



## 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  $\leq 0.6$ , 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.<sup>a</sup>

	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
<b>ROC curve analysis</b>	<b>In-hospital death</b>	<b>AUC</b>	<b>95% CI</b>		<b>ICU admission</b>	<b>AUC</b>	<b>95% CI</b>
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
<b>Univariate regression analysis</b>	<b>In-hospital death</b>	<b>OR</b>	<b>95% CI</b>		<b>ICU admission</b>	<b>OR</b>	<b>95% CI</b>
Age $> 62$ years		6.86	3.8–12.2	$< 0.001$		0.90	0.5–1.5
Admission hypoK		1.21	0.7–2.0	0.477		1.42	0.8–2.5
Nadir hypoK		1.07	0.7–1.7	0.774		1.65	1.0–2.8

ICU, intensive care unit, K, potassium; ROC, receiver operating characteristic; AUC, area under the ROC curve; CI, confidence interval; OR, odds ratio.

<sup>a</sup> 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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