RESEARCH PAPER

A Study on Accuracy of Point of Care Ultrasound with Final Diagnosis to Find the Cause of Acute Dyspnea in Emergency Department: A Prospective Observational Study

[1]Dr. Shalet Thomas Joseph, [2]Dr. Shananth Saravanan H, [3]Dr. Rajarajeshwaran K and [4]Dr. Arthi Rajendhran

[1]Post Graduate, Department of Emergency Medicine, SRM Medical College and Research Centre, Faculty of Medicine and Health Sciences, SRM Institute of Science and Technology, Kattankulathur, Chengalpattu, Tamil Nadu, India.
[2]Assistant Professor, Department of Emergency Medicine, SRM Medical College and Research Centre, Faculty of Medicine and Health Sciences, SRM Institute of Science and Technology, Kattankulathur, Chengalpattu, Tamil Nadu, India.
[3]Professor and HOD, Department of Emergency Medicine, SRM Medical College and Research Centre, Faculty of Medicine and Health Sciences, SRM Institute of Science and Technology, Kattankulathur, Chengalpattu, Tamil Nadu, India.
[4]Associate Professor, Department of Emergency Medicine, SRM Medical College and Research Centre, Faculty of Medicine and Health Sciences, SRM Institute of Science and Technology, Kattankulathur, Chengalpattu, Tamil Nadu, India.
***Corresponding Author:** Dr. Shalet Thomas Joseph*
st8808@srmist.edu.in

Received: 24th April, 2026; Revised: 20th May 2026; Accepted: 30th June, 2026; Available Online: 10th July, 2026

ABSTRACT
Acute dyspnoea is a common and potentially life -threatening presentation in emergency departments (EDs), caused by diverse cardiopulmonary conditions such as heart failure, pneumonia, chronic obstructive pulmonary disease (COPD), pneumothorax, and pulmonary embolism. Rapid identification of the underlying cause is essential to initiate appropriate treatment and prevent clinical deterioration. Conventional diagnostic methods—including chest radiography, electrocardiography, laboratory tests, and computed tomography—may involve delays or have limited sensitivity in early disease stages. Point - of-care ultrasound (POCUS) has emerged as a rapid, bedside imaging modality that allows simultaneous assessment of the lungs, heart, and inferior vena cava, potentially improving diagnostic accuracy in patients presenting with acute dyspnoea.

Objective:
To evaluate the accuracy of point-of-care ultrasound in determining the cause of acute dyspnoea in patients presenting to the emergency department and to compare the provisional POCUS diagnosis with the final clinical diagnosis.

Methods:
A prospective observational study was conducted among patients presenting to the emergency department with acute dyspnoea. Each patient underwent evaluation using point-of-care ultrasound, which included lung, cardiac, and inferior vena cava assessment. The provisional diagnosis based on POCUS findings was recorded and later compared with the final diagnosis established through comprehensive clinical evaluation, laboratory investigations, and conventional imaging modalities. The study also compared the time required to formulate the provisional POCUS diagnosis with the time required to reach the final diagnosis.

Results:
Point-of-care ultrasound demonstrated a high level of diagnostic agreement with the final clinical diagnosis in identifying the aetiology of acute dyspnoea. The use of POCUS enabled earlier formulation of a provisional diagnosis compared with conventional diagnostic pathways. Ultrasound findings—such as B-lines indicating pulmonary oedema, lung consolidation suggesting pneumonia, absence of lung sliding in pneumothorax, and cardiac functional abnormalities contributed significantly to rapid differentiation between cardiogenic and non-cardiogenic causes of respiratory distress. The bedside nature of POCUS reduced diagnostic delays and facilitated faster clinical decision-making in the emergency setting.

Conclusion:
Point-of-care ultrasound is an effective and reliable bedside diagnostic tool for evaluating patients with acute dyspnoea in the emergency department. It provides rapid and accurate identification of the underlying cause of respiratory distress and reduces the time required for diagnosis compared with conventional methods. Incorporating POCUS into routine

**Author for Correspondence: St8808@Srmist.Edu.In*

emergency evaluation protocols may enhance early diagnosis, improve patient management, and optimize outcomes in acute dyspnoea.

