

Point of Care Ultrasound during the medical teaching rounds in the COVID-19 Era; The Hospitalist Perspective

Christian Espana Schmidt^{1*}, Warda Alam²

¹ University of Vermont School of Medicine, Danbury Hospital, Dept of Internal Medicine, Connecticut, USA

² American University of the Caribbean, School of Medicine, Connecticut, USA

* **Corresponding Author:** Christian Espana Schmidt **E-mail:** chrsciencia@yahoo.com

ABSTRACT

Objective: In Internal Medicine, POCUS is gaining significant favorability. An increasing number of clinicians are interested in being trained for POCUS. The newer portable ultrasounds are small and can be transported easily during rounds. Their design is now for a more intuitive use. Training of Internists now involves assessing patients utilizing POCUS technology in residency. Here at Danbury Hospital, we have formal POCUS training. Attending internists are now attempting to incorporate POCUS training as a part of continuing medical education. POCUS in the hospitalist or general practitioner world has not been completely defined. Generally, the patient seen in the medical ward is not ill as the patients seen in intensive care units (ICU), Emergency Department (ED), and other high acute-care settings. However, from time to time, internists need to treat high acuity patients on the medical floors before transferring them to a higher level of care or when they are required to cover an open ICU or Progressive Care Unit (step-down unit). The role of POCUS while managing stable patients may differ significantly compared to the role in more acute patients. A well-defined spectrum for the use of POCUS does not currently exist. However, there are efforts in this regard.

POCUS is an emerging and exciting diagnostic modality in the medical ward. We believe that the pandemic has given it a new meaning for the hospitalist and general practitioner, and we expect that its use and significance will only grow in the few years ahead.

Keywords: Point-of-care-ultrasound, Ultrasound, Lung, COVID-19, POCUS

INTRODUCTION

Point of Care Ultrasound (POCUS) is widely used in many disciplines such as Cardiology, Emergency Medicine, Anesthesia, Critical Care, and others.

POCUS is used commonly for hemodynamic, functional, and anatomical assessment as well in procedural medicine.

In critically ill patients has proven useful in evaluating dyspnea and shock [1, 2]. POCUS is not limited to critical medical care and plays a role in other settings [3].

POCUS is a tool that requires technical training, anatomical knowledge, and a deep physiologic understanding of the processes that imaging documents. It is essential to understand the limitations of POCUS since this is not a comprehensive examination.

It requires a portable ultrasound machine that is appropriate to perform the type of examination required.

POCUS is different from other comprehensive ultrasound studies. It is used to answer a question that the clinician has while visiting a patient and can often yield useful diagnostic data in real-time to aid in clinical decision making. Some examples include but are not limited to evaluating the ejection fraction of the heart or the presence of abnormal fluid in cavities such as pleural effusions and ascites [3].

Short Communication

Received 12-03-2020

Accepted 29-03-2021

Available Online: 02-04-2021

Published 30-04-2021

Distributed under
Creative Commons CC-BY-NC 4.0

OPEN ACCESS



In Internal Medicine, POCUS is gaining significant favorability. An increasing number of clinicians are interested in being trained for POCUS. The newer portable ultrasounds are small and can be transported easily during rounds. Their design is now for a more intuitive use [4].

Training of Internists now involves assessing patients utilizing POCUS technology in residency. Here at Danbury Hospital, we have formal POCUS training. Attending internists are now attempting to incorporate POCUS training as a part of continuing medical education.

POCUS in the hospitalist or general practitioner world has not been completely defined [4, 5]. Generally, the patient seen in the medical ward is not ill as the patients seen in intensive care units (ICU), Emergency Department (ED), and other high acute-care settings. However, from time to time, internists need to treat high acuity patients on the medical floors before transferring them to a higher level of care or when they are required to cover an open ICU or Progressive Care Unit (step-down unit). The role of POCUS while managing stable patients may differ significantly compared to the role in more acute patients. A well-defined spectrum for the use of POCUS does not currently exist. However, there are efforts in this regard [6].

