

ANY GRADE OF OVERHYDRATION IS ASSOCIATED WITH CARDIOVASCULAR EVENTS AND MORTALITY IN CHRONIC KIDNEY DISEASE

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OBJECTIVES

Purpose. Chronic fluid overload has been shown to be a mortality and morbidity risk factor in patients undergoing hemodialysis. Patients with advanced chronic kidney disease (CKD) have also a higher risk of developing cardiovascular (CV) events and mortality.

The objective of this study was to analyze hydration status in patients with CKD stage 4 and its relationship with CV events, mortality, and progression to CKD stage 5.

METHODS

This is a retrospective study.

We included 356 stage 4 CKD patients.

We collected baseline characteristics and cardiovascular events.

We analyzed inflammation and nutrition status with laboratory parameters.

Body composition was analyzed by spectroscopic bioimpedance (BIS).

We analyzed overhydration status adjusted by extracellular water (OH/ECW) and we classified them in 3 groups:

-Any degree of overhydration (OH/ECW>0%).

-OH/ECW>10%.

-OH/ECW>15%.

During a median follow up 22 [3-49] month we collected:

-Cardiovascular events.

-Mortality.

-Start of renal replacement therapy.

RESULTS

Table 1. Baseline characteristics and p for trend for variables in association with different degrees of hydration.

	Basal n=356	HS 0% n=236	HS 10% n=71	HS 15% n=25	P for trend
Sex (male)	64	65	74	80	0.002
Age (years)	67±13	67±14	71±12	69±12	0.022
Diabetes (%)	36	37	35	64	0.022
Hypertension (%)	87	87	91	91	NS
Dyslipidemia (%)	72	69	85	81	NS
Myocardial Infarction	28	32	38	41	0.04
CHF (%)	27	30	32	41	0.017
Ictus (%)	15	15	18	22	0.03
PVD (%)	12	21	15	14	NS
Creatinine (mg/dL)	3.5±1.5	3.3±1.1	3.5±1.2	3.4±2.8	NS
Proteinuria (g/24h)	0.5 (0.2-1.5)	0.5 (0.2-1.5)	0.8 (0.2-2.2)	1.1 (0.2-4.7)	NS
Albumin (g/dL)	4.1±0.4	4.1±0.4	3.9±0.4	3.8±0.4	0.02
Nt-proBNP (ng/dL)	84 (37-181)	99 (46-215)	140 (46-215)	150 (50-288)	0.02
CRP (mg/dL)	0.3 (0.1-0.7)	0.2 (0.1-0.7)	0.3 (0.1-0.7)	0.3 (0.1-0.7)	NS
Prealbumin (mg/dL)	32 (27-38)	31.0±7.2	32±16	29.8±9	0.009
Charlson Index	7.2±2.7	7.4±2.8	8.3±1.9	7.8±2.2	NS

Abrév.: CHF: congestive heart failure. PVD: Peripheral vascular disease. CRP: C-reactive protein

Table 3. Multivariate analysis (Cox regression) for CV events, mortality and RRT.

	CV events*		Mortality**		RRT***	
	HR (95%CI)	P	HR (95%CI)	P	HR (95%CI)	P
Volumen status						
HS 0%	1.85(0.89-3.84)	0.09	2.24(0.93-5.39)	0.07	0.91(0.54-1.54)	0.72
HS 10%	1.29(0.66-2.52)	0.45	0.83(0.31-2.22)	0.71	1.22(0.66-2.25)	0.52
HS 15%	1.83(0.54-6.15)	0.32	2.69(0.62-11.6)	0.18	1.39(0.57-3.39)	0.45

* Adjusted for sex, age, Charlson index, creatinine, proteinuria, albumin, prealbumin, C-reactive protein.

