
Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Journal of Critical Care 60 (2020) 351–352

Contents lists available at ScienceDirect

Journal of Critical Care

journal homepage: www.journals.elsevier.com/journal-of-critical-care

# Utility of point of care ultrasonography for COVID-19

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the virus first detected in Wuhan, China, is responsible for the disease COVID-19. Nine months after its detection it has infected more than 32 million people worldwide and is responsible for over 900 thousand deaths [1]. The high contagiousness of SARS-CoV-2, the worldwide shortage of personal protective equipment [2], the need for strict patient isolation and the limitation of patient transport outside of biocontainment units have deemed ultrasonography a valuable skill in the evaluation and treatment of these patients. Lung ultrasonography is used for the identification of lung involvement, severity, progression and regression of the disease which can reduce the utilization of radiographic modalities like X-ray and CT scan, and limit health care professionals exposure to the virus [3,4]. Here we provide a video with an overview of the common uses of ultrasound in patients infected with SARS-CoV-2 as well as some pathologic findings.

Ultrasound can be used when evaluating patients before, during, and even after endotracheal intubation. The rate of inadvertent esophageal intubations in the nonoperating room environment can be high ranging from 1.3% to 15.3% [5,6] depending on the technique, acuity, setting and location of the procedure. Airway ultrasound can be a valuable adjunct for ruling out esophageal intubation. Limited lung ultrasonography goes hand in hand with airway ultrasound and is used for the visualization of bilateral lung sliding (seashore sign) indicative of endotracheal position.

In addition, complete lung ultrasonography can be performed using a 12 zone technique. Observations sought include evaluation of smoothness or irregularity/interruption of the pleural line, and distribution of B lines. Common ultrasound findings include focal, multifocal and confluent B lines which correlate with ground glass opacities on CT scan and severity of the disease, thickening and irregularity of the pleural line, subpleural consolidation, as well as reappearance of A lines during the recovery phase of the disease. The ultrasonographic findings are most commonly located in the posterior lung fields but with disease progression can be seen bilaterally and in most, if not all, of the lung zones. Interestingly, pleural effusions seem to be uncommon findings [7,8].

Finally, central venous catheter insertion is a common procedure in the critical care environment. Placement of a central venous catheter is guided with the use of ultrasonography and is confirmed using chest radiography. Although chest radiography is considered the gold standard for confirmation of both the catheter position and absence of pneumothorax, ultrasonography can provide a rapid diagnosis at the bedside, while minimizing the risk of equipment contamination and healthcare worker exposure. The presence of A lines in the ipsilateral anterior chest without lung sliding but with presence of lung point is specific to pneumothorax [9]. When looking for pneumothorax lung pulse is used as an equivalent to lung sliding [10]. Focused echocardiography is used to verify appropriate CVC placement by identifying the "rapid atrial swirl" sign which is defined as opacification of the right atrium within 2 seconds of a 10 mililiters normal saline injection. A standard subcostal or an apical four chamber transthoracic cardiac window is used for the visualization of the right heart. This technique has been shown to be easy to learn and perform after short training sessions and has good diagnostic accuracy [11,12].

Overall COVID19 has created a tremendous burden on the healthcare system and due to its high transmissibility and shortage of skilled healthcare workers it is pivotal to minimize any potential exposure to the staff as well as the cross infection of non-covid patients. The use of lung ultrasonography as shown in this video tutorial can help decrease the risk of nosocomial transmission.

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jcrc.2020.10.011.

## References

[1] https://coronavirus.jhu.edu/map.html.
[2] Ranney ML, Griffeth V, Jha AK. Critical supply shortages — the need for ventilators and personal protective equipment during the Covid-19 pandemic. N Engl J Med 2020. https://doi.org/10.1056/NEJMp2006141.
[3] Vetrugno L, Bove T, Orso D, et al. Our Italian experience using lung ultrasound for identification, grading and serial follow-up of severity of lung involvement for management of patients with COVID-19. Echocardiography 2020;37:625–7. https://doi.org/10.1111/echo.14664.
[4] Soldati G, Smargiassi A, Inchingolo R, Buonsenso D, Perrone T, Briganti DF, et al. Is there a role for lung ultrasound during the COVID-19 pandemic? J Ultrasound Med 2020. https://doi.org/10.1002/jum.15284.
[5] Martin LD, Mhyre JM, Shanks AM, et al. 3,423 emergency tracheal intubations at a university hospital: airway outcomes and complications. Anesthesiology 2011; 114:42–8.
[6] Gottlieb M, Holladay D, Peksa GD. Ultrasonography for the confirmation of endotracheal tube intubation: a systematic review and meta-analysis. Ann Emerg Med 2018;72(6):627–36.
[7] Peng QY, Wang XT, Zhang LN, Critical C, Ultrasound C, S. Group. Findings of lung ultrasonography of novel coronavirus pneumonia during the 2019 – 2020 epidemic. Intensive Care Med 2020:6–7.
[8] Huang Y, Wang S, Liu Y, et al. A preliminary study on the ultrasonic manifestations of peripulmonary lesions of non-critical novel coronavirus pneumonia (COVID-19) Available at SSRN 3544750 ; 2020.
[9] Lichtenstein DA, Meziere GA. Relevance of lung ultrasound in the diagnosis of acute respiratory failure: the BLUE protocol. Chest 2008;134(1):117–25.
[10] Lichtenstein DA. Lung ultrasound in the critically ill. Ann Intensive Care 2014;4:1. https://doi.org/10.1186/2110-5820-4-1.
[11] Korsten P, Mavropoulou E, Wienbeck S, Ellenberger D, Patschan D, et al. The "rapid atrial swirl sign" for assessing central venous catheters: Performance by medical residents after limited training. PLOS ONE 2018;13(7):e0199345. https://doi.org/10.1371/journal.pone.0199345.

https://doi.org/10.1016/j.jcrc.2020.10.011
0883-9441/

[12] Weekes AJ, Johnson DA, Keller SM, Efune B, Carey C, Rozario NL, et al. Central vascular catheter placement evaluation using saline flush and bedside echocardiography. Acad Emerg Med 2014;21:65–72.

Stamatis Baronos
*Department of Anesthesiology and Critical Care Medicine, Johns Hopkins Medicine, USA*
Corresponding author.
*E-mail address:* sbaronos@gmail.com

Gabriel Prada MD
*Department of Anesthesiology and Critical Care Medicine, Johns Hopkins University, USA*

Lee A. Goeddel MD, MPH
*Department of Anesthesiology and Critical Care Medicine, Johns Hopkins University, USA*

José L. Díaz-Gómez MD
*Department of Anesthesiology and Critical Care Medicine, Baylor College of Medicine, USA*

Aliaksei Pustavoitau MD, MHS
*Department of Anesthesiology and Critical Care Medicine, Johns Hopkins Medicine, USA*