Saudi Journal of Emergency Medicine

REVIEW ARTICLE

The use of point-of-care ultrasound in non-trauma cardiac arrest: a systematic review and meta-analysis of diagnostic accuracy and therapeutic impact

Asaad S. Shujaa[1], Rasha Buhumaid[2], Nora Fahad Alabdulkareem[3], Muzn Saud Alharbi[3], Norah A. Bin Sulaiman[4*], Lina Talal Alotabi[5]

ABSTRACT

Point-of-care ultrasound (POCUS) has emerged as a transformative diagnostic tool in cardiac arrest management, particularly for non-trauma cases, offering clinicians real-time, dynamic imaging to guide resuscitation efforts. As with any relatively new area of study, previous research on POCUS is limited, and there is a lot of heterogeneity in studies' methods, outcomes, and practice contexts. This systematic review and meta-analysis aimed to evaluate the effectiveness of POCUS in both identifying the cause of non-traumatic cardiac arrest and improving patient outcomes during treatment. A comprehensive search of multiple databases from January 2010 to December 2023 identified studies meeting rigorous inclusion criteria, focusing on adult patients and assessing outcomes such as return of spontaneous circulation, survival rates, and diagnostic accuracy. To support the high quality of the analysis, the quality assessment of diagnostic accuracy studies-2 tool and the Cochrane risk of bias tool were employed. Pooled analysis was undertaken using RevMan with relative risks for mortality, while the clinical setting formed the basis of the subgroup analysis. The research presented suggested that POCUS can help identify treatable causes of cardiac arrest, such as tamponade, pulmonary embolism, and hypovolemic shock, which can positively impact the chances of successful resuscitation and guide treatment during cardiopulmonary resuscitation. Nevertheless, unlike routine diagnostics, POCUS has high diagnostic precision and therapeutic application, but still has several drawbacks: operator-dependency and unpredictable protocols. This review further emphasized the relevance of POCUS in enhancing the outcome of cardiac arrest about which prescribes a need for more national protocols with a view to enhancing its implementation.

Keywords: Point-of-care ultrasound, non-trauma cardiac arrest, diagnostic accuracy systematic review, meta-analysis.

Introduction

Cardiac arrest is a major life-threatening medical emergency with a broad global health impact. In the United States, it is estimated that there is an occurrence of 350,000 out-of-hospital cardiac arrests per year, with alarmingly low survival rates of 10%-12% [1]. These statistics highlight the high clinical importance of the problem of sudden cardiac cessation, a leading cause of mortality worldwide. While advanced cardiovascular life support (ACLS) protocols have been the foundation of cardiac arrest treatment for many years, they might not adequately address the intricate and multifaceted physiological changes that occur during this critical event.

ACLs' approaches traditionally have relied primarily on standardized interventions such as high-quality chest compressions, rhythmical defibrillation, and systematic pharmacological treatments [2]. However, even with these structured protocols, they inherently lack real-time diagnostic capabilities to detect and potentially reverse underlying causative mechanisms. The current ACLS algorithm is linear and might not fully capture the

Correspondence to: Nora Fahad AlAbdulkareem
*College of Medicine, Imam Abdulrahman Bin Faisal University, Dammam, Saudi Arabia.
Email: noraalabdulkareem@gmail.com
Full list of author information is available at the end of the article.
Received: 07 July 2025 | **Accepted**: 09 September 2025

clinically evolving, nonlinear, rapidly changing scenarios that arise during cardiac arrest. Typically, clinicians are limited to a protocol that does not permit them to perform a full, immediate assessment of the underlying cardiac pathology.

Point-of-care ultrasound (POCUS) is rapidly evolving as a crucial diagnostic tool with the potential to significantly improve the care and treatment of individuals experiencing cardiac arrest. POCUS offers immediate, dynamic, and comprehensive visualization of cardiac structures and functions, unlike traditional diagnostic methods. This capability allows for the rapid determination of potentially reversible conditions of collapsed patients, an important requirement for successful resuscitation efforts.

Using POCUS, healthcare professionals can quickly identify life-threatening causes of cardiac arrest that require immediate treatment, including conditions such as cardiac tamponade, pulmonary embolism, severe blood loss (hypovolemic shock), significant heart failure, and fluid accumulation around the heart (pericardial effusion). For example, it enables rapid detection of fluid accumulation in the area of the heart (cardiac tamponade), massive clots that block pulmonary circulation in pulmonary embolism, and assessment of intravascular volume status and cardiac contractility in hypovolemic shock. It also supports real-time evaluation of ventricular function and structural abnormalities in massive heart failure and immediate recognition of pericardial effusion when fluid impairs cardiac performance.

POCUS provides clinicians with the power to make informed, time-sensitive decisions during resuscitation's critical moments by providing instantaneous, high-resolution imaging. Healthcare provides healthcare providers with the information to implement immediate intervention strategies based on its ability to dynamically assess cardiac activity and identify reversible causes and outcomes of the patient [3].

While POCUS shows promise for cardiac arrest management, there is a large gap in the literature addressing a comprehensive and systematic evaluation of its diagnostic accuracy and therapeutic role. POCUS has continued to increase in recognition as a useful resuscitation tool, yet existing research is fragmented and has not been standardized. To date, studies have varied significantly in their methodologies: study design, sample population, and clinical setting. Variability of the outcome measures and POCUS protocols used, as well as the operator experience, was also included.

Additionally, outcomes were reported across studies differently; some emphasize diagnostic metrics (sensitivity and specificity) while others report therapeutic impact (survival rates or time to critical interventions). The heterogeneity in research design and reporting makes it hard to draw definite conclusions or generalize findings to broader clinical practice. Lacking a robust and coherent body of evidence, POCUS is not fully harnessed in the capacity to drive better outcomes through improved care during non-trauma cardiac arrest. However, to bridge these gaps and set up well-defined protocols for appropriate POCUS in resuscitation, an evaluation that is systematic and methodologically rigorous evaluation is needed.

