Predictive Modeling Including Point-of-Care Lung Ultrasound (P-LUS) for Emergency Triage of Patients with Acute Respiratory Symptoms Related to COVID-19

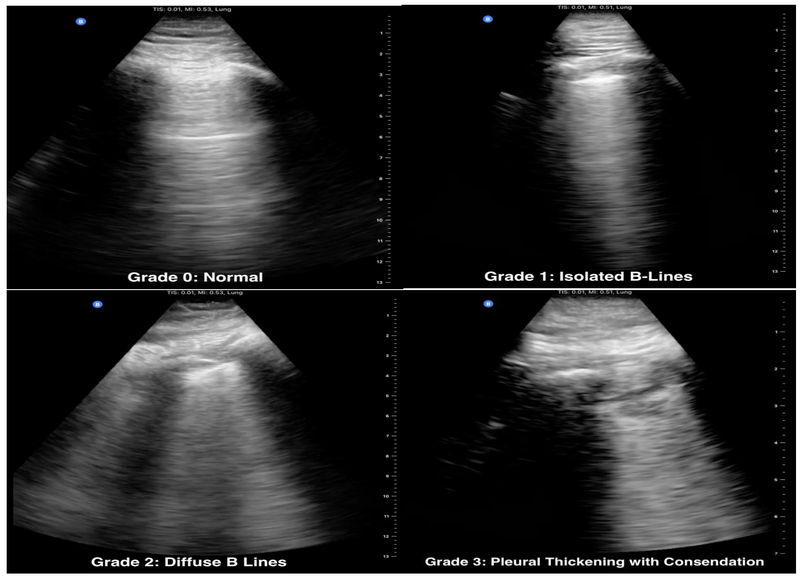
Ana Fernandez-Bustamante, MD, PhD[1]; Maria Castaneda, MS[2]; Anna L Garcia[2]; Brittany Daley, MPH[3]; Michael J Morris, MD[3]; Shelia Savell, PhD[2]; Vikhyat S Bebarta, MD[1];John L Kendall, MD[1]; Patrick C Ng, MD[2,3]

[1]University of Colorado School of Medicine, Anschutz Medical Campus, [2]United States Air Force En Route Care Research Center/59MDW/ST, [3]Brooke Army Medical Center, Fort Sam Houston, TX

Background

- The COVID-19 pandemic caused by the SARS-CoV-2 has had detrimental effects worldwide with over 4 million deaths
- Rapid triage of patients with COVID-19 is limited; Imaging and labs take time and contribute to virus spread with having to transport patients for the studies
- P-LUS can be done at the bedside and detect lung pathology with high sensitivity
- Portable ultrasound (US) probes are noninvasive, provide rapid P-LUS imaging, low cost, low maintenance, and reduce exposure (radiation and virus) of personnel and patients
- Inter-user validation for P-LUS images is needed

Objectives



- Using Lung Ultrasound (LUS) images obtained from a portable device, we aimed to assess the inter-rater agreement of the previously acquired LUS images for the triage of patients with COVID-19

Methods

- Performed a multicenter retrospective and prospective pragmatic study of adults with respiratory symptoms possibly related to COVID-19
- LUS were obtained with portable US without a specific image acquisition protocol
- Images were reviewed by physician investigators with Point of Care Ultrasound (POCUS) experience who were blinded to patients' clinical presentation/outcome
- Reviewers reported specific, pre-defined LUS findings using a scoring matrix adjusted from Soldati et al., and then classified as:
  - "Low Risk": Score 0-1
  - "High Risk": Score 2-3

Results

- Over 150 images in the retrospective phase of the study were used to develop the scoring system
- The analysis phase is still ongoing
  - 68 images were scored by at least 3 reviewers
  - 92 patients who presented to the ED were discharged home; 58 required admission to the COVID floor or Intensive Care Unit (ICU)
  - There was >75% inter-rater agreement of P-LUS scores for the cases scored thus far
  - Isolated B-lines were the most frequent pathologic LUS finding; air bronchogram was the least frequent
  - 64% of LUS exams had 100% agreement on risk classification
  - Presence of diffuse B-lines was the LUS finding with the highest interclass correlation coefficient (ICC):0.790 (95% CI 0.681-0.866)(p<0.001)
  - Those admitted appeared to have higher scores compared to those discharged

Conclusion/Discussion

- POCUS can be a low-cost, low-maintenance option to obtain point of care images in busy emergency departments, at other military treatment facilities (MTFs) and in the operational environment
- In this study, there was good inter-rater agreement in the overall risk classification based on scoring of LUS images of patients being evaluated for COVID-19
- Inter-rater agreement is most promising for the detection of diffuse B-lines and LUS exams classified as "high risk" using our simplified scoring matrix

Limitations

- Inter-rater agreement of only 3 reviewers
- Small subset of patients with COVID-19

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Corresponding author:
Patrick.c.ng.mil@mail.mil