

COVID-19 & Ultrasound: Monitoring Lung Conditions in COVID-19 Patients

Background

In December 2019 the world discovered Sars-Cov-2 (Covid-19), a pneumonia-like illness that is caused by a severe acute respiratory syndrome.³ The outbreak has spread rapidly through China and now affects most of the world causing a worldwide pandemic.⁴ Patients that present with Covid-19 can have a wide variety of symptoms, but some include lower respiratory tract illness with fever, dry cough, and dyspnea.³ This disease can easily be mistaken for influenza, but is highly contagious and has the ability to cause severe lung damage.

Healthcare professionals are looking for ways to monitor Covid-19 in patients without continuously exposing the patient to high amounts of radiation. Lung ultrasound is increasing in demand, as there is growing evidence showing usefulness in patients with Covid-19.⁵ Ultrasound provides diagnostic imaging without the harmful effects of radiation. In addition, "the risk of transporting unstable patients with hypoxemia and hemodynamic failure make chest CT a limited option for the patient with suspected or established COVID-19."² Considering ultrasound units can be portable, even handheld, allows the patient to remain isolated while limiting contamination of medical equipment and exposure to the healthcare team.

Methods

Hospitals and healthcare professionals are utilizing handheld ultrasound devices now more than ever in the response of the Covid-19 pandemic. When assessing a patient that has tested positive for Covid-19, these devices are wrapped in a sterile cover, which decreases the risk of contamination.⁵ For hospitals and clinics that do not have access to a handheld ultrasound device, dedicated portable machines are still reliable, but extra care must be taken for proper sterilization and disinfection. A team of experts designed two different ways to perform a lung ultrasound with a handheld device. The first method involves the sonographer performing the exam while the other operator freezes and saves the images. The second operator has the option to be beside the sonographer or at a 6-foot distance from the patient. Depending on the facility, the second operator may even be able to stand outside the room to eliminate the risk of exposure.⁵

Sonographers will typically use convex or linear transducers depending on the patient body habitus. Sonographers need to keep in mind the ALARA principle during a lung ultrasound. The time during the observation should always be kept at a minimum and the mechanical index should be at or below 0.7, as anything higher can increase potential risk of damage to the lung tissue.⁵ It should also be noted that only one focal point should be used and set on the pleural line. This helps maximize the tiniest details of the lung surface to observe abnormalities that may be present.⁵

When performing an acquisition protocol for Covid-19 lung ultrasound, the sonographer needs to be intercostal and at the widest surface, primarily posterior. There are fourteen primary landmarks (3 posterior, 2 lateral, 2 anterior) where the patient should be scanned in an upright, sitting position (shown in Figure 1).⁵ Posterior areas on a patient on a ventilator will be difficult to access, but can still be partially assessed starting with landmark number 7.⁵

Objective

To determine the role and benefits of lung ultrasound in hospitalized COVID-19 patients.