We believe that training Internists and Hospitalists is critical, helping better physicians with better clinical outcomes.

Training internists in POCUS seems feasible since studies have found that medical students can better identify heart conditions with ultrasound than cardiologists using a stethoscope [7]. Trained nurses can also distinguish the patient with pulmonary edema in the outpatient setting when adequately trained in lung ultrasound [8]

We use POCUS in a myriad of procedures.

The use of POCUS by the general practitioner seems necessary.

In the acute setting as POCUS lung ultrasound (LUS) may lead to the identification of the cause of dyspnea of a patient and start treatment as necessary [1]; in contrast, in the Medical Ward, an evaluation of a more stable patient by an internist, may need a more detailed and thorough examination of the lungs to advance diagnosis and treatment. Proper identification of scanned areas and proper positioning of the patient while being scanned is essential to obtain a more anatomical idea of the patient's affliction; this should always be paired with the lungs' auscultation.

For LUS, we have found that use of 8 frontal zones [9] (figure 1) and at least four posterior zones (as per our definition with a two-point examination for each hemithorax: The low point in the mid-scapular line usually near the 10th intercostal space with the patient sitting; the superior point in the space between the spine and the midpoint of the scapular body) (figure 2) is useful to evaluate for most lung disease. We also advise that every lung ultrasound is paired with thorough auscultation of the chest and evaluation of other imaging if available. The images should be documented and adequately assigned to specific scanning zones. They should be well described in the medical records of the patients. We recommend the use of four-second clips for all point-of-care ultrasounds for recording. As such, all images and interpretations should be subjected to systematic quality analysis by peers to identify opportunities for further training and improvement. We use POCUS to evaluate the heart and systemic veins better to assess patients' volume status and hemodynamics better. This is especially important when heart failure, thrombosis, sepsis, or acute kidney injury is suspected [10].