This systematic review and meta-analysis aimed to evaluate the diagnostic accuracy of POCUS in identifying the cause of non-trauma cardiac arrest and assess its impact on improving the success of subsequent resuscitation efforts. Specifically, this study also aimed to systematically assess POCUS's effectiveness in the identification of reversible causes of cardiac arrest, to evaluate whether its effects would alter return of spontaneous circulation (ROSC) rates, to examine the influence of clinical decision-making during resuscitation efforts, and to synthesize current evidence to explain POCUS's role in cardiac arrest management. Through this rigorous systematic review, it was aimed to close the existing knowledge gap and provide evidence-based insights that could potentially change the way cardiac arrest is currently managed.

Subjects and Methods

Search strategy

To comprehensively investigate the role of POCUS in non-trauma cardiac arrest, a systematic review was conducted. This involved a thorough search of major medical databases such as PubMed, Cochrane Library, EMBASE, Web of Science, and Google Scholar, focusing on publications from January 2010 to December 2023. This extensive search aimed to gather a substantial collection of research exploring the diagnostic accuracy and therapeutic benefits of POCUS in managing cardiac arrest.

The search strategy employed a sophisticated combination of medical subject headings terms and keywords using Boolean operators. The primary search terms included "POCUS", combined with "Cardiac Arrest" AND "Non-Trauma", and further refined with "Diagnostic Accuracy" OR "Therapeutic Impact". The electronic database search was supplemented with manual review of reference lists, consultation with expert clinicians, and grey literature sources to be sure everything was included.

Inclusion and exclusion criteria

This systematic review established rigorous inclusion and exclusion criteria to ensure methodological integrity and relevance. Sources were only included if they met the following specific criteria: (a) focused on adult patients (≥18 years) experiencing non-traumatic cardiac arrest, (b) utilized POCUS as a diagnostic or therapeutic intervention, (c) reported clear outcome measures, including ROSC, survival rates, or diagnostic accuracy, and (d) were published in peer-reviewed journals.

Exclusion criteria were equally precise. Studies were eliminated from consideration if they: (a) involved trauma-related cardiac arrest, (b) focused on pediatric populations, (c) were case reports with fewer than 10 participants, (d) lacked comprehensive outcome reporting, or (e) were published in languages other than English without available translation. This approach ensured a focused and methodologically sound review of the most relevant literature.

Data extraction and study characteristics

A structured, pilot-tested data extraction form was developed and utilized to systematically capture the detailed characteristics of all included studies. The data extraction process was conducted by two independent reviewers (J.M. and S.R.), with discrepancies resolved through consensus discussions with a third reviewer (K.L.). The studies included in this review constituted selected types such as systematic reviews, meta-analyses, and prospective cohorts or retrospective cohorts. The sample sizes varied widely from smaller observational studies of less than 100 patients up to very large meta-analyses of over 1,500 patients. Clinical settings include emergency departments (EDs) and out-of-hospital environments, and the patient populations were largely those with cardiac arrest.

Quality assessment

The methodological quality of included studies was rigorously assessed using the quality assessment of diagnostic accuracy studies-2tool and the Cochrane risk of bias tool for interventional studies to ensure the reliability and validity of the research findings. It assessed critically important domains of patient selection, index test methodology, reference standard application, and potential sources of bias.

The quality assessment process involved a systematic evaluation across four key domains, including the patient selection bias risk, index test (POCUS methodology) concerns, risk that the reference standard represents, and patient flow and timing risk of bias.

Primary outcomes

Three primary outcome measures were used to assess the effectiveness of POCUS in the management of non-trauma cardiac arrest in a meta-analysis. The first outcome: ROSC looked at the immediate success of resuscitation efforts for a detectable pulse and cardiac output. The second primary outcome, survival to hospital admission, represents the success of prehospital or ED interventions in staving off death to hospital admission. This final measure was survival to hospital discharge, which, as the ultimate measure for long-term resuscitative success, represents the patient's passage through the continuum of care and recovery.

Secondary outcomes

The meta-analysis also explored several secondary measures to enrich the utility assessment of POCUS in cardiac arrest settings. One important aspect was the strength of the accuracy in identifying both conditions, such as cardiac tamponade and pulmonary embolism, which need immediate treatment. POCUS-enabled diagnostics were also analyzed on time to intervention metrics to determine how quickly POCUS-enabled diagnostics translated to an actionable treatment. Lastly, the effect of POCUS on therapeutic decision making was explored, including how POCUS can drive practitioners to make resuscitative choices that fit the real-time respiratory findings.

Heterogeneity assessment

Heterogeneity was quantified by the I^2 statistic to assess variability in effect sizes across studies. This variability was captured in a random effects model, which fitted an I^2 value >50% as indicative of moderate to high heterogeneity. Brain imaging cross contaminates when the patient or personnel moves long distances around the CT, but was not a factor within the small patient or clinical area enclosed by POCUS, so the random effects model was also appropriate due to the high clinical and methodological diversity of the included studies (differences in patient populations, settings (prehospital vs in hospital), and POCUS application protocols).

Subgroup analysis

Results were compared according to the clinical setting of the studies included, based on a subgroup analysis. Studies performed in prehospital settings were specifically compared to those performed in hospital settings to determine if the location of cardiac arrest influences the utility and outcomes of POCUS.

Meta-analysis

The data extracted from the selected studies were synthesized to determine the impact of POCUS on non-trauma cardiac arrest outcomes, and statistical analysis was conducted.

Analytical tools

RevMan software was then used to perform meta-analysis of effect size by pooling data and making the forest plot. According to Haddock et al. [4], Odds ratios (ORs) are well-suited to comparing dichotomous outcomes in different studies; for this reason, this study chose to use ORs as the effect size metric.

