Proposal to Unify the Colorimetric Triage System With the Standardized Lung Ultrasound Score for COVID-19

To the Editor: I read with great interest the findings published by Soldati et al., who proposed a magnificcent and simple standardization of the lesions captured by pulmonary ultrasound (US) for patients with coronavirus disease 2019 (COVID-19). This approach opens the possibilities of treatment in out-of-hospital settings such as care by highly trained personnel who work in ground or air ambulances or remote locations and those with limited resources such as countries with emerging economies. The 3 scoring levels proposed according to the characteristics of the lung lesions are correlated with our colorimetric triage proposal and can be linked together in a joint classification system, as proposed below.

Colorimetric Triage

We recently published a proposal for US triage based on the characteristic lesion patterns caused by COVID-19 (severe respiratory syndrome coronavirus 2) that are identifiable by lung ultrasound (LUS) and the possible type of clinical presentation of a patient with or without respiratory symptoms, without the need for a confirmatory test when interviewing the patient at a geographic location with an accelerated contagion mechanism. The triage is divided into 3 colors (green, yellow, and red), making for an intuitive and rapid classification of the severity of the patients as follows:

1. Green: suspicious—confirmed (with fever, cough, and general malaise, does not have manifestations of dyspnea, normal oxygen saturation, and epidemiologic links), needs isolation at home, waiting for recovery phase or confirmatory test results. Ultrasound pattern: normal lung pattern A, with dry lung, presence of A-lines, and presence of pleural sliding with power Doppler imaging.

2. Yellow: suspicious—confirmed case, mild COVID-19 disease (with fever, cough, general malaise, mild dyspnea, and normal or low oxygen saturation), needs isolation at home if the patient can be closely monitored, hospital observation if symptoms progress, LUS reassessment at home or hospital. Ultrasound pattern: wet lung pattern B, with 2 to 3 B-lines (vertical artifacts), diminished or abolished pleural sliding, mild pulmonary edema, and regular to slightly irregular pleura.

3. Red: suspicious—confirmed case, moderate-to-severe disease, needs hospital emergency department (ED) observation or intensive care unit (ICU), patient with moderate-to-severe dyspnea, low oxygen saturation, and pulmonary crackles. Ultrasound pattern: wet lung pattern B, with more than 4 B-lines (multiple vertical artifacts), severe-to-moderate alveolar or interstitial pulmonary edema, a broken pleural line, an interrupted image, presence of white lung, and subpleural consolidations.

This system allows professionals to determine the severity even in the prehospital phase because of the acknowledgment of any suggestive imaging that is highly suspicious of severity.

With portable or pocket devices at the patient’s bedside, the exploration allows a real-time reassessment of the condition of patients in their home, the ED, the ICU, or field hospitals, reducing time, money, and the risk of nosocomial exposure to the virus, helping prevent saturation of the medical service sector, as is happening already in the rest of the world, especially in developing economies and those lacking resources. The point-of-care ultrasound (POCUS) lung scan has the versatility of being reproduced as many times as necessary with immediate results, having the opportunity to change the triage color at the moment, reclassifying the severity or improvement of the disease. This POCUS lung triage can help professionals identify low-risk (green) cases at first contact, which can lead to considering them “negative by LUS” and testing them, and the patients can be put in isolation; those “suggestive or positive by LUS” (yellow and red) with abnormal patterns ought to be evaluated in the ED.

Unification Proposal

We suggest that health care workers, particularly those operating in low- to middle-resource settings, unify the LUS COVID proposed score with the colorimetric triage, as exemplified in Figures 1 and 2.

1. Green: Those confirmed or suspected COVID-19 cases with good clinical conditions and an LUS
score of 0 in most lung areas or 1 in some areas. These patients are at low risk and can be monitored at home.