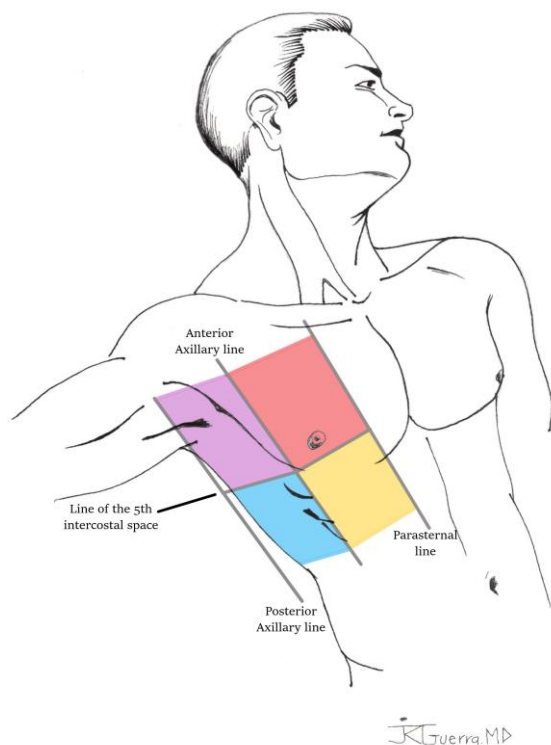


Figure 1: The 8 frontal zones for LUS

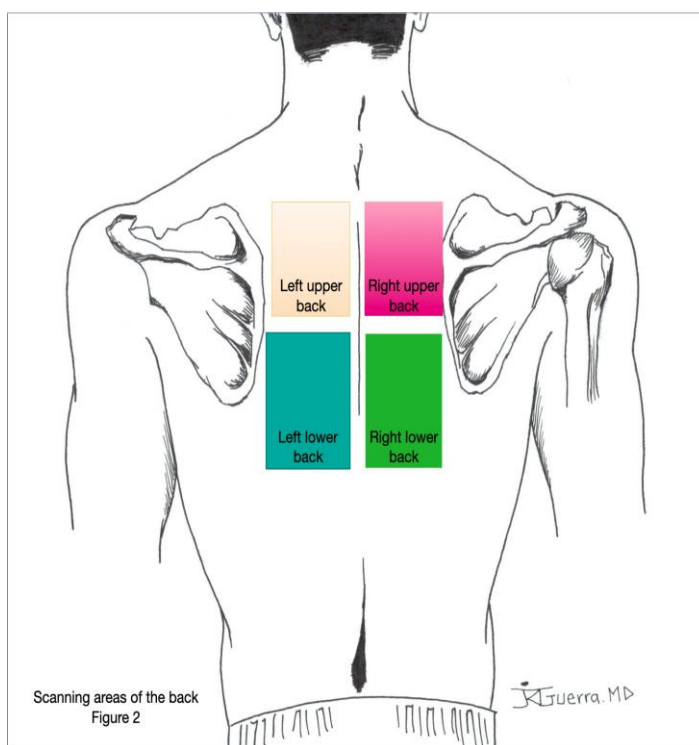


Figure 2: four posterior zones for LUS

Some of the limitations for POCUS use are lack of equipment, deficiency of consistent training, absence of motivation, lack of sufficient time during rounds, questions about documentation, and liability [4, 11]. Also may be limited by the perception that there is no medical decision associated with the procedure and revenue. Hospitalists, especially teaching hospitalists, may face large lists of patients making time to teach during rounds scarce and difficult.

POCUS appears to improve clinical results:

An observational study implemented at a tertiary level ICU aimed to investigate whether incorporating POCUS during the morning round on a routine basis improved clinical outcomes in critically ill patients with sepsis. This, by measuring mortality, duration of mechanical ventilation, vasopressor utilization, volume status. The intervention group had shorter durations of mechanical ventilation (MV) (4.5 ± 1.2 vs. 5.7 ± 1.0 days; $p = 0.034$) and more negative fluid balance (-143 vs. 48 ml/24 h; $p = 0.003$) on day 3. In association with the multivariable model, routine incorporation of POCUS lowered the risk of prolonged (>7 days) ICU stay (OR: 0.39, 95% CI: 0.29–0.88; $p = 0.029$) [14].

A systematic review and a proportion meta-analysis focused on the frequency of abnormalities found on LUS in Covid-19 patients revealed that almost all SARS-CoV-2-infected patients have abnormal LUS. The most common abnormality is interstitial involvement depicted as B-pattern. These findings emphasize the potential role of POCUS in the triage, diagnosis, and follow-up of COVID-19 patients [13].

The rise of POCUS in rounding in the patient with COVID 19:

Since March of 2020, Danbury Hospital saw an exponential increase of admissions secondary to COVID-19, in turn making Danbury Hospital one of the de-facto COVID hospitals of the NuVance Health system in Connecticut and New York. During the first wave of the pandemic and now with the second wave, we have seen a surge of patients in severe respiratory failure where classic clinician tools, such as the stethoscope, have shown to be of little help (unpublished data), and this has complicated the evaluation of the disease and volume status.

We used the POCUS approach to these problems. We began to perform lung ultrasound (LUS) and heart POCUS to help evaluate the lungs and heart in patients with COVID-19, which to our experience, lacks enough auscultatory and physical examination findings (unpublished data).

POCUS helps evaluate volume status, which seems to be paramount in these patients suffering from various COVID-19 pathologies [14].

Like many other studies, we have found that the infection of SARS-COV-2 has a characteristic appearance in the LUS, and the prognosis of these patients and the clinical status, can be affected severely by the volume status and presence of other complications such as venous and pulmonary thromboembolism.