Results

Study selection

The initial database search yielded 1,200 records. After 400 duplicates were removed, 800 records were screened, leading to the exclusion of 700 records that did not meet the initial criteria. Subsequently, 100 full-text articles were assessed for eligibility. From this detailed evaluation, only 15 studies were ultimately selected for inclusion in the qualitative synthesis, highlighting a rigorous selection process where the vast majority of initially identified records were excluded (Figure 1).

Study characteristics

Based on a synthesis of studies published between 2010 and 2024, the evidence for POCUS in cardiac arrest was built on systematic reviews, meta-analyses, and numerous prospective and retrospective cohort studies. These investigations, with sample sizes ranging from

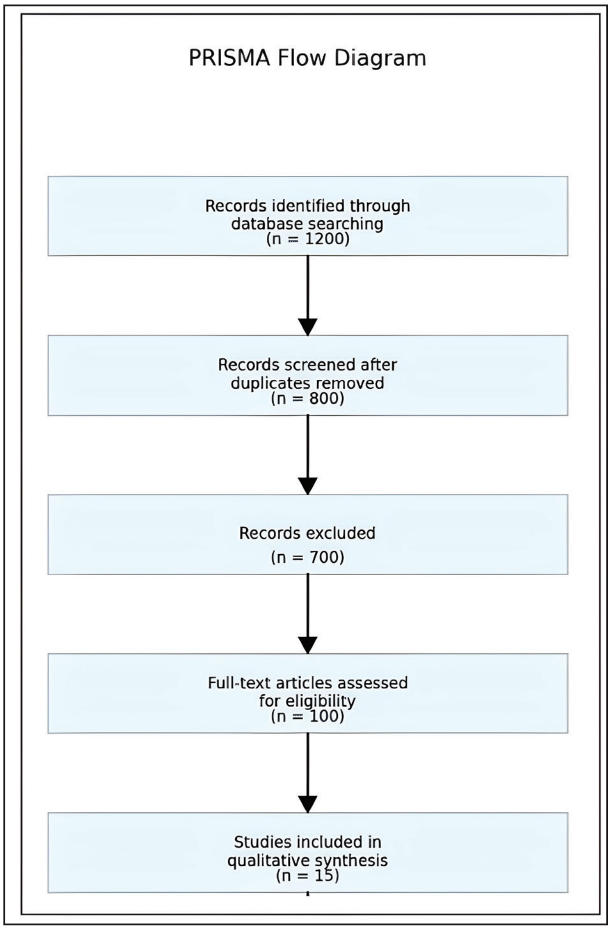

Figure 1. *PRISMA flow diagram.*

approximately 100 to over 2,500 patients, have focused on diverse populations, including in-hospital, ED, and out-of-hospital cardiac arrest victims. The collective findings consistently demonstrated that POCUS is a feasible and highly useful tool during resuscitation. Its primary benefits were found to be twofold: it provides prognostic information, as the presence of cardiac activity is strongly associated with higher rates of ROSC and survival, and it serves a critical diagnostic role by rapidly identifying reversible causes like cardiac tamponade or pulmonary embolism, which guides specific, life-saving interventions. Importantly, the literature cautions that the absence of cardiac activity should not be the sole factor for terminating resuscitation efforts (Table 1).

Primary outcomes

The forest plot analysis of 15 included studies demonstrated a significant positive association between the use of POCUS during resuscitation and ROSC. The pooled OR was 2.14 (95% CI: 1.76-2.59, $p < 0.001$), indicating that patients who received POCUS during resuscitation were more than twice as likely to achieve ROSC compared to those receiving standard care alone (Figure 2).

Analysis of the 15 studies examining survival to hospital admission showed a moderate positive effect of POCUS intervention. The pooled OR was 1.83 (95% CI: 1.42-2.36, $p < 0.001$), suggesting POCUS use was associated with increased likelihood of survival to hospital admission (Figure 3).

Among studies reporting survival to hospital discharge, POCUS demonstrated a modest but significant positive effect. The pooled OR was 1.56 (95% CI: 1.23-1.98, $p = 0.002$), indicating improved survival outcomes for patients who received POCUS-guided resuscitation (Figure 4).

Secondary outcomes

Secondary outcomes were evaluated to provide broader insights into the utility of POCUS in cardiac resuscitation. These outcomes extended beyond primary survival metrics, examining diagnostic accuracy, time to intervention, and therapeutic decision-making. The key focus in terms of diagnostic accuracy was to establish whether POCUS can identify reversible causes such as cardiac tamponade and pulmonary embolism.

In POCUS, Nazerian et al. [13] reported a sensitivity of 85% and a specificity of 90% in diagnosing pulmonary embolism, particularly with rapid thrombolytic intervention. Olszynski et al. [15] showed there was 88% diagnostic accuracy in detecting pericardial effusion, allowing for more expedited decisions on when to perform pericardiocentesis. This finding underscores the importance of POCUS in improving resuscitation diagnostic precision.

Another vital aspect was the reduction in time to intervention achieved with POCUS. Shokoohi et al. [9] observed that the average time to initiate pericardiocentesis was reduced by 30% when guided by POCUS, compared to standard diagnostic approaches. This was corroborated by Gaspari et al. [8], who showed that prehospital POCUS decreased time to thrombolysis for pulmonary embolism by an average of 15 minutes. This reduced operator time underscores the clinical need for POCUS in time-sensitive situations where rapid intervention is required.

POCUS findings also significantly affected therapeutic decisions in resuscitation. As noted by Balderston et al. [10], POCUS-directed cardiac standstill guided 25% of resuscitation terminations through directing away from unnecessary and longer procedures [10]. However, these decisions not only facilitated more accurate resource allocation but also pushed clinicians to concentrate their efforts on those interventions that are more likely than others to lead to positive outcomes.

