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THE CLINICAL IMPACTS OF INTEGRATING POCUS INTO MEDICAL PRACTICE IN EMERGENCY ENVIRONMENTS: A LITERATURE REVIEW

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Abstract: This study explores the growing importance of point-of-care ultrasound (POCUS) in contemporary medical practice. The method allows healthcare professionals to perform imaging exams quickly and efficiently, directly at the point of patient care, without the need to travel to an imaging center. This is an integrative review that analyzed previous scientific articles from the National Library of Medicine (PubMed) and Virtual Health Library databases, after applying inclusion and exclusion criteria, a total of 16 articles were obtained. The article also discusses the challenges related to using POCUS, such as the need for specific training for professionals and ensuring the quality of the images. However, the authors argue that the implementation of appropriate training programs and the use of state-of-the-art equipment can minimize these obstacles. Its ability to provide accurate, real-time diagnostic information is transforming the way healthcare professionals care for patients, improving the quality of care, reducing costs and contributing to patient safety.

Keywords: POCUS; Medical Emergency; Agility.

INTRODUCTION

The emergency department is a high-pressure environment, where the need to care for critically ill patients and make rapid decisions requires healthcare professionals to be able to act quickly and accurately. Identifying patients with life-threatening conditions who require immediate attention is crucial, but the reality of the emergency room presents additional challenges, such as a shortage of professionals, excessive demand and the need for a cohesive and harmonious team for the service to function properly. Added to this complex dynamic is the emotional overload of professionals, who deal with the responsibility of making decisions

that can directly impact the life or health of patients, often in critical condition (GARCÍA-TUDELA et al., 2022).

Ultrasound, which uses sound waves to create images of the body, evolved from the sonar of the First World War. The first image of a human skull was taken in 1947, and the technique spread to various medical fields. From the 1990s onwards, the emergence of smaller ultrasound machines made it possible to use the examination at the point of care, but the quality of the images was inferior to those from larger machines. Since 2010, technology has advanced, enabling compact machines with images of similar quality to those of larger equipment (BARIBEAU et al., 2020).

Point-of-care ultrasound is a promising tool for differentiating cardiac and pulmonary diseases, but its value in the hands of emergency physicians with different levels of experience is still questionable (LAI et al., 2022). Serial point-of-care ultrasound (PoCUS) has the potential to revolutionize acute patient care, allowing treatment to be personalized based on the dynamic evolution of the images obtained (MATTILA et al., 2023).

POCUS has become an essential tool for many health professionals, acting as a crucial complement to the physical examination. Integrating POCUS with existing assessment methods provides a more complete analysis, contributing to more effective decision-making (EL-HUSSEIN, et al., 2022).

With the aim of gaining a comprehensive understanding, this article presents a literature review to analyze how the various clinical and practical aspects of POCUS integration in emergency medical environments can be encompassed, seeking to highlight its benefits and challenges in a complete and comprehensive manner.

METHODOLOGY

This qualitative, retrospective and cross-sectional study was carried out by means of an integrative literature review in the PubMed and Virtual Health Library databases, using the descriptors “point-of-care ultrasound” and “emergency medicine” combined by the Boolean operator “AND”. In order to guarantee the relevance of the articles, the inclusion criteria were those that addressed the themes proposed for this research. Eligibility parameters were established (articles published between 2019 and 2024, in English, Portuguese or Spanish, open access).

Articles which did not directly address the proposal in question, which did not meet the previously defined inclusion criteria or which appeared to be duplicates were excluded. The search resulted in a total of 4096 papers, of which 3324 were found in the PubMed database and 772 in the BVS.

RESULTS AND DISCUSSION

After applying the selection criteria, 71 articles were screened in the two databases, of which, after reading and manual selection, 16 journals were chosen for analysis. After applying the inclusion and exclusion criteria, 10 articles were selected from the PubMed database and 6 from the BVS, as shown in Figure 1.

