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POINT OF CARE ULTRASOUND (POCUS) IN NEONATOLOGY

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INTRODUCTION

Recently, the utilization of point-of-care ultrasound (POCUS) shows a significant step toward more dynamic, real-time diagnostic and therapeutic capabilities in neonatal medicine. With its portability, adaptability, and non-invasiveness, this cutting-edge imaging modality has quickly become a vital tool in neonatal medicine including intensive care units (NICUs), emergency and other settings. By offering quick visual insights into the physiological and pathological states of newborns, POCUS enhances physicians' diagnostic skills and enables timely and well-informed therapeutic decision-making by providing rapid real time information. A larger trend in medicine toward improving patient care through technological innovation is highlighted by the introduction of POCUS in neonatology.[1]

Neonatology which is intrinsically concerned with a population at the limits of human viability, has particular difficulties in terms of diagnosis and treatment. Premature and critically ill infants usually require meticulous and urgent medical interventions, often cannot be safely transported out of the neonatal intensive care unit (NICU) for external radiology studies. Despite that, traditional imaging modalities are informative, but sometimes limited by logistical constraints, the need for transport, and concerns over radiation exposure. On the other hand, POCUS presents a robust alternative. It overcomes many of the drawbacks of traditional imaging methods and provides bedside examination of intensive care patients, particularly preterm and critically ill newborns, as moving these patients carries a risk of instability.

Ultrasound waves are non-ionizing radiation and consider as patient friendly due to it is readily available, doesn't need anesthesia or sedation, and less expensive than other imaging modalities such as MRI, CT and X-ray. Furthermore, recent technology of ultrasound machines is compact, portable with improved image quality allowing utilization and delivery at all medical care department. Bringing this clinical tool considerably closer to the bedside and making US more accessible to pediatric clinicians beyond traditional imaging specialists.

Practically, POCUS in clinical decisions is fundamentally different from the traditional practice model, in which a provider orders a study, waits for an outside service to obtain and interpret the images, and then applies the results into the clinical context. Instead of that, POCUS utilized as a specialized tool to address a specific clinical study or examination. The same provider performs the study, interprets and integrates obtained information within the clinical context. POCUS dynamically offering the ability to repeat the study to identify any changes associated with interventions.[2, 3]

Recently, despite the significant role of POCUS utilization to enhance neonatal care and treatment. The practical integration of POCUS in neonatal clinical application is not without challenges. Firstly, the most important challenge is the technical learning involved in gaining the skills needed to operate ultrasound technology effectively. Also, acquisition of precise ultrasound images required deep understanding of neonatal anatomy and pathophysiology in combined with technical skills.[4] In addition, the continuous improvement in ultrasound technology and applications require standardized training curricula, certification, and

ongoing training programs tailored specifically for neonatologists and NICU staff to ensure optimal utilization of POCUS applications, protocols, and guidelines. However, studies and literature about POCUS' applications, benefits, and limitations in neonatology is still growing and provide fragmented view. Our systematic review aims to highlight the potential of POCUS in neonatal care.

METHODOLOGY

Web based review study was conducted to explore the role of Point of Care Ultrasound (POCUS) in Neonatology through published studies since 2020. The literature search was conducted in Google Scholar, using a combination of keywords and MeSH terms including: point-of-care ultrasound and neonatology, POCUS, applications of POCUS, limitations, guidelines.

Applications of POCUS in Neonatology

- **Diagnostic Applications**

Point-of-care ultrasound (POCUS) has emerged as one of the fundamental diagnostic tools in neonatology, with cardiac assessment representing its most prevalent application. It enables rapid, bedside, and goal-directed evaluation of hemodynamic status, facilitating urgent clinical decision-making and guiding resuscitative interventions, particularly in resource-limited settings where access to comprehensive echocardiography is restricted.[5-7] POCUS offers vital insights into cardiovascular physiology, including cardiac output, preload status, and ventricular function, through real-time evaluation of myocardial performance using both qualitative and quantitative measures like ejection fraction, myocardial strain, tricuspid annular plane systolic excursion (TAPSE), and mitral annular plane systolic excursion (MAPSE).[1, 8, 9] Furthermore, it facilitates the assessment of systemic and cerebral perfusion by measuring great vessel flow and superior vena cava dynamics, along with evaluating volume status through inferior vena cava indices.[10, 11]

