

# Physiotherapists use of Lung Ultrasound during the COVID-19 pandemic

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## A practical guideline on supporting acute hospital colleagues.

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Over the past decade physiotherapists around the globe have started to perform and use diagnostic lung ultrasound (LUS) within their clinical practice (1). The number of LUS trained physiotherapists within the United Kingdom (UK) has increased gradually over the last four years and, as it stands, twenty five have gained accreditation through the Focused Ultrasound Intensive Care (FUSIC) from the UK Intensive Care Society (2).

Despite these relatively low numbers it may prove important over the coming weeks and months that LUS trained physiotherapists know how they can utilise their LUS skills to support acute hospital colleagues with the increased demand on healthcare services in the current COVID-19 pandemic.

Lung ultrasound has a higher degree of accuracy than the bedside chest radiograph and approaches levels of accuracy seen with computed tomography (CT) for many pathologies that reach the pleura (3). Many of these pathologies are the being seen in the COVID-19 affected patients such as pleural irregularities, interstitial syndrome & consolidation (4).

The aim of this short article is to explain the current known COVID-19 presentation and progression under LUS assessment to allow appropriately trained physiotherapists to contribute to the acute and critical care workforce as well as guide their own physiotherapy interventions.

### Setting the scene

Some basic assumptions have needed to be made for this article:

Physiotherapists accredited in LUS have been granted permission to use ultrasound machines within clinical areas considering these machines will be in high demand. Aim to be involved with the COVID-19 planning within your teams.

The high patient caseload expected during the spread of COVID-19 does not really allow for the continued support of physiotherapists currently training in LUS. This will depend on the workloads of local mentors but many training programmes like FUSIC are adding a 3-month extension as standard. Physiotherapists must remember that LUS will only come within their scope of practice once appropriately trained. If adequate mentoring cannot be achieved during this time, then all LUS training should cease.

Local infection control measures for the use of LUS during the scanning of patients with confirmed or suspected COVID-19 must be well understood and performed. Guidance on ultrasound machine decontamination in a COVID-19 +ve patient population has been produced by FUSIC (2).

## COVID-19

Key LUS findings in the patient admitted to hospital with COVID-19 symptoms include (5):

- Interstitial syndrome pattern – extensive B-line presentation which may start as discrete then begin to coalesce as symptoms progress. Distribution will be varied and potentially multifocal throughout all lung zones.
- Development of pleural thickening and irregularity.
- Small “sub-pleural” consolidations may develop which would correlate with the “ground glass” distribution seen on CT.
- Increasing size of consolidations particularly in dependent basal areas. Both translobar and non-translobar consolidations can develop across both lungs with dynamic air-bronchograms.
- Pleural effusions are either small or rare but may develop with the onset of alternative pathologies.
- During the recovery phase the transition back toward A-lines will be seen.

Regular daily LUS can be used to track disease progression during the deterioration and recovery phases. It can also be used to guide treatment options and the timings of interventions. **Figure 1** highlights how this progression can often present in relation to lung aeration loss with the same being seen in reverse as symptoms improve during recovery (6).

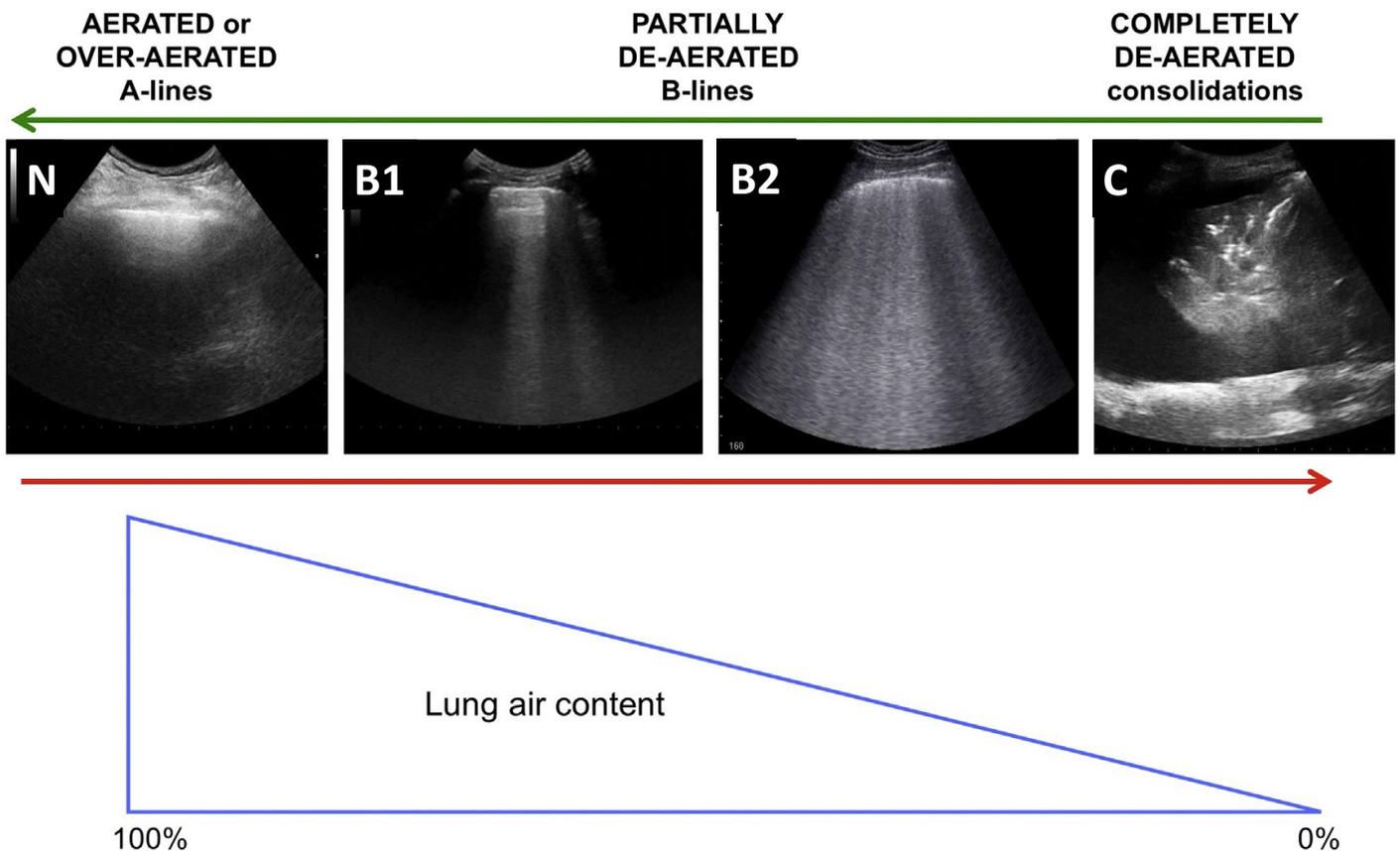
Massimo Gianni gave his experiences of COVID-19 in Italy in a JAMA webinar (7) where he describes LUS findings that fall into two distinct patterns:

