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Research Article

The Role of Point of Care Ultrasounds (POCUS) in the Setting of In-Hospital Pulseless Electrical Activity Cardiac Arrest

Ali R Jebur[1], Afnan Z Noaman[2*]

[1]Head of Emergency Department, AL-Forat General Hospital, Baghdad, Iraq

[2]Head of Emergency Division, Department of Operations and Emergency Medical Services, Baghdad, Iraq

***Correspondence author:** Afnan Z Noaman, Head of Emergency Division, Department of Operations and Emergency Medical Services, Baghdad, Iraq; Email: abeergatea@hotmail.com

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Abstract

Point-of-Care Ultrasound (POCUS) is increasingly utilized during cardiac arrest to identify potentially reversible causes of Pulseless-Electrical Activity (PEA). This study analyzed 20 cases where PEA was the initial rhythm, utilizing curved prove through the subxiphoid view to minimize interruptions during chest compressions. In 20 cases, POCUS findings were negative for reversible causes including cardiac temponade, tension pneumothorax, pulmonary embolism or cardiac thrombus. All patients received standard Advanced Cardiovascular Life Support (ACLS) interventions. Despite these measures, all 20 patients succumbed and the decision to terminate resuscitation was based on clinical judgments rather than POCUS findings of cardiac contractility. These results highlight the limited impact of POCUS findings on resuscitation outcomes in this cohort and emphasize the need for further research into its role in guiding clinical decision-making during cardiac arrest.

Keywords: Point of Care Ultrasounds (POCUS); Pulseless-Electrical Activity (PEA); Pulseless Electrical Activity; Non-Shockable Rhythm; Cardiac Arrest

Introduction

The American Heart Association (AHA) defines cardiac arrest as the abrupt loss of heart function which it can come on suddenly or in the wake of other symptoms [1]. Pulseless Electrical Activity (PEA) is defined clinically by the absence of a palpable pulse in an unconscious patient with organized electrical activity on the ECG [2]. The causes of PEA are 4Hs (hypovolumia, hypoxia, hypo/hyperkalemia and metabolic acidosis, Hypo/hyperthermia) and 4Ts (Toxicity, Tension pneumothorax, Cardiac Temponade, Thromboembolism (MI or PE)) [3]. It's associated with poor prognosis and the number of cases showing this rhythm group has been increasing over the last 20 years [4].

Pseudo- PEA is a severe shock state that is different from PEA. It can be identified in the absence of palpable pulse by (a. arterial line placement during cardiac arrest with presence of blood pressure; b. High $ETCO_2$ reading in intubated patient C. Echo shows cardiac pulsation). It was seen to be associated with better outcomes than patient with PEA [3,5].

Point-Of-Care Ultrasound (POCUS) is an invaluable tool in the setting of cardiac arrest as it can identify reversible causes of cardiac arrest [6]. It has the potential to be used as an effective diagnostic and prognostic tool during cardiac arrest, especially in the presence or absence of cardiac activity [7]. It was first implemented in the American Heart Association (AHA) 2010 as part of the monitoring parameters during CPR to diagnose treatable causes of cardiac arrest and guide treatment decisions [8].

Aim of the Study

To study the usefulness of POCUS in identifying the causes and enhancing the chances of survival of patients with PEA rhythm cardiac arrest.

Ethical Statement

The project did not meet the definition of human subject research under the purview of the IRB according to federal regulations and therefore, was exempt.

Material and Methods

We conducted a prospective study of in-Hospital witnessed cardiac arrest of 71 patients in Al-Forat General Hospital Emergency room/Baghdad over a period of 6 months (Sep.2024-Feb.2025). Those cases presented a verity of symptoms ranging from severe medical symptoms to dying upon arriving at the emergency room. We focused our study on those who went into cardiac arrest with initial cardiac rhythm non-shockable and using POCUS during the ongoing CPR.

The patients excluded from this study were:

1. Pediatric age group
2. Pregnant women
3. Patients who showed shockable rhythms (VF, pulseless VT) as initial rhythm

All cases went through proper ACLS protocol, which includes:

- Early starting for chest compressions
- Control airway and proper ventilation methods (Bag valve mask ventilation, ETT)
- Open wide bore lines
- Epinephrine doses of 1mg/ml of 1:1000 diluted in 9 ml of Normal saline 0.9%

We implemented the use of POCUS during the (check pulse phase) on those whose rhythm were PEA to find any reversible causes and guide our management. From those 71 cases that we received, 20 showed initial rhythm of PEA which we targeted in our study and the rest were showing initial rhythm of asystole. Most of Those 20 cases arrived with chief complains of shortness of breath (13 cases) the remaining (7 cases) where complaining of fever and altered mental status.

Results

We used a curved probe of Point-Of-Care Ultrasound as it was the only probe available in our device and we took the subxephoid view for optimal view and away from the site of chest compression to minimize interruptions. The study showed that among the 20 cases that dealt with according the initial rhythm of PEA. All 20 cases, their POCUS finding was negative for any reversible causes (cardiac temponade, tension pneumothorax, massive pulmonary embolism or cardiac thrombus).

