

LETTER



Findings of lung ultrasonography of novel corona virus pneumonia during the 2019–2020 epidemic

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Dear Editor,

Up to 24 February 2020, there have been 77,269 officially reported confirmed cases of 2019 novel corona virus (SARS-CoV-2) infection in China. As lung abnormalities may develop before clinical manifestations and nucleic acid detection, experts have recommended early chest computerized tomography (CT) for screening suspected patients [1]. The high contagiousness of SARS-CoV-2 and the risk of transporting unstable patients with hypoxemia and hemodynamic failure make chest CT a limited option for the patient with suspected or established COVID-19. Lung ultrasonography gives the results that are similar to chest CT and superior to standard chest radiography for evaluation of pneumonia and/or adult respiratory distress syndrome (ARDS) with the added advantage of ease of use at point of care, repeatability, absence of radiation exposure, and low cost [2].

In this report, we summarize our early experience with lung ultrasonography for evaluation of SARS-CoV-2 infection in China with the intent of alerting frontline intensivists to the utility of lung ultrasonography for management of COVID-19.

Ultrasonographic features of nCoV pneumonia

We performed lung ultrasonography on 20 patients with COVID-19 using a 12-zone method [3].

Characteristic findings included the following:

1. Thickening of the pleural line with pleural line irregularity;
2. B lines in a variety of patterns including focal, multifocal, and confluent;
3. Consolidations in a variety of patterns including multifocal small, non-translobar, and translobar with occasional mobile air bronchograms;
4. Appearance of A lines during recovery phase;
5. Pleural effusions are uncommon.

The observed patterns occurred across a continuum from mild alveolar interstitial pattern, to severe bilateral interstitial pattern, to lung consolidation. Table 1 summarizes typical lung ultrasonography finds in patients with COVID-19 respiratory disease in comparison with chest CT findings. Typical lung ultrasonography images are shown in the supplementary material (Supplementary Fig. 1.)

The findings of lung ultrasonography features of SARS-CoV-2 pneumonia/ARDS are related to the stage of disease, the severity of lung injury, and comorbidities. The predominant pattern is of varying degrees of interstitial syndrome and alveolar consolidation, the degree of which is correlated with the severity of the lung injury. A recognized limitation of lung ultrasonography is that it cannot detect lesions that are deep within the lung, as aerated lung blocks transmission of ultrasonography, i.e., the abnormality must extend to the pleural surface to be visible with on ultrasonography examination. Chest CT is required to detect pneumonia that does not extend to the pleural surface.

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Table 1 CT and ultrasonographic features of COVID-19 pneumonia

Lung CT	Lung ultrasound
Thickened pleura	Thickened pleural line
Ground glass shadow and effusion	B lines (multifocal, discrete, or confluent)
Pulmonary infiltrating shadow	Confluent B lines
Subpleural consolidation	Small (centomeric) consolidations
Translobar consolidation	Both non-translobar and translobar consolidation
Pleural effusion is rare.	Pleural effusion is rare
More than two lobes affected	Multilobar distribution of abnormalities
Negative or atypical in lung CT images in the super-early stage, then diffuse scattered or ground glass shadow with the progress of the disease, further lung consolidation	Focal B lines is the main feature in the early stage and in mild infection; alveolar interstitial syndrome is the main feature in the progressive stage and in critically ill patients; A lines can be found in the convalescence; pleural line thickening with uneven B lines can be seen in patients with pulmonary fibrosis

Based upon our experience, we consider that lung ultrasonography has major utility for management of COVID-19 with respiratory involvement due to its safety, repeatability, absence of radiation, low cost and point of care use; chest CT may be reserved for cases where lung ultrasonography is not sufficient to answer the clinical question. We find there is utility of lung ultrasonography for rapid assessment of the severity of SARS-CoV-2 pneumonia/ARDS at presentation, to track the evolution of disease, to monitor lung recruitment maneuvers, to guide response to prone position, the management of extracorporeal membrane therapy, and for making decisions related to weaning the patient from ventilatory support.

Electronic supplementary material

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Compliance with ethical standards

Conflicts of interest

On behalf of all authors, the corresponding author states that there is no conflict of interest.

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References

1. National Health Commission of the people's Republic of China. Diagnosis and treatment of novel coronavirus pneumonia (trial, the fifth version) [EB/OL]. (2020-02-05)[2020-02-06]. <http://www.nhc.gov.cn/yzygj/s7653p/202002/3b09b894ac9b4204a79db5b8912d4440.shtml>
2. Mayo PH, Copetti R, Feller-Kopman D, Mathis G, Maury E, Mongodi S, Mojoli F, Volpicelli G, Zanobetti M (2019) Thoracic ultrasonography: a narrative review. *Intensive Care Med* 45:1200–1211. <https://doi.org/10.1007/s00134-019-05725-8>
3. Soummer A, Perbet S, Brisson H, Arbelot C, Constantin JM, Lu Q, Rouby JJ, Lung Ultrasound Study Group (2012) Ultrasound assessment of lung aeration loss during a successful weaning trial predicts postextubation distress. *Crit Care Med*. 40(7):2064–2072. <https://doi.org/10.1097/CCM.0b013e31824e68ae>