International Journal of Science and Research Archive
eISSN: 2582-8185
Cross Ref DOI: 10.30574/ijsra
Journal homepage: https://ijsra.net/

(RESEARCH ARTICLE)

Check for updates

Use of point-of-care ultrasound in the rapid diagnosis of critical conditions in the emergency room

Wanessa Gabriela de Liandro, Carolina Fátima Gioia Nava, Marjorie Bindá Leite, Erika Roberta Soares de Oliveira, Mikael Mendes Ferreira, Gabriella Cucci da Paixão, Murilo Henrique Silva da Silva and Marinaldo Soares Leite *

Centro Universitário Alfredo Nasser.

International Journal of Science and Research Archive, 2025, 14(02), 764-767

Publication history: Received on 02 January 2025; revised on 10 February 2025; accepted on 13 February 2025

Article DOI: https://doi.org/10.30574/ijsra.2025.14.2.0456

Abstract

POCUS is a powerful tool in emergency care, providing a fast, accessible, and effective way to diagnose and monitor critical conditions. However, to fully harness its potential, it is crucial to ensure the competence of operators through specialized and ongoing training. The aim of this paper is to assess the use of Point-of-Care Ultrasound (POCUS) in emergency medicine, focusing on its diagnostic accuracy, impact on reducing time to diagnosis, cost-effectiveness, and the importance of continuous training to ensure operator competence. This study is a narrative review of the literature, aimed at evaluating the application and implications of using Point-of-Care Ultrasound (POCUS) in emergency medicine. The review was conducted through the search and analysis of scientific articles published in the last five years (2019-2024), in English and Portuguese. The search for articles was performed in databases recognized by the scientific community, including PubMed (Medline), Scopus, Web of Science, Google Scholar, and SciELO. The use of Point-of-Care Ultrasound (POCUS) in the rapid diagnosis of critical conditions in the emergency room has become an essential practice, offering significant advantages in assessing critically ill patients. POCUS refers to the use of portable ultrasound devices directly in the emergency room or at the bedside, allowing doctors, nurses, and other healthcare professionals to perform quick and easily accessible exams without the need to transport the patient to another department, such as radiology. This can be crucial in urgent situations, where time is a key factor in treatment success. POCUS represents a revolution in emergency care, providing faster, more accurate, and efficient diagnoses, with a significant impact on reducing morbidity and mortality in critically ill patients.

Keywords: Bedside Ultrasound; Emergency medicine; Portable ultrasound; Clinical application

1. Introduction

In the context of emergency medicine, the use of Point-of-Care Ultrasound (POCUS) has proven to be highly valuable, with applications in a wide range of clinical conditions. POCUS can be used for immediate diagnosis in situations such as trauma, acute abdominal conditions, heart failure, and cardiac arrest. It is also essential in image-guided procedures, such as punctures, catheterizations, and fluid drainages. Regarding hemodynamic monitoring, POCUS aids in the evaluation of patients in shock or with hemodynamic instability, providing quick and accurate information for immediate therapeutic decisions (COSTA, 2024).

One of the main advantages of POCUS is its ability to significantly reduce diagnosis time. This occurs because the technology allows real-time visualization of internal body structures, enabling faster and more accurate diagnoses compared to conventional imaging methods, such as CT scans and MRIs. Additionally, portable ultrasound equipment

* Corresponding author: Marinaldo Soares Leite

is easily transportable, allowing the exam to be performed at the bedside, improving the mobility of care and making access to technology faster and more efficient in critical situations (PELLEGRINI et al., 2022 & COSTA, 2024).

From an economic standpoint, POCUS offers a significant cost-effectiveness ratio. By performing ultrasound exams at the point of care, it reduces the need for transportation to conventional diagnostic rooms and shortens hospital stays, thus avoiding the use of other more expensive imaging methods (PELLEGRINI et al., 2022 & COSTA, 2024).

However, POCUS is not without its limitations. The accuracy of the results obtained heavily depends on the experience and skill of the operator, meaning its effectiveness is closely tied to the competence of the professional performing the exam. Ongoing training is crucial to ensure the accuracy and clinical utility of POCUS, as lack of expertise can compromise diagnoses (PELLEGRINI et al., 2022 & ROCHA et al., 2023).

Furthermore, technical factors such as patient obesity and the presence of air or gas in the body can interfere with image quality, making it difficult to adequately visualize internal structures. These limitations highlight the importance of proper training for healthcare professionals to minimize variables that can affect exam quality and, consequently, the accuracy of diagnoses (PELLEGRINI et al., 2022 & ROCHA et al., 2023).

In summary, POCUS is a powerful tool in emergency care, offering a fast, accessible, and effective way to diagnose and monitor critical conditions. However, to fully maximize its potential, it is essential to ensure operator competence through specialized and continuous training. The goal of this work is to evaluate the use of Point-of-Care Ultrasound (POCUS) in emergency medicine, focusing on its diagnostic accuracy, impact on reducing time to diagnosis, cost-effectiveness, and the importance of continuous training to ensure operator competence.