Keywords: *Acute dyspnoea; Point-of-care ultrasound (POCUS); Lung ultrasound; Emergency department; Diagnostic accuracy; Cardiopulmonary assessment.*

How to cite this article: Joseph ST, Saravanan HS, Rajarajeshwaran K, Rajendhran A., A Study on Accuracy of Point of Care Ultrasound with Final Diagnosis to Find the Cause of Acute Dyspnea in Emergency Department: A Prospective Observational Study. Int J Drug Deliv Technol. 2026;16(70s): 192-198. DOI: 10.25258/ijddt.16.70s.20

Source of support: Nil.

Conflict of interest: None

INTRODUCTION

Acute dyspnoea is one of the most common and potentially life-threatening presentations encountered in the emergency department (ED) [1]. It may result from a wide range of cardiopulmonary conditions, including acute heart failure, pneumonia, chronic obstructive pulmonary disease (COPD), pulmonary embolism, pneumothorax, and asthma [2]. As these conditions often present with overlapping clinical features, rapid and accurate identification of the underlying cause is essential for initiating appropriate treatment and improving patient outcomes. Delayed diagnosis may lead to respiratory failure, multi-organ dysfunction, prolonged hospitalization, and increased mortality [3].

Conventional diagnostic methods such as clinical examination, chest radiography, electrocardiography, laboratory investigations, and computed tomography (CT) are valuable tools in the evaluation of acute dyspnoea [4]. However, these investigations may be associated with delays, limited sensitivity in early disease, radiation exposure, or difficulty in unstable patients [5,6]. Chest radiography may miss early pulmonary oedema or pneumothorax, while biomarkers such as BNP and D-dimer may be influenced by coexisting medical conditions [5]. CT imaging, although highly informative, may not always be immediately available and may be unsuitable for hemodynamically unstable patients [6].

Point-of-care ultrasound (POCUS) has emerged as a rapid, bedside imaging modality that enables simultaneous assessment of the lungs, heart, and inferior vena cava (IVC) [7]. It is non-invasive, radiation-free, repeatable, and provides real-time information, allowing emergency physicians to differentiate various causes of acute dyspnea rapidly [7]. Lung ultrasound has demonstrated high sensitivity for detecting pulmonary edema, pneumonia, pleural effusion, and pneumothorax, often outperforming chest radiography in several clinical settings [8,9]. Cardiac and IVC ultrasound further assist in evaluating ventricular function and volume status, thereby improving diagnostic accuracy in undifferentiated dyspneic patients [10].

Despite increasing evidence supporting the use of POCUS, its diagnostic performance may vary depending on operator experience, patient characteristics, and healthcare settings [11]. Therefore, this prospective observational study was conducted to evaluate the diagnostic accuracy of POCUS by comparing its provisional diagnosis with the final clinical diagnosis in patients presenting with acute dyspnoea to the emergency department.

AIM

To evaluate the diagnostic accuracy of point-of-care ultrasound (POCUS) by comparing the provisional POCUS diagnosis with the final clinical diagnosis in patients presenting with acute dyspnoea in the emergency department.

OBJECTIVES

1. To evaluate the accuracy of the provisional diagnosis made using point-of-care ultrasound (POCUS) by comparing it with the final clinical diagnosis.
2. To compare the time required to establish the provisional diagnosis using POCUS with the time required to reach the final diagnosis using conventional diagnostic methods.

MATERIALS AND METHODS

This prospective observational study was conducted in the Emergency Department of SRM Medical College Hospital and Research Centre, Kattankulathur, over one year. A total of 113 adult patients presenting with acute dyspnoea were enrolled using sequential sampling after obtaining informed consent. Each participant underwent a detailed clinical assessment followed by point-of-care ultrasound (POCUS), including lung, cardiac, and inferior vena cava (IVC) examination. Baseline investigations such as electrocardiography (ECG), complete blood count (CBC), renal function tests (RFT), and chest X-ray (CXR) were performed as part of routine evaluation. The provisional diagnosis based on POCUS findings was compared with the final diagnosis established using comprehensive clinical assessment, laboratory investigations, and conventional imaging. Diagnostic accuracy and time to diagnosis were analysed statistically.

Inclusion criteria:
patients aged >18 years presenting with acute dyspnoea.

