DETECTION OF PULMONARY CONGESTION BY CHEST ULTRASOUND IN NON-DIALYSIS CKD PATIENTS: OVERHYDRATION OR CARDIAC DYSFUNCTION?

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BACKGROUND

The use of lung ultrasonography to detect extravascular lung water (ELW) has proved to be useful in predicting all-cause mortality and cardiac events in patients undergoing dialysis. However, ELW has not been studied in non-dialysis chronic kidney disease (CKD) patients. Either overhydration (OH) and/or cardiac dysfunction can increase ELW; thus, we aimed to evaluate their contribution to ELW accumulation in non-dialysis CKD patients.

METHODS

This cross-sectional, single-center study prospectively enrolled 67 clinically stable CKD patients (75% male gender, 65.3 (95%CI 62.1, 68.4) years, median eGFR 17 (95%CI 13, 19) mL/min) with OH >1L, as assessed by Body Composition Monitor (BCM™ - Fresenius Medical Care). The ultrasound lung comets (ULC) score was used to evaluate ELW. Hydration status was evaluated using BCM™ (OH), inferior vena cava diameter (IVCD) and chest X-Ray. The patients were grouped and compared according to the ULC score as no (<16 comets; n=44; 66%) or moderate to severe (≥16 comets; n=23; 34%) pulmonary congestion.

RESULTS

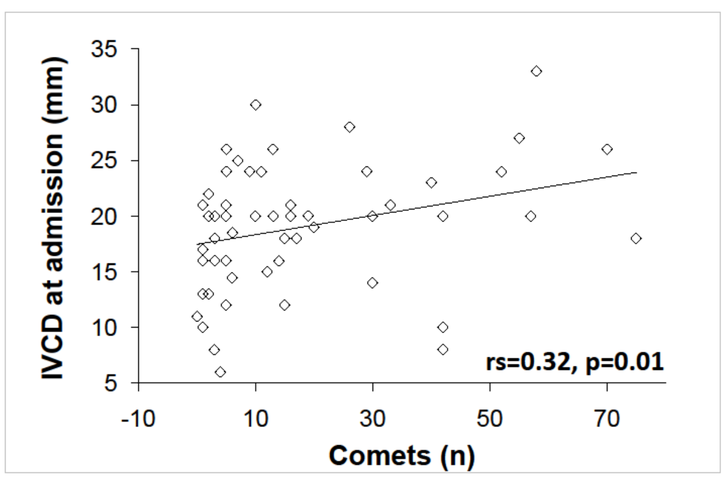
Median OH for the entire cohort was 4.5 (95%CI 3.9, 5.2) L; estimated left ventricular ejection fraction (LVEF) was 55% (95%CI 50, 60%) and mean arterial pressure (MAP) was 103.9mmHg (95%CI 99.5, 108.2mmHg); 31% had left ventricular hypertrophy (LVH); there were no differences between the studied groups regarding these parameters.

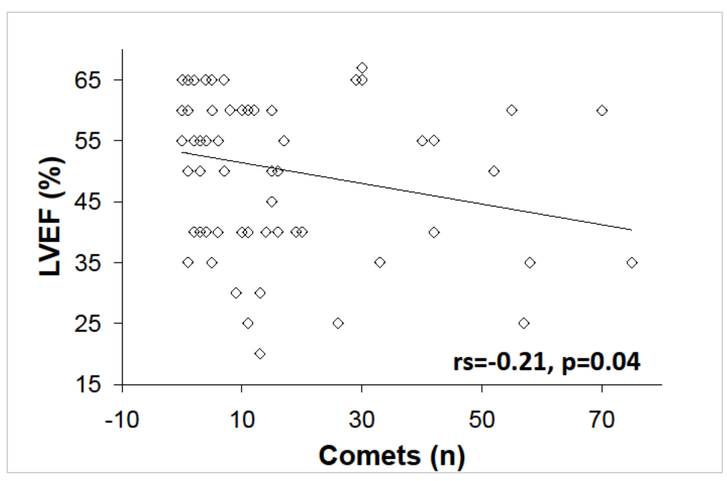
Patients with pulmonary congestion more frequently had CV co-morbidities, higher IVCD and more often congestion signs on chest X-Ray.

