The Intriguing, Still Undercovered, Clinical Role of Echocardiography in Critically Ill Coronavirus Disease Patients

Chiara Lazzeri, MD
Manuela Bonizzoli, MD
Adriano Peris, MD

To the Editor:

We read with interest the article published in a recent issue of *Critical Care Medicine* by Chotalia et al (1) who investigated the prognostic role of right ventricle (RV) dilatation and/or dysfunction in 172 mechanically ventilated patients with acute respiratory distress syndrome (ARDS) due to severe acute respiratory syndrome coronavirus 2 (coronavirus disease [COVID]) disease. This elegant article (1) does confirm the potential clinical role of echocardiography in critically ill patients with COVID-related ARDS.

However, in our opinion, the interpretation of the results obtained by Chotalia et al (1) may be limited by the selection criteria of the study population. According to their local clinical practice, echocardiography was performed not systematically but only in a subset of ICU COVID patients, characterized by increased troponin values and/or hemodynamic instability. About one third of the entire population (89/267 patients; 33%) was excluded from an echocardiographic assessment. This may prevent from an holistic understanding of echocardiographic findings in the real world of critically ill COVID patients. Furthermore, patients with preexistent heart disease were not included despite the known association between cardiovascular diseases and COVID disease progression (2). The negative correlation between RV alterations and urine output should be confirmed in larger unselected populations. Indeed, a high use of renal replacement therapy (46.5%) was reported by Chotalia et al (1), that is, almost half of the population was supposed to be anuric, and no biohumoral signs of systemic congestion was detectable in patients with RV dilatation and dysfunction (as inferred by comparable values of transaminase among the three subgroups).

When exploring the relation between the RV and "pulmonary pathophysiology," significant higher values of peak inspiratory airway and positive end-expiratory pressures observed in patients with RV dilatation and dysfunction cannot rule out a causative link between increased ventilatory pressures and RV alterations, as previously described in no-COVID ARDS (3). Unfortunately, no data on inflammatory activation (i.e., D-dimer) were provided in the article by Chotalia et al (1), so the link between RV alteration and pulmonary disease severity cannot by clearly elucidated.

Due to nonuniformity of COVID disease, the clinical significance of echocardiography may be understood and achieved, especially in critically COVID patients by three-step approach: 1) a detailed and comprehensive description of echo findings in COVID ICU patients by a systematic use of echocardiography (4). This approach allows, in the real-world population, the identification of those echo variables with prognostic role; 2) serial echocardiographic

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examinations, in order to gain a more in-depth understanding of heart-lung interactions across different disease severity phases in the single patient (5); 3) an "operative" approach, in which echocardiography helps in tailoring therapy and in assessing its efficacy. For instance, the detection by echocardiography of RV dilatation and severe pulmonary hypertension may lead to initiation of inhaled nitric oxide therapy whose effects can be monitored in the single patients by serial echocardiographic examinations.

Intensive Care Unit and Regional ECMO Referral Centre, Azienda Ospedaliero-Universitaria Careggi, Florence, Italy

The authors have disclosed that they do not have any potential conflicts of interest.

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The authors reply:

We thank Lazzeri et al (1) for their insightful comments on our article (2), recently published in *Critical Care Medicine*, and support their notion that assessment of right ventricular (RV) dysfunction (RVD) is important in the management of patients with coronavirus disease 2019 (COVID-19) acute respiratory distress syndrome (ARDS).

They correctly highlight that we did not perform transthoracic echocardiography (TTE) in all our COVID-19 ICU patients, introducing a selection bias: a common flaw in retrospective (3) and prospective (4) critical care echocardiography studies. However, TTE requests were screened and protocolized: patients must have had an elevated high sensitivity (HS)-troponin I (> 14 ng/dL). As such, although one-third of these patients did not receive a TTE, they displayed a low risk of RVD and mirrored the normal RV subgroup. They had low median HS-troponin I values (12 [interquartile range (IQR), 5–14]), D-dimer values (1,264 [IQR, 510–2,230]), prevalence of renal replacement therapy (RRT) (28.1%), and 90-day mortality rate (23.6%). Nonetheless, we have not characterized RV function in all COVID-19 ICU patients, and this remains a notable limitation of the study.

Second, we suspect RV dilation was associated with venous congestion due to the weak correlation between urine output and RV:left ventricular end-diastolic area, however, agree that this requires prospective validation. Although approximately half of the cohort received RRT, this was at any time point during ICU stay and not necessarily during the time of TTE. The lack of association between liver function tests and RV size does not exclude an isolated congestive hepatopathy (5). The hepatic arterial buffer response may protect the liver at any given central venous pressure/right atrial pressure where kidney dysfunction occurs. It is unknown whether the weak correlations observed between ventilator parameters and RV fractional area change were a cause, consequence, or simply an association of the RV systolic function that was measured.

Minesh Chotalia, BMBCh[1,2]
Muzzammil Ali, MRCP[2]
Joseph Alderman, MBChB[1,2]
Manish Kalla, DPhil[2]
Dhruv Parekh, PhD[1,2]
Mansoor Bangash, PhD[1,2]
Jaimin Patel, PhD[1,2]

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