Those 20 cases were resuscitated according to Advanced Cardiovascular Life Support (ACLS) protocols. All 20 cases eventually died despite full resuscitation and the termination of resuscitation was made by clinical decision rather than depending on POCUS findings of cardiac contractility.

Discussion

This study analyzed 20 cases of patients with Pulseless-Electrical Activity (PEA) who underwent Point-Of-Care Ultrasound (POCUS) during Cardiopulmonary Resuscitation (CPR). In all cases, POCUS revealed no cardiac activity and none of the patients survived. These finding reinforce the potential prognostic value of POCUS in PEA and its role in guiding resuscitation efforts. However, the use of POCUS required some interruption in chest compressions, which may have influenced patient outcomes. Additionally, POCUS assessments were sometimes challenging due to patient body habitus or positioning, leading to delays in obtaining optimal views and further affecting CPR timing.

Clinical Implications

The absence of cardiac activity on POCUS during CPR has been previously associated with poor survival outcome in PEA. Our study further supports this association, suggesting that when no cardiac motion is observed, the likelihood of successful resuscitation is minimal. These results highlight the potential utility of POCUS in decision-making regarding termination of resuscitation. However, clinical judgments remain essential, as other factors such as underlying etiology, response to interventions and duration of resuscitation efforts must also be considered [9].

Among the 20 cases, 13 patients had hypoxia prior to the cardiac arrest, which was identified and thoroughly treated before the event. The remaining seven patients exhibited high Systemic Inflammatory Response Syndrome (SIRS) scores due to sepsis and hypovolemic shock, both of which were managed appropriately. Despite these targeted interventions, all patients progressed to PEA and subsequently did not survive. This suggests that while addressing reversible causes is crucial, the absence of cardiac activity on POCUS remains a strong predictor of poor prognosis [10].

Furthermore, POCUS assessments did not identify tension pneumothorax, Pulmonary Embolism (PE) or cardiac temponade in any of the cases. These findings indicate that these potentially reversible causes of PEA were not contributing factors in these patients, furthermore, reinforcing the association between absent cardiac activity and poor outcomes [10].

The integration of POCUS into CPR also raises concerns regarding its impact on resuscitation cycle. The need to perform ultrasound assessments may have led to interruptions in chest compressions, potentially compromising perfusion [11]. Additionally, obtaining clear ultrasound images was sometimes difficult due to patient body build or positioning, requiring more time for proper probe placement and image acquisition. These delays may have further impacted the efficiency of CPR and overall patient outcomes. While POCUS is valuable for prognostication, its role must be balanced with the priority of high-quality, continuous CPR [12].

Comparison with Existing Literature

Previous studies have suggested that the presence of cardiac activity on POCUS correlates with higher chances of Return of Spontaneous Circulation (ROSC), while its absence is linked to poor outcome [7]. Our findings align with these reports, reinforcing the idea that lack of cardiac motion on POCUS may indicate a poor prognosis. However, rare cases of survival despite initial absence of cardiac activity have been documented, suggesting that while POCUS is useful prognostic tool, it should not be the sole determinant of resuscitation discontinuation.

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Limitations

This study has several limitations. The small size of 20 cases restricts the generalization of our findings. Additionally, variability in POCUS interpretation and operator expertise may influence the accuracy of cardiac activity assessment. Another limitation is lack of detailed information on potential reversible causes beyond hypoxia and sepsic/hypovolemic shock cases. Furthermore, the use of POCUS required pauses in chest compressions, which may have contributed to suboptimal CPR quality and affected the patient survival. The challenge of obtaining adequate ultrasound views due to patient body habitus or positioning further prolonged assessment times, potentially leading to additional delays in CPR and decision- making.

Conclusion

In our study, the absence of cardiac activity on POCUS in PEA patients was consistently associated with poor survival outcomes. Despite appropriate treatment of reversible causes such as hypoxia, sepsis and hypovolemic shock, all patients progressed to PEA and did not survive. Additionally, POCUS findings ruled out tension pneumothorax, pulmonary embolism and cardiac temponade as contributing factors. While these findings support the prognostic value of POCUS, resuscitation decisions should consider comprehensive clinical assessment. Additionally, the impact of POCUS-related interruptions and imaging challenges on CPR effectiveness must be carefully weighted. Continued research is needed to enhance our understanding of the role of POCUS in CPR and develop evidence-based guidelines for its application in PEA management.

Recommendation

Further research with larger, multicenter studies is needed to validate these findings and refine the role of POCUS in PEA management. Additionally, investigating whether specific subgroups of patients with PEA and absent cardiac activity may still benefit from prolonged resuscitation efforts could help optimize treatment protocols. Further studies should also examine the impact of POCUS-related CPR interruptions on survival outcomes and explore strategies to minimize compression pauses while integrating ultrasound assessment. Efforts to improve ultrasound accessibility, training and efficiently in emergency settings may help mitigate some of the challenges related to imaging difficulties and time constraints.

Conflict of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

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Consent to Participate
Informed consent was also obtained from each subject who participated in the study.

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Data Availability
Data is available for the journal. Informed consents were not necessary for this paper.

Author's Contribution
The authors contributed equally.

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