In pathological conditions like persistent pulmonary hypertension, POCUS provides a rapid way to evaluate pulmonary pressures, shunt physiology, and ventricular interactions. Facilitating the distinction between pre- and post-capillary etiologies and promotes customized management approaches.[11, 12] Additionally, it plays a vital part in neonatal resuscitation by distinguishing between real and pseudo-pulseless electrical activity and identifying reversible causes of cardiovascular collapse, such as ventricular failure and pericardial effusion.[6, 13, 14] Additionally, POCUS assists in determining intracardiac masses like vegetations or thrombi, intracardiac shunts, valvular anomalies, and congenital heart disease.[15, 16]

Moreover, POCUS provides rapid lung examination by differentiation between normal and pathological lung states based on ultrasound characteristic patterns, including A-lines, B-lines, consolidation signs, and pleural abnormalities.[17, 18] It enables accurate diagnosis of neonatal respiratory conditions such as transient tachypnea of the newborn, respiratory distress syndrome, pneumothorax, and pneumonia, while also allowing monitoring of disease progression and response to therapy.[19, 20]

Additionally, Cranial POCUS facilitating diagnosis of hemorrhage, hydrocephalus, periventricular leukomalacia, and hypoxic-ischemic injury, as well as assessment of cerebral perfusion via Doppler techniques.[3, 13] While, Abdominal POCUS supports the identification of gastrointestinal and intra-abdominal pathologies, including necrotizing enterocolitis, bowel perforation, and vascular compromise, while also enabling functional assessment of gastrointestinal motility and perfusion.[11, 21]

Furthermore, POCUS helps to detect structural abnormalities, thrombosis, urinary obstruction, and elevated intracranial pressure in airway, urogenital, vascular, and ocular examination.[12,14,24,36,48] Focused cardiac ultrasound (FOCUS), focused assessment with sonography in trauma (FAST), and rapid assessment of the neonate with sonography (RANS) are examples of structured POCUS protocols that enable quick identification of life-threatening conditions and direct prompt interventions in emergency situations.[14,21]

- **Procedural Applications**

On the other hand, POCUS plays a dynamic role in procedural applications in neonatology, improving the safety, accuracy, and timeliness of a wide range of bedside interventions in both neonatal intensive care and emergency settings. POCUS is mostly utilized in airway management, enabling for real-time confirmation of the position, depth, and size of endotracheal tubes (ETTs), leading to minimize complications such esophageal or endobronchial intubation.[22, 23]

Additionally, POCUS is essential to vascular access because it provides real-time imaging and guidance as central and peripheral lines, such as peripherally inserted central catheters and umbilical venous and arterial catheters, are placed. The probability of serious consequences such arrhythmias, thrombosis, perforation, and cardiac tamponade is decreased when catheter tips are precisely positioned within central venous structures.[24-26] Clinical trials have shown the safety and viability of using several echocardiographic images for accurate catheter tracking in neonates.[27]

In advanced critical care, POCUS supports extracorporeal membrane oxygenation (ECMO) by guiding cannulation, confirming catheter placement, and monitoring for complications such as pneumothorax, effusions, and altered perfusion.[16, 28, 29]

Other procedural applications include confirmation of enteral tube placement, guidance for fluid drainage

procedures like pericardiocentesis, thoracocentesis, and paracentesis, which minimizes iatrogenic complications, and ultrasound-guided lumbar puncture, which increases needle placement accuracy and decreases traumatic attempts.[11, 23] Additionally, POCUS provides real-time visibility for treatments such abscess drainage, urinary catheterization, and suprapubic aspiration.[3, 23]

DISCUSSION

Recently, Point-of-care ultrasound (POCUS) has become an integral bedside diagnostic, monitoring, and procedural modality in neonatal intensive care, and its utilization is increasingly guided by international evidence-based frameworks. POCUS guidelines in neonatology offer structured approaches to utilize ultrasound in various clinical scenarios to aid in rapid assessment and decision-making. Several protocols have been developed by researchers and experts in the field to address specific needs in neonatal care.