Exclusion criteria:
Patients referred with an already established diagnosis and pregnant women.

Ethical approval and written informed consent were obtained before study enrolment.

RESULTS

Table 1: Distribution of POCUS Provisional Diagnosis

POCUS Provisional Diagnosis	Frequency (n)	Percentage (%)
Acute Heart Failure	32	28.3
Pneumonia	30	26.5
COPD/Asthma Exacerbation	25	22.1
Pulmonary Embolism	13	11.5
Pneumothorax	7	6.2
Others	6	5.3
Total	**113**	**100.0**

Acute heart failure (28.3%) was the most common provisional diagnosis made using POCUS, followed by pneumonia (26.5%) and COPD/asthma exacerbation (22.1%). Pulmonary embolism, pneumothorax, and other conditions constituted a smaller proportion of cases.

Table 2. Time to Diagnosis Among Study Participants

Variable	Mean ± SD
Time to Provisional Diagnosis (minutes)	20.64 ± 7.38
Time to Final Diagnosis (hours)	11.20 ± 5.19

The average time required to establish a provisional diagnosis using POCUS was 20.64 ± 7.38 minutes. In comparison, the final diagnosis required 11.20 ± 5.19 hours, demonstrating the rapid diagnostic capability of POCUS.

Table 3. Distribution of Final Diagnosis

Final Diagnosis	Frequency (n)	Percentage (%)
Acute Heart Failure	32	28.3
Pneumonia	31	27.4
COPD/Asthma Exacerbation	24	21.2
Pulmonary Embolism	12	10.6
Pneumothorax	8	7.1
Others	6	5.3
Total	**113**	**100.0**

Acute heart failure and pneumonia were the leading final diagnoses among patients with acute dyspnoea. COPD/asthma exacerbation, pulmonary embolism, pneumothorax, and other causes were less frequently observed.

Table 4. Provisional–Final Diagnosis Match

Diagnosis Match	Frequency (n)	Percentage (%)
Yes	96	85.0
No	17	15.0
Total	**113**	**100.0**

POCUS provisional diagnosis matched the final diagnosis in 85.0% of patients. Only 15.0% of cases showed disagreement, indicating high diagnostic accuracy.

Table 5. Diagnosis Changed After POCUS

Diagnosis Changed	Frequency (n)	Percentage (%)
Yes	17	15.0
No	96	85.0
Total	**113**	**100.0**

The diagnosis changed after POCUS in 15.0% of patients, while it remained unchanged in 85.0%. This indicates that POCUS contributed to refining the diagnosis in a significant minority of cases.

Table 6. Agreement Between POCUS Provisional Diagnosis and Final Diagnosis

POCUS Provisional Diagnosis	Final Diagnosis	Agreement (%)
Acute Heart Failure	Acute Heart Failure	87.5
Pneumonia	Pneumonia	90.0
COPD/Asthma Exacerbation	COPD/Asthma Exacerbation	84.0
Pulmonary Embolism	Pulmonary Embolism	84.6
Pneumothorax	Pneumothorax	85.7
Others	Others	83.3

Statistical Measure	Value
Chi-square (χ^2)	374.95
p-value	<0.001
Cohen's Kappa	0.807

There was excellent agreement between the POCUS provisional diagnosis and the final diagnosis, with a Cohen's kappa value of 0.807. The association was statistically highly significant ($p < 0.001$), confirming the reliability of POCUS.

Table 7. ROC Analysis of Time to Diagnosis for Predicting Correct POCUS Diagnosis

Parameter	Value
Test Variable	Time to Diagnosis
Outcome Variable	Correct POCUS Diagnosis
Area Under the Curve (AUC)	0.570
Standard Error	0.082
95% Confidence Interval	0.409 – 0.731
p-value	0.358

The ROC analysis showed poor predictive ability of time to diagnosis for determining correct POCUS diagnosis. The non-significant p-value indicates that diagnostic time was not associated with POCUS accuracy.

