EDITORIAL

Lung Ultrasound: COVID-19's Silver Lining

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Keywords: B-lines, Chest X-ray, COVID-19, Lung ultrasound, Shred sign.
Indian Journal of Critical Care Medicine (2021): 10.5005/jp-journals-10071-23703

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How to cite this article: Pichamuthu K. Lung Ultrasound: COVID-19's Silver Lining. Indian J Crit Care Med 2021;25(1):8–9.

Source of support: Nil

Conflict of interest: None

Although lung ultrasound (LUS) was described more than 20 years ago, its incorporation into routine bedside practice has been slow. Its superiority over clinical examination and traditional radiography has been repeatedly demonstrated in the diagnoses of various lung conditions. It is also very quick, giving us a clear diagnosis in most patients in a matter of minutes.[1] Combining it with cardiac ultrasound increases its diagnostic ability.[2] It does not require an expensive or sophisticated ultrasound machine. Users can be trained to do reliable LUS scans with a short period of training and a knowledge of just 10 LUS signs.[3,4]

The COVID-19 pandemic that is sweeping the globe has thrown up huge challenges in diagnosis, triaging, and prognostication on an exceptionally large scale. Its predilection to cause severe involvement of the lower respiratory tract has meant a focus on chest imaging in the form of chest radiography, chest computed tomography (CT) scans, and LUS. Characteristic findings have been described in CT scans and CT imaging has found a prominent place in the diagnostic pathways in many health systems during COVID-19 surges with a high influx of patients.

The role of LUS, on the contrary, has not been well defined and its intensity of usage in COVID patients has been highly variable. Lung ultrasound is already known to have a sensitivity >90% in diagnosing viral pneumonia.[5] Many authors have described the LUS features of COVID-19 which include confluent and isolated B-lines, thickened or irregular pleural lines, presence of subpleural consolidations with or without air bronchograms, shred sign, and areas of sparing. Shred sign is the irregular interface between a subpleural consolidation and the underlying aerated lung. A new sign—a "light beam" or "waterfall sign" has been described in early COVID-19 pneumonia.[6] This shining band-form artifact spreads down from a large portion of a regular pleural line, often appearing and disappearing with an on–off effect during respiration. While small pleural effusions can be seen in COVID pneumonia, the presence of large or complicated effusions suggests an alternate diagnosis. However, the LUS signs of COVID-19 pneumonia including the "light beam" sign can be seen in other inflammatory conditions of the lung. Hence, while LUS for COVID lung involvement is sensitive, it is not very specific and its interpretation should factor in the prevalence of COVID and the presence of coexisting lung conditions.

In the present issue of IJCCM, Behera et al. describe the chest X-ray and LUS features of 50 patients with moderate or severe COVID-19 pneumonia.[7] While 96% of these patients had typical chest X-ray findings, all of them had LUS abnormalities, particularly shred signs and thickened pleura. B-line score and number of areas with shred sign and pleural line abnormalities correlated with clinical severity of illness. The presence of thickened pleura was associated with an increased need for organ support. Association with other clinical outcomes, such as, length of stay, ventilator-free days, or mortality were not studied. Sequential changes in chest X-ray and LUS through the course of the illness were not documented.

This study confirms what many other reports have shown—that LUS findings are present in all patients with COVID-19 pneumonia and the density of lesions correlates with the severity of the disease. It also demonstrates that it is feasible in the Indian setting to screen COVID-19 patients with a point-of-care ultrasound scanning at admission.

So then, what could be the possible role of LUS in managing the COVID-19 epidemic in our country? First, it can be used in emergency departments of primary, secondary, and tertiary hospitals, for the early detection of pulmonary involvement in symptomatic patients suspected to have COVID-19. This is of particular importance when virological testing is delayed, unavailable, or overwhelmed. Patients with symptoms and LUS findings suggestive of COVID, who are reverse transcription-polymerase chain reaction (RT-PCR) negative, should have a repeat swab. Various LUS-guided triage algorithms have also been suggested.[8,9] Second, in the wards, LUS can be used for risk stratification and monitoring treatment response. A validated grading system for COVID-19 has been developed for this purpose using machine learning.[10] Each of the 12 areas of the lung can be graded from 0 to 3 and added to get a total score which could range from 0 to 36. Daily LUS can also help anticipate clinical deterioration and guide the timing of endotracheal intubation. Lastly in the intensive care unit (ICU), LUS is indispensable in monitoring response, titrating mechanical ventilation, deciding on optimal positioning, and detecting hyperinflation and pneumothoraces. Lung ultrasound in conjunction with echocardiography can help in the detection of pulmonary embolism and cardiac dysfunction, both of which are not uncommon in COVID-19. Also, the technical ease of acquiring LUS images, repeatability, easy disinfection of portable ultrasound machines, and the difficulties of auscultating and ordering chest X-rays and CT scans in COVID-19 patients make a strong case for the regular use of LUS in their management.

What then are the barriers hindering us from doing this? A lack of widespread expertise in LUS may be one reason. Lung ultrasound is technically easy to perform and interpretation of the 10 signs can

be learned over a short time. Technologically driven solutions to this include artificial intelligence (AI) tools available with the latest ultrasound machines which guide correct LUS image acquisition and interpretation.[11] Work is in progress to create AI tools that will interpret all LUS images of a patient and indicate the probability of the patient having COVID. The other solution to lack of expertise is telemedicine, where the images acquired can be interpreted by an expert anywhere else in the world. The high cost of ultrasound machines is another barrier. However, lower-cost ultraportable devices, which are about a quarter the cost of the standard portable machine, are becoming more popular in the market in the wake of COVID-19 fueled demand. Many of these devices also wirelessly store images acquired in the cloud or on existing picture archiving and communication systems (PACS). This allows the review of images for refuting or confirming findings, overcoming a commonly cited drawback of traditional portable machines.

The fresh focus on LUS brought about by the COVID-19 is one of the silver linings of this dreary pandemic. Although our experience has shown that this is a game-changing bedside imaging tool, the need of the hour is well-designed prospective studies looking at the impact of LUS-guided triage and clinical decision-making on meaningful patient outcomes in COVID-19.

It is also time to capitalize on this enthusiasm for LUS by clearly defining its role in critical care beyond COVID, widely disseminating ultrasound training, and making LUS a part of the standard assessment of patients in the ICU. This way, we can ensure that all critically ill patients can reap the benefits of this promising imaging modality.

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