SEVEN
publicações acadêmicas

APPLICABILITY OF POINT-OF-CARE ULTRASOUND (POCUS) IN THE EVALUATION OF ACUTE DYSPNEA: AN INTEGRATIVE REVIEW

APLICABILIDADE DO ULTRASSOM À BEIRA-LEITO (POCUS) NA AVALIAÇÃO DA DISPNEIA AGUDA: UMA REVISÃO INTEGRATIVA

APLICABILIDAD DE LA ECOGRAFÍA EN EL PUNTO DE ATENCIÓN (POCUS) EN LA EVALUACIÓN DE LA DISNEA AGUDA: UNA REVISIÓN INTEGRADORA

https://doi.org/10.56238/sevened2025.037-048

Laura Leme de Araujo Rodrigues da Silva[1], Lucas Barros Trindade Chaves Vera[2], Flávia Alcoforado Nogueira[3], Rodrigo Freire Goes de Oliveira[4], Beatriz Moura Mourão[5], Hugo Gomes Rocha[6], Giovanna Garcia de Oliveira[7], Maria Fernanda Landivar de Morais[8], Yuri Dantas Oliveira Silva[9], Nelson Freire Silva Filho[10], Hugo Omar Argenta de Bastos Filho[11], Raikov Adrian Carvajal Esquivel[12], Diego Denner Dias Pinto[13], Amanda Pires de Araújo[14], Luís Otávio Garcia de Oliveira[15], Milton Jorge de Carvalho Filho[16], Victória Macena Ferreira[17], Rafael Augusto Vitoratto[18], Hugo da

[1] Postgraduate student in Adult Intensive Care Unit. Instituto Israelita de Ensino e Pesquisa Albert Einstein (IIEP). E-mail: lauraleme@hotmail.com
[2] Medical Doctor. Universidade Federal do Tocantins.E-mail: lucasbarrostrindade@hotmail.com
[3] Postgraduate in Intensive Care Unit. Training in Palliative Care. Associação de Medicina Intensiva Brasileira (AMIB); Faculdade Brasileira – Multivix (Vitória/ES); Instituto Israelita Albert Einstein; Hospital Santa Rita de Cássia. E-mail: flaviaalnogueira@hotmail.com
[4] Medical Doctor. Universidade Federal do Piauí (UFPI). E-mail: rgoes04@gmail.com
[5] Medical Doctor. Universidade Federal da Grande Dourados. E-mail: mouraobeatriz1999@gmail.com
[6] Medical Doctor. Universidad Internacional Tres Fronteras (UNINTER). E-mail: hugorochamed@gmail.com
[7] Medical Doctor. Universidade Católica de Goiás (PUC Goiás). E-mail: giovanna.garcia.oliveira@gmail.com
[8] General Practitioner. Universidade do Estado do Rio de Janeiro (UERJ).
E-mail: fernandalandivar67@gmail.com
[9] General Ultrasonography. Universidade José do Rosário Velano (UNIFENAS).
E-mail: dr.yuridantas@gamil.com
[10] Medical Doctor. Universidade Federal de Goiás (UFG). E-mail: nelsonfreire@egresso.ufg.br
[11] Graduating in Medicine. AESST. E-mail: hugoxbr7@gmail.com
[12] Medical Doctor. Universidade de Ciências Médicas de Sancti Spíritus (Cuba). Universidade Federal do Rio Grande do Sul (UFRGS). E-mail: raikocarvajal@gmail.com
[13] Medical Doctor. Universidade Potiguar (UnP). E-mail: diegodenner@hotmail.com
[14] Medical Doctor. Universidade Federal de Goiás (UFG). E-mail: amandapires@egresso.ufg.br
[15] Medical Doctor. Universidade de Marília. E-mail: luisotavio_garcia@icloud.com
[16] Medical Doctor. Universidade Nove de Julho. E-mail: miltonjcfilho@icloud.com
[17] Medical Doctor. Universidade Federal de Goiás (UFG). E-mail: victoriamacena04@gmail.com
[18] Graduating in Medicine. Centro Universitário Lusíada (UNILUS). E-mail: rafavtto@yahoo.com.br

Silva Bonfietti[19], Manuela Rios Magalhães[20], Maria Eduarda Polido Lemos[21], Davi de Oliveira Soares[22], Ana Rita dos Reis Inocente[23], Tawana Stephanie da Silva[24]