Crashing Neonate Protocol (CNP) which was developed and designed by Elsayed et al. for neonatal emergencies with severe cardiorespiratory instability. Both term and preterm infants are covered by it. CNP is a step-by-step, systematic, focused examination employing basic ultrasound views that is used as an addition to the current guidelines for neonatal resuscitation. Lung POCUS for pulmonary emergencies such as pneumothorax or pleural effusion, cardiac POCUS for shock and hemodynamic instability, cranial POCUS for acute brain hemorrhage, abdominal POCUS for abdominal emergencies, and central line POCUS for central line complications are some of these perspectives.[30]

Moreover, Yousef et al. designed a targeted point-of-care ultrasound (POCUS) method designed for neonatologists to rapidly diagnose life-threatening complications in suddenly decompensating NICU infants known as Sonographic Assessment of liFe-threatening Emergencies — Revised (SAFE-R). It is intended to quickly screen for common life-threatening problems in newborns in the neonatal intensive care unit who are unexpectedly decompensating. It incorporates heart, lung, abdominal, and cranial POCUS to check for myocardial dysfunction, tension pneumothorax, acute abdominal problems, and intraventricular hemorrhage, much like the CNP created by Elsayed et al.[31] Additionally, Hardwick and Griksaitis suggested a structured approach for point-of-care ultrasound (POCUS) screening strategy for the rapid evaluation of pediatric shock, emphasizing a goal-directed, physiology-based approach to hemodynamic assessment. The approach enable distinguish between hypovolemic, cardiogenic, obstructive, and distributive shock at the bedside, by integration and combination of focused cardiac ultrasound to evaluate ventricular function and pericardial effusion, lung ultrasound to detect pneumothorax or pulmonary edema, and inferior vena cava evaluation to estimate intravascular volume status.[32]

Also, Maddaloni and colleagues offer clinically significant evidence to support integrating point-of-care ultrasonography (POCUS) into neonatal care pathways for complicated surgical diseases such congenital diaphragmatic hernia (CDH). The protocol supports the idea that ultrasound should be used as a targeted, physiology-driven tool to guide real-time management decisions, by demonstrating the usefulness of bedside ultrasound in the dynamic assessment of pulmonary hypertension, cardiac function, lung aeration, and diaphragmatic anatomy. Significantly, the protocol emphasizes how repeated POCUS exams can optimize ventilatory and pharmaceutical techniques and provide customized hemodynamic monitoring without the delays that come with traditional imaging. These results are in line with current guidelines that support lung ultrasonography and functional echocardiography as essential skills in neonatal critical care.[33]

Furthermore, the international evidence-based guidelines on POCUS for critically ill neonates and children issued by the POCUS Working Group of the European Society of Paediatric and Neonatal Intensive Care (ESPNIC) provide comprehensive recommendations for cardiac, lung, vascular, cerebral, and abdominal POCUS based clinical guidelines for the use of POCUS in critically ill neonates and children.[3]

ESPNIC developing practice fundamental recommendations and guidelines for the targeted use of ultrasound in NICU and PICU, for most diagnostic applications such as (heart, lungs, brain and abdomen) and procedural applications such as (line placement and fluid drainage). However, during the utilization of POCUS in neonates, clinicians should be aware that undetected congenital heart abnormalities can present at during this period, so clinicians should be aware of their limitations and refrain from using POCUS as a screening method to identify or rule out congenital cardiac abnormalities. Neonates with a suspected critical congenital heart defect should be quickly referred to a paediatric cardiologist. On the other hand, patients with low suspicion of critical heart defect or those with suspicions of a non-critical abnormality more expectative care management can be provided. It is internationally highly recommended to utilize and integrate pulse oximetry screening for congenital cardiac abnormalities during decision making process.[34, 35]

These recommendations help to standardize clinical practice among doctors and health care providers and facilities. It is intended to highlight the key components of structured POCUS applications in clinical practice rather than to be prescriptive. Since ultrasound machines are nearly always available in the majority of newborn and pediatric intensive care units, following these principles will frequently have no financial impact on the equipment.[3]

On the other hand, despite that Point-of-care ultrasonography (POCUS) has a growing role in neonatology, but it has a number of significant drawbacks and limitations that should be carefully taken into account in clinical practice. Because image acquisition and interpretation require extensive training, technical proficiency, and a comprehensive understanding of neonatal anatomy and pathophysiology, operator dependence is one of the main challenges. Variability in skill level can result in diagnostic errors and inter-observer inconsistency.[3, 4]