2. Yellow: Those confirmed or suspected patients with medium risk according to clinical symptoms and an LUS score of 1 in most areas (those with an irregular and indented pleural line with vertical artifacts will have a score of 1) or 2 in some areas (broken pleural line, subpleural consolidation, and patchy areas of white lung). These patients have a moderate risk and should be evaluated in the hospital, unless accurate and frequent home medical services can be guaranteed.

3. Red: Those moderately to seriously ill patients evaluated by health care workers with an LUS

---

Figure 1. Colorimetric triage with clinical and US traits, including the numeric score for each color: unification proposal.
**Figure 2.** Colorimetric triage with US images for COVID-19–positive patients: classifications of lung lesions and the score to which they belong according to the proposed unification. Dry lung, some vertical artifacts (A-B) Asterisks indicate an indented and ruptured pleural line, arrows indicate vertical artifacts below the pleural rupture. (C-D) Multiple subpleural consolidations and a broken pleural line are presented (E). Multiple diffuse B-lines (vertical artifacts) are presented, which start from the irregularity of the pleural line (F), a pattern of multiple vertical artifacts in a multiple subpleural consolidation, and patchy areas of white lung (G and H). All findings are from the middle and inferior areas from the posterior thorax.

| **Lung POCUS TRIAGE-SCORE. Traits for COVID-19** |
|--------------------------------------------------|
| **Pattern A:** Dry lung. Presence of Lines A. Presence of Pleural Sliding, vertical artifacts, pleural line indented. **Lung POCUS Score: 0-1.** |
| **Wet lung:** Pattern B, 2 to 3 vertical artifacts, Pleural Sliding, Mild pulmonary edema. Irregular-broken pleural line, subpleural consolidation. **Lung POCUS Score: 1-2.** |
| **Pattern B,** +4 lines B. moderate/Severe alveolar-interstitial pulmonary edema. Patchy areas of white lung. Pleural line completely broken, Subpleural consolidation areas, Power Doppler signal loss around consolidations. **Lung POCUS Score: 2-3.** |
score of 2 or 3 in most areas (mainly in the middle and basal areas of the posterior thorax). These patients are at high risk and should be quickly evaluated in the hospital and admitted.

Conclusions

The proposed unification of the criteria maintains the simplicity of both systems and strengthens them by providing diagnostic tools and allowing classification and rapid dispatch of patients to other areas. It can provide opportunities for participation of a wide variety of professionals in the ER and ICU and allow physicians from different settings to speak the same language in observation areas, field hospitals, remote rural areas with a lack of resources, and ground and air ambulances.

In summary, a green triage will indicate a patient with mild illness and a POCUS lung score of 0 in almost all areas: observe at home. A yellow triage will indicate a patient with moderate disease with a possible transition to severe disease and a POCUS lung score of 1 in most areas or 2 in some: close observation at home if it can be guaranteed; otherwise, assess in the hospital. A red triage will indicate a patient with serious or critical illness and yield a POCUS lung score of 2 or 3 in most areas: provide hospital care. The versatility of this system allows the identification of confirmed or suspected patients due to the type of lung injury captured during the lung POCUS exploration and clinically suspicious presentations at geographic locations with an accelerated contagion curve for COVID-19.

Omar Yassef Antúnez-Montes, MD
Departamento de Docencia e Investigación, Instituto Latinoamericano de Ecografía en Medicina (ILEM), Ciudad de Mexico, Mexico
SOLJAC Medical Division, Servicios Médicos de Emergencia, Ciudad de Mexico, Mexico
doi:10.1002/jum.15446

References

1. Soldati G, Smargiassi A, Inchingolo R, et al. Proposal for international standardization of the use of lung ultrasound for patients with COVID-19: a simple, quantitative, reproducible method. J Ultrasound Med 2020; 39:1413–1419.
2. Antúnez-Montes OY, Buonsenso D. Routine use of point-of-care lung ultrasound during the COVID-19 pandemic [Published online ahead of print April 22, 2020]. Med Intensiva. 2020; doi:org/https://doi.org/10.1016/j.medin.2020.04.010