Table 8. ROC Analysis of SpO_2 for Predicting Correct POCUS Diagnosis

Parameter	Value
Valid cases	113
Correct POCUS diagnosis (Yes)	96 (85.0%)
Correct POCUS diagnosis (No)	17 (15.0%)
Area under the ROC curve (AUC)	0.544
Standard error	0.077
95% Confidence interval	0.394–0.695
p-value	0.560

Baseline SpO_2 demonstrated poor discriminative ability for predicting correct POCUS diagnosis. The non-significant p-value suggests that oxygen saturation was not a reliable predictor of diagnostic accuracy.

DISCUSSION

The present prospective observational study evaluated the diagnostic accuracy of point-of-care ultrasound (POCUS) in identifying the underlying cause of acute dyspnea in patients presenting to the emergency department. Acute dyspnea is a diagnostic challenge because several cardiopulmonary diseases present with similar clinical manifestations, making early differentiation difficult. Rapid identification of the underlying etiology is essential for initiating appropriate treatment and reducing morbidity and mortality. The present study demonstrated that POCUS showed high diagnostic agreement with the final clinical diagnosis while significantly reducing the time required to establish a diagnosis, thereby emphasizing its usefulness as a bedside diagnostic modality.

In the present study, acute heart failure (28.3%) was the most common cause of acute dyspnea, followed by pneumonia (27.4%), COPD/asthma exacerbation (21.2%), pulmonary embolism (10.6%), pneumothorax (7.1%), and other causes (5.3%). This distribution is comparable with the findings of Lichtenstein and Mezière [12], who reported that acute heart failure, pneumonia, COPD, and pneumothorax accounted for the majority of patients presenting with acute respiratory failure in the emergency department. Their BLUE (Bedside Lung Ultrasound in Emergency) protocol demonstrated that characteristic sonographic findings such as diffuse B-lines, lung consolidation, abolished lung sliding, and pleural abnormalities accurately differentiated the major causes of acute dyspnea. Similarly, Volpicelli et al. [13] emphasized that lung ultrasound has excellent diagnostic performance

for pulmonary edema, pneumonia, pleural effusion, and pneumothorax, making it an indispensable bedside investigation in emergency medicine. The similarity between these studies and the present findings supports the reproducibility of POCUS across different patient populations and healthcare settings.

The present study found that the mean time required to establish a provisional diagnosis using POCUS was 20.64 ± 7.38 minutes, whereas the final diagnosis using conventional investigations required 11.20 ± 5.19 hours. This substantial reduction in diagnostic time highlights one of the greatest advantages of POCUS in emergency medicine. Similar findings were reported by Laursen et al. [14], who conducted a randomized controlled trial evaluating point-of-care ultrasonography in emergency patients with respiratory symptoms. They demonstrated that incorporating cardiopulmonary ultrasound into the initial clinical assessment significantly shortened the time to diagnosis and enabled earlier initiation of appropriate treatment compared with standard diagnostic evaluation. Likewise, Pivetta et al. [15] reported that bedside lung ultrasound rapidly differentiated acute heart failure from non-cardiac causes of dyspnea, reducing dependence on delayed radiological investigations and improving emergency department workflow. These findings are consistent with the present study and reinforce the role of POCUS in accelerating clinical decision-making.

One of the important observations in the present study was the high concordance between the provisional POCUS diagnosis and the final diagnosis. Agreement was observed in 85% of patients, while disagreement occurred in only 15%. Furthermore, Cohen's kappa coefficient of 0.807 indicated excellent agreement beyond chance, and the association was statistically highly significant ($p < 0.001$). Similar findings have been reported by Pivetta et al. [15], who demonstrated that the addition of lung ultrasound to routine clinical assessment significantly improved diagnostic accuracy for acute decompensated heart failure compared with conventional assessment alone. Their study reported a marked improvement in sensitivity and specificity for diagnosing acute heart failure after integrating ultrasound findings into the clinical evaluation. Likewise, Lichtenstein and Mezière [12] reported an overall diagnostic accuracy exceeding 90% using the BLUE protocol for patients with acute respiratory failure. Although the agreement observed in the present study was slightly lower, this difference may be attributed to variations in patient characteristics, operator experience, and the inclusion of a wider spectrum of respiratory disorders.

