectrical impedance analysis (BIA)
  - 8-point total body electrical impedance method
  - Rapid and non-invasive
  - Easily performed, reliable and fast measurements
  - Directed
  - Provides the fluid status in patients with severe edema during BIA measurements in the supine position
  - May also monitor fluid in renal segments

Phase 1. Development of new prediction method

- UF amount and % changes in ECF/IBW in patients
  - % changes of ECF/IBW = UF amount (kg) x 1.887 x 1.083
    \[ \text{Equation (1)} \]
  - % changes of ECF/IBW = UF amount (kg) x 1.887 x 60
    \[ \text{Equation (2)} \]

Phase 2. Validation

- Measurement of ECF/IBW by BIA (Biospace Co., Seoul, Korea) before and after HD in newly enrolled HD patients

- Using current DW (cDW) of subjects as reference
- Compared the accuracy of pDW1 (DW predicted using our devised method) and pDW2 (predicted using the nomocromio/hyperolemia slope method) on the plot between ECF and BW.

Subjects

- Induction criteria
  - HD patients maintained for a period of >1 year
  - HD on assessment of hydration status

- Exclusion criteria
  - Diabetes (HbA1c > 6.5) patients on assessment of hydration status, on intensive insulin, or co-morbidities (atherosclerosis, heart failure, cirrhosis, diabetes, etc.)
  - HD patients on dialysis (HbA1c > 6.5) patients
  - > 17 patients
  - HD
  - 6 hypertensive, 3 diabetics, and 2 diabetes (HbA1c > 6.5)

- In HD patients, it was postulated that ingested and metabolically derived water amounts to ECF and that BW increases in a 1:1 relation to fluid intake between two HD sessions

- ECF = BW + 1.08
  - (3B + constant)

- If we know HD patient's post-HD BW and ECF
  - use the point of intersection between HD patient's ECF and normal population's BW

- Example
  - 6 female HD patients and post-HD BW: 58.56 kg, ECF: 11.7 kg
  - 6BW + 1.08 x 56 = +0.8
  - ECF = 56 + 1.08 x 56 = 45.3
  - ECF = 56 + 1.08 x 56 = 45.3 kg
  - BW (pre-HD BW + pDW): 56.2 kg

Assessment of hydration status

- NF
- Clinical assessments of attending physicians + clinical score system + BIA

- Clinical assessment
  - Absence of symptoms and signs of hyper- or hypovolemia
  - No diuresis-hypertension (SBP < 120 mmHg) and renal function
  - No proteinuria (renal and serum creatinine ratios by creatinine, 10 mmol/L), albumin excretion, or sodium output

Result

Table 1. Patient characteristics

| Age (years) | 59.0 |
| Height (cm) | 167.5 |
| Weight (kg) | 58.3 |
| BMI | 22.8 |
| Diastolic pressure | 90.0 |
| Primary renal disease | N/A |
| Dialysis type | Hemodialysis |
| No. of patients | 6 |

Correlations between differences and means (A) between pDW1 and cDW and (B) between pDW2 and cDW

Summary & Conclusion

- Based on 8-polar BIA measurements, we developed a new method of predicting DW using the relationship at right lower extremes after HD

- No significant differences were found between cDW, pDW1, and pDW2

- The devised method appears to be as accurate as the nomocromio/hyperolemia slope method.