HIGH-VOLUME ON-LINE HEMODIAFILTRATION IS NOT ASSOCIATED WITH MALNUTRITION

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BACKGROUND: Chronic malnutrition is a common problem in patients with end-stage renal disease (ESRD) on hemodialysis[1,2]. High-volume online hemodiafiltration (OL-HDF) has been associated with improved patient survival compared to conventional hemodialysis[3,4,5]. Some studies have reported elevated albumin loss into dialysis fluid[6]. The purpose of this study is to assess the nutritional status of patients undergoing maintenance postdilution high-volume OL-HDF, to confirm a high elimination of medium-sized molecules and to analyze whether possible losses of nutrients during ultrafiltration could be associated with malnutrition.

METHODS: Demographic and clinical data, comorbidities, corporal composition with bioimpedance spectroscopy (BIS), a four-hour OL-HDF session features, albumin loss into dialysis fluid and laboratory parameters pre and post-dialysis were collected in twenty-eight patients with ESRD undergoing postdilution OL-HDF with stable convective volumes over 28 liters/session.

Demographic and clinical data

Age (years)	61.3±16
Gender (males [%])	75
Diabetes mellitus (%)	25
Comorbidities (%)	35.7
AV Fistula (%)	92.9%
Time on dialysis (months)	52.3±48

OL-HDF session features

Qb (ml/min)	470 ± 42
Blood volume processed (L)	108.4 ± 11.6
Qd (ml/min)	588 ± 58
Kt/V*	1.96 ± 0.49
Ultrafiltration (L)	1.99 ± 0.73
Convective volume (L) [UF + substitution]	32.7 ± 3.34
TMP (mmHg) at:	
- the beginning	112 ± 53
- 15 minutes	156 ± 49
- 30 minutes	164 ± 67
- 60 minutes	186 ± 44
- 120 minutes	225 ± 35

*Qb: blood flow. Qd: dialysate flow. UF: ultrafiltration. TMP: transmembrane pressure. *Kt/V by dialysance(K) and bioimpedance(V).*

Corporal composition parameters

Height (cm)	165 ± 12
Pre-dialysis weight (Kg)	69.4 ± 13.7
Body mass index (Kg/m^2)	25.4 ± 4.6
Overhydration (L) *	1.04 ± 1.24
Total body water (L) *	38.2 ± 8.1
Extracellular water (L) *	17.3 ± 3.1
Intracellular water (L) *	20.9 ± 5.3
Lean tissue index (Kg/m^2) *	15.8 ± 3.8
Fat tissue index (Kg/m^2) *	9.5 ± 5.2
Body cell mass (Kg) *	25.5 ± 9.2

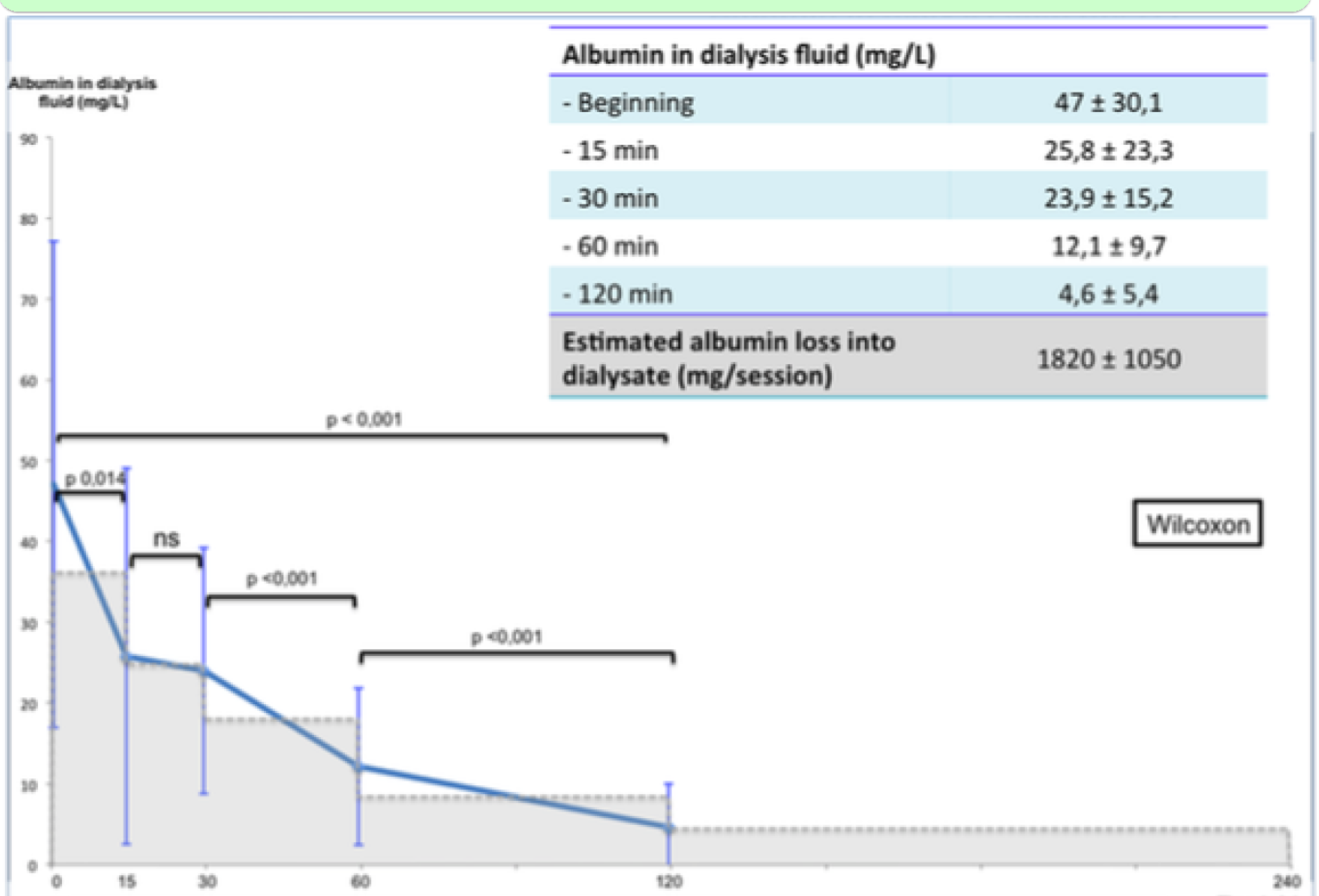
** Measurements from bioimpedance spectroscopy(Body Composition Monitor, FMC®)*