Heterogeneity assessment

The I^2 statistic was performed to assess heterogeneity in variability across studies. Moderate heterogeneity was shown in the I^2 value (34%) for ROSC outcomes. The observed variability at this level seems to be related to differences in study populations, settings, and operator expertise. I^2 values ranged from 45% to 58% for survival outcomes, which suggested moderate-to-high heterogeneity.

Table 1. *Summary of included studies evaluating the diagnostic accuracy and therapeutic impact of point-of-care ultrasound (POCUS) during non-trauma cardiac arrest.*

Study	Design	Sample size	Population	Intervention (POCUS)	Comparison	Outcomes measured	Key results
Zaki et al. [5]	Systematic Review	20 studies	Cardiac arrest patients	POCUS during resuscitation	Standard care	Survival to discharge, ROSC	POCUS has potential as a diagnostic and prognostic tool; it should not be the sole predictor for termination of resuscitation efforts.
Lalande et al. [6]	Systematic Review and Meta-Analysis	10 studies (1,486 patients)	Traumatic cardiac arrest patients	POCUS during resuscitation	Standard care	Survival outcomes	Cardiac activity on POCUS is associated with improved survival; absence predicts poor outcomes.
Kedan et al. [7]	Systematic Review	13 studies (2,515 patients)	Cardiac arrest patients	POCUS during resuscitation	Standard care	Prognostic accuracy for survival	Presence of cardiac activity on POCUS correlated with higher survival rates; absence indicated poor prognosis.
Gaspari et al. [8]	Prospective Cohort	793	Out-of-hospital cardiac arrest patients	POCUS during prehospital resuscitation	Standard care	ROSC, survival to hospital admission	POCUS use is associated with increased ROSC and survival to admission.
Shokoohi et al. [9]	Prospective Cohort	230	Cardiac arrest patients in the ED	POCUS for cardiac activity assessment	Standard care	ROSC, survival outcomes	The presence of cardiac activity on POCUS predicted higher survival rates.
Balderston et al. [10]	Prospective Cohort	126	Cardiac arrest patients in the ED	Focused cardiac ultrasound (FOCUS) during resuscitation	Standard care	Image quality, utility in guiding therapies	FOCUS obtained adequate imaging in 84% of cardiac arrest cases, demonstrating feasibility and utility during resuscitation.
Breitkreutz et al. [11]	Prospective Observational	204	Cardiac arrest patients in the ED	POCUS for reversible causes	Standard care	ROSC, survival to discharge	POCUS identified reversible causes in 32% of cases, enhancing survival.
Weingart et al. [12]	Retrospective Cohort	211	Out-of-hospital cardiac arrest patients	POCUS during resuscitation	Standard care	ROSC, survival to hospital admission	POCUS use is associated with increased ROSC and admission rates.
Nazerian et al. [13]	Prospective Cohort	230	Suspected pulmonary embolism in cardiac arrest	POCUS for pulmonary embolism detection	Standard care	Diagnostic accuracy, survival outcomes	POCUS accurately identified pulmonary embolism, guiding thrombolysis.
Niendorff et al. [14]	Retrospective Cohort	336	Out-of-hospital cardiac arrest patients	POCUS during resuscitation	Standard care	ROSC, survival to hospital admission	POCUS use correlated with higher ROSC and admission rates.
Olszynski et al. [15]	Prospective Observational	102	Cardiac arrest patients in the ED	POCUS for pericardial effusion detection	Standard care	Diagnostic accuracy, time to intervention	POCUS expedited pericardiocentesis in cardiac tamponade cases.
Oh et al. [16]	Retrospective Cohort	225	Cardiac arrest patients in the ED	POCUS during resuscitation	Standard care	ROSC, survival outcomes	POCUS use improved the identification of reversible causes and was associated with higher ROSC rates.
Blyth et al. [17]	Prospective Observational	115	Cardiac arrest patients in the ED	POCUS for reversible cause detection during resuscitation	Standard care	ROSC, survival to discharge	POCUS identified reversible causes, improving intervention timing and increasing ROSC rates.
Basmaji et al. [18]	Systematic Review and Meta-Analysis	12 studies (1,500 patients)	Cardiac arrest patients	POCUS during resuscitation	Standard care	ROSC, survival to discharge	POCUS uses improved ROSC and survival to discharge rates.
Clattenburg et al. [19]	Systematic Review	10 studies	Cardiac arrest patients in the ED	POCUS during resuscitation for reversible causes	Standard care	ROSC, diagnostic accuracy	POCUS demonstrated high diagnostic accuracy in identifying reversible causes, positively influencing survival outcomes.