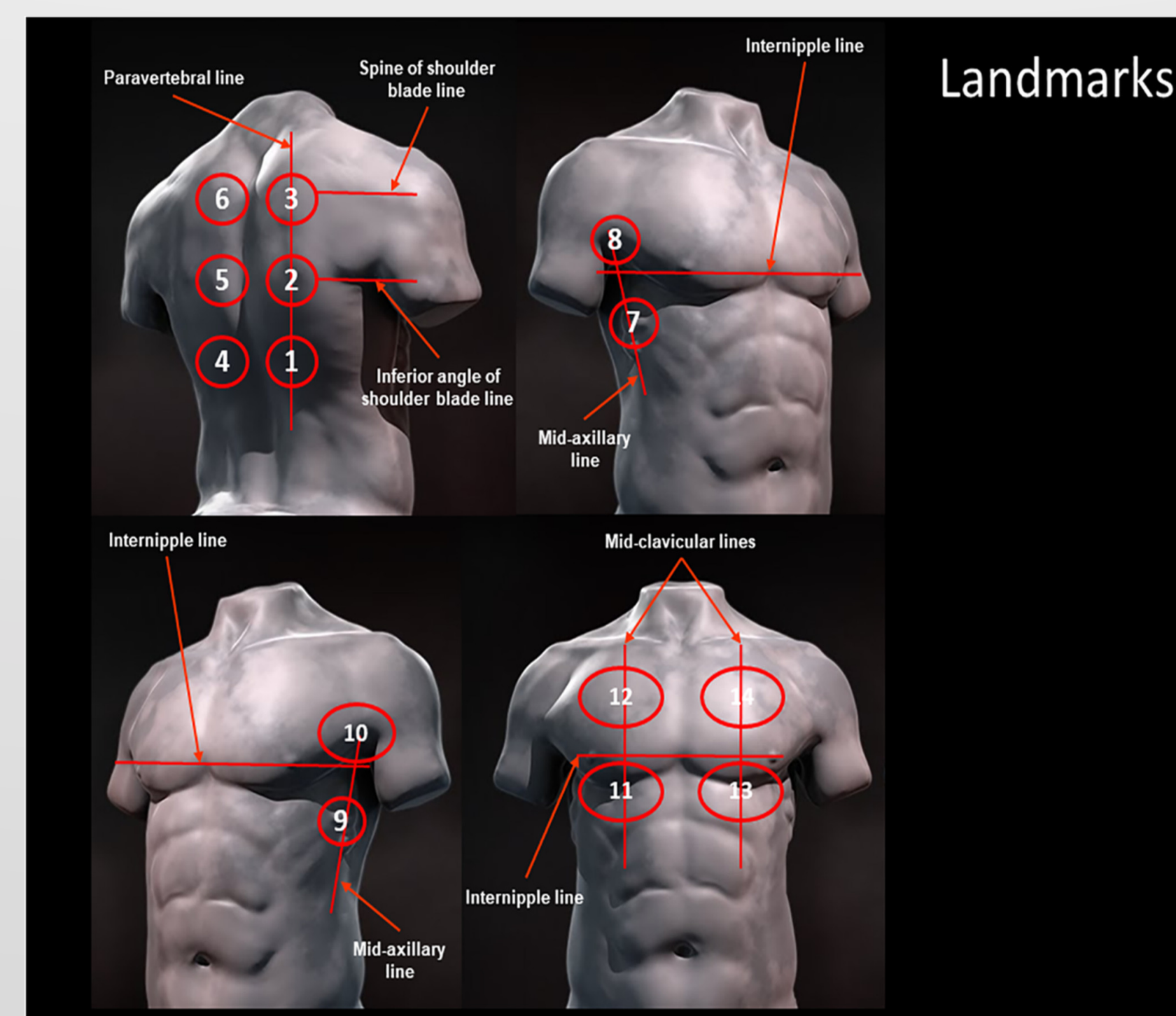


Figure 1. Acquisition protocol locations.