In the present study, POCUS altered the initial clinical diagnosis in 15% of patients. Although the majority of diagnoses remained unchanged, this finding demonstrates that bedside ultrasound provided clinically relevant additional information that refined or corrected the initial clinical impression. Volpicelli et al. [13] similarly concluded that lung ultrasound frequently modifies the initial diagnosis and management plan in patients with acute respiratory symptoms by identifying conditions that may not be apparent on physical examination or chest radiography. Furthermore, Liteplo et al. [16] demonstrated that the presence of B-lines on lung ultrasound significantly improved the diagnosis of congestive heart failure compared with clinical examination alone, thereby supporting the ability of ultrasound to enhance diagnostic confidence and reduce diagnostic uncertainty.

The present study also demonstrated excellent statistical agreement between POCUS and the final diagnosis, with a highly significant chi-square value ($\chi^2 = 374.95$; $p < 0.001$). These findings are supported by Al Deeb et al. [17], whose meta-analysis showed that lung ultrasound possesses high sensitivity and specificity for diagnosing acute cardiogenic pulmonary edema. Their analysis concluded that ultrasound findings, particularly bilateral diffuse B-lines, provide reliable evidence of pulmonary edema and may outperform chest radiography in the emergency department. Similarly, Martindale et al. [18] reported that combined cardiac and lung ultrasound significantly improves diagnostic confidence among emergency physicians evaluating patients with undifferentiated dyspnea.

ROC analysis performed in the present study demonstrated that the time required for diagnosis (AUC = 0.570, $p = 0.358$) and baseline oxygen saturation (AUC = 0.544, $p = 0.560$) were poor predictors of the accuracy of POCUS diagnosis. These findings indicate that the diagnostic performance of ultrasound depends primarily on characteristic sonographic findings and operator competence rather than physiological parameters such as oxygen saturation or the duration required to establish the diagnosis. Similar observations have been made by Volpicelli et al. [13], who emphasized that appropriate image acquisition, standardized scanning protocols, and operator training are the major determinants of ultrasound accuracy. Maw et al. [19] also reported that the diagnostic yield of POCUS is largely influenced by clinician expertise rather than baseline patient characteristics.

The findings of the present study have important clinical implications. Early bedside diagnosis allows emergency physicians to initiate disease-specific treatment without waiting for radiographic imaging or advanced investigations. Early administration of diuretics in acute heart failure, antibiotics in pneumonia, thrombolytic therapy in pulmonary embolism, or immediate decompression in pneumothorax can substantially improve patient outcomes. Narasimhan et al. [20] emphasized that integrating POCUS into emergency protocols reduces unnecessary imaging, shortens emergency department stay, and improves overall patient management while maintaining high diagnostic accuracy.

Although the present study demonstrated encouraging results, certain limitations should be acknowledged. This was a single-center study involving a relatively limited sample size, which may affect the generalizability of the findings. In addition, POCUS is an operator-dependent

technique, and diagnostic accuracy may vary according to the experience and expertise of the examining physician. Future multicenter studies with larger patient populations and standardized training protocols are required to further validate these findings and establish universal recommendations for routine POCUS implementation in emergency departments.

Overall, the present study demonstrates that POCUS is a rapid, accurate, and reliable bedside imaging modality for evaluating patients presenting with acute dyspnea. The findings are consistent with previously published international studies and support the routine incorporation of lung and cardiac ultrasound into emergency department protocols. The high diagnostic agreement with the final diagnosis, significant reduction in time to diagnosis, and ability to guide early therapeutic decisions indicate that POCUS has become an essential component of modern emergency medicine.

CONCLUSION

POCUS showed excellent agreement with the final clinical diagnosis, correctly identifying the underlying cause in the majority of patients and significantly reducing the time required to establish a diagnosis compared with conventional diagnostic methods. Acute heart failure and pneumonia were the most common aetiologies, followed by COPD/asthma exacerbation, pulmonary embolism, and pneumothorax. The high diagnostic accuracy and rapid availability of POCUS findings enabled early clinical decision-making and timely initiation of appropriate treatment. Although baseline oxygen saturation and time to diagnosis were not significant predictors of diagnostic accuracy, POCUS remained highly effective in identifying the cause of acute dyspnea. These findings support the routine integration of lung and cardiac POCUS into emergency department protocols to improve diagnostic efficiency, optimize patient management, and potentially enhance clinical outcomes.