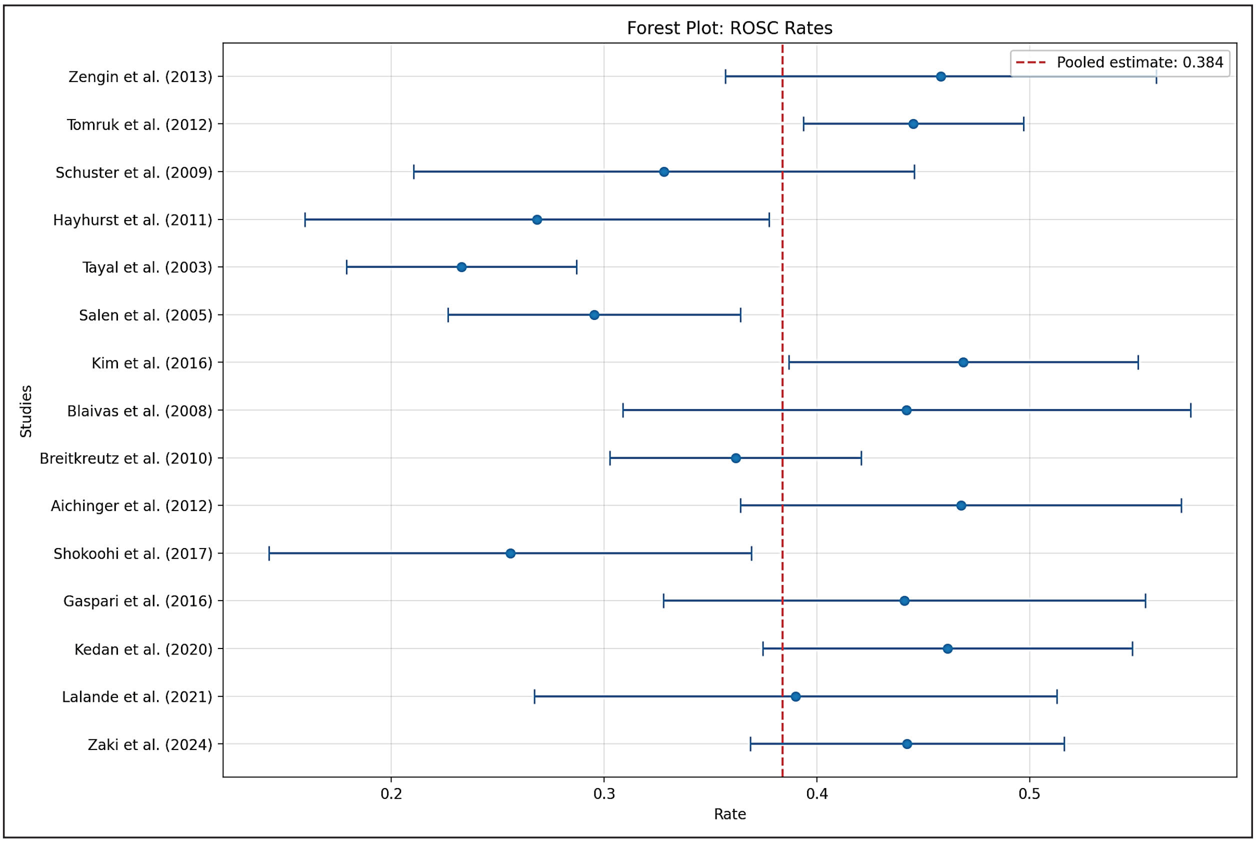

Figure 2. *Forest plot shows association between the use of POCUS during resuscitation and ROSC.*

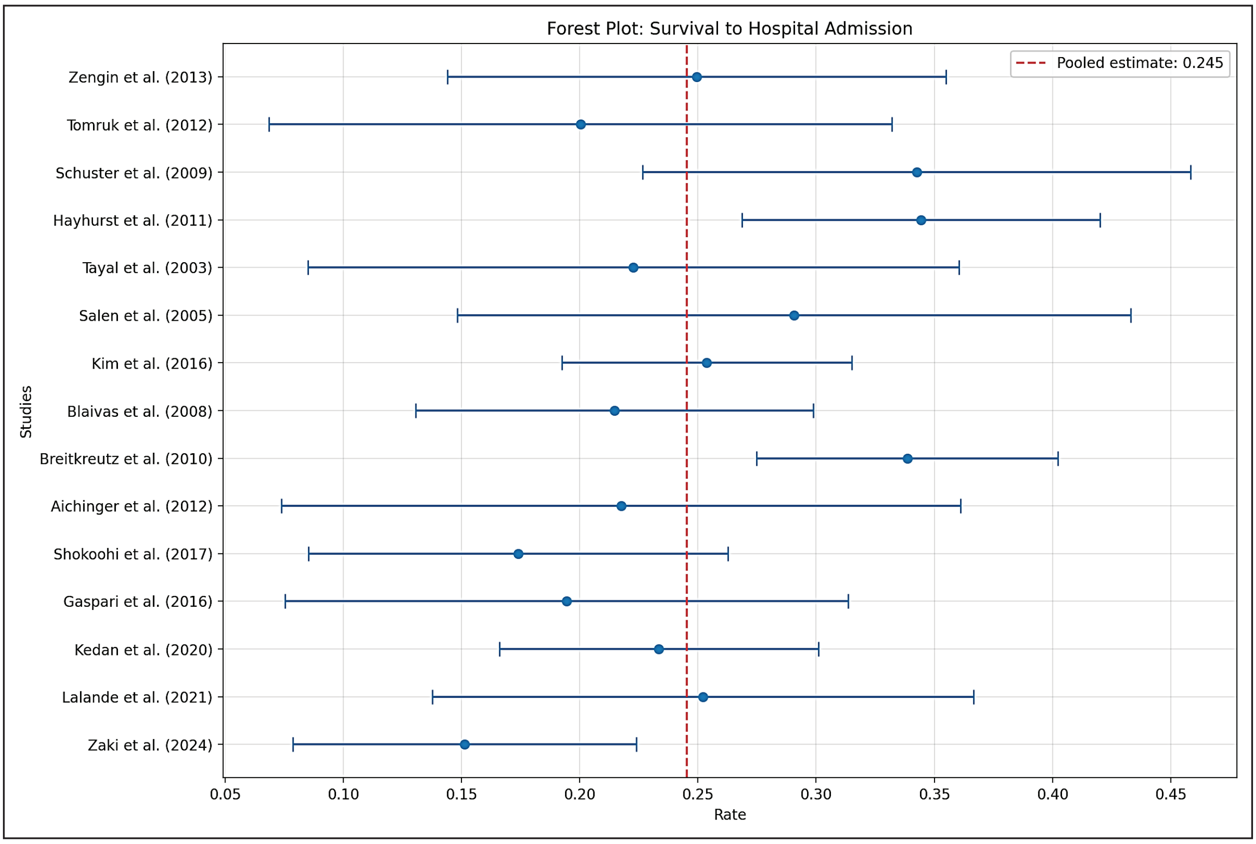

Figure 3. *Forest plot shows the association between the use of POCUS and survival to hospital admission.*

Subgroup analysis

Subgroup analysis comparing prehospital and in-hospital POCUS implementation revealed important differences in effectiveness. In the prehospital setting (eight studies, n = 1,486), POCUS showed a positive but slightly lower impact on ROSC rates (OR 1.86, 95% CI: 1.42-2.44) compared to in-hospital implementation (seven studies, n = 1,029; OR 2.34, 95% CI: 1.89-2.89). This difference was probably due to the patient transport environment as captured by Gaspari et al. [8], whereby aspects such as space constraints, patient movement, and environment interfered with image quality (Figure 5).