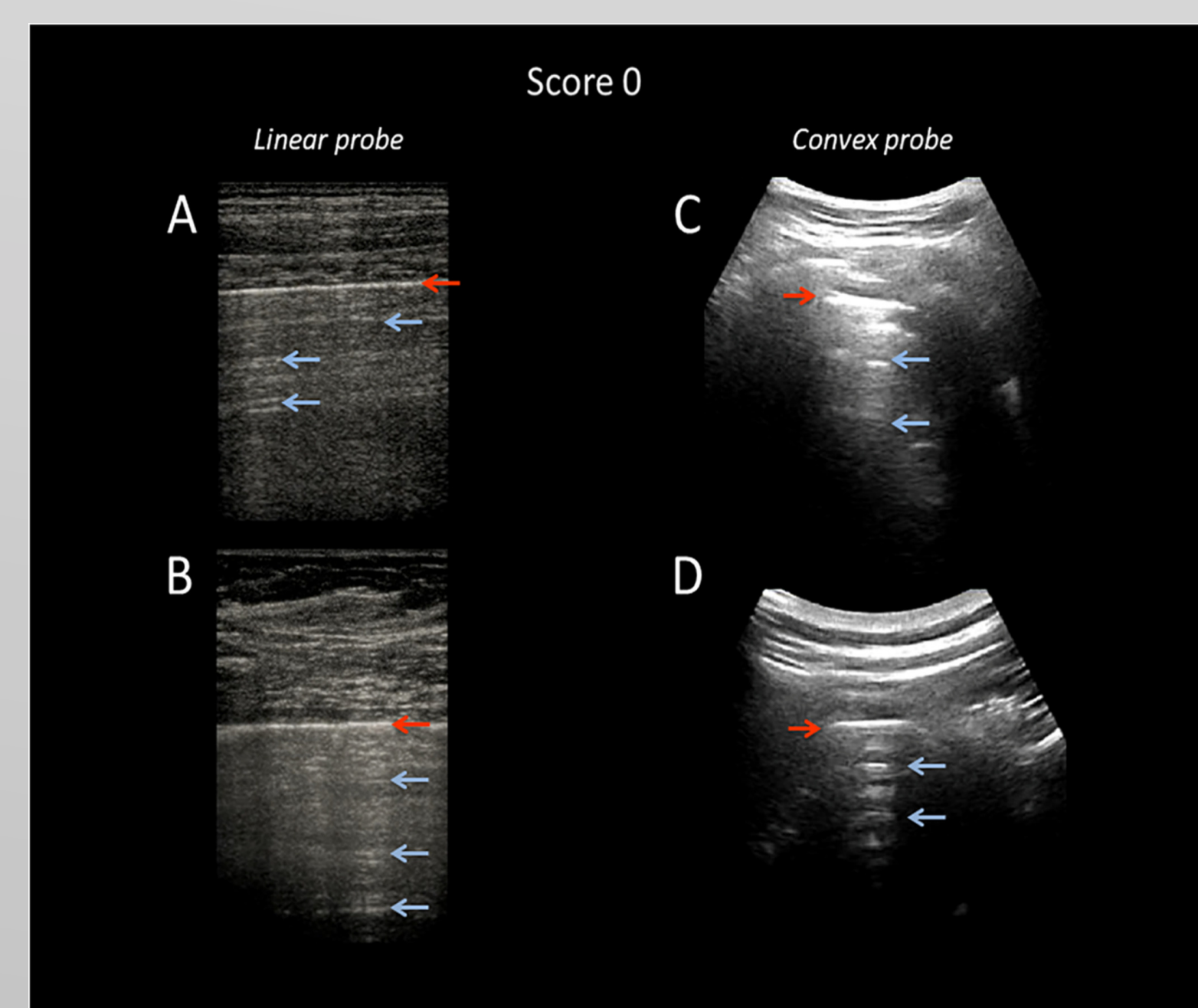


Figure 2. Red arrows – Pleural line; Blue arrows – A-lines. These are normal findings.