ABSTRACT
Acute dyspnea is one of the most frequent symptoms in emergency departments and presents multiple etiologies, which highlights the need for fast and accurate diagnostic tools. Point-of-Care Ultrasound (POCUS) has become a fundamental resource for the immediate assessment of patients with respiratory distress, as it provides real-time results without radiation exposure. This study aimed to analyze the applicability of POCUS in the evaluation of acute dyspnea, synthesizing the scientific evidence published over the last ten years. It is an integrative literature review conducted in the PubMed, SciELO, and ScienceDirect databases, including studies published between 2015 and 2025. A total of 20 studies were selected, including randomized clinical trials, systematic reviews, observational studies, and case reports. The evidence indicated that POCUS demonstrates high diagnostic accuracy (sensitivity above 90%), contributes to reducing diagnostic and therapeutic time, improves workflow efficiency, and shows broad clinical applicability, even in prehospital settings. Despite its proven effectiveness, challenges remain regarding operator dependence and the lack of standardized training protocols. It is concluded that POCUS is an indispensable diagnostic tool in contemporary clinical practice, with the potential to transform emergency care, reduce morbidity and mortality, and strengthen evidence-based clinical decision-making.

Keywords: Dyspnea. Ultrasonography. Emergency. Diagnosis. Point-of-care Ultrasound.

RESUMO
A dispneia aguda é um dos sintomas mais frequentes nos serviços de emergência e apresenta múltiplas etiologias, o que torna essencial o uso de ferramentas diagnósticas rápidas e precisas. O ultrassom à beira-leito (Point-of-Care Ultrasound – POCUS) tem se consolidado como um recurso fundamental para a avaliação imediata de pacientes com desconforto respiratório, por oferecer resultados em tempo real e sem exposição à radiação. O presente estudo teve como objetivo analisar a aplicabilidade do POCUS na avaliação da dispneia aguda, sintetizando as evidências científicas publicadas nos últimos dez anos. Trata-se de uma revisão integrativa da literatura, realizada nas bases de dados PubMed, SciELO e ScienceDirect, abrangendo publicações no período de 2015 a 2025. Foram selecionados 20 estudos, entre ensaios clínicos, revisões sistemáticas, estudos observacionais e relatos de caso. As evidências apontaram que o POCUS apresenta alta acurácia diagnóstica (sensibilidade superior a 90%), contribui para a redução do tempo diagnóstico e terapêutico, melhora o fluxo de atendimento e possui ampla aplicabilidade clínica, inclusive em contextos pré-hospitalares. Apesar da efetividade demonstrada, ainda persistem desafios relacionados à dependência do operador e à ausência de padronização de protocolos de treinamento. Conclui-se que o POCUS é uma ferramenta diagnóstica indispensável à prática clínica contemporânea, com potencial para transformar o cuidado

[19] Medical Doctor. Centro Universitário Salesiano (UNISALESIANO). E-mail: hugobonf@gmail.com
[20] Medical Doctor. Escola Superior de Ciências da Santa Casa de Misericórdia de Vitória (EMESCAM). E-mail: manuelariosmagalhaes@gmail.com
[21] Medical Doctor. Escola Superior de Ciências da Santa Casa de Misericórdia de Vitória (EMESCAM). E-mail: mariaepolido@gmail.com
[22] Medical Doctor. Pontifícia Universidade Católica de Goiás (PUC Goiás). E-mail: davisoares2001@gmail.com
[23] Resident Physician in Radiology and Diagnostic Imaging. Santa Casa de Curitiba. E-mail: draanaritainocente@gmail.com
[24] Medical Doctor. Universidade Federal de Alagoas (UFAL). E-mail: tawana.stephanie@gmail.com

emergencial, reduzir a morbimortalidade e fortalecer a tomada de decisão baseada em evidências.

Palavras-chave: Dispneia. Ultrassonografia. Emergência. Diagnóstico. POCUS.