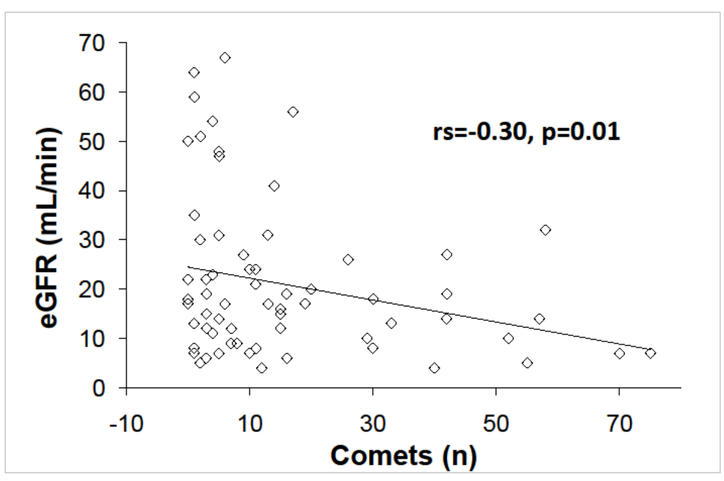
ULC score was correlated directly with IVCD and inversely with eGFR and LVEF.

In a binary logistic regression model in which the dependent variable was pulmonary congestion and the independent variables were CV, OH and renal parameteres, only CV comorbidities and IVCD were significantly and independently related to a ULC score ≥16.

	All N=67	≥16 comets n=23	<16 comets n=44	p
Male gender (%)	75	74	75	0.9
Age (years)	65.3 (62.1, 68.4)	67.8 (61.9, 73.7)	63.9 (60.2, 67.6)	0.2
MAP (mmHg)	103.9 (99.5, 108.2)	107.1 (99.4, 114.8)	102.2 (96.8, 107.6)	0.2
eGFR (mL/min)	17 (13, 19)	14 (10, 19)	17.5 (13, 24)	0.1
Hypertension (%)	87	91	84	0.4
CV comorbidities (%)	78	91	70	0.05
OH at admission (L)	4.5 (3.9, 5.2)	4.8 (3.6, 6.2)	4.4 (3.7, 5.2)	0.5
IVC diameter (mm)	18.9 (17.4, 20.4)	20.1 (17.5, 22.7)	18.1 (16.2, 20.0)	0.09
LVEF (%)	55 (50-60)	50 (40-55)	55 (50-60)	0.1
Pulmonary congestion (Rx; %)	58	78	48	0.01
Hb (g/dL)	9.9 (9.4, 10.4)	9.1 (8.4, 9.8)	10.3 (9.6, 11.0)	0.02







Variables	B	SE	Wald	df	p	Exp(B)(95%CI)
MAP	0.03	0.02	2.80	1	0.09	1.03 (0.99-1.07)
Inferior vena cava diameter at admission	0.16	0.07	5.28	1	0.02	1.18 (1.02-1.36)
CV comorbidities: yes versus no	1.79	0.93	3.66	1	0.05	6.00 (0.95-37.5)
Constant	-8.79	3.22	7.43	1	0.06	

Variables introduces at step 1: age, eGFR, urinary P/Cr, OH at admission, inferior vena cava diameter at admission, mean arterial blood pressure (MAP), cardio-vascular (CV) comorbidities

Cox and Snell R^2 = 0.22; Nagelkerke R^2 =0,30; (χ^2 = 12.4; df = 3; p = 0.006)

CONCLUSIONS

Moderate to severe pulmonary congestion appears to be relatively frequent in non-dialysis CKD patients, since it was observed in one third of the studied patients. In patients with advanced CKD ULC seems more related to CV parameters than to overhydration, ULC score seems to be an indicator of CV disease, as is in patients without CKD. Thus, lung comet guided clinical management may improve clinical outcome in high-risk non-dialysis CKD patients with cardiac disease, but additional research is warranted for validation.

53 ERA
310--MP
Chronic Kidney Disease. Clinical Epidemiology.
Gabriel Stefan
DOI: 10.3252/pso.eu.53era.2016
ePosters supported by F. Hoffmann- La Roche Ltd.
53rd CONGRESS ERA-EDTA VIENNA AUSTRIA MAY 21st-24th, 2016
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