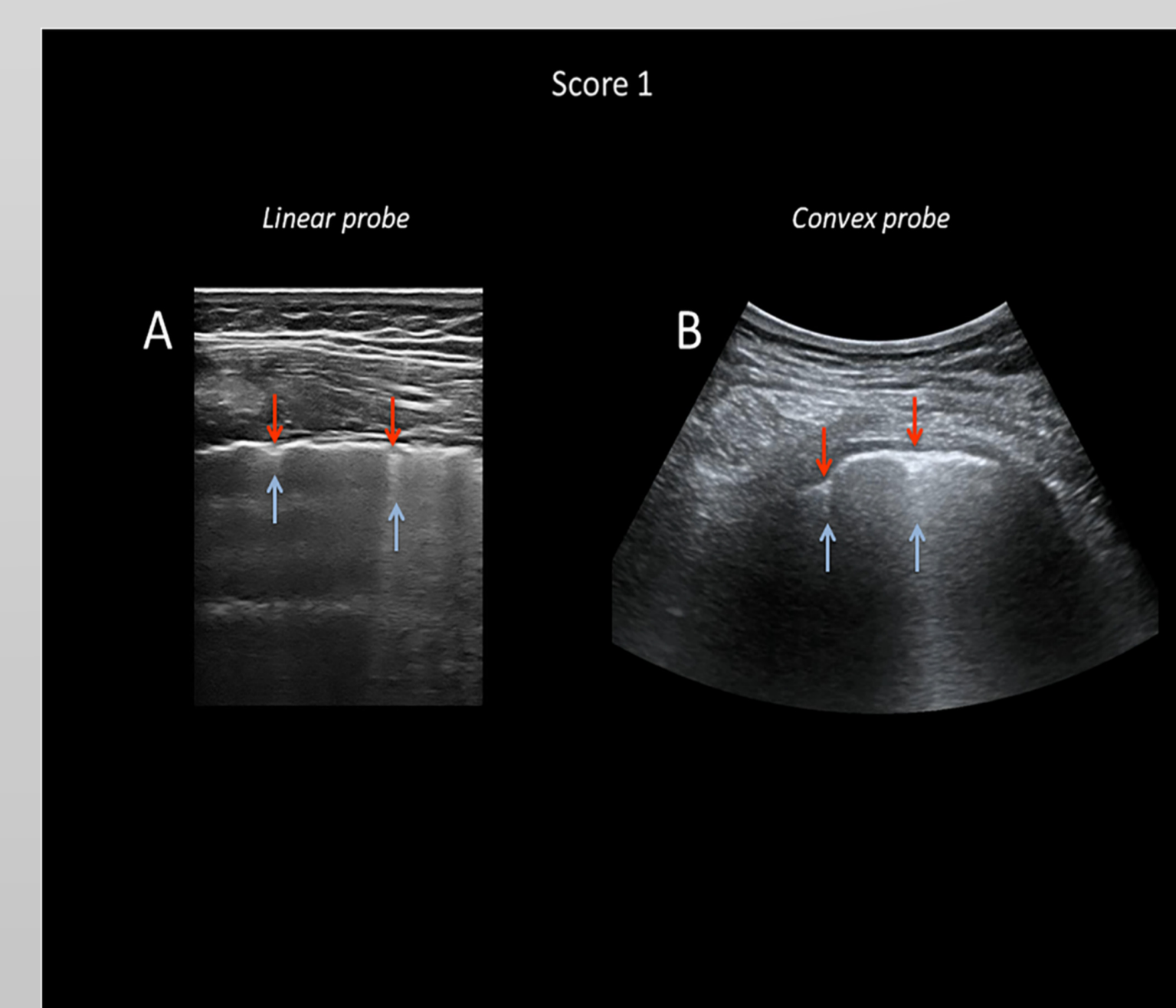


Figure 3. Red Arrows – Indented pleural line; Blue Arrows – B-lines. These are abnormal findings.