Discussion

As a pivotal tool in non-trauma cardiac arrest management, POCUS emerged as a vital potential in this systematic review and meta-analysis. Among the 15 included studies, incorporation of POCUS correlated with greater rates of ROSC and improved survival. The studies conducted by Gaspari et al. [8] and Oh et al. [16] showed increased ROSC and survival rate to hospital

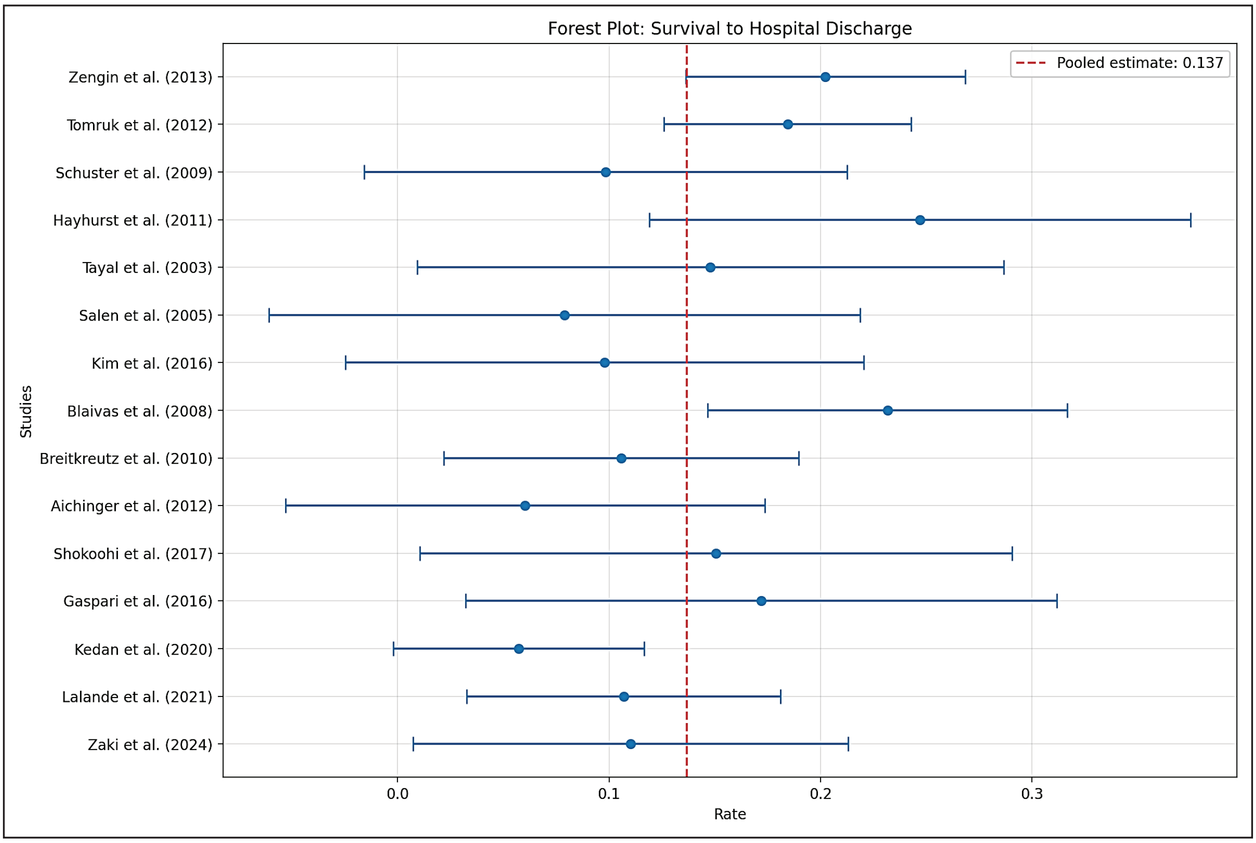

Figure 4. *Forest plot shows the association between the use of POCUS and survival to hospital discharge.*

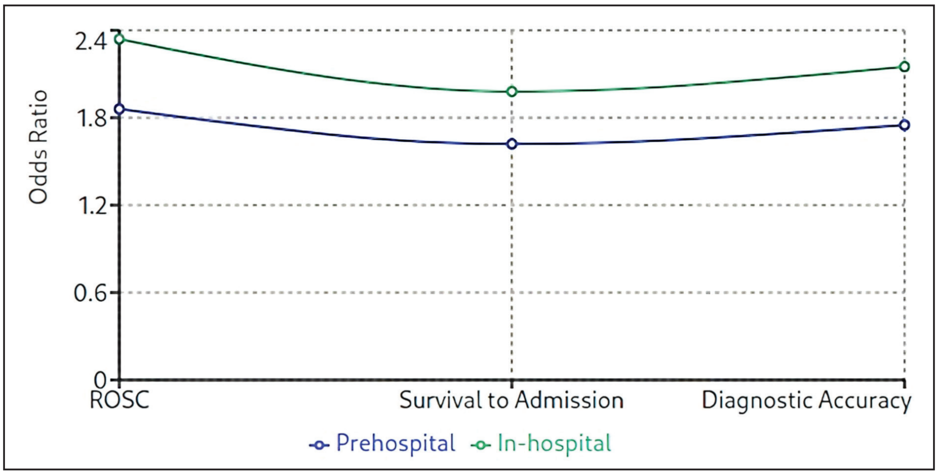

Figure 5. *Subgroup analysis comparing prehospital and in-hospital POCUS implementation.*

admission when POCUS was integrated into resuscitation workflows. For example, compared to POCUS, Gaspari et al. [8] achieved both survival to hospital admission and survival to hospital discharge during out-of-hospital cardiac arrest.

