Nurse-led Point of Care Ultrasound in the Intensive Care COVID-19 Population

A service evaluation to assess the usefulness of nurse-led cardiac and lung point-of-care ultrasound in the management of the critically ill COVID-19 patient

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Introduction

Point-of-Care Ultrasound (PoCUS) can rapidly diagnose presence and severity of COVID-19 disease and associated pathologies (1). PoCUS identifies life-threatening complications at the bedside, with the potential to reduce the need for out-of-department transfers for imaging, alongside associated radiation exposure and spread of infection (2). Use of PoCUS by doctors in the intensive care unit (ICU) is becoming increasingly widespread. However, uptake by ICU nurses is poor despite evidence to suggest comparable accuracy in acquiring and reporting PoCUS scans, and the potential benefit to patients as a result of an increased workforce of competent PoCUS clinicians (3-5). This case series reports findings in critically ill COVID-19 patients identified through nurse-led PoCUS.

Method

This case series was part of the national service evaluation led by the ICS, SAM, FUSIC, and FAMUS. Conduct was approved by the departmental lead for critical care ultrasound at King's College Hospital. An ICU nurse trained in Focused Intensive Care Echocardiography (FICE) and Focused Ultrasound in Intensive Care (FUSIC) performed focused cardiac and 6-point lung PoCUS scans on ICU patients with confirmed COVID-19 disease during the recovery phase. Severity of disease was scored between 0-3 (Table 1) in each lung region (upper anterior; mid-anterior; posterolateral) and a total score calculated (0-18). PoCUS scans were only performed on patients identified by the treating ICU consultant. Correlations between PoCUS findings and patient demographics, key clinical data, physiological parameters, and 30-day outcome were analysed using Pearson's coefficient. Descriptive statistics analysis (mean; standard deviation/ mode; interquartile range) were used to analyse data.

Table 1. Lung PoCUS severity scoring system

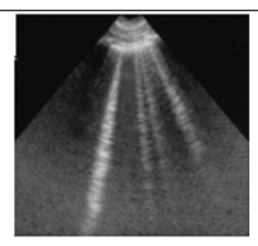
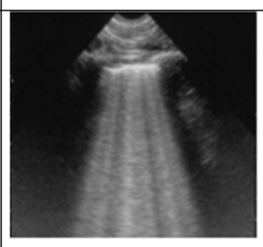
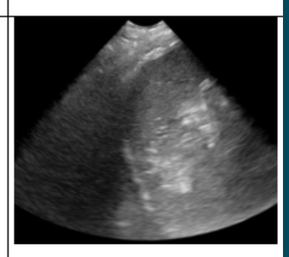
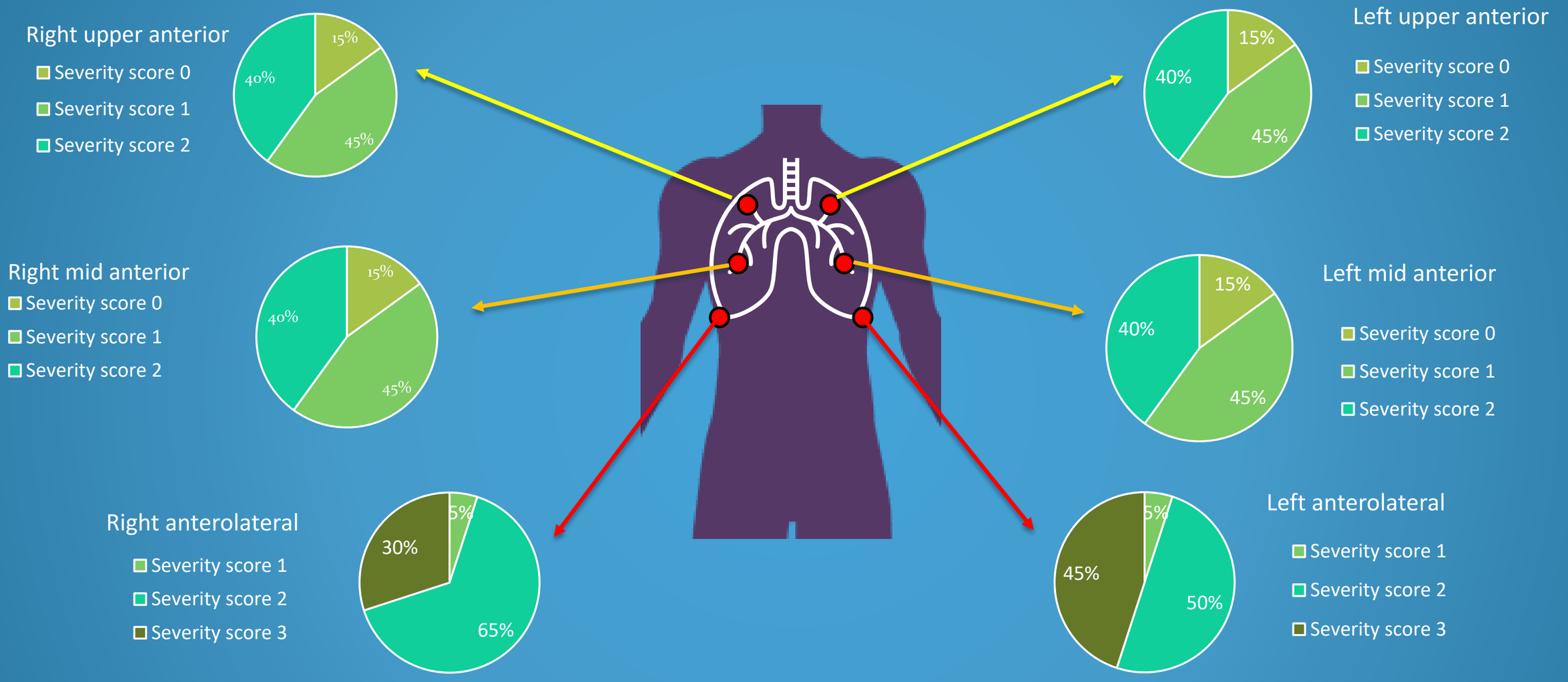
Score	0 (Normal aeration)	1 (Mild or early COVID 19)	2 (Moderate or progressing COVID 19)	3 (Severe COVID 19)
Visual example				
Profile (a or b lines)	A-lines or ≤2 B-lines	≥2 well-spaced B-lines	coalescent B-lines, particularly in lung bases	Tissue-like pattern (hepatisation)
Pleura (+/- effusion)	Lung sliding and normal pleural appearance	rough, thickened pleura; sub-pleural consolidation	Small consolidations <1cm visible in some cases	Frank consolidation and consolidations >1cm visible in some cases