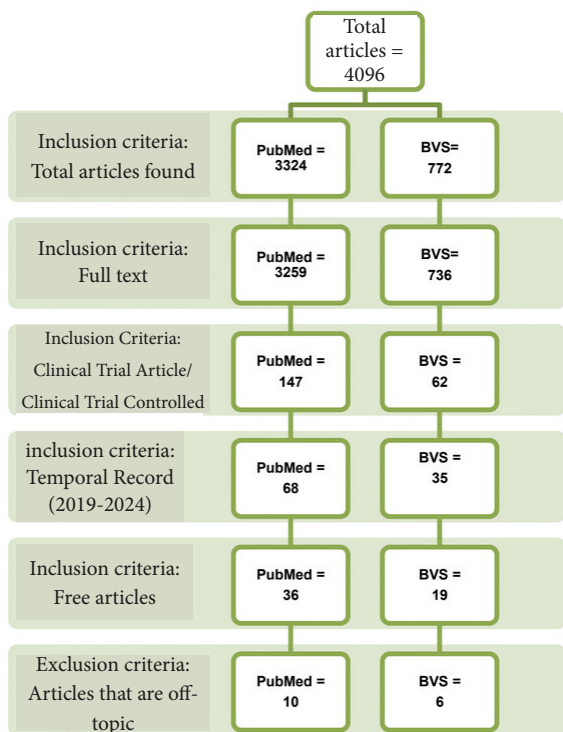


Figure 1. Flowchart for identifying and selecting the selected articles

Source: Authors (2024)

Of the 16 studies selected, 12 were applied to present results that were relevant to the study's considerations.

The integration of Point-of-Care Ultrasound (POCUS) into medical practice in emergency settings has demonstrated a significant clinical impact, both in improving diagnosis and treatment and in improving the efficiency of care. Of the 12 articles selected, the implementation of POCUS helped in the rapid diagnosis of stroke, sudden dyspnea of unknown origin and undifferentiated hypotension. It has helped to make decisions and reduce the hospital stay for patients with respiratory failure, renal colic and bronchiolitis. In addition, POCUS proved to be more effective than traditional radiography in diagnosing some orthopedic emergencies. In addition, POCUS reduces the time it takes to perform nerve plexus blocks in patients with hip fractures.

Table 1 below shows the locations of case studies and randomized studies.

The integration of POCUS in emergencies has had significant clinical impacts, improving diagnosis and treatment, reducing complications and increasing the efficiency of care. With proper training and the development of standardized protocols, the use of this tool can continue to expand, bringing benefits to both professionals and patients.

The study by Ebinger et al. (2021) carried out a 3-month study of Berlin patients with out-of-hospital ischemic stroke, comparing those who received care via a mobile stroke unit (with pre-hospital computed tomography with or without angiography, laboratory tests at the point of care and the possibility of pre-hospital thrombolysis) with those who were cared for by a conventional ambulance, so it was possible to determine that access to the advanced resources of the mobile stroke unit led to a reduction in damage to patients after the event.

Riishede et al. (2021), on the other hand, noted that for patients with signs of respiratory failure in the emergency department, performing cardiopulmonary ultrasound at the point of care, together with a standard clinical examination, by emergency physicians with varied ultrasound experience, will increase the agreement between presumptive diagnoses and final diagnoses four hours after admission, compared to standard clinical examination alone.

When studying the impact of cardiopulmonary POCUS on patients with acute dyspnea, it was reported that serial cardiopulmonary POCUS-guided therapy, together with usual care, can facilitate a greater improvement in dyspnea severity, especially in patients with ACI, compared to usual care with a single POCUS in the emergency department. This study also suggests considering the routine use of

Author	Year	Type of study	Main conclusions
Ebinger et al.	2021	Case series (n= 1543)	Patients who received care from mobile stroke units showed a significant reduction in overall disability after three months, compared to those who only received care from conventional ambulances.
Riishede et al.	2021	Clinical Trial (n=218)	The inclusion of focused cardiopulmonary ultrasound in the standard clinical examination for patients with suspected respiratory failure did not improve diagnostic accuracy. However, this approach led to a significant increase in the proportion of patients who received appropriate treatment and also in the proportion of patients who remained in hospital for less than a day.
Arvig et al.	2023	Randomized study (n=206)	Performing serial cardiopulmonary ultrasound (pocus) in addition to standard treatment resulted in a more significant improvement in the severity of breathlessness, especially for patients with acute heart failure (AHF), compared to standard treatment with just one pocus in the emergency room.
Crombach et al.	2020	Case series (n=242)	The combined use of ultrasound (pocus) and physical examination proved to be an effective tool for diagnosing ankle and fifth metatarsal fractures in common clinical situations, with results comparable to radiography.
Zare et al.	2021	Case series (n=103)	Performing ultrasound early on patients with acute shortness of breath of unknown cause in the emergency room allows for a reduction in the waiting time for care and an increase in the accuracy of the diagnosis.
Kim et al.	2019	Case series (n=147)	The use of POCUS in patients with acute renal colic who come to the emergency room has been shown to be more effective than usual clinical practice in reducing the length of hospital stay and medical costs, without compromising patient safety over the following 30 days.
Snelling et al.	2023	Case series (n=270)	In children and adolescents with a suspected distal forearm fracture and no apparent deformity, the ultrasound scan performed and interpreted by the doctor in the emergency room proved to be more accurate in identifying the correct diagnosis than the X-ray interpreted by the doctor.
Bergmann et al.	2021	Case series (n=256)	Results indicate that the diagnostic accuracy of POCUS performed by experienced clinical sonographers is similar, or even superior, to that of RADUS in detecting clinically significant intussusception.
Supineet al.	2019	Case series (n=76)	The study demonstrates that lung ultrasound in children with bronchiolitis can be a useful method to be integrated into the clinical evaluation to better define the individual prognosis of each patient.
Cal et al.	2024	Case series (n=30)	Teleorientation improves image acquisition time and the clinical applicability of ultrasound images obtained even by untrained operators.
Peach et al.	2023	Case series (n=270)	POCUS had good diagnostic performance in undifferentiated hypotensive patients, especially as an inclusion test.
Lee et al.	2021	Case series (n=36)	POCUS-GRA (ultrasound for nerve block) in the majority of eligible hip fracture patients seen, with half of them performing three or more blocks. The time to perform the POCUS-GRA is 15 minutes, suggesting that time should not be a barrier to the test, nor to optimizing analgesia for the elderly in the emergency room immediately after the hip fracture.

