

CORRESPONDENCE



Can lung ultrasound predict histologic pattern of lung injury in critically ill patients with COVID-19?

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Dear Editor,

We have read with great interest the study by de Almeida Monteiro et al. [1] recently published in *Intensive Care Medicine*, where authors studied the relationship between histopathological data and lung ultrasonographic (LUS) findings in patients with severe coronavirus disease 2019 (COVID-19). The authors confirmed that consolidation observed by LUS may reflect fibroproliferative diffuse alveolar damage (DAD). At the same time, no relationship was found between fibroproliferative DAD and the severity of interstitial syndrome or pleural line characteristics. However, we have some concerns about the interpretation of the results of this study.

First, an important feature of this study is that only post-mortem LUS was performed, and we do not know how much it corresponds to pre-mortem LUS. In accordance with the design, this study included only deceased patients, that is, mainly patients with catastrophic lung damage incompatible with life. Therefore, it is possible that the results obtained will be difficult to extrapolate to other patients with COVID-19.

Second, the authors identified the histological features of fibroproliferative changes, and interpreted these findings as «progression of pulmonary fibrosis», although pulmonary fibrosis is not an obligatory consequence of fibroproliferative DAD. By now, only a small number of studies are available on the follow-up of LUS changes in patients with COVID-19. However, nevertheless, one of these studies demonstrated that LUS changes had significantly reduced 5–6 weeks after discharge. Interestingly,

in this study, the incidence of consolidations also underwent a significant reduction (from 61.7% to 12.5%) [2]. In our daily clinical practice, we perform LUS both in the acute phase of the COVID-19, and after discharge, and we also noted the disappearance or reduction of the consolidations with recovery.

Reversibility of changes in the lung parenchyma after COVID-19 can also be confirmed by computed tomography (CT) based studies. In a recent study by Han et al. [3], in survivors of severe COVID-19 pneumonia, follow-up CT scans 6 months after discharge showed either complete radiological resolution (38%) or residual ground-glass opacification or interstitial thickening (27%). Given these positive LUS and CT changes, we can hardly judge the progression of pulmonary fibrosis, a condition that by definition is irreversible. It is quite possible that other morphological changes, such as organizing pneumonia, microvascular changes, alveolar hemorrhage, atelectasis, and others, also contribute to the LUS pattern of consolidation.

Finally, LUS is a promising method for assessing interstitial lung diseases, but, unfortunately, is not yet capable of detecting pulmonary fibrosis with high reliability [4]. It is possible that complementary methods, such as ultrasound elastography, can improve the diagnosis of pulmonary fibrosis, but these diagnostic methods are not yet sufficiently developed and standardized [5].

Besides these remarks, we would like to applaud the authors for performing such an important study, which is one of the first to directly compare morphological and ultrasound changes in the lung parenchyma of COVID-19 patients. Further clinical and functional studies, in conjunction with pre-mortem imaging techniques, may

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complement the pioneering data by de Almeida Monteiro et al.

Author contributions

All authors have contributed equally to the conception, drafting, and final editing of this manuscript.

Declarations**Conflict of interest**

The authors have no conflicts to report.

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References

1. de Almeida Monteiro RA, Duarte-Neto AN, Ferraz da Silva LF et al (2021) Ultrasound assessment of pulmonary fibroproliferative changes in severe COVID-19: a quantitative correlation study with histopathological findings. *Intensive Care Med.* <https://doi.org/10.1007/s00134-020-06328-4>
2. Alharthy A, Faqih F, Abuhamdah M et al (2020) Prospective longitudinal evaluation of point-of-care lung ultrasound in critically ill patients with severe COVID-19 pneumonia. *J Ultrasound Med.* <https://doi.org/10.1002/jum.15417>
3. Han X, Fan Y, Alwalid O et al (2021) Six-Month follow-up chest CT findings after severe COVID-19 pneumonia. *Radiology.* <https://doi.org/10.1148/radiol.2021203153>
4. Wang Y, Gargani L, Barskova T et al (2017) Usefulness of lung ultrasound B-lines in connective tissue disease-associated interstitial lung disease: a literature review. *Arthritis Res Ther* 19(1):206. <https://doi.org/10.1186/s13075-017-1409-7>
5. Zhou B, Yang X, Zhang X et al (2020) Ultrasound elastography for lung disease assessment. *IEEE Trans Ultrason Ferroelectr Freq Control* 67(11):2249–2257. <https://doi.org/10.1109/TUFFC.2020.3026536>