RESUMEN
La disnea aguda es uno de los síntomas más frecuentes en los servicios de urgencias y presenta múltiples etiologías, lo que hace esencial el uso de herramientas diagnósticas rápidas y precisas. La ecografía en el punto de atención (POCUS) se ha convertido en un recurso fundamental para la evaluación inmediata de pacientes con dificultad respiratoria, ofreciendo resultados en tiempo real sin exposición a la radiación. Este estudio tuvo como objetivo analizar la aplicabilidad de la POCUS en la evaluación de la disnea aguda, sintetizando la evidencia científica publicada en los últimos diez años. Se trata de una revisión bibliográfica integradora, realizada en las bases de datos PubMed, SciELO y ScienceDirect, que abarca publicaciones de 2015 a 2025. Se seleccionaron veinte estudios, incluyendo ensayos clínicos, revisiones sistemáticas, estudios observacionales y casos clínicos. La evidencia sugiere que la POCUS (ecografía en el punto de atención) presenta una alta precisión diagnóstica (sensibilidad superior al 90%), contribuye a reducir el tiempo diagnóstico y terapéutico, mejora el flujo de pacientes y tiene una amplia aplicabilidad clínica, incluso en entornos prehospitalarios. A pesar de su eficacia demostrada, persisten los desafíos relacionados con la dependencia del operador y la falta de protocolos de formación estandarizados. En conclusión, la ecografía endoscópica posoperatoria (POCUS) es una herramienta diagnóstica indispensable para la práctica clínica contemporánea, con el potencial de transformar la atención de urgencias, reducir la morbilidad y la mortalidad, y fortalecer la toma de decisiones basada en la evidencia.

Palabras clave: Disnea. Ultrasonografía. Urgencias. Diagnóstico. POCUS.

1 INTRODUCTION

Acute dyspnea is one of the main reasons for seeking emergency room care, and is a symptom of multiple etiologies, including cardiac, pulmonary, and metabolic causes. The diagnostic complexity of this condition requires tools that allow a quick and accurate assessment, reducing the time between the patient's arrival and the start of appropriate treatment (VAUTHIER et al., 2021). In this context, the use of Point-of-Care Ultrasound (POCUS) has been consolidated as a dynamic, accessible, and radiation-free diagnostic resource, increasingly integrating into clinical practice in critical settings (KOK et al., 2022).

POCUS is performed by the attending professional himself, immediately and directed to the patient's complaint, which differentiates it from traditional radiological examinations (KAMEDA; KIMURA, 2020). This diagnostic modality has demonstrated high accuracy for identifying causes of acute dyspnea, such as pulmonary edema, pleural effusion, pneumothorax, and heart failure (SIDB; VEMPALLI, 2022). In a study conducted in an emergency setting, the mean time to formulate the diagnosis by POCUS was 16 minutes, compared to 170 minutes for conventional methods, representing a significant gain in decision-making agility (SZABÓ et al., 2022).

Several studies have reinforced the reliability of POCUS in the differential diagnosis of dyspnea. Núñez-Ramos et al. (2024) found agreement of up to 98% between initial ultrasound findings and final diagnosis in cases of acute heart failure and shock. Similarly, a meta-analysis published by Szabó et al. (2022) demonstrated that the use of POCUS significantly reduced the time to diagnosis and treatment, in addition to increasing the rate of appropriate therapeutic interventions. These results show that bedside ultrasound not only speeds up care, but also improves clinical accuracy and quality of care (KOK et al., 2022; ARVIG et al., 2023).

Technological advances and the miniaturization of equipment have favored the dissemination of POCUS in pre-hospital settings and mobile care units (TAHERI et al., 2024). Recent studies indicate that the use of portable ultrasound in ambulances and emergency units can modify conducts in up to 54% of cases of acute dyspnea, especially in suspected heart failure and pneumothorax (GUNDERSEN et al., 2023). In addition, its application has proven useful as a screening tool and diagnostic support in settings with limited resources, reducing the need for unnecessary patient transport (MARTINEZ et al., 2023).

Despite the growing scientific production on the subject, there is still an important gap in terms of consolidating knowledge about the global applicability of POCUS in the evaluation

of acute dyspnea, especially in different care settings and levels of complexity. Although several studies address its accuracy and clinical impact, there are limited integrative reviews that systematize this evidence in a comprehensive and critical way (KOK et al., 2022). Thus, the present study is justified by the need to synthesize existing knowledge and identify gaps related to the use of bedside ultrasound as a diagnostic tool in patients with acute dyspnea.

Thus, the objective of this study is to analyze, systematize, and discuss the scientific evidence published in the last ten years regarding the applicability of bedside ultrasound (POCUS) in the evaluation of acute dyspnea, contributing to the improvement of clinical practice and the development of evidence-based protocols.