Table 1. Characterization of articles according to year of publication, type of study and main conclusions

Source: Authors (2024)

serial POCUS to help the physician stabilize the patient more quickly (ARVIG et al., 2023).

In the study by Crombach et al. (2020), which involved a total of 242 subjects, compared to radiographic images, POCUS offers a reasonable level of diagnostic value in identifying suspected fractures of the ankle and fifth metatarsal.

Kim et al. (2019), pointed out that although there is little evidence on the impact of the imaging modality on the length of hospital stay, studies indicate that a diagnosis made using POCUS can result in a reduction in this time, especially for cases of acute renal colic. However, if a second imaging exam is required, the length of hospital stay can become longer.

There is growing interest in the ability of point-of-care ultrasound (POCUS) to diagnose distal forearm fractures in children, so while the diagnostic accuracy of ultrasound image interpretation by clinicians should reflect the condition of the injuries, progress is needed in the search for new ways to reduce the need for unnecessary radiographs or procedures (SNELLING et al. 2023).

Bergmann et al. (2021), in a study comparing sonographers and radiologists not certified in radiology, POCUS demonstrated diagnostic accuracy equivalent to that of RADUS (ultrasound performed by radiologists), when analyzing children aged 3 months to 6 years, with very close accuracy rates respectively. The analysis suggests that POCUS may be useful as a screening tool for children with suspected intussusception when used by experienced pediatricians.

Supino et al (2019) showed that lung ultrasound performed in a hospital environment can be useful in stratifying the risk of bronchiolitis and predicting respiratory failure and the need for invasive mechanical ventilation, without the risks associated with ionizing radiation.

Point-of-care ultrasound improves diagnostic accuracy and speeds up life-saving procedures. Remote areas disproportionately underuse ultrasound (US) due to a shortage of US-trained professionals, imaging tools and a lack of quality assurance. Thus, the teleorientation approach improves image acquisition time and the clinical applicability of ultrasound images obtained by untrained scanners (Cal et al. 2024).

The randomized study considered that POCUS is a consolidated tool in the mana-

gement of hypotensive patients in emergency services, so when it compared the diagnostic performance of a POCUS protocol with standard care without POCUS in undifferentiated hypotensive patients in the emergency room, the results showed the ability to present good diagnostic results, especially with regard to the reference test (PEACH et al., 2023).

Lee et al. (2021) carried out a feasibility study and clinical trial that evaluated the effectiveness of a two-hour training session for 32 emergency physicians. The results showed that 22 emergency physicians were able, with the help of POCUS, to complete the nerve block in an average of 15 minutes, and 90% of the nerve blocks were performed in less than 30 minutes.

The study by Zare et al. (2022) showed that the use of POCUS accelerated diagnosis in patients with different conditions: 37 minutes less for congestive heart failure (CHF), 16 minutes for pneumonia and 28 minutes for pulmonary thromboembolism (PTE).

FINAL CONSIDERATIONS

The integration of POCUS in emergency medical environments offers several benefits, positively impacting the quality of care, clinical decision-making and patient outcomes. However, it is essential that the implementation of POCUS is carefully planned and monitored to ensure adequate training, standardization of protocols and equitable access to equipment and qualified professionals. Despite the challenges, POCUS has the potential to continue revolutionizing medical practice in emergency environments, providing faster, more accurate and safer care for patients.

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