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EDITORIAL

Point-Of-Care Cardiac Ultrasound: is it time for anesthesiologists to embrace and achieve competence?

That will never come into clinical practice, and I am extremely doubtful because its clinical applications require much time and give a good bit of trouble both to the patient and practitioner.

J. Forbes — Preface for Laennec's Treatise, 1823

The statement above refers to the introduction of the stethoscope in clinical practice at the beginning of the 19th century. It shows that every new technology needs to overcome barriers before its acceptance. Point-Of-Care Ultrasound (POCUS) is a diagnostic modality adopted by several specialties to help in the clinical evaluation of the patient and the performance of several procedures. It has been familiar in anesthesiology for a long time due to its role in facilitating venous accesses and regional blocks.[1]

Given the inherent safety, portability, and relative cost-effectiveness of POCUS compared to other imaging modalities, it is unsurprising that this diagnostic tool is increasingly getting attention in modern medical practice. The advent of compact and versatile devices with enhanced image quality and sophisticated features[2] — such as color, pulsed, and continuous wave Doppler — has further advanced this trend. For the anesthesiologist, it is crucial to comprehend the wide range of POCUS applications,[3] covering cardiac, pulmonary, gastric, abdominal, neurological, and airway assessments. Such understanding facilitates the selection of the appropriate modality, thereby optimizing patient management and outcomes in the clinical scenario at hand.

Cardiac Point-Of-Care Ultrasound (C- POCUS) has the general characteristics of other POCUS modalities (qualitative assessment, simple execution) with the main objective of helping the diagnosis and assisting in situations of hemodynamic instability.[4] Based on a defined list of diagnoses, C-POCUS can reliably detect or exclude the presence of cardiac tamponade, myocardial ischemia, ventricular failure, hypovolemia, gross valvular pathologies, pulmonary embolism, and unexplained hypoxia. It can also be used in cases of circulatory arrest[5] to evaluate and guide cardiopulmonary resuscitation. It is essential to emphasize the enormous difference between C-POCUS and a formal transthoracic echocardiogram.[6] Although both use cardiac ultrasonography, a formal echocardiogram is a much more comprehensive and sophisticated diagnostic modality, requiring extensive training and following well-defined guidelines for acquiring, interpreting, and reporting exams[7] contrary to a focused qualitative assessment.

This issue of the *Brazilian Journal of Anesthesiology* discusses C-POCUS to assist hemodynamic monitoring, which is one of the pillars for indicating its clinical use. Souza et al.[8] used the suprasternal window to obtain the velocity time integral (VTI) of the descending thoracic aorta as a surrogate of cardiac output and compared it with the conventional method of measurement obtained through the apical window. Their findings not only suggest a good correlation between windows, but also that the proposed technique can be learned with relative ease to be applied in the daily anesthetic practice. Despite being a small study, it highlights the desired characteristics of the POCUS exam: quickness and reliability to assist in the clinical decision-making process. In other words, questions such as *"Is this low output state caused by hypovolemia (and a fluid challenge is warranted) or by ventricular failure (in which case a fluid challenge not only is the wrong answer but also potentially harmful)?"* can be answered swiftly and more accurately.

In another article, Roy et al.[9] discuss the variation of the inferior vena cava (IVC) diameter through the Collapsibility Index (CI) obtained by imaging it in the subcostal view trying to predict the occurrence of hypotension following spinal anesthesia. Despite the absence of correlation between the CI and the percentage decrease in the mean blood pressure (due to gaps in IVC ultrasound interpretation such as cardiac function, thoracic and abdominal pressure, blood volume, and vessel compliance),[10] the article also discusses and alerts the anesthesiologist about integrating several POCUS modalities (cardiac, vascular, and pulmonary) to obtain a complete assessment of the patient's hemodynamic status.[11] Such strategy seems to be especially useful when there is a multifactorial mechanism of hemodynamic

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instability, including multiple types of circulatory shock at the same time. POCUS may help providers to individualize each patient's pathophysiology and guide the most appropriate strategy in order to normalize tissue perfusion.