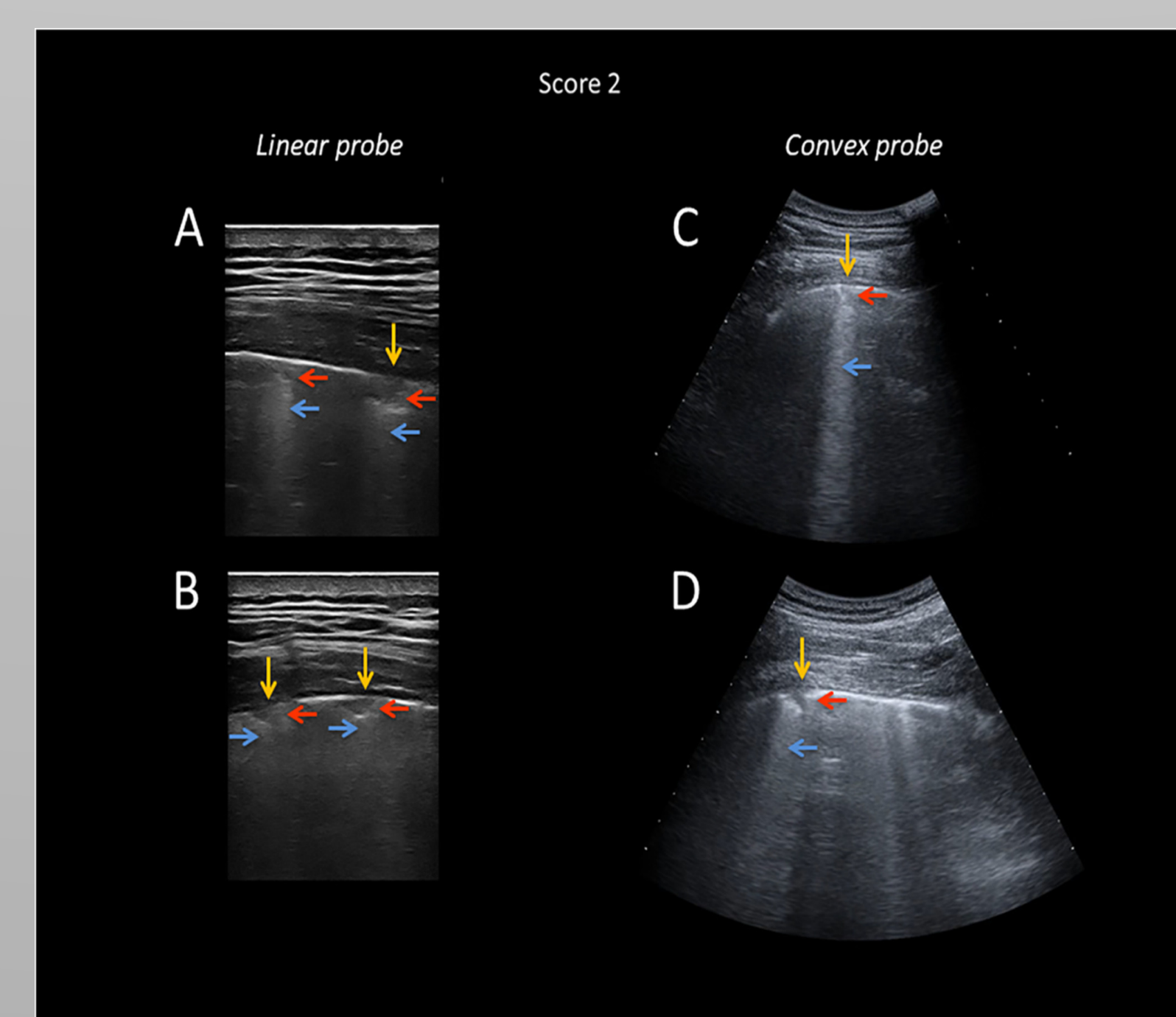


Figure 4. Orange Arrows – Broken pleural line; Red Arrows – Consolidation (small area); Blue Arrows – white lung (small area). These are all abnormal findings.