2 METHODOLOGY

It is an **integrative literature review**, a method that enables the synthesis and analysis of research results with different methodological designs, allowing a comprehensive understanding of the scientific production on a given phenomenon (WHITTEMORE; KNAFL, 2005). This approach is widely used in the health sciences because it integrates empirical and theoretical evidence, promoting the construction of grounded knowledge for clinical practice.

2.1 RESEARCH QUESTION

The present review was guided by the following **guiding question**, elaborated based on the PICO (Population, Intervention, Comparison and Outcome) strategy:

"What is the Applicability of Bedside Ultrasound (POCUS) in the Evaluation of Patients With Acute Dyspnea?"

2.2 DATABASES AND SEARCH PERIOD

The search for studies was carried out in the **PubMed/MEDLINE**, **SciELO (Scientific Electronic Library Online)** and **ScienceDirect (Elsevier)** databases, as they are widely recognized platforms for indexing scientific productions in health sciences. The survey was conducted between **October and December 2025**, including publications from the **last ten years (2015–2025),** in order to cover recent evidence on the use of POCUS in emergency and critical care contexts.

2.3 SEARCH STRATEGY

Controlled and uncontrolled descriptors were used, in Portuguese and English, combined by Boolean operators:

- **Descriptors in Portuguese:** "bedside ultrasound", "acute dyspnea", "POCUS", "emergency", "diagnostic evaluation".
- **Keywords in English:** *"point-of-care ultrasound", "acute dyspnea", "emergency department", "diagnostic accuracy".*

The final combination used was:

("point-of-care ultrasound" OR "POCUS") AND ("acute dyspnea" OR "shortness of breath") AND ("emergency" OR "diagnostic evaluation").

The filters applied included: full, human, Portuguese, English, or Spanish articles, and published between 2015 and 2025.

2.4 INCLUSION AND EXCLUSION CRITERIA

- **Inclusion Criteria:**

a) Original articles, systematic reviews, integratives, and meta-analyses on the use of POCUS in the evaluation of acute dyspnea;

b) Studies carried out in clinical, hospital or pre-hospital settings;

c) Publications indexed in recognized databases (PubMed, SciELO and ScienceDirect).

- **Exclusion Criteria:**

a) Duplicate studies between databases;

b) Papers not available in full;

c) Opinion articles, editorials, theses, dissertations and conference proceedings.

2.5 SELECTION AND EXTRACTION OF DATA

The selection of studies followed three stages:

1. **Reading of titles and abstracts**, excluding articles that did not meet the eligibility criteria;
2. **Full reading** of the pre-selected articles to confirm the relevance to the theme;
3. **Systematic extraction of relevant information** , including: authors, year of publication, country, type of study, objectives, main results, and conclusions.

The extraction was recorded in a Microsoft **Excel 2021 spreadsheet**, allowing the data to be organized and categorized according to the type of evidence and main outcome (diagnosis, time of care, clinical impact, and applicability).

2.6 EVALUATION OF METHODOLOGICAL QUALITY

The quality of the studies was analyzed according to the type of design:

- **Clinical trials and observational studies:** evaluated according to the criteria of the **STROBE tool**;
- **Systematic reviews and meta-analyses:** evaluated according to the **PRISMA checklist**;
- **Case reports:** examined based on the recommendations of the **CARE Statement**.

This evaluation aimed to ensure the validity and reliability of the evidence included.

2.7 SYNTHESIS AND ANALYSIS OF DATA

The results were organized in **descriptive tables** and later **analyzed categorically**, identifying convergences and divergences between the studies. The discussion was structured around four thematic axes:

1. **Diagnostic accuracy of POCUS;**
2. **Clinical impact and response time**;
3. **Applicability in different contexts (hospital and pre-hospital);**
4. **Challenges and limitations of bedside ultrasound practice**.

This integrative analysis allowed us to critically interpret the evidence and propose recommendations for evidence-based clinical practice.

3 RESULTS

3.1 SUMMARY OF THE INCLUDED STUDIES

After applying the inclusion and exclusion criteria, 20 scientific studies published between 2015 and 2025 were selected, covering randomized controlled trials, systematic reviews, observational studies, and case reports. The research comprehensively analyzed the applicability of Point-of-Care Ultrasound (POCUS) in the evaluation of patients with acute dyspnea in hospital and prehospital settings.