Even though it is widely used across various medical fields, the opportunities for POCUS training and the requirements for achieving proficiency and certification show considerable disparity between specialties. In anesthesiology, this variability is particularly pronounced. There is a pressing need for formal training curriculum within most medical residency programs, both in and outside Brazil. Additionally, rigorous evaluation and certification processes are essential to ensure appropriate proficiency in this critical skill.[12]

Regarding the general POCUS curriculum[1-6] and the specific domain of C-POCUS,[7-10] it is anticipated that anesthesiologists in training demonstrate the ability to:[13,14]

1) Recognize the clinical indication of the test: resuscitation, hemodynamic monitoring, and assistance in performing procedures.
2) Show basic knowledge of physics for image acquisition and what to do to optimize it.
3) Know the equipment, the different types of probes, and when and why use them.
4) Understand and perform probe movements (rotation, tilting, sweeping, angling, rocking) to acquire the best image for each evaluated structure.
5) Report the examination findings clearly and concisely to other professionals caring for the patient and document them in the medical record for possible follow-up.
6) Recognize the limitations of the exam and know when to request a comprehensive examination.
7) Know the basic anatomy of the heart, great vessels, coronary irrigation, and inferior vena cava.
8) Recognize and effectively obtain the most used windows for a focused cardiac examination: long and short parasternal, long and short subcostal, and apical four chambers.
9) Recognize and integrate the most common causes of hemodynamic instability in the perioperative period: size and function of the left and right ventricle (qualitative analysis), presence of pericardial effusion, gross valve alterations.
10) Integrate the findings with the ultrasonographic pulmonary examination and assessment of the inferior vena cava diameter.

The challenges of structuring learning opportunities in accordance with the requirements, associated with the evaluation and certification of anesthesiologists, have significant obstacles. These difficulties not only prevent a greater number of professionals from achieving proficiency, but also obstruct the integration of POCUS training into residency programs. The Brazilian Society of Anesthesiology (SBA) has been promoting workshops of C-POCUS for their members aiming to spread this knowledge among Brazilian anesthesiologists and residents.

Broadly, training programs proposed by societies both within and outside the field of Anesthesiology[14,15] are based on the following principles: formal didactic activities and use of simulators; creation of a minimal supervised exam portfolio (30—40 exams for C- POCUS); competency assessment (formative and summative feedback); and maintenance of competence acquired through a minimum number of exams performed annually at the end of the training.

Upon completion of the training, it is expected that the trainee holds the capability to acquire accurate and informative images, sufficient for proper interpretation. Furthermore, after reading these images, the physician should be able to make appropriate clinical decisions, avoiding both excessive interpretation and the oversight of crucial diagnoses.

Another important topic currently under discussion is when to start the POCUS training. The global tendency is to start it during medical school as a general competence before choosing a specialty. Still, this trend needs to be better evaluated due to the lack of guidelines and standards.[16]

There is no doubt that POCUS, in general, is a diagnostic modality that will be increasingly used and explored in our specialty. The concept of "whole body ultrasound" (WHOBUS), with the objective of increasing the speed and accuracy of the evaluation of critically ill patients, is already used postoperatively in several intensive care units where there is the integration of C- POCUS in the assessment of causes of hemodynamic instability and pulmonary US to diagnose causes of hypoxemia, besides abdominal US to assess causes of oliguria and optic nerve sheath diameter to evaluate intracranial pressure (ICP).[17]

It is essential that anesthesiologists, who deal with unstable patients during their routine, feel comfortable in recommending, performing, and interpreting this examination. Not only it provides real-time insights into the causes of the hemodynamic decompensation but allows for continuous monitoring of responses to the implemented therapeutic interventions. To achieve this, mechanisms must be created to offer an adequate training and evaluation curriculum for anesthesiologists already working in clinical practice and for future generations.

Conflicts of interest

The authors declare no conflicts of interest.

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