Figure 1. Prevalence of lung severity scores according to lung region using 6-point lung PoCUS



Severity score 0 = no COVID-19; severity score 1 = mild/early COVID-19; severity score 2 = moderate/progressing COVID-19; severity score 3 = severe/late COVID-19. Severity scores with a prevalence of zero were not included in the pie charts.

Results

A cardiac and 6-point lung PoCUS scan was performed on 15 patients. Fourteen (93%) scans were performed to answer lung-specific clinical questions including assessment of ventilation strategy (ventilation mode; PEEP level) in 5 (33%) patients, extravascular lung water assessment in 9 (60%), and lung assessment prior to tracheostomy decannulation in 1 (7%). Moderate to severe COVID-19 was apparent in all lung fields with severity scores from 6 to 14 (Figure 1). Left ventricular (LV) function was normal in 13 (87%) patients, 2 (13%) demonstrated signs of a dilated right ventricle (RV), and 1 (6%) had impaired LV and RV function (Figure 2). Ten scans identified pathologies that contributed to a change in clinical management immediately following the scan (Figure 3). Interventions included: (1) change in fluid management (increased fluid removal on renal filtration, new furosemide prescription) (4 (27%) patients) and a level 2 echo assessment due to identification of new cardiac pathologies (3 (20%) patients). The remaining 5 patients had no change in care. We identified a moderate positive correlation between lung severity score and APACHE II (Pearson's coefficient: 0.69; p value <0.01). Weak correlation was found between lung severity score and white cell count, SOFA score, and PaO2/FiO2. There was no difference in 30-day outcome in patients with a higher lung severity score or abnormal cardiac scan.

