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Association between absolute blood volume based on dialysate dilution and body composition using bioimpedance analysis of patients undergoing hemodialysis.

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Objectives : A procedure for calculating the absolute blood volume (aBV) before hemodiafiltration (before aBV) of a patient at the beginning of hemodialysis using the continuous relative blood volume measurement and dialysate infusion functions has been reported. In this study, we applied this procedure on patients undergoing intermittent hemodiafiltration (IHDF). Furthermore, aBV after IHDF (after aBV) and excess aBV (overhydrate) were calculated. The association among the parameters used to determine the dry weight (DW) of patients was also examined.
Methods : Twenty-eight patients undergoing IHDF using a DCS-200Si versatile dialysis monitoring device (Nikkiso Co. Ltd., Tokyo, Japan) equipped with a BV meter were included in the study. Simultaneously, the plasma values of human atrial natriuretic peptide (hANP) and cardiothoracic ratio (CTR) were also obtained. The csv file from the DCS-200Si, Microsoft Excel, and Visual Basic for application programing were used. Before aBV was measured based on the change in the relative blood volume during five intermittent dialysate infusions of each IHDF. After aBV was measured as a product of before aBV and relative blood volume at the end of the treatment. Overhydrate was computed as the difference between after aBV and 8% of weight after treatment Regression analysis of these parameters was conducted based on the CTR, hANP, and body water composition.
Results : After aBV1–after aBV5 and overhydrate1–overhydrate5 significantly correlated with plasma hANP levels. Correlations with overhydrate were higher than those with after aBV ($r = 0.490–0.582$). After aBV1–after aBV5 were significantly correlated with extracellular water content ($r = 0.508–0.545$).
Conclusions : When the aBV of patients undergoing hemodialysis were calculated using IHDF, we found that after aBV was associated with extracellular water and overhydrate was reflected in cardiac load. Thus, aBV may be a useful indicator of DW.

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Table 1 Correlation to hANP in the 28 hemodialysis patients

Variable	Correlation coefficient (r)	Statistical significance (p)
After aBV1 (mL)	0.360	0.060
After aBV2 (mL)	0.450	0.016
After aBV3 (mL)	0.393	0.039
After aBV4 (mL)	0.355	0.064
After aBV5 (mL)	0.461	0.013
After aBV1/W (L/kg)	0.478	0.010
After aBV2/W (L/kg)	0.569	0.002
After aBV3/W (L/kg)	0.456	0.015
After aBV4/W (L/kg)	0.444	0.018
After aBV5/W (L/kg)	0.560	0.002
overhydrate1 (mL)	0.512	0.005
overhydrate2 (mL)	0.582	0.001
overhydrate3 (mL)	0.505	0.006
overhydrate4 (mL)	0.490	0.008
overhydrate5 (mL)	0.580	0.001
TBW (kg)	0.204	0.298
ICW (kg)	-0.277	0.154
ECW (kg)	0.497	0.007
ICW/FFM (L/kg)	-0.515	0.005
ECW/FFM (L/kg)	0.587	0.001
ECW/TBW (L/kg)	0.574	0.001

W;weight after treatment; TBW, total body water; ICW,intracellular water; ECW,extracellular water; FFM,free fat mass.

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Table 2 Correlation to ECW in the 28 hemodialysis patients

Variable	Correlation coefficient (r)	Statistical significance (p)
After aBV1 (mL)	0.541	0.003
After aBV2(mL)	0.510	0.006
After aBV3 (mL)	0.508	0.006
After aBV4 (mL)	0.545	0.003
After aBV5 (mL)	0.539	0.003
Dry weight (kg)	0.473	0.011
Height (cm)	0.625	<0.001

ECW,extracellular water