** Adjusted for age, Charlson index, C-reactive protein, albumin and prealbumin.

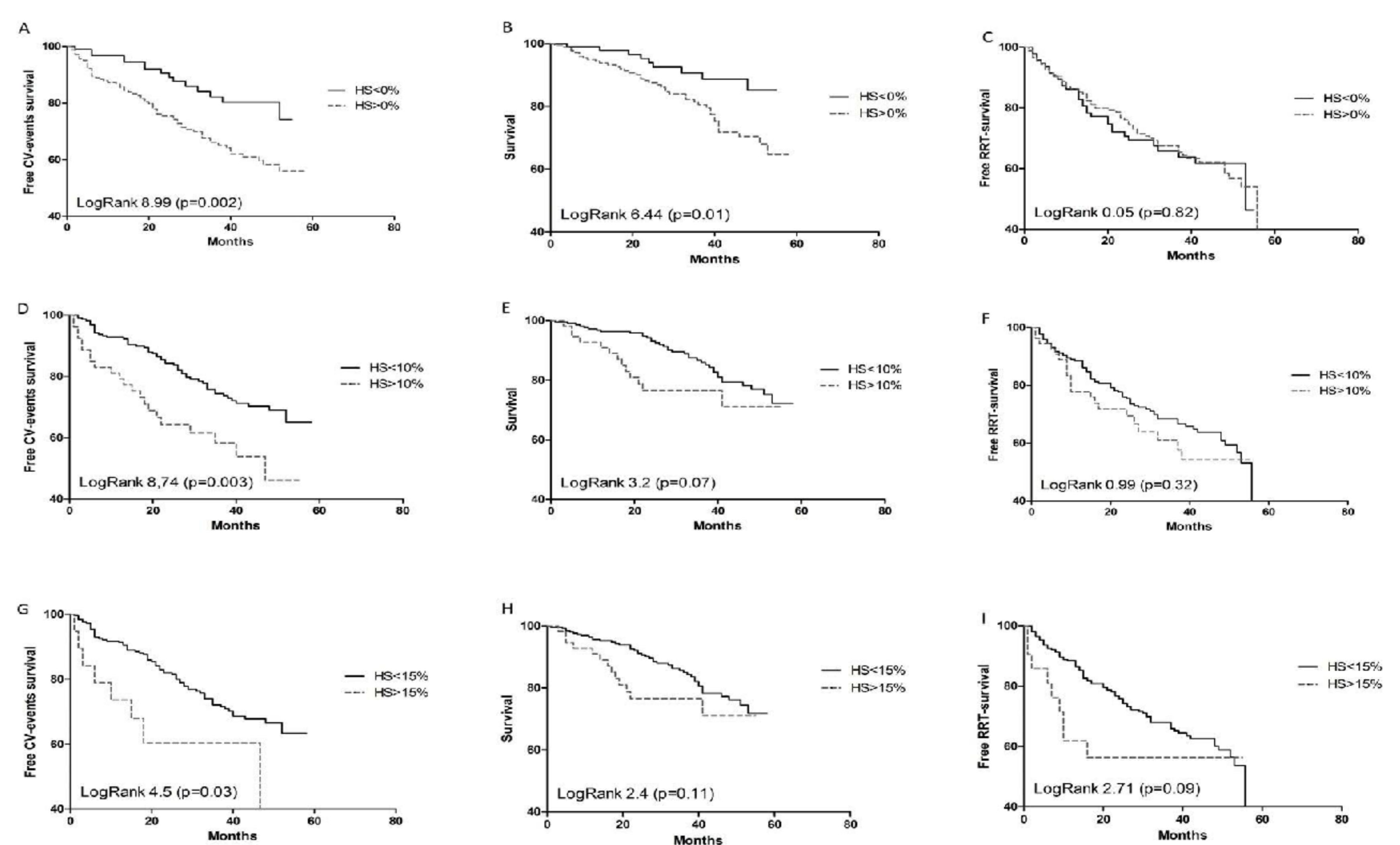
*** Adjusted for age, Charlson index, creatinine, proteinuria, albumin and prealbumin.