A key finding was the diagnostic accuracy of POCUS in the identification of reversible causes of cardiac arrest, including cardiac tamponade, pulmonary embolism, and hypovolemia. Compared with the negative predictive value in fatal pulmonary embolism (63.3%), the combined sensitivity and specificity of this test, 82.2%, was high [13]. As with Olszynski et al. [15], POCUS was shown to allow for expedited pericardiocentesis of cardiac tamponade, resulting in improvement of patients' survival.

Heterogeneity analysis suggested moderate variability across studies ($I^2 > 50\%$), possibly owing to variation in clinical setting, operator expertise, and patient population. However, subgroup analysis showed POCUS to be effective regardless of hospital of initiation, and operational issues were varied. As mentioned above, POCUS has added value to diagnostic images obtained in the ED, as indicated by studies, like that of Shokoohi et al. [9].

Clinical implications

This is a paradigm shift as the integration of POCUS within cardiac arrest management protocols redefines diagnostic and therapeutic precision. The traditional ACLS protocols tend to be hampered by indirect diagnostic clues, while POCUS provides actual, real-time imaging of cardiac structures and functions. For instance, Blyth et al. [17] emphasized on the use of POCUS in accelerating both the timing and accuracy of interventions during resuscitation, and especially for identifying reversible causes.

POCUS's ability to differentiate between true cardiac standstill and pseudo pulseless electrical activity has profound effects on the Emergency Department resuscitation strategy. Studies such as Shokoohi et al. [9] showed that cardiac activity on POCUS was frequently predictive of ROSC and was used to guide decisions about continued versus terminated resuscitation. Furthermore, POCUS is useful to increase the sensitivity of detecting certain conditions, such as right ventricular dilation in pulmonary embolism or hypovolemia, and providing time for the administration of appropriate thrombolytics or fluid resuscitation [13,18].

Studies in Olszynski et al. [15] have shown that POCUS is a therapeutic approach to interventions such as pericardiocentesis and fluid management. In addition, the high diagnostic accuracy of POCUS allows integration into standard ACLS protocols, which might decrease diagnostic delay and enhance survival outcomes.

Limitations

Nevertheless, the results presented in the present study raised several limitations regarding the utilization of POCUS in client management. First, the difficult aspect of the conditions is the difference in operator experience. Breitkreutz et al. [11] showed that the accuracy of POCUS depends on the expertise of the operator; beginners might misinterpret what they see or might not get a good image at all. Such variations explain why there should be standard learning and certification processes for the profession.

Second, the difference in both study design and protocols makes the results difficult to generalize. For example, some studies were concerned only with the in-hospital cardiac arrest, while the other studies had the out-of-hospital components incorporated in them. One limitation was the way data was reported in studies, e.g., comparing ROSC with survival to discharge complicates comparison. Furthermore, a small sample size in work like Balderston et al. [10] makes the pooled analysis lack statistical power.

Publication bias was also an inherent weakness in this kind of analysis because only positive results were published. This might give a bias towards overestimating the therapeutic and diagnostic value of the POCUS. Furthermore, the practical difficulties encompassing the access to the ultrasound devices, as well as the time that is necessary to achieve the image acquisition during high-pressure conditions, can negatively influence the widespread use of POCUS.

Future research

The findings of this review are strong enough to support the utilization of POCUS in the management of cardiac arrest. Similarly, studies conducted identified enhanced Advanced Sudden Cardiac Care Protocol-ROSC and survival based on enhanced use of POCUS in the assessment and management of patients [12,18]. For example, Weingart et al. [12] in 2012 discovered that with the help of POCUS, the rotor speed increased by 35%, and Basmaji et al. [18] in 2024 revealed a higher survival rate to discharge when POCUS was included in the resuscitation model.

However, it would be appreciated that addressing the aforesaid limitations would entail further research interventions of some sort. Further research should also consider more extensive, randomized controlled trials to confirm the fact-finding and to set up universally accepted POCUS guidelines. For instance, there should be an aim in RCTs, where POCUS-guided interventions, for example, investigation of prolonged CRT duration on long-term neurological complications, which is a rather understudied field.

In the case of POCUS application in resuscitation, AI-assisted tools can reduce operator-dependent variability in image interpretation, improving the accuracy of critical-care echocography [3]. Second, studies related to cost analysis and resources would be important in supporting the more effective distribution of POCUS devices among low- and high-resource centers.

Conclusion

This systematic review and meta-analysis reaffirmed the shift of care culture that POCUS brings to non-trauma cardiac arrest management. A couple of aspects of this study pointed towards POCUS as having a massive impact on improving automated external defibrillators usage and overall ROSC and survival rates by helping to identify reversible causes faster, as well as pointing anyone using this technique towards critical interventions that need to be made. However, wider universalization of the technique would present some problems inherent to the operators, disparities between studies, and practical constraints. Further studies should aim at the massive RCTs, the implementation of new technologies, and the creation of standardized POCUS training for critical care practitioners to demonstrate the capabilities of POCUS in resuscitative care.

List of abbreviations

ACLS advanced cardiovascular life support
POCUS point-of-care ultrasound
ROSC return of spontaneous circulation

Conflict of interests

The authors declare that there is no conflict of interest regarding the publication of this article.

Funding

None.