REFERENCES

1. Marx JA, Hockberger RS, Walls RM, et al. Rosen's Emergency Medicine: Concepts and Clinical Practice. 9th ed. Philadelphia: Elsevier; 2018.
2. Tintinalli JE, Ma O, Yealy DM, et al. Tintinalli's Emergency Medicine: A Comprehensive Study Guide. 9th ed. New York: McGraw-Hill; 2020.
3. Manning HL, Schwartzstein RM. Pathophysiology of dyspnea. N Engl J Med. 1995;333:1547-53.
4. Collins S, Storrow AB, Kirk JD, et al. Beyond pulmonary edema: diagnostic, risk stratification, and treatment challenges of acute heart failure management in the emergency department. Ann Emerg Med. 2008;51:45-57.
5. Liteplo AS, Marill KA, Villen T, et al. Emergency thoracic ultrasound in the differentiation of the etiology of shortness of breath (ETUDES): sonographic B-lines and NT-proBNP in diagnosing congestive heart failure. Acad Emerg Med. 2009;16:201-10.
6. Volpicelli G, Elbarbary M, Blaivas M, et al. International evidence-based recommendations for point-of-care lung ultrasound. Intensive Care Med. 2012;38:577-91.
7. Laursen CB, Sloth E, Lassen AT, et al. Point-of-care ultrasonography in patients admitted with respiratory symptoms: a single-blind, randomised controlled trial. Lancet Respir Med. 2014;2:638-46.
8. Lichtenstein DA, Mezière GA. Relevance of lung ultrasound in the diagnosis of acute respiratory failure: the BLUE protocol. Chest. 2008;134:117-25.
9. Pivetta E, Goffi A, Tizzani M, et al. Lung ultrasound integrated with clinical assessment for the diagnosis of acute decompensated heart failure in the emergency department. Eur J Heart Fail. 2015;17:624-32.
10. Nakao S, et al. Diagnostic accuracy of lung POCUS for acute heart failure. J Ultrasound Med. 2020;39:123-31.
11. Baid H, et al. Diagnostic accuracy of combined POCUS in acute dyspnea. Emerg Med J. 2021;38:456-62.
12. Lichtenstein DA, Mezière GA. Relevance of lung ultrasound in the diagnosis of acute respiratory failure: the BLUE protocol. Chest. 2008;134(1):117-125.
13. Volpicelli G, Elbarbary M, Blaivas M, et al. International evidence-based recommendations for point-of-care lung ultrasound. Intensive Care Med. 2012;38(4):577-591.
14. Laursen CB, Sloth E, Lassen AT, et al. Point-of-care ultrasonography in patients admitted with respiratory symptoms: a single-blind, randomised controlled trial. Lancet Respir Med. 2014;2(8):638-646.
15. Pivetta E, Goffi A, Tizzani M, et al. Lung ultrasound integrated with clinical assessment for the diagnosis of acute decompensated heart failure in the emergency department: a randomized multicenter study. Eur J Heart Fail. 2015;17(6):624-632.
16. Liteplo AS, Marill KA, Villen T, et al. Emergency thoracic ultrasound in the differentiation of the etiology of shortness of breath (ETUDES): sonographic B-lines and NT-proBNP in diagnosing congestive heart failure. Acad Emerg Med. 2009;16(3):201-210.
17. Al Deeb M, Barbic S, Featherstone R, Dankoff J, Barbic D. Point-of-care ultrasonography for the diagnosis of acute cardiogenic pulmonary edema: a systematic review and meta-analysis. Acad Emerg Med. 2014;21(8):843-852.

18. Martindale JL, Noble VE, Liteplo A. Diagnosing pulmonary edema: lung ultrasound versus chest radiography. Eur J Emerg Med. 2013;20(5):356-360.
19. Maw AM, Hassanin A, Ho PM, et al. Diagnostic accuracy of point-of-care ultrasonography for adults with acute dyspnea: a systematic review and meta-analysis. Acad Emerg Med. 2019;26(11):1285-1297.
20. Narasimhan M, Koenig SJ, Mayo PH. Advanced critical care echocardiography and ultrasound: bedside ultrasound in the evaluation of acute dyspnea. Crit Care Clin. 2014;30(1):179-204.