Table 2. Univariate analysis (Cox regression) for CV events, mortality and RRT

	CV events		Mortality		RRT	
	HR (95%CI)	P	HR (95%CI)	P	HR (95%CI)	P
Sex (male)	1.30 (0.79-1.93)	NS	0.71 (0.39-1.29)	NS	0.83 (0.54-1.30)	NS
Age (years)	1.06 (1.03-1.08)	<0.001	1.08 (1.05-1.12)	<0.001	0.98 (0.97-0.99)	<0.001
Diabetes (%)	2.57 (1.65-3.97)	<0.001	1.90 (1.09-3.31)	0.024	1.3 (0.87-1.97)	NS
Hypertension (%)	25.6 (1.70-386.4)	0.019	1.71 (0.60-4.79)	NS	0.98 (0.53-1.78)	NS
Dyslipidemia (%)	2.44 (1.34-4.33)	0.003	1.29 (0.69-4.30)	NS	1.03 (0.66-1.56)	NS
Myocardial Infarction (%)	3.54 (1.89-5.68)	<0.001	2.01 (1.28-3.45)	0.004	1.01 (0.87-1.12)	NS
CHF (%)	3.36 (2.15-5.24)	<0.001	1.95 (1.10-3.43)	0.021	0.95 (0.60-1.05)	NS
Ictus (%)	2.21 (1.26-3.89)	<0.001	1.97 (0.91-4.23)	0.084	0.69 (0.34-1.40)	NS
PVD (%)	2.63 (1.59-4.25)	<0.001	2.56 (1.37-4.75)	0.003	0.78 (0.43-1.43)	NS
Charlson index	1.14 (1.06-1.22)	0.006	1.24 (1.14-1.35)	<0.001	0.94 (0.87-1.02)	NS
Creatinine (mg/dL)	0.76 (0.60-0.94)	0.014	0.81 (0.60-1.10)	NS	1.14 (1.08-1.14)	<0.001
Proteinuria (g/24h)	1.10 (1.06-1.18)	0.049	1.10 (1.04-1.21)	NS	1.00 (1.00-1.00)	<0.001
Albumin (g/dL)	0.36 (0.22-0.60)	<0.001	0.42 (0.22-0.82)	0.011	0.43 (0.27-0.67)	<0.001
Nt-proBNP (ng/dL)	1.15 (1.03-1.23)	0.044	1.00 (1.00-1.01)	NS	1.01 (0.98-1.02)	NS
CRP (mg/dL)	1.27 (1.05-1.54)	0.013	1.41 (1.17-1.70)	<0.001	0.72 (0.49-1.07)	NS
Prealbumin (mg/dL)	0.97 (0.95-1.01)	NS	0.96 (0.92-0.99)	0.033	1.00 (0.98-1.03)	NS
Volumen status						
HS 0%	2.33 (1.33-4.09)	0.003	2.47 (1.20-5.03)	0.014	0.97 (0.64-1.47)	NS
HS 10%	2.09 (1.28-3.39)	0.003	1.79 (1.25-3.39)	0.073	1.35 (0.82-2.22)	NS
HS 15%	2.38 (1.19-4.38)	0.015	1.42 (1.26-2.09)	0.05	1.90 (0.98-3.65)	0.057

Abrév.: CHF: congestive heart failure. PVD: Peripheral vascular disease. CRP: C-reactive protein. HS: relative hydration status. HR (95%CI): hazard ratio (95% confidence interval). NS: non significant. CV: cardiovascular. RRT: renal replacement therapy

Figure 1. Kaplan Meier analysis for the studied outcomes (CV events, Mortality and RRT (renal replacement therapy)) in relation to overhydration (HS) higher than 0% (A-C), 10% (D-F) and 15% (G-I).



CONCLUSIONS

In conclusion, any grade of overhydration results in higher rates of CV events and mortality in CKD patients.

However, hydration status depends on several factors that must be taken into account in order to improve patient prognosis.