Effect of Expanded Hemodialysis on Body Composition and Nutritional Status

Mohamed Belmouaz Marc Bauwens Estelle Desport Pierre Jamet
Frank Bridoux

Department of Nephrology Hemodialysis, Poitiers University Hospital, Poitiers, France

Dear Editor,

Protein energy wasting (PEW), defined as loss of muscle mass and fuel reserves of the body, is a frequent and deleterious complication in hemodialysis (HD) patients. Several factors, including inflammation, retention of middle molecule uremic toxins, and dialysis procedure contribute to PEW [1]. HD with medium cut-off (MCO) dialyzer has demonstrated efficient depuration of middle uremic toxins and reduced inflammation [2, 3], which may have beneficial effects on PEW. To test the hypothesis that MCO-HD may positively affect body composition and nutritional status in HD patients, as compared to high-flux (HF) HD, we performed a 12-month single-center retrospective pilot study. Patients were recruited from the cohort of 40 patients evenly distributed on MCO-HD and HF-HD in a previous randomized study [4] and then continued maintenance HD using the same dialyzer as allocated after randomization. Among these patients, 16 patients (8 on MCO-HD and 8 on HF-HD) receiving 4 h, thrice weekly HD sessions using bicarbonate and citrate-containing acetate-free ultrapure dialysate were retrospectively analyzed (Table 1). All had a minimum of 12 months of

Table 1. Patient characteristics at baseline

	MCO-HD (n = 8)	HF-HD (n = 8)
Age, years	76±7	73±9
Sex (female/male)	2/6	3/5
Dialysis vintage, months	31 (14–92)	44 (35–79)
BMI, kg/m ²	28±3.3	29±4.2
Residual urine output <200 mL/day, n	8	8
CKD etiology, n		
Nephrosclerosis	3	4
Diabetic nephropathy	1	2
Interstitial	3	1
Unknown	1	1
Comorbidity, n		
Diabetes mellitus	3	4
Hypertension	5	4
Heart disease	3	4
Cerebrovascular disease	1	1
Peripheral vascular disease	2	2
Vascular access, n		
Arteriovenous fistula	5	4
Tunneled catheter	3	4

Quantitative data are expressed as mean±SD or median (IQR).
MCO, medium cutoff; HF, high flux; HD, hemodialysis.

Table 2. Effect of MCO-HD and HF-HD after 12 months on body composition and biological nutritional parameters

Parameters	Treatment	Baseline	Month 12	Mean values comparison, <i>p</i> value	Variation rate from baseline, %	Variation rate comparison, <i>p</i> value
SMI, kg/m ²	MCO-HD	8.7±1.1	9±0.9	0.6	4±14	0.046
	HF-HD	9.2±1.1	8.1±1.3	0.2	-11±13	
LTI, kg/m ²	MCO-HD	12.7±4	16.6±3.9	0.2	36±37	0.013
	HF-HD	15.6±5.5	12.9±5	0.4	-12±31	
FTI, kg/m ²	MCO-HD	10.8±3.7	9.9±3	0.6	-6±20	0.6
	HF-HD	12.6±4.3	10.8±4.1	0.4	-11±23	
SMM, kg	MCO-HD	24.3±5	25.4±3.9	0.7	6±12	0.02
	HF-HD	25.9±4.9	22.8±5.2	0.3	-11±15	
LTM, kg	MCO-HD	34.4±9.7	44.4±6.6	0.04	37±36	0.008
	HF-HD	43.1±14.1	35.3±12.9	0.3	-14±30	
FTM, kg	MCO-HD	29.9±10.9	27.2±8.9	0.6	-5.4±21	0.6
	HF-HD	34.9±10.8	29.3±9.1	0.3	-12±24	
Albumin, g/L	MCO-HD	37±2.7	37±3.4	0.9	0.6±15	0.4
	HF-HD	39.6±3.6	38±2.4	0.3	-4±6	
Pre-albumin, g/L	MCO-HD	0.3±0.05	0.27±0.04	0.3	-7±18	0.5
	HF-HD	0.33±0.09	0.27±0.06	0.2	-15±26	
Cr, µmol/L	MCO-HD	580±52	684±110	0.02	19±24	0.044
	HF-HD	670±173	626±224	0.9	-6±22	
Total cholesterol, g/L	MCO-HD	1.54±0.3	1.5±0.3	0.7	-2±12	0.2
	HF-HD	1.56±0.3	1.4±0.5	0.3	-12±17	
Triglycerides, g/L	MCO-HD	1.5±0.6	1.8±0.8	0.3	30±108	0.2
	HF-HD	2.3±0.5	1.6±0.6	0.3	-19±49	

