

LETTER TO THE EDITOR

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Intravascular volume status in patients with moderate to severe COVID-19: a case series

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1. To the editor-in-chief

Coronavirus disease 2019 (COVID-19) is a transmissible disease instigated by the coronavirus (SARS-CoV-2) which has been identified for few years (1). Patients with COVID-19 may present with hypovolemia due to vomiting, anorexia, or diarrhea. However, treatment guidelines recommend a “conservative” fluid administration strategy with dynamic measuring parameters to assess fluid response (2). Since physical examination has a limited ability to predict volume status, other non-invasive methods such as point-of-care ultrasound (POCUS) have been extensively used for this purpose in other diseases (2). In this case series, we describe intravascular volume status in patients with moderate to severe COVID-19 as measured by inferior vena cava (IVC) calibre and distensibility.

This study included all adult patients (age ≥ 18 years) with moderate to severe COVID-19 who were admitted to a university-affiliated tertiary care teaching hospital between March 20th and April 10th, 2020. COVID-19 was confirmed by either positive RT-PCR test on oropharynx or nasopharynx swab samples or with chest computed tomography (CT) imaging findings. We defined moderate to severe COVID-19 as oxygen saturation $\leq 93\%$ or respiratory rate (RR) ≥ 24 . Upon admission and before starting intravascular hydration, a POCUS scan of the IVC was performed; The IVC measurement was obtained with the patient in the supine position. The data were collected by grayscale (B-mode) and motion-mode (M-mode) with a 3.5-Mhz curved array ultrasound probe. All scans were performed by emergency physicians experienced in POCUS. This respiratory variability was calculated as the IVC collapsibility index (IVCCI): $[(\text{maximum IVC diameter} - \text{minimum IVC diameter}) / \text{maximum IVC diameter}] \times 100$. (3) The sonographer then recorded IVC size in 2 categories: under 21 millimetres (mm) and over 21mm. IVCCI was also documented as either $>50\%$ or $<50\%$.

During the study period, we identified 34 critically ill patients with confirmed COVID-19 infection. The mean (\pm SD) age of the patients was 63.3 ± 13.9 years and 64.7% were men. Twenty-four patients (70%) presented with the chief com-

plaint of dyspnea at the time of hospital admission. Two patients (5.9%) had diarrhea, 2 patients (5.9%) had vomiting, and 2 patients (5.9%) reported reduced urine volume. Documented fever was present in 9 patients (26.5%) on admission to the hospital.

Thirty-three patients (97.1%) had IVC size < 21 mm and only in 1 patient the IVC size was ≥ 21 mm. On the other hand, 32 patients (94.1%) had IVCC of $>50\%$ and only 2 patients revealed an IVCC below that. Of note, only one patient had collapsibility $<50\%$ and IVC size <21 mm and 32 patients had low intravascular volume.

In this study, we used POCUS scan of IVC diameter and collapsibility to assess volume status in COVID 19 patients with moderate to severe disease. Our findings support the hypothesis that low intravascular volume by ultrasonography is common in moderate to severe COVID -19 patients. It was compatible with the finding of fluid management for patients with sepsis or acute respiratory distress syndrome was published (4). In our cohort, 26% of the patients had fever at the time of admission. In previous studies, fever was documented in only half of the patients (1). In contrast, similar to previous reports, more than two-third of our patients reported respiratory symptoms at the time of presentation (1). While our study showed prevalence of low intravascular volume in severe COVID 19 patients, no previous work on the assessment of dehydration with IVC size in COVID 19 patients has been conducted.

Our study has some notable limitations. Mainly, our sample size was very small, and we did not have follow-up to ascertain about other relevant findings. In addition, our population was from one centre and could have resulted in selection bias. We have used only IVC indices for dehydration and did not assess other findings such as right ventricular function and interstitial oedema of lung, which are important mechanisms that affect IVC size. As another factor, the indices are highly dependent upon the patient's respiratory effort that is variable in COVID 19 patients (5).

In conclusion, almost all patients with moderate to severe COVID-19 have severe dehydration based on the IVC size and

collapsibility as assessed by ultrasonography.

2. Declarations

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2.2. Authors' contribution

All authors have contributed to this manuscript equally.

2.3. Conflict of interest

None.

2.4. Funding

None.

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