2. Methodology

This study is a narrative literature review, aimed at evaluating the application and implications of using Point-of-Care Ultrasound (POCUS) in emergency medicine. The review was conducted through the search and analysis of scientific articles published in the last five years (2019-2024), in English and Portuguese. The search for articles was carried out in databases recognized by the scientific community, including PubMed (Medline), Scopus, Web of Science, Google Scholar, and SciELO. Included studies were original research, systematic reviews, meta-analyses, and articles addressing the main applications of POCUS, its limitations, benefits, and impact on clinical practice in medical emergencies.

Inclusion and exclusion criteria were established for article selection. The inclusion criteria were: articles published between 2019 and 2024; original studies, systematic reviews, and meta-analyses; articles in English or Portuguese; and articles discussing the use of POCUS in emergency conditions, such as trauma, heart failure, cardiac arrest, acute abdominal conditions, among others. The exclusion criteria included duplicate articles, studies that did not directly address the use of POCUS in emergency medicine, case reports, or articles that did not present relevant data on the practical application of POCUS.

The search was conducted with the help of controlled descriptors based on DeCS (Health Sciences Descriptors) and MeSH (Medical Subject Headings). The main descriptors used were: “Point-of-Care Ultrasound,” “Emergency Medicine,” “Trauma Diagnosis,” “Acute Abdominal Conditions,” “Cardiac Arrest,” “Hemodynamic Monitoring,” “Portable Ultrasound,” “Diagnostic Accuracy,” “Clinical Application,” and “Cost-Effectiveness.”

The selected articles were qualitatively analyzed, highlighting the main conclusions about the advantages, limitations, efficiency, and costs associated with the use of POCUS in emergency medicine. The synthesis of findings will be presented to provide an overview of POCUS’s contribution to improving the diagnosis and management of patients in emergency situations.

3. Literature Review

The use of Point-of-Care Ultrasound (POCUS) in the rapid diagnosis of critical conditions in the emergency room has become a fundamental practice, offering significant advantages in the evaluation of critically ill patients. POCUS refers to the use of portable ultrasound devices directly in the emergency room or at the bedside, allowing doctors, nurses, and other healthcare professionals to perform quick and easily accessible exams without the need to transport the patient to another department, such as radiology. This can be crucial in urgent situations where time is a determining factor for treatment success (PELLEGRINI et al, 2022 & ROCHA et al, 2023).

3.1. Applications of POCUS in Emergency Medicine

3.1.1. Abdominal and Thoracic Trauma

Bedside ultrasound is widely used for the rapid assessment of internal injuries in trauma patients, such as in the FAST (Focused Assessment with Sonography for Trauma) protocol. This quick exam can detect intra-abdominal bleeding, hemothorax, or pneumothorax, assisting in immediate decisions regarding patient management, such as the need for surgical intervention or drainage procedures (MARTINS et al, 2021).

3.1.2. Heart Failure and Cardiac Arrest

In patients with acute heart failure or cardiac arrest, POCUS can be used to assess ventricular function and detect potential causes of circulatory failure, such as cardiac tamponade or internal bleeding, which may be contributing to the condition. Early detection of these conditions can be essential for the implementation of appropriate treatments, such as pericardial drainage or fluid administration (MARTINS et al, 2021).

3.1.3. Hemodynamic Monitoring

POCUS allows for rapid and continuous evaluation of hemodynamic parameters, such as central venous pressure (CVP), cardiac output, and ventricular function, especially in patients with shock. This approach is crucial for adapting treatment and determining the need for specific interventions, such as fluid infusion, vasopressors, or adjustments in mechanical ventilation (MARTINS et al, 2021).

3.1.4. Acute Abdominal Conditions

POCUS is effective in assessing acute abdominal conditions such as appendicitis, cholecystitis, and intestinal obstructions, enabling rapid diagnoses that assist in deciding whether surgery is necessary. This is particularly relevant in emergency settings where quick diagnoses can reduce waiting times and improve prognosis (MARTINS et al, 2021).

3.2. Advantages of POCUS

POCUS offers rapid evaluation that can be performed simultaneously with the clinical exam, allowing immediate diagnoses that directly influence therapeutic decisions. This is particularly important in emergency situations where time is crucial to prevent severe complications or death (NETO; FILHO; QUEIROZ, 2024).

The portable ultrasound is easily transportable to any area of the emergency room, allowing healthcare professionals to perform bedside exams without the need to move the patient. This reduces the risk of clinical deterioration during transport and avoids wasting time on transfers (NETO; FILHO; QUEIROZ, 2024).

Compared to other diagnostic imaging methods, such as computed tomography (CT) and magnetic resonance imaging (MRI), POCUS is a low-cost and easy-to-maintain alternative, which is crucial in emergency environments where resources may be limited (NETO; FILHO; QUEIROZ, 2024).

