

HYDRATION STATUS AND OVERHYDRATION IN HD PATIENTS – A EUROPEAN MULTICENTRE STUDY

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Background and Objectives

In hemodialysis (HD) patients the assessment of hydration status and overhydration may be a problem and should then be assessed by objective methods [EBPG Guideline 2007]. Non-invasive bioimpedance spectroscopy with a body composition model is a validated method to assess fluid volumes (e.g. total body water [Moissl *Physiol Meas* 2006] and overhydration [Chamney *Am J Clin Nutr* 2007]). This study investigates whether the application of a new bed-side bioimpedance spectroscopy device (Fresenius Medical Care [FME], Germany) is feasible in a normal clinical setting.

Methods

HD patients from 3 centres were selected according to inclusion criteria (age ≥ 18 years, written informed consent) and exclusion criteria (active systemic inflammation (HBV, HCV, HIV), pace maker, implanted pump, amputation) and measured once with bioimpedance spectroscopy. The device provides body composition and quantifies overhydration of the patient within minutes after a single pre-dialytic measurement. Mann-Whitney test was used for comparison, and $P < 0.05$ was considered as statistically significant.

Results

The bioimpedance spectroscopy device was integrated into the clinical routine without problems. 139 HD patients were investigated. The patients were sorted concerning their pre-dialytic overhydration in quartiles (35 (34) patients per group) from I (=lowest overhydration) to IV (=highest overhydration) (Fig. 1, Table 1); overhydration ranged up to 10 L.

Fig. 1

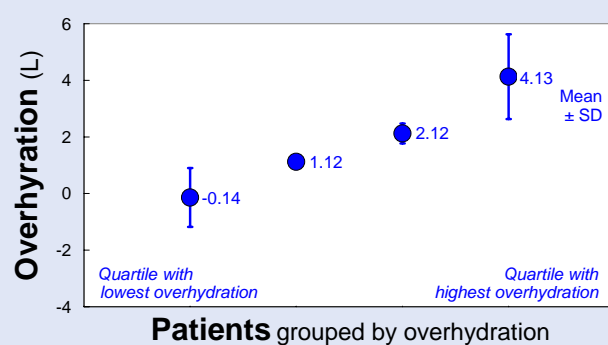


Table 1 Measured parameters in total population of 139 patients, sorted into 4 groups (quartile I-IV), values as mean \pm standard deviation.

Parameter:	I	II	III	IV	P	Comparison
Overhydration (L)	-0.14 \pm 1.04	1.12 \pm 0.22	2.12 \pm 0.35	4.13 \pm 1.50	<0.01	all
Male gender (%)	43	35	54	77	<0.01	I-IV, II-IV
Age (years)	61.8 \pm 13.4	66.7 \pm 14.4	64.7 \pm 11.1	60.5 \pm 14.0	<0.05	II-IV
Hypertension (%)	82.4	76.5	85.7	94.1	<0.05	II-IV
UF volume (L)	3.00 \pm 0.92	2.59 \pm 0.80	2.74 \pm 0.95	3.08 \pm 0.81	<0.05	II-IV, III-IV
BMI (kg/m ²)	27.8 \pm 4.5	26.29 \pm 5.3	24.2 \pm 4.5	25.0 \pm 4.3	<0.01	I-III, I-IV
Dry weight (kg)	74.8 \pm 14.1	70.7 \pm 13.7	67.0 \pm 12.5	71.9 \pm 11.5	<0.02	I-III
BP _{systolic} (mmHg)	136 \pm 22	136 \pm 18	143 \pm 18	140 \pm 22	NS	
BP _{diastolic} (mmHg)	71 \pm 15	67 \pm 11	71 \pm 10	72 \pm 13	NS	

UF - Ultrafiltration, BMI - Body Mass Index, BP - Blood Pressure

In the quartile with the highest overhydration we found predominantly men (Fig. 2) and patients slightly younger than the mean age of the investigated patients (Fig. 3).

In each quartile at least $\frac{3}{4}$ of the patients had hypertension (according to the medical files), the incidence of hypertension was at maximum with a value of 94% in the quartile with the highest overhydration (Fig. 4). Nevertheless, the pre-dialytic blood pressure was not statistically different between the groups (Table 1), probably due to antihypertensive medication.