Because of that, we started to perform LUS in our patients, scanning eight frontal zones looking for the common artifacts in COVID in the lung, and performing a heart ultrasound and systemic veins to evaluate volume status. When patients can cooperate, we perform back ultrasounds. We paired the LUS with the assessment of the heart function and right ventricle, and in patients with acute kidney injury, we have been able to quickly evaluate the kidneys and ureters of the patients avoiding transporting these patients to the ultrasound and CT scan suits.

We have stored all POCUS and proposed some of our findings for publication (results not published).

Results from cardiac views were always compared with formal echocardiograms when available.

Using POCUS gave us light in the general ward to manage those patients to add to the primary diagnosis and its complications.

We modified our morning rounds to take advantage of POCUS during this pandemic with good results even when patients' census was high.

Implementing POCUS in COVID Teaching Rounds:

During the first peak of COVID 19, the team scanned all patients with COVID 19 and compared the images to what was already published. We evaluated all the images with a pulmonologist, and we have submitted our findings to a peer-reviewed journal (unpublished data). During the second peak of COVID 19, we used the experience gained during the first peak. All patients who presented with worsening shortness of breath were flagged for LUS and cardiac ultrasound to evaluate volume status. All patients with stable findings would be evaluated by ultrasound on a case-by-case basis.

Some patients with improvement will be evaluated by ultrasound in order to document changes.

Methodology and Considerations during POCUS utilized Morning Rounds:

1. We will present and discuss all cases before entering the patients' room.
2. The case presentations will be concise and based on the specifics of the patient.
3. The sicker patients will be evaluated and scanned.
4. From these patients, those who will need further workup or particular intervention will be discussed with subspecialties and the lung ultrasound results and point of care cardiac ultrasound if possible.
5. The less urgent ultrasounds will be performed in a second clinical round after the first evaluation, especially those improving.
6. All ultrasounds performed by residents or students were performed under direct supervision.
7. All ultrasound findings will be documented in the paper chart, and the images properly identified and saved for future evaluation.

8. We found out that using a small ultrasound with a small footprint, in our case, a Mindray TE7 with a phased array probe (2-4Mh in lung setting), was appropriate for the relatively small-sized rooms. The use of this probe made it easy to change the settings to evaluate other organs rapidly.
9. We covered the ultrasound with the available PPE and letting only the probe and the screen be exposed to avoid contamination. The equipment was easy to clean with the available peroxide solution and antiviral solution in the hospital.
10. Planning was crucial since the use of ultrasound by trainees may exceed the 5 minutes proposed in other articles [15]. Before ultrasound rounds with the residents and students, we supervised the proper use of PPE.
11. To avoid cross-contamination, we scanned patients with multi-resistant bacteria at the end of the round.
12. All ultrasound results and images were discussed compared with other imaging and diagnosis with the residents.
13. All decisions based on the findings of the ultrasound were discussed during and after rounds. These discussions include the imaging description, reasoning on why to obtain imaging, quality of the imaging, and the physiology behind the ultrasound. On every patient admitted with the diagnosis of COVID-19, an LUS was performed to establish a baseline.
14. All findings were documented in the medical record and associated with a medical decision when appropriate.

We believe that the POCUS use gave us light in the general ward to manage those patients to add to the primary diagnosis and its complications.

Last thoughts

It appears that the use of ultrasound during rounds improves satisfaction in medical students and residents. It also appears to improve patients satisfaction [16]. It also appears that may improve clinical outcomes.

Despite (perhaps because of) the pandemic, POCUS has increasingly used on the general medical wards. We believe the need for POCUS will continue to grow, and it is equally important to implement consistent and quality training. It is also vital to supply adequate equipment and focus on the financial costs of utilizing POCUS.

It is necessary to support and evaluate if the use of POCUS in the medical Wards improves outcomes, and for that, studies will need to be done.

CONCLUSION

We recommend that medical schools, as well as internal medicine residencies, implement the study of POCUS. We also recommend that the hospitals make available portable ultrasounds that are intuitive to use, producing images that are of good quality for decision-making and

storing it for quality improvement. We must offer continuous continuing medical education opportunities for the attending, residents, and students to improve and maintain ultrasound

use quality. It is also essential to educate how to describe and document POCUS use in charts and how this can help in revenue.

