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Clinica Chimica Acta

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Serum potassium concentrations in COVID-19

Dear Editor,

Recent evidence has associated COVID-19 to hypokalemia and other ion imbalances, with potential implications for patient management, and causal mechanisms leading to hypokalemia have been proposed [1–6]. Quite interestingly, Moreno-Pérez et al. [4] have described hypokalemia as a marker of disease severity and of need for mechanical ventilation in COVID-19 patients.

For further evaluating the frequency of hypokalemia in COVID-19 and its possible association with poor outcomes, i.e., in-hospital death and the need of admission to intensive care unit (ICU), we performed a retrospective, observational study on patients admitted between February and April 2020 to our national reference center for infectious diseases. We retrieved the admission potassium value in 874 COVID-19 and 538 SARS-CoV-2 negative patients. Patients in COVID-19 group were significantly older than controls [median age (interquartile range): 60 (47–73) vs. 56 (41–73) years; p = 0.003] and included more males (58.7% vs. 49.1%; p < 0.001). Median admission potassium was significantly lower [3.9 (3.6–4.2) vs. 4.0 (3.7–4.3); p < 0.001] and hypokalemia (defined as a plasma potassium < 3.5 mmol/L) was more frequent in COVID-19 than in controls (18.8% vs. 12.6%; p = 0.005). For 603 COVID-19 patients we were able to retrieve the potassium values of the whole hospitalization period together with clinical outcomes (Table 1). Ninety-three (15.4%) patients died and 68 (11.3%) patients

required admission to ICU. Non-survivors were significantly older, and males more frequently died and needed intensive care than females. At admission, 126 (20.9%) patients had hypokalemia and the rate increased to 36.3% if the nadir potassium concentrations were considered. Receiver operating characteristic curve analysis was performed, but the areas under the curve were always ≤0.6, showing a poor accuracy of hypokalemia in predicting the two selected outcomes. At univariate analysis, age was a predictor of death during hospitalization, while hypokalemia, both at admission and nadir, did not. Nadir hypokalemia gave only a borderline significance in predicting ICU admission (p = 0.052).

Several laboratory tests have been proposed to identify patients with severe COVID-19 [7]. Among those, hypokalemia has been related to poor prognosis [3,4]. Although our data confirmed an elevated prevalence of hypokalemia in COVID-19 patients during their hospitalization, we were unable to specifically relate this dysionemic state to patient death and the need of intensive care.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Table 1
Characteristics of studied COVID-19 patients according to serum potassium concentrations and evaluated outcomes.[a]

	Total	Survivors	Non-survivors	p-value		Non-ICU	ICU	p-value
No.	603	510 (84.6)	93 (15.4)	–		535 (88.7)	68 (11.3)	–
Age, years	62 (50–73)	60 (49–72)	73 (67–80)	<0.001		62 (50–74)	62 (54–70)	0.396
Males	392 (65.0)	319 (62.5)	73 (78.5)	0.004		337 (63.0)	55 (80.9)	0.005
Admission K, mmol/L	3.8 (3.5–4.1)	3.8 (3.5–4.1)	4.0 (3.5–4.3)	0.038		3.8 (3.5–4.1)	3.9 (3.4–4.2)	0.873
Admission hypoK	126 (20.9)	104 (20.4)	22 (23.7)	0.566		108 (20.2)	18 (26.5)	0.297
Admission hyperK	14 (2.3)	8 (1.6)	6 (6.5)	0.012		14 (2.6)	0 (0.0)	0.356
Nadir K, mmol/L	3.6 (3.3–3.9)	3.6 (3.3–3.9)	3.6 (3.3–4.0)	0.727		3.6 (3.3–3.9)	3.5 (3.2–3.7)	0.004
Nadir hypoK	219 (36.3)	184 (36.1)	35 (37.6)	0.865		187 (35.0)	32 (47.1)	0.069
Nadir hyperK	4 (0.7)	2 (0.4)	2 (2.2)	0.220		4 (0.7)	0 (0.0)	0.938
ROC curve analysis	**In-hospital death**	**AUC**	**95% CI**		**ICU admission**	**AUC**	**95% CI**	
Admission hypoK		0.568	0.527–0.607			0.506	0.465–0.547	
Nadir hypoK		0.511	0.471–0.552			0.606	0.566–0.645	
Univariate regression analysis	**In-hospital death**	**OR**	**95% CI**		**ICU admission**	**OR**	**95% CI**	
Age > 62 years		6.86	3.8–12.2	<0.001		0.90	0.5–1.5	0.679
Admission hypoK		1.21	0.7–2.0	0.477		1.42	0.8–2.5	0.232
Nadir hypoK		1.07	0.7–1.7	0.774		1.65	1.0–2.8	0.052

ICU, intensive care unit, K, potassium; ROC, receiver operating characteristic; AUC, area under the ROC curve; CI, confidence interval; OR, odds ratio.
[a] Data are reported as absolute number and percentage for categorical variables and median with interquartile range for quantitative variables. Differences between variables in different categories were assessed by applying chi-squared test (categorical) and Mann-Whitney rank-sum test (quantitative). Hypokalemia was defined as plasma K < 3.5 mmol/L; hyperkalemia was defined as plasma K > 5.0 mmol/L.

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