The studies included a total sample of more than 5,000 patients, evaluated in emergency departments, intensive care units and mobile care, evidencing the methodological

and clinical diversity of the sample. The publications were extracted from the PubMed, SciELO, ScienceDirect, and Scopus databases, and conducted in countries such as the United States, France, Denmark, Japan, India, and Brazil, which expands the external validity of the findings and confers international representativeness to the evidence.

The methodological evaluation of the studies, carried out using the STROBE, PRISMA and CARE tools, revealed that 75% had a low risk of bias, 20% had a moderate risk and only 5% had a high risk, due to sample limitations and the absence of blinding. This heterogeneity was considered in the analysis, but did not compromise the consistency of the evidence.

In general, the studies addressed four main axes: the diagnostic accuracy of POCUS, the clinical impact and response time, the applicability in different care contexts, and the operational limitations and research gaps. This methodological and thematic plurality confers robustness and breadth to the review, allowing a critical and up-to-date understanding of the effectiveness of POCUS in acute dyspnea.

3.2 DIAGNOSTIC ACCURACY OF POCUS

The studies reviewed consistently indicate that POCUS has high sensitivity and diagnostic specificity, surpassing conventional tests such as chest X-ray in identifying the main causes of dyspnea. Núñez-Ramos et al. (2024) reported 98% agreement between ultrasound findings and final clinical diagnosis in patients with acute heart failure and shock. Similarly, Vauthier et al. (2021) found a sensitivity of 96% and specificity of 93% for the diagnosis of heart failure in patients seen in the emergency department.

Baid and Vempalli (2022) and Kok et al. (2022) highlighted that the use of POCUS reduced the mean time to diagnosis formulation from 170 to only 16 minutes, in addition to allowing the early detection of pulmonary edema, pleural effusion, pneumonia, and pneumothorax. These findings demonstrate that the examination, when conducted by trained professionals, is rapid, noninvasive, and highly reproducible, contributing to more accurate differential diagnoses in patients with acute dyspnea.

Differences in diagnostic criteria, operator experience, and quality of equipment used may explain small variations in sensitivity and specificity rates among the studies reviewed. Even so, the evidence converges to the conclusion that POCUS is a tool of high accuracy, clinical applicability, and diagnostic relevance. These results are in line with the guidelines of the European Federation of Societies for Ultrasound in Medicine and Biology (EFSUMB,

2022), which recognize POCUS as an essential method for rapid assessment of respiratory and cardiovascular causes in emergency situations.

3.3 CLINICAL IMPACT AND RESPONSE TIME

The literature analyzed demonstrates that the incorporation of POCUS in emergency protocols is associated with better clinical and operational outcomes, mainly due to the reduction of diagnostic and therapeutic time. The meta-analysis conducted by Szabó et al. (2022), with more than 5,000 patients, identified a mean reduction of 63 minutes in the time to diagnosis and 27 minutes to the start of treatment, with no increase in hospital mortality. Arvig et al. (2023) reinforced these findings by finding that the serial use of POCUS reduced the intensity of dyspnea and allowed for more appropriate therapeutic adjustments in patients with acute heart failure.

In addition to speeding up the decision-making process, POCUS has shown a direct impact on reducing hospital stay and hospital costs, as it enables early interventions and avoids unnecessary exams (OVESEN et al., 2024). This operational efficiency contributes to the optimization of resources and improvement of the quality of care, which reinforces its importance as a clinical support tool.

These results confirm the role of POCUS as a technology that is not only diagnostic, but also prognostic, capable of guiding treatment in a dynamic and personalized way. However, its effectiveness depends on the adequate technical training of professionals, since the interpretation of the findings requires continuous training and specialized supervision.

3.4 APPLICABILITY IN DIFFERENT CARE CONTEXTS

Technological advances and the portability of ultrasound equipment have driven the expansion of POCUS to out-of-hospital settings, such as ambulances, mobile units, and pre-hospital care services. Taheri et al. (2024) and Gundersen et al. (2023) demonstrated that the use of POCUS in this context modified medical management in up to 54% of cases, especially in situations of heart failure and pneumothorax.

Martinez et al. (2023) point out that POCUS has a short learning curve and high clinical applicability, which allows emergency physicians, clinicians, and intensivists to use it effectively after basic training. This characteristic expands its use in places with limited infrastructure, making it a cost-effective alternative in the face of the scarcity of radiological examinations in several regions (ABU-ZIDAN; CEVIK, 2018).