- Pattern 1 – diffuse B-lines – in ventilated patients this may respond well to increased positive end expiratory pressure (PEEP).
- Pattern 2 – consolidation, parapneumonic effusions and atelectasis. With significant posterior atelectasis in ventilated patient they may respond well to pronation.

This pattern of LUS findings is also corroborated by the team from the Chinese Critical Ultrasound Group (CCUSG) in their series of webinars (8).

Massimo Gianni goes on to describe how the daily LUS scan findings can allow clinicians to make judgements about how to proceed with changes to the management plan or to continue to monitor the patient’s presentation.

There should be no reason why **physiotherapists** who have gained LUS accreditation could not contribute to the LUS scanning and input into these decision-making processes by feeding back their findings to the medical team.



**Fig. 1.** The concept of lung ultrasound as a densitometer: different ultrasound patterns for different levels of lung aeration. (Adapted from Gargani 2019) [6]

#### Use of LUS by physiotherapists in patients admitted with **MODERATE** cases of COVID-19

- The need for physiotherapists to perform LUS in moderate uncomplicated cases of COVID-19 will be limited.
- If symptoms of respiratory distress increase in this group, then LUS may be performed to differentiate between a developing COVID-19 pathology (see “pattern 1” above) or alternate diagnoses.
- Monitor for an increase in B-line presentation as severity increases.
- De-escalation of respiratory support as COVID-19 symptoms resolve towards a global A-line presentation and reduction in sub-pleural consolidations.

#### Use of LUS by physiotherapists in patients admitted with **LESS SEVERE** cases of COVID-19

- Monitoring patients with COVID-19 as the “pattern 1” symptoms of diffuse B-lines and sub-pleural consolidation progresses.
- Liaise with senior team member to discuss the initiation or titration of interventions such as non-invasive ventilation (NIV) i.e. CPAP.
- Monitor those on NIV for early signs of deterioration towards diffuse multi-lobar consolidation.
- If sputum load increases or additional superimposed infection develops then areas of consolidation or atelectasis can be identified, and appropriate physiotherapy intervention initiated.
- If signs of respiratory compromise in this group continue, then LUS may be performed to differentiate between a developing COVID-19 pathology (see “pattern 2” above) or alternate diagnoses.
- De-escalation of respiratory support as COVID-19 symptoms resolve towards non-confluent B-line and a normal pleura.

Use of LUS by physiotherapists in patients admitted with **MORE SEVERE** cases of COVID-19

- Likely be intubated and on mechanical ventilation.
- Identify patients whose disease progression warrants the consideration of:
  - \* Prone position
  - \* PEEP titration
  - \* Recruitment
  - \* Postural drainage
- Monitor response to prone positioning (responders & non-responders)
- Identify patients suitable to return to a supine position.
- Identify complications of positive pressure ventilation/recruitment manoeuvres e.g. pneumothorax.
- De-escalation of respiratory support as COVID-19 symptoms resolve away from consolidation towards diffuse B-line presentation with subpleural consolidations.

First and foremost physiotherapists must perform LUS to inform their own clinical judgements and practice. However, an additional value of physiotherapists performing LUS in resource limited settings lies in feeding their findings back to the medical team who may not be trained in LUS or are unable to perform LUS due to clinical caseload pressures.

It is going to be a difficult time for everyone in hospitals and resources are going to be dramatically stretched. Physiotherapists who have learnt these skills will help save the wider teams precious time, allow closer monitoring of rapidly changing patients and limit unnecessary additional investigations. Lung ultrasound will empower frontline physiotherapists to contribute to this global pandemic in a way not previously seen before.

## References

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