Fig. 2

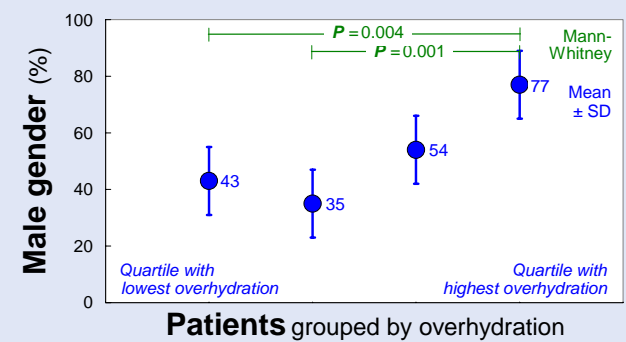


Fig. 3

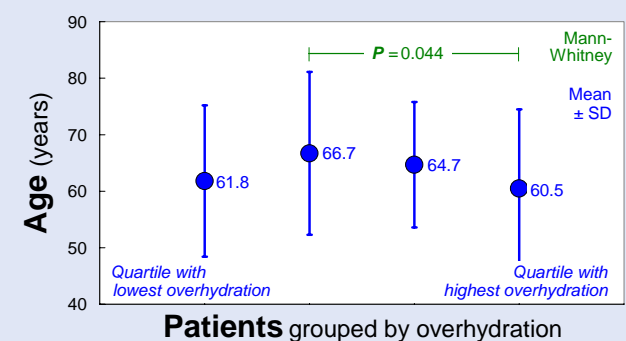
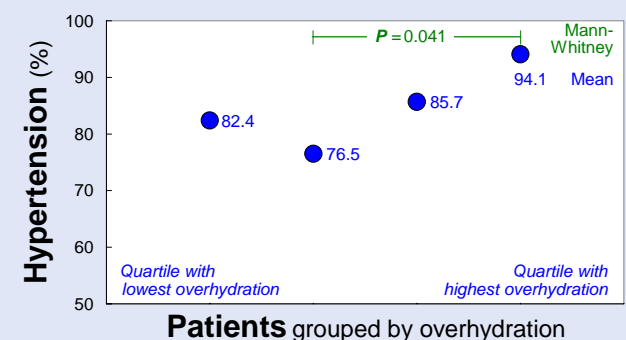
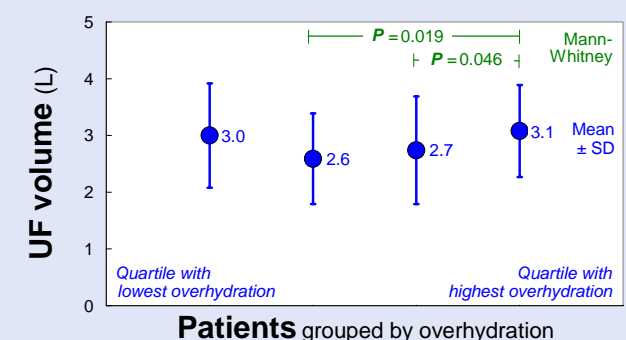


Fig. 4



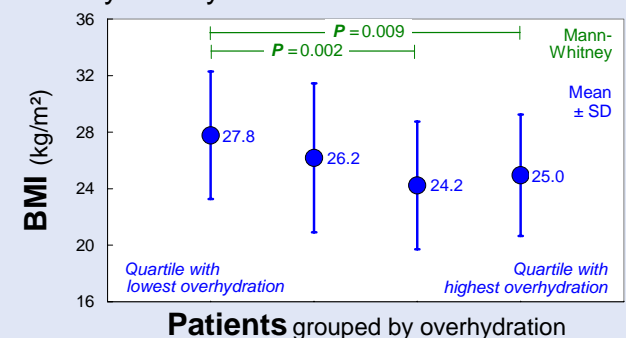
The highest ultrafiltration (UF) volumes were observed in the quartile with the highest overhydration (Fig. 5).

Fig. 5



Patients with high body mass index (BMI) (Fig. 6) and high body weight were less likely overhydrated.

Fig. 6



Conclusions

Overhydration is present in many HD patients, often unexpected. The analysis shows that special patient groups deserve particular attention (male, hypertensive, high UF volume). Bioimpedance spectroscopy allows to detect overhydration easily, providing the basis to initiate the appropriate measures to normalize the fluid status.