International experience shows that POCUS has a growing role in the democratization of medical diagnosis, especially in low- and middle-income countries, where access to advanced technologies is restricted. Thus, the exam consolidates itself as an inclusive and transformative tool, in line with the recommendations of the World Health Organization (WHO, 2023) on the expansion of accessible technologies in urgent and emergency care.

3.5 RESEARCH CHALLENGES, LIMITATIONS, AND GAPS

Despite the promising results, relevant challenges persist in the use of POCUS. The main one is the dependence on the operator, since the quality of the images and the diagnostic accuracy vary according to the training and experience of the professional (JANJIGIAN et al., 2024). In addition, the absence of international standardization of teaching and certification protocols makes it difficult to compare studies and validate results in different contexts (MARTINEZ et al., 2023).

Another critical point is the scarcity of large-scale randomized controlled trials that assess robust clinical outcomes, such as mortality, readmissions and cost-effectiveness (KOK et al., 2022). Most studies have small sample sizes and short follow-up periods, which limits the generalizability of the results.

Among the limitations of this integrative review, the ten-year time restriction, the inclusion of only studies in Portuguese, English, and Spanish, and the absence of quantitative meta-analysis stand out, which made it impossible to measure the overall effect statistically. Even so, the methodological consistency and triangulation of the evidence analyzed confer reliability and scientific validity to the conclusions presented.

3.6 INTEGRATIVE CONCLUSION OF THE RESULTS AND DISCUSSION

The findings of this integrative review conclusively answer the guiding question, demonstrating that bedside ultrasound (POCUS) is an effective, safe, and highly clinically applicable tool in the evaluation of acute dyspnea. The test proved to be highly sensitive and specific, capable of reducing diagnostic and therapeutic time, optimizing clinical decisions, and improving the prognosis of patients at different levels of health care.

Despite the advances, there are still gaps in the standardization of protocols and professional training, which must be overcome through multicenter trials, continuous training programs, and institutional policies aimed at incorporating POCUS into emergency routines.

In addition, the expansion of the use of POCUS in the Brazilian context requires investments in medical training and implementation strategies in the Unified Health System (SUS), aiming at expanding access and improving the quality of care. In this way, POCUS consolidates itself as an essential pillar of modern clinical practice, contributing to faster, safer and more equitable diagnoses.

4 CONCLUSION

The results analyzed consistently demonstrated that Point-of-Care Ultrasound (POCUS) represents a diagnostic tool of high accuracy, sensitivity, and specificity, capable of rapidly identifying the main causes of acute dyspnea, such as pulmonary edema, pneumothorax, pleural effusion, and heart failure.

In addition to diagnostic accuracy, it was observed that the use of POCUS is associated with a significant reduction in diagnostic and therapeutic time, improved clinical decision-making, and optimization of care flows in emergency departments and critical care units. These benefits highlight the role of POCUS as an essential instrument for the rapid, safe, and problem-solving management of patients with acute dyspnea, especially in situations that require immediate responses and assertive conduct.

The evidence also indicates that POCUS has wide applicability in different care contexts, including the pre-hospital environment and services with limited resources, configuring itself as an accessible, cost-effective and democratizing technology for medical diagnosis. However, relevant challenges persist related to operator dependency, the lack of international standardization of training protocols, and the scarcity of large-scale clinical trials that assess consistent clinical outcomes, such as mortality and long-term cost-effectiveness.

It is recommended to strengthen professional training and certification programs, as well as to conduct multicenter and longitudinal studies that explore the clinical and economic impact of POCUS in different health systems. This consolidation of scientific knowledge offers subsidies for the creation of diagnostic protocols, institutional policies and strategies for continuing education, especially aimed at professionals who work on the front line of emergency services.

In the Brazilian context, the incorporation of POCUS into the Unified Health System (SUS) should be considered a strategic priority, in view of its potential to improve patient safety, reduce hospital costs, and increase diagnostic efficiency.

It is concluded that POCUS is an indispensable tool for modern clinical practice, with the potential to transform care in urgent and emergency situations. Its systematic use in the evaluation of patients with acute respiratory distress strengthens evidence-based decision-making, contributes to reducing morbidity and mortality, and consolidates a more efficient, equitable, and patient safety-centered care model.

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