National service evaluation of lung and heart ultrasound in patients with suspected or proven COVID-19

Introduction

Point of care ultrasound (POCUS) is currently being used internationally in the management of patients with a COVID-19 infection. COVID-19 pandemic is a rapidly progressing emergency within the UK. Information gathered by this project may help clinical teams manage their patients and determine markers that guide disease severity.

POCUS indications for patient triage in COVID-19

1. **Lung ultrasound (LUS):** Identification of ultrasound signs consistent with viral interstitial pneumonia / non-cardiogenic pulmonary oedema to facilitate *early, timely identification* of patients who may have COVID-19 vs alternative respiratory illness. This may allow patients to be labelled as COVID-19 suspected in cases where a positive COVID-19 PCR result is not yet obtained. This may have benefits in terms of patient triaging. Current reports suggest that there is a typical picture of *diffuse but patchy B-lines (skip lesions) with spared regions and associated pleural line abnormalities* that correlates with diffuse ground-glass changes seen on CT imaging [1]. In contrast, near normal early appearances in symptomatic patients may confer a better prognosis and aid discharge and safe outpatient management.

2. **Cardiac ultrasound:** Identification of significant co-morbidities at presentation and throughout the illness.

POCUS indications for patient management in COVID-19

1. **Lung / cardiac ultrasound:** Diagnose alternative causes of clinical deterioration. This may include acute cardiomyopathy +/- pulmonary oedema, evidence consistent with pulmonary embolism, super-added infection, pneumothorax.

2. **Lung ultrasound:** POCUS may differentiate two lung patterns in intubated patients with COVID-19 associated respiratory failure and on-going / worsening hypoxia. These are;
   1) bilateral, diffuse, anterior, multiple B-line with pleural abnormalities vs
   2) ‘normal’ anterior lung (or anterior lobar consolidation) with postero-lateral / basal atelectasis / consolidation.

   These two patterns may identify patients who are better treated with increased PEEP trials (pattern 1) or prone ventilation (pattern 2).

3. **Lung ultrasound:** Monitoring of extra-vascular lung water. Careful management of fluid balance is important in a population of patients who suffer primarily from respiratory failure.

4. **Cardiac ultrasound:** Monitoring of right heart function in a population of patients who are at risk of suffering acute cor pulmonale secondary to either hypoxic vasoconstriction and / or ventilator induced lung injury. Left heart function may also be assessed as COVID-19 patients can develop acute cardiomyopathy.
5. **Lung ultrasound:** Resolution or non-progression of ultrasound appearances may be associated with a stable or improving clinical outcome, allowing a step down in care and / or may facilitate discharge decisions

**Service evaluation**

The Intensive Care Society FUSIC and Society for Acute Medicine FAMUS committees plan to orchestrate a POCUS national service evaluation project. The objective is to describe:

1) the use of POCUS during the UK COVID-19 pandemic
2) the typical lung ultrasound patterns seen in COVID-19 respiratory failure at hospital admission (including patients who may be well enough for early discharge and ambulatory management), and during intensive care support
3) an estimate of the incidence of acute cardiomyopathy in COVID-19

It is planned that data is centralised and analysed at a number of time-points during the project.

Only units where POCUS is a routine part of clinical practice will be invited to contribute.

**Data management**

Only fully anonymised, routine clinical and sonographic data will be collected (data that is typically collected by that unit). Data will be stored onto a standardised excel database at each unit (kept on password protected, NHS computers). At completion of each local service evaluation project, data will be centralised by NHS email or directly entered onto a secured central database. The central data team will have no access to any patient identifiable data.

A database is currently being designed. Data will be entered via a form initially. Teams will be able to recall incomplete forms to enter data as it becomes available.

**IRAS application**

A project as described above does not meet the HRA criteria for a research project (http://www.hra-decisiontools.org.uk/research/). Accordingly, IRAS application is not required. Caldicott oversight is also not required as no patient identifying data will be stored on either the local database or the national database (although individual sites may decide to seek approval from their local Caldicott guardian). Confidentiality Advisory Group approval is also not required. The key facts in this argument are that only routinely collected data is being stored, there is no way for an individual at either the local site or national group to link findings back to a patient and the data is not being used to answer a research question, but instead describe the findings of a service.

**Data collection**

For each patient we plan to compile the following routinely collected data:
• Date of scan
• Date of hospital/ICU admission; death; hospital/ICU discharge
• COVID status (suspected or positive; date became COVID+)
• Patient location (e.g. ED, ward, ICU; hospital); admitted from
• Demographics (age, sex)
• Clinical frailty score
• Major comorbidities
• Diagnostic markers (e.g. Troponin, D-dimer, Ferritin if available)
• Last imaging (e.g. CXR, CT; date and report)
• Disease severity scores (NEWS2, SOFA; APACHE2/ICNARC if available)
• Respiratory physiology/support (e.g. saturations +/- walk test saturations, airway; support mode; P/F; PEEP, dynamic compliance)
• Cardiovascular physiology/support (e.g. vasoactives; HR; BP/MAP, CVP, calibrated SV/CO)
• Important co-morbidities
• Indication for the scan (e.g. diagnosis/triage, pre/post intervention, EVLW assessment, shock, other)
• Lung US data (basic: 6-point profile; advanced: 12/14 point B-line counts / disease severity)
• Heart US (basic: LV/RV dilatation/severe impairment; advanced: FS, TAPSE, MAPSE, LVOT VTI, TR Vmax, E/e’)
• Outcome (ICU/hospital survival/LOS)
• Generic management decisions following scan

Core data is highlighted in bold. The remaining data can be collected as required either contemporaneously or retrospectively, depending on the time and IT systems available.

Data analysis


Data dissemination

The plan is to try and analyse and disseminate data at regular intervals during the project. The hope is that this project will produce clinically important data and this will need to be communicated. This may be in the form of written communications to journals, but social media will be as, if not more, important. This may be via appropriate twitter feeds or FUSIC/FAMUS email contact list.
References