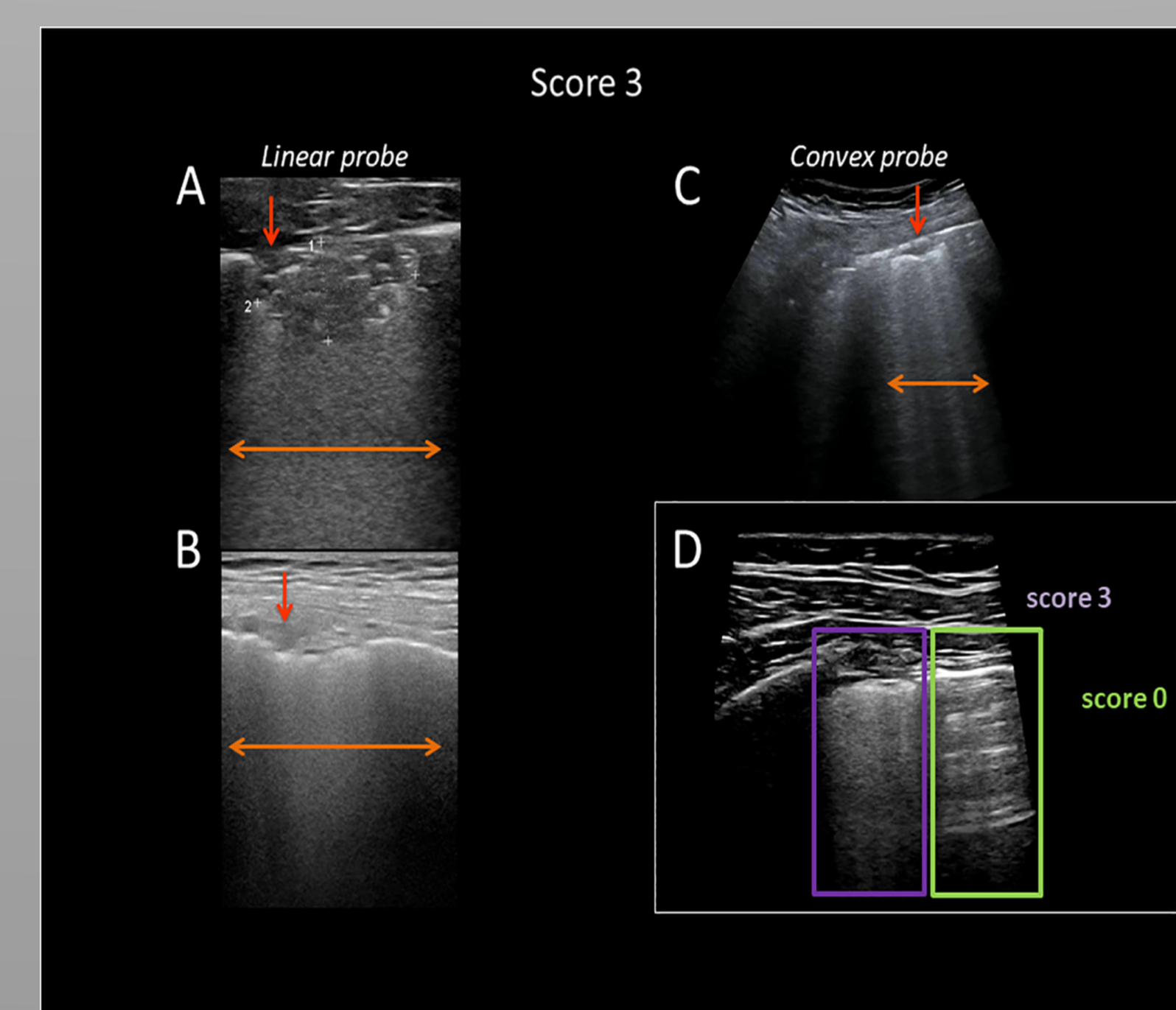


Figure 5. Broken pleural line demonstrated. Red Arrows – Consolidation (large area); Orange Arrows – white lung (large area). Image D would be scored as a Score 3.

Results

Each image obtained in the acquisition protocol will be scored using the following procedure:

Score 0: A continuous and regular pleural line with horizontal artifacts (A-lines) is observed. A-lines are reverberations of the pleural line and should be observed in a healthy lung.^{4,5}

Score 1: An indented pleural line with vertical bands of white (B-lines) seen posterior to the indent are visualized. This comet tail artifact represents replacement of air by water, blood or tissue.^{1,5}

Score 2: A broken pleural line is seen. Consolidated regions (darker regions) with white regions below the consolidated region (white lung) are seen posterior to the broken pleural line. The consolidated regions grow darker due to aeration loss. Regions of white lung signify those regions still have aeration although they are contained in a tissue-like substance.⁵

Score 3: Dense and expansive white lung and bigger consolidations may or may not be present.⁵

The clinician will notate the highest score for each quadrant at the end of the exam.⁵

This standardized acquisition protocol and scoring mechanism will give physicians a well-rounded view to monitor what is happening to a patient's lungs throughout their Covid-19 illness.

Conclusion

Utilizing a standard scanning protocol and scoring system will help physicians effectively and safely monitor lung conditions in hospitalized patients with Covid-19. Ultrasound is non-invasive, non-ionizing and provides quick results. The exams can be performed at the patient's bedside, therefore, patient exposure to other areas of the hospital will be eliminated. The use of wireless transducers and tablets or portable ultrasound machines reduces exposure of medical devices and healthcare professionals to patients with Covid-19.

The sharing of images and knowledge internationally will help health practitioners stay abreast of new developments as they occur.

References

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