POCUS is an emerging and exciting diagnostic modality in the medical ward. We believe that the pandemic has given it a new meaning for the hospitalist and general practitioner, and we expect that its use and significance will only grow in the few years ahead.

Acknowledgements: Thanks to Dr. Rodolfo Guerra (MD) for illustrations Figure 1 and 2

Author contributions: CES, WA; Literature search and study design, WA; Writing article and revisions

Conflict of interest: The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article. This research did not receive and specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Ethical issues: All authors declare originality of research.

REFERENCES

1. Lichtenstein, D.A., BLUE-protocol and FALLS-protocol: two applications of lung ultrasound in the critically ill. *Chest*, 2015. 147(6): p. 1659-1670.
2. Black, H., et al., Expert Facilitated Development of an Objective Assessment Tool for Point-of-Care Ultrasound Performance in Undergraduate Medical Education. *Cureus*, 2016. 8(6): p. e636.
3. Chen, Z., et al., 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: p. 62-66.
4. Gandhi, D., et al., Current role of imaging in COVID-19 infection with recent recommendations of point of care ultrasound in the contagion: a narrative review. *Ann Transl Med*, 2020. 8(17): p. 1094.
5. Howard, Z.D., et al., Bedside ultrasound maximizes patient satisfaction. *J Emerg Med*, 2014. 46(1): p. 46-53.
6. Kobal, S.L., et al., Comparison of effectiveness of hand-carried ultrasound to bedside cardiovascular physical examination. *Am J Cardiol*, 2005. 96(7): p. 1002-6.
7. Koratala, A., C. Ronco, and A. Kazory, Need for Objective Assessment of Volume Status in Critically Ill Patients with COVID-19: The Tri-POCUS Approach. *Cardiorenal Med*, 2020. 10(4): p. 209-216.
8. Ma, I.W.Y., et al., Canadian Internal Medicine Ultrasound (CIMUS) Expert Consensus Statement on the Use of Lung Ultrasound for the Assessment of Medical Inpatients With Known or Suspected Coronavirus Disease 2019. *J Ultrasound Med*, 2020.
9. Mohamed, M.F.H., et al., Frequency of Abnormalities Detected by Point-of-Care Lung Ultrasound in Symptomatic COVID-19 Patients: Systematic Review and Meta-Analysis. *Am J Trop Med Hyg*, 2020. 103(2): p. 815-821.
10. Mumoli, N., et al., Accuracy of Nurse-Performed Lung Ultrasound in Patients With Acute Dyspnea: A Prospective Observational Study. *Medicine (Baltimore)*, 2016. 95(9): p. e2925.
11. Schnitke, N. and S. Damewood, Identifying and Overcoming Barriers to Resident Use of Point-of-Care Ultrasound. *West J Emerg Med*, 2019. 20(6): p. 918-925.
12. Simon, R., et al., A.B.C. approach proposal for POCUS in COVID-19 critically ill patients. *Med Ultrason*, 2020.

13. Smallwood, N. and M. Dachselt, Point-of-care ultrasound (POCUS): unnecessary gadgetry or evidence-based medicine? *Clin Med (Lond)*, 2018. 18(3): p. 219-224.
14. Torres-Macho, J., et al., Point-of-care ultrasound in internal medicine: A position paper by the ultrasound working group of the European federation of internal medicine. *Eur J Intern Med*, 2020. 73: p. 67-71.
15. Volpicelli, G., et al., International evidence-based recommendations for point-of-care lung ultrasound. *Intensive Care Med*, 2012. 38(4): p. 577-91.
16. Wong, J., et al., Barriers to learning and using point-of-care ultrasound: a survey of practicing internists in six North American institutions. *Ultrasound J*, 2020. 12(1): p. 19.