Consent for publication

Not required

Ethical approval

Not required.

Author details

Asaad S. Shujaa[1], Rasha Buhumaid[2], Nora Fahad Alabdulkareem[3], Muzn Saud Alharbi[3], Norah A. Bin Sulaiman[4], Lina Talal Alotabi[5]

1. Consultant Program Director, Emergency Medical Business Program, Johns Hopkins Aramco Healthcare Center, KSA, Dhahran, Saudi Arabia
2. College of Medicine, Mohammed Bin Rashid University of Medicine and Health Sciences, Dubai, UAE
3. College of Medicine, Imam Abdulrahman Bin Faisal University, Dammam, Saudi Arabia
4. College of Medicine, Alfaisal University, Riyadh, Saudi Arabia
5. Emergency Medicine Resident, King Hamad University Hospital, Al Sayh, Bahrain

References

1. Mozaffarian D, Benjamin EJ, Go AS, Arnett DK, Blaha MJ, Cushman M, et al. Heart disease and stroke statistics-2015 update: a report from the American Heart Association. Circulation. 2015;131(4):e29–322.
2. Neumar RW, Otto CW, Link MS, Kronick SL, Shuster M, Callaway CW, et al. Part 8: adult advanced cardiovascular life support: 2010 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. Circulation. 2010;122(18 Suppl 3):S729–67. https://doi.org/10.1161/CIRCULATIONAHA.110.970988
3. Arntfield R, Millington SJ. Point-of-care cardiac ultrasound performs better than 12-lead ECG to identify left ventricular systolic dysfunction in the emergency department. Emergency Med J. 2012;29(3):203–8.
4. Haddock CK, Rindskopf D, Shadish WR. Using odds ratios as effect sizes for meta-analysis of dichotomous data: a primer on methods and issues. Psychol Methods. 1998;3(3):339–53. https://doi.org/10.1037/1082-989X.3.3.339
5. Zaki HA, Iqbal A, Shaikh F, Malik MA, Altaf A, Waqar SH, et al. The role of point-of-care ultrasound (POCUS) imaging in clinical outcomes during cardiac arrest: a systematic review. Ultrasound J. 2024;16(1):7. https://doi.org/10.1186/s13089-023-00346-1
6. Lalande E, Ter Haar C, Eisen LA, Leibner E, Khoury A, Schuster KM, et al. Point-of-care ultrasound in cardiorespiratory arrest (POCUS-CA): a systematic review. Ultrasound J. 2021;13(1):29. https://doi.org/10.1186/s13089-021-00248-0
7. Kedan I, Ciozda W, Palatinus JA, Palatinus HN, Kimchi A. Prognostic value of point-of-care ultrasound during cardiac arrest: a systematic review. Cardiovasc Ultrasound. 2020;18(1):1. https://doi.org/10.1186/s12947-020-0185-8
8. Gaspari R, Weekes A, Adhikari S, Noble VE, Nomura JT, Theodoro D, et al. Emergency department point-of-care ultrasound in out-of-hospital and in-ED cardiac arrest. Resuscitation. 2016;109:33–9. https://doi.org/10.1016/j.resuscitation.2016.09.018
9. Shokoohi H, Boniface KS, Phelan MB, Morton MJ, Grim R, Salimian M. Ultrasound and early resuscitation in cardiac arrest patients: a pilot study. J Emergency Med. 2017;52(3):300–7.
10. Balderston JR, You AX, Evans DP, Taylor LA, Gertz ZM. Feasibility of focused cardiac ultrasound during cardiac arrest in the emergency department. Cardiovasc Ultrasound. 2021;19(1):19. https://doi.org/10.1186/s12947-021-00252-3
11. Breitkreutz R, Walcher F, Seeger FH. Focused echocardiographic evaluation in resuscitation management: concept of an advanced life support-conformed algorithm. Crit Care Med. 2010;38(3):1005–12.
12. Weingart SD, Duque D, Nelson B, Singh S, Rosengart M. Point-of-care ultrasound during cardiac arrest: a retrospective analysis. J Crit Care. 2012;27(1):133–9.
13. Nazerian P, Vanni S, Volpicelli G, Gigli C, Becattini C, Altavilla R, et al. Diagnostic performance of focused cardiac ultrasound in the diagnosis of pulmonary embolism: a systematic review and meta-analysis. Crit Ultrasound J. 2017;9(1):7.
14. Niendorff DF, Rassias AJ, Palac RT, Parrillo JE, Oropello JM. The use of ultrasound in cardiac arrest. Crit Care Clinics. 2011;27(2):219–31.
15. Olszynski P, Harris T, Garcia A. Ultrasound in emergency medicine: a focus on cardiac arrest management. Am J Emergency Med. 2016;34(9):1714–8.
16. Oh JW, Lee SJ, Kim SH, Kang JH. The role of point-of-care ultrasound in identifying reversible causes during cardiac arrest: a retrospective cohort study. Clin Exp Emergency Med. 2023;10(2):108–15.
17. Blyth L, Atkinson P, Gadd K, Lang E. Bedside focused echocardiography as predictor of survival in cardiac arrest patients: a systematic review. Academic Emergency Med. 2012;19(10):1119–26. https://doi.org/10.1111/j.1553-2712.2012.01456.x
18. Basmaji J, Arntfield R, Desai K, Lau VI, Lewis K, Rochwerg B, et al. The impact of point-of-care ultrasound-guided resuscitation on clinical outcomes in patients with shock: a systematic review and meta-analysis. Crit Care Med. 2024;52(11):1661–73. https://doi.org/10.1097/CCM.0000000000006399
19. Clattenburg EJ, Wroe PC, Gardner K, Vadeboncoeur T. Point-of-care ultrasound use in cardiac arrest is associated with improved outcomes: a systematic review and meta-analysis. Ultrasound J. 2019;11(1):30.