Figure 2. FICE scan findings

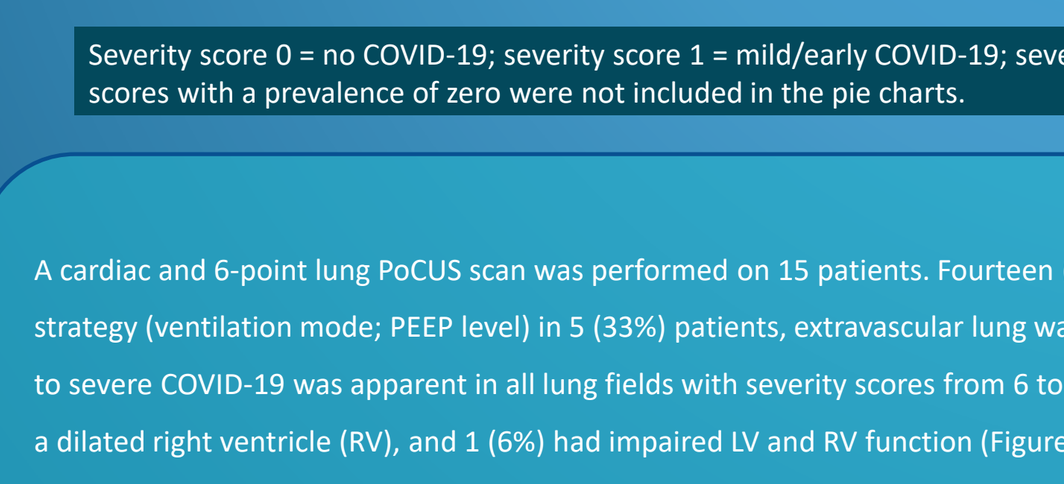
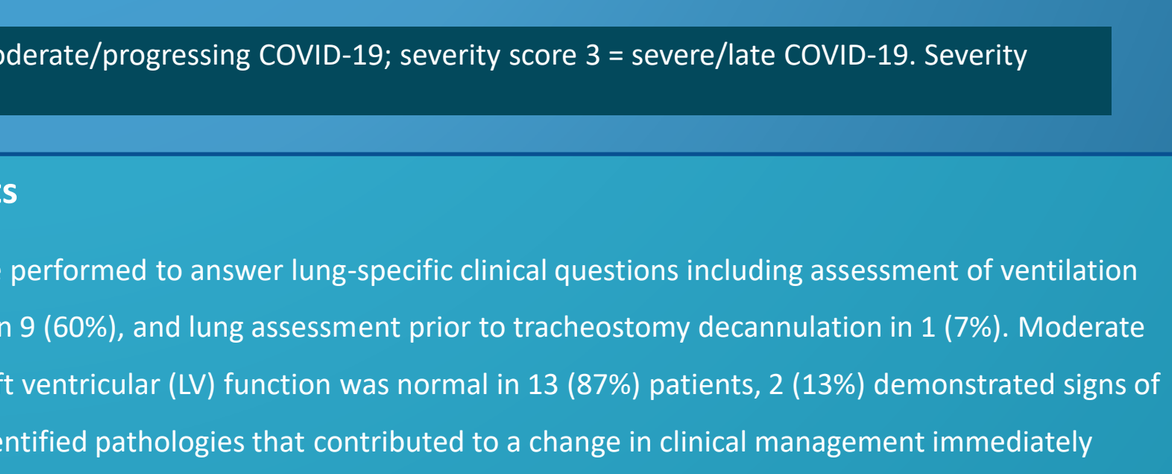


Figure 3. Number and type of changes made to clinical management after PoCUS scan



Conclusion

Cardiac and lung PoCUS is a vital tool in the assessment of COVID-19 disease. The addition of ICU nurses to the growing workforce of PoCUS competent clinicians increases availability of real-time imaging.

1.Karp J, Burke K, Daubaras SM, McDermott C. The role of PoCUS in the assessment of COVID-19 patients. J Ultrasound. 2021:1-9. **2.**Mayo P, Arntfield R, Balik M, Kory P, Mathis G, Schmidt G, et al. The ICM research agenda on critical care ultrasonography. Intensive Care Medicine. 2017;43(9):1257-69. **3.**Mumoli N, Vitale J, Giorgi-Pierfranceschi M, Cresci A, Cei M, Basile V, et al. Accuracy of Nurse-Performed Lung Ultrasound in Patients With Acute Dyspnea: A Prospective Observational Study. Medicine (Baltimore). 2016;95(9):e2925. **4.**Chen Z, Hong Y, Dai J, Xing L. Incorporation of point-of-care ultrasound into morning round is associated with improvement in clinical outcomes in critically ill patients with sepsis. J Clin Anesth. 2018;48:62-6. **5.**Pontet J, Yic C, Díaz-Gómez JL, Rodriguez P, Sviridenko I, Méndez D, et al. Impact of an ultrasound-driven diagnostic protocol at early intensive-care stay: a randomized-controlled trial. The Ultrasound Journal. 2019;11(1):24.