The use of POCUS has been associated with a reduction in mortality among critically ill patients, as it enables rapid interventions, reducing diagnostic time and increasing the chances of treatment success (NETO; FILHO; QUEIROZ, 2024).

3.3. Limitations of POCUS

Despite the numerous advantages, POCUS has some limitations that should be considered, such as the fact that the accuracy of results depends significantly on the operator's experience and skill. Inadequate interpretation of images can lead to erroneous diagnoses. Therefore, continuous training is essential to ensure the effectiveness of POCUS in clinical practice (LUQUETTI et al, 2024).

Image quality may be impaired in obese patients or when air or gas is present (such as in pneumothorax or intestinal distension), which can hinder the visualization of internal structures (LUQUETTI et al, 2024).

POCUS may be limited in terms of viewing areas, especially for conditions requiring more detailed or deeper assessment, such as very internal organs or hard-to-reach areas (LUQUETTI et al, 2024).

4. Conclusion

In conclusion, the use of Point-of-Care Ultrasound (POCUS) in the emergency room has proven to be an essential and effective tool for the rapid diagnosis and management of critical conditions. Its immediate application in trauma scenarios, heart failure, cardiac arrest, and acute abdominal conditions provides accurate, real-time diagnosis, enabling early therapeutic interventions that are crucial for improving clinical outcomes and reducing mortality. The portability of the equipment and its direct bedside accessibility are characteristics that make POCUS particularly valuable in emergency settings, where time is a determining factor in the patient's prognosis.

However, the effectiveness of POCUS depends heavily on the experience and skill of the operator, which highlights the importance of continuous training and professional development. Furthermore, although POCUS offers numerous advantages, such as cost reduction and improved mobility, it has technical limitations, such as image quality in cases of obesity or the presence of air or gas, which can hinder the visualization of certain internal structures.

Therefore, to optimize the use of POCUS and ensure its effectiveness, a combination of proper training, well-defined clinical protocols, and critical evaluation of the results obtained is necessary. POCUS represents a revolution in emergency care, providing faster, more accurate, and efficient diagnoses, with a significant impact on reducing morbidity and mortality in critically ill patients.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

References

[1] COSTA, Giovani Davanço. The use of bedside ultrasound (POCUS) in the emergency department: a literature review. Cuadernos de Educación y Desarrollo, v. 16, n. 12, p. 01-04, 2024. DOI: 10.55905/cuadv16n12-134. Received on: Oct 22, 2024. Accepted on: Nov 21, 2024.

[2] LUQUETTI, Camilla Maganhin et al. Overview of the diagnostic uses of point-of-care ultrasound (POCUS). Journal of Medical and Biosciences Research, v. 1, n. 3, p. 1273-1283, 2024.

[3] MARTINS, Ana Carolina Lopes; RIBEIRO, Bruno Eustáquio Rocha; SILVA, Douglas Costa; SANTOS, Layla Vieira dos; FÓFANO, Gisele Aparecida. The use of point-of-care ultrasound in the care of patients in emergency and urgent care: a literature review. Brazilian Journal of Surgery and Clinical Research – BJSCR, v. 36, n. 1, p. 78-86, Sept.-Nov. 2021. Available at: http://www.mastereditora.com.br/bjscr. Accessed on: Feb 5, 2025.

[4] NETO, Miguel José Francisco; LIRA FILHO, Edgar Bezerra de; QUEIROZ, Marcos Roberto Gomes de. Point-of-care in clinical practice: a consolidated reality. Arquivos Brasileiros de Cardiologia, v. 121, n. 1, p. e20230688, 2024. DOI: https://doi.org/10.36660/abc.20230688.

[5] PELLEGRINI, José Augusto Santos et al. Use of bedside echocardiography in the care of critically ill patients - a joint consensus document of the Brazilian Intensive Care Medicine Association, Brazilian Emergency Medicine Association, and Brazilian Hospital Medicine Society. Crit Care Sci, v. 35, n. 1, p. 2-10, 2023. DOI: 10.5935/2965-2774.20230307-pt. Submitted on: Sep 6, 2022. Accepted on: Dec 3, 2022.

[6] ROCHA, Miriam Marques Nogueira; FERREZ, Marta Junqueira Reis; PIFFER, Amanda Grippa; RAITER, Bruna Thais; SOUSA, Giovanna Rosa de; FERREIRA, Gustavo Henrique Mendes; CHEN, Kewin Tjioe; GALHARDO, Andeile de Albuquerque. Point-of-care ultrasound in the emergency department: diagnosis of mechanical complication after acute myocardial infarction. Brazilian Journal of Health Review, Curitiba, v. 6, n. 6, p. 33571-33579, Nov./Dec. 2023. DOI: 10.34119/bjhrv6n6-541. Received on: Nov 24, 2023. Accepted on: Dec 28, 2023.