Laboratory data

	Pre-dialysis analysis	Post-dialysis analysis	Reduction rates (%)
Serum albumin (g/dL)	3.72 ± 0.29	3.84 ± 0.42	
Total proteins (g/dL)	6.38 ± 0.47		
Prealbumin (mg/dL)	21.3 ± 6.9		
Vitamin B12 (ng/L)	412.5 ± 148		
Folic acid (µg/L)	4.9 (3.3 – 6.5)		
Urea (mg/dL)	101.4 ± 133.8	17 ± 9.3	84.0 ± 5.4
Creatinine (mg/dL)	7.86 ± 2.75		
Potassium (mmol/L)	4.58 ± 0.7		
Total cholesterol (mg/dL)	153.3 ± 35		
LDL-cholesterol (mg/dL)	85.4 ± 32.54		
HDL-cholesterol (mg/dL)	47.9 ± 13		
Triglycerides (mg/dL)	99.1 ± 37.7		
HbA1c (%)	5.69 ± 1.24		
Calcium (mg/dL)	8.24 ± 0.59		
Phosphorus (mg/dL)	3.63 ± 1.44		
Magnesium (mg/dL)	2.32 ± 0.49		
PTH (ng/L)	459 ± 327		
25-OH vit.D (µg/L)	8.75 ± 4.17		
Platelets (10^3/mcL)	163 ± 45		
Leukocytes (10^3/mcL)	5.95 ± 2.14		
Neutrophils (10^3/mcL)	3.83 ± 1.7		
Lymphocytes (10^3/mcL)	1.33 ± 0.81		
Hemoglobin (g/dL)	11.2 ± 1.2	11.9 ± 1.3	
Hematocrit (%)	33.7 ± 3.6	35.7 ± 4.1	
Bicarbonate (mmol/L)	23.2 ± 2.33	27.4 ± 2.21	
C-reactive protein (mg/dL)	0.3 (0.1 – 0.9)		
β2-microglobulin (mg/L)	23.2 ± 4.8	3.69 ± 1.36*	84.2 ± 3.8
Cystatin C (mg/L)	6.06 ± 0.89	1.11 ± 0.25*	81.6 ± 3.47

LDL: low-density lipoprotein. HDL: high-density lipoprotein. HbA1c: glycosylated hemoglobin. PTH: parathyroid hormone. 25-OH vit.D: 25-hydroxyvitamin D.
**Beta-2 microglobulin and cystatin C post-dialysis levels were adjusted to ultrafiltration.*

Albumin concentrations in dialysate and estimated albumin loss into dialysate



Albumin in dialysis fluid (mg/L)	
- Beginning	47 ± 30,1
- 15 min	25,8 ± 23,3
- 30 min	23,9 ± 15,2
- 60 min	12,1 ± 9,7
- 120 min	4,6 ± 5,4
Estimated albumin loss into dialysate (mg/session)	1820 ± 1050

Estimated albumin loss through the membrane:
L = [15·(C0+C15)/2 + 15·(C15+C30)/2 + 30·(C30+C60)/2 + 60·(C60+C120)/2+ 120·C120]/240 · {[UF + Sust + (Qd·240)/1000]}.
C: albumin concentration in dialysate at the beginning[C0], 15[C15], 30[C30], 60[C60] y 120[C120] minutes(mg/L). UF: ultrafiltration(L). Sust: substitution volume(L). Qd: dialysate flow(ml/min).

Estimated albumin loss into dialysis fluid was not correlated with serum albumin, proteins, other biochemical variables or BIS measurements, or to convective volume. HDL-cholesterol levels (47.9±13 mg/dL) were inversely correlated with pre-dialysis beta-2 microglobulin (23.2±4.8 mg/L) (p0.033) and were directly correlated with convective volume (p0.042), Kt/V (p0.049), beta-2 microglobulin reduction rate (p0.001) and cystatin C reduction rate (p0.007). Multivariable regression analysis confirmed blood flow (Beta 0.580, p<0.001) and serum albumin (Beta -0.381, p0.037) as independent predictors for convective transport volume; corrected r^2 0.634.

CONCLUSION: High volume OL-HDF results in better elimination of middle molecules and it has been associated with improved patient survival. In this study there is no relation between high-volume OL-HDF and malnutrition. Albumin and nutrients loss into dialysis fluid should not be a limiting factor of the substitution volume.

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53 ERA 623--SP
Dialysis. Protein-energy wasting, inflammation and oxidative stress.
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DOI: 10.3252/pso.eu.53era.2016