

CORRESPONDENCE



# Characterising right ventricular dysfunction in acute respiratory distress syndrome due to COVID-19: which measurements are best?

Minesh Chotalia<sup>1,2\*</sup> , Jaimin Patel<sup>1,2</sup>, Dhruv Parekh<sup>1,2</sup> and Mansoor Bangash<sup>1,2</sup>

© 2022 Springer-Verlag GmbH Germany, part of Springer Nature

We read with great interest the study by Huang et al. describing the echocardiographic findings in 677 patients admitted in intensive care unit (ICU) with pneumonia due to coronavirus disease 2019 (COVID-19) [1]. Right ventricular (RV) dysfunction (RVD) varies in definition and we commend the authors for reporting multiple measures of RV size and function. Here, we interpret which RVD markers are most closely associated with mortality and thus are most useful in characterising cardiovascular dysfunction in acute respiratory distress syndrome (ARDS) due to COVID-19.

Visually estimated RV systolic dysfunction (RVSD) had a low incidence (23%) and was not associated with mortality, perhaps reflecting the complex geometry of the RV making accurate estimation of its function difficult. In supplementary Fig. 3C, a substantial proportion of patients with visual RVSD had normal tricuspid annular plane systolic excursion (TAPSE), demonstrating the relative preservation of longitudinal RV function in COVID-19 ARDS. This has important ramifications, as most studies have used TAPSE to assess RVSD [2]. Surprisingly, RV fractional area change (RVFAC) was measured less frequently (49%) and the incidence of low RVFAC (< 35%) and its correlation with outcome was not reported: a significant omission as it is deemed a more sensitive marker of RVSD than TAPSE [3]. Although American echocardiography guidelines recommend

using RVSD markers to define RVD, we have demonstrated that in COVID-19 ARDS, objective RVSD is only associated with mortality when combined with RV dilation [3].

In contrast, RV dilation was more common (present in 50%), but only 35% of these patients had concomitant acute cor pulmonale (ACP). RV dilation has not previously been associated with mortality in COVID-19 ARDS [3], although this was not reported in this study.

Instead, the importance of paradoxical septal motion (PSM) has been highlighted, which, although less frequent (19%), was related to disease severity and had a higher incidence (81%) of concomitant ACP. Furthermore, ACP (a combination of PSM and objective RV dilation) was the only tested RVD marker to be independently associated with mortality. This is somewhat at odds with previous literature, where a correlation between ACP and mortality was not demonstrated in COVID-19 [4] and non-COVID-19 ARDS [5]. Whether selection bias or the inclusion of spontaneously ventilating patients has contributed to these findings warrants further research.

Although RV dilation may preserve stroke volume via the Frank–Starling mechanism, excessive distension may precipitate RVSD. We found the two markers in combination independently associated with mortality [3] and in a clustering analysis also combined to define the highest mortality risk subgroup [6] in COVID-19 ARDS. Supplementary Fig. 2 shows that 86 patients had a combination of RV dilation and RVSD, and whether this marker aligns with patient outcomes warrants investigation. Recent studies in line with the European Society of Intensive Care Medicine (ESICM) guidance have defined RVD as objective RV dilation with central venous pressure

\*Correspondence: mines.chotalia@nhs.net

<sup>1</sup> Birmingham Acute Care Research Group, University of Birmingham, Birmingham, UK

Full author information is available at the end of the article

(CVP) > 8 [7] and the prognostic utility of this marker was not reported, despite central venous pressure being recorded in all patients.

It is unclear which RVD definition most closely aligns with patient outcome. We suggest studies aim to report all markers and their association with mortality, to allow identification of a prognostically enriched cohort of patients with RVD in which RV protective interventions may then be trialled.

#### Author details

<sup>1</sup> Birmingham Acute Care Research Group, University of Birmingham, Birmingham, UK. <sup>2</sup> Department of Anaesthetics and Critical Care, Queen Elizabeth Hospital, Birmingham, UK.

#### Author contributions

All authors contributed to writing the correspondence and approve its submission.

#### Declarations

#### Conflicts of interest

No financial or non-financial interests are directly or indirectly related to the work submitted for publication. On behalf of all authors, the corresponding author states there is no conflict of interest.

#### Publisher's Note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Published: 20 May 2022

#### References

1. Huang S, Vignon P, Mekontso-Dessap A, Tran S, Prat G, Chew M, Balic M, Sanfilippo F, Banauch G, Clau-Terre F, Morelli A (2022) Echocardiography findings in COVID-19 patients admitted to intensive care units: a multi-national observational study (the ECHO-COVID study). *Intensive Care Med* 21:1–2
2. Corica B, Marra AM, Basili S, Cangemi R, Cittadini A, Proietti M, Romiti GF (2021) Prevalence of right ventricular dysfunction and impact on all-cause death in hospitalized patients with COVID-19: a systematic review and meta-analysis. *Sci Rep* 11(1):1–9
3. Chotalia M, Ali M, Alderman JE, Kalla M, Parekh D, Bangash MN, Patel JM (2021) Right ventricular dysfunction and its association with mortality in coronavirus disease 2019 acute respiratory distress syndrome. *Crit Care Med* 49(10):1757
4. Cavaleiro P, Masi P, Bagate F, d'Humières T, Mekontso DA (2021) Acute cor pulmonale in Covid-19 related acute respiratory distress syndrome. *Crit Care* 25(1):1–3
5. MekontsoDessap A, Boissier F, Charron C, Bégot E, Repessé X, Legras A, Brun-Buisson C, Vignon P, Vieillard-Baron A (2016) Acute cor pulmonale during protective ventilation for acute respiratory distress syndrome: prevalence, predictors, and clinical impact. *Intensive Care Med* 42(5):862–870
6. Chotalia M, Ali M, Alderman JE, Patel JM, Parekh D, Bangash MN (2022) Cardiovascular subphenotypes in patients with COVID-19 pneumonitis whose lungs are mechanically ventilated: a single-centre retrospective observational study. *Anaesthesia*
7. Vieillard-Baron A, Prigent A, Repessé X, Goudelin M, Prat G, Evrard B, Charron C, Vignon P, Geri G (2020) Right ventricular failure in septic shock: characterization, incidence and impact on fluid responsiveness. *Crit Care* 24(1):1–8

Received: 12 May 2022 Accepted: 13 May 2022