Quantitative data are expressed as mean±SD. MCO, medium cutoff; HF, high flux; HD, hemodialysis; SMI, skeletal muscle index; SMM, skeletal muscle mass; LTI, lean tissue index; LTM, lean tissue mass; FTI, fat tissue index; FTM, fat tissue mass; Cr, creatinine; SD, standard deviation.

follow-up without change in dialyzers or dialysis modality and a multifrequency bioimpedance spectroscopy (BIS) measurements performed at baseline and at 12 months. None of the patients had prescribed oral or intravenous nutritional supplements.

BIS measurements including skeletal muscle (SM), lean tissue (LT) and fat tissue (FT), mass (M), and index (I) were performed at the start of a mid-week HD session (Z-Hydra™; Meditor, France) at baseline and after 12 months. Routine biological parameters, including albumin, pre-albumin, creatinine (Cr), total cholesterol, and triglycerides were collected at the same time intervals. The variation rate regarding each BIS and biological parameter was calculated by the unit change from baseline to 12 months divided by the baseline value and was ex-

pressed as a mean percentage ±SD. Comparison between each group was assessed by Mann-Whitney U test. The study was approved by Poitiers Ethics Committee (MR004-3218140520).

Compared to HF-HD after 12 months, MCO-HD improved significantly the variation rate of LTM (37 ± 36 vs. -14 ± 30%, *p* = 0.008), LTI (36 ± 37 vs. -12 ± 31%, *p* = 0.013), SMM (6 ± 12 vs. -11 ± 15%, *p* = 0.02), SMI (4 ± 14 vs. -11 ± 13, *p* = 0.046), and pre-dialysis serum Cr (19 ± 24 vs. -6 ± 22%, *p* = 0.044). Comparison between mean values at baseline and month 12 were only significant for LTM (*p* = 0.04) and pre-dialysis serum Cr (*p* = 0.02) in MCO-HD. Comparison of FTM, FTI, and other nutritional markers did not show significant difference (Table 2).

Preventing PEW in HD patients is challenging. Online hemodiafiltration (OL-HDF) may improve PEW by preserving lean body mass probably through decreased inflammation, stimulation of appetite, and better removal of uremic toxins [5]. Compared to HF-HD, MCO-HD as OL-HDF increases removal of higher weight molecules [6, 7], which mostly encompass proteins closely related to inflammation and PEW in the uremic milieu. In our previous randomized study, we found that after 3 months, MCO-HD was associated with a decrease in beta2-microglobulin, oxidized low-density lipoprotein, kappa and lambda free light chain pre-dialysis levels, without significant change in other inflammatory, uremic toxins, and oxidative stress biomarkers [4]. Thus, the long-term benefit on body composition may be related to an effect on other non-measured malnutrition biomarkers.

In this study, MCO-HD resulted in an improved variation rate of LTI and SMI which are presumably good surrogate markers of PEW [8], together with pre-dialysis serum Cr level, whereas other biological parameters appeared less sensitive to denote nutritional changes [5]. Moreover, albumin levels remained stable after 12 months of MCO-HD, suggesting long-term balance between increased albumin hepatic synthesis and dialysate loss.

The present retrospective pilot study is too small and had several limitations, including lack of nutrition con-

trol to confirm the beneficial effect of MCO on PEW. However, it showed a promising tendency for MCO-HD to preserve body composition.

Conflict of Interest Statement

M. Belmouaz and M. Bauwens report having received speaker fees from Baxter, but none related to this study. The other authors have no conflicts of interest to declare.

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Author Contributions

Co-authors Marc Bauwens, Estelle Desport, Pierre Jamet, and Frank Bridoux were all implicated in this manuscript. Research conception and study design: M. Belmouaz, F.B., M.B., E.D., and P.J.; supervision or mentorship: F.B. Each author contributed important intellectual content during manuscript drafting and accepts accountability for the overall work by ensuring that questions pertaining to the accuracy or integrity of any portion of the work are appropriately investigated and resolved. M. Belmouaz takes responsibility that this study has been reported honestly, accurately, and transparently.

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