Additionally, POCUS is a focused, goal-directed modality and does not take the place of comprehensive and traditional imaging studies where expert input is still crucial such as formal echocardiography or radiological evaluations, especially when evaluating complex congenital anomalies, including critical congenital heart disease.[34]

Technical limitations including image quality and interpretation may also be hampered by technical issues including small patients, motion artifacts, restricted acoustic framerates, and the impact of motion artifacts, hemodynamic instability or ventilation. Furthermore, consistent implementation and oversight of POCUS standards in newborn care are still hampered by the absence of globally defined training programs, credentialing systems, and quality assurance frameworks across institutions.[2, 3, 14]

Concerns have also been raised about over-reliance on POCUS results and findings in the absence of sufficient clinical correlation, which could lead to incorrect diagnoses or postpone conclusive research. Lastly, although though POCUS lowers radiation exposure, its growing use presents medicolegal and documentation issues, especially in environments with weak formal reporting guidelines and archiving systems. All of these drawbacks highlight the necessity of organized training, following evidence-based recommendations, and incorporating POCUS within a multidisciplinary diagnostic framework in order to guarantee its safe and efficient use in newborns.[3, 36, 37]

CONCLUSION

In summary, point-of-care ultrasound (POCUS) has developed into a vital, versatile tool in neonatal care, providing real-time bedside diagnostic, monitoring, and procedural capabilities that significantly enhance clinical decision-making in critically ill neonates. The wide range of POCUS utilizes across organ systems is highlighted in this systematic review, which also shows the role of POCUS in enhancing diagnostic precision, directing therapies, and improving patient outcomes. Significantly, a paradigm shift toward standardized, physiology-driven ultrasound integration in neonatal practice is reflected in the development of targeted approaches like CNP and SAFE-R as well as structured protocols and international guidelines such as the European Society of Paediatric and Neonatal Intensive Care (ESPNIC). The growing body of evidence supports evidence supports the integration of POCUS into standard newborn care systems, never the less current issues with training, competency, and governance. Future efforts should focus on establishing unified training standards, certification pathways, and robust clinical governance to ensure safe, effective, and consistent implementation of POCUS within neonatal guidelines worldwide.

REFERENCES

1. Stewart, D.L., et al., *Use of point-of-care ultrasonography in the NICU for diagnostic and procedural purposes.* Pediatrics, 2022; 150(6): p. e2022060053.
2. Nguyen, J., et al., *The state of point-of-care ultrasonography use and training in neonatal–perinatal medicine and pediatric critical care medicine fellowship programs.* Journal of Perinatology, 2016; 36(11): p. 972-976.
3. Singh, Y., et al., *International evidence-based guidelines on Point of Care Ultrasound (POCUS) for critically ill neonates and children issued by the POCUS Working Group of the European Society of Paediatric and Neonatal Intensive Care (ESPNIC).* Critical Care, 2020; 24(1): p. 65.
4. Pai, V.V., et al., *Implementation of a bedside point-of-care ultrasound program in a large academic neonatal intensive care unit.* American Journal of Perinatology, 2024; 41(S 01): p. e76-e84.
5. Jain, A., et al., *Clarification of boundaries and scope of cardiac POCUS vs. Targeted Neonatal Echocardiography.* Journal of Perinatology, 2023; 43(10): p. 1207-1210.
6. Singh, Y., et al., *The evolution of cardiac point of care ultrasound for the neonatologist.* European Journal of Pediatrics, 2021; 180(12): p. 3565-3575.
7. Ben Fadel, N., L. Pulgar, and F. Khurshid, *Point of care ultrasound (POCUS) in Canadian neonatal intensive care units (NICUs): where are we?* Journal of Ultrasound, 2019; 22(2): p. 201-206.
8. Conlon, T.W., D. Baker, and S. Bhombal, *Cardiac point-of-care ultrasound: Practical integration in the pediatric and neonatal intensive care settings.* European Journal of Pediatrics, 2024; 183(4): p. 1525-1541.
9. Miller, L.E., J.Z. Stoller, and M.V. Fraga, *Point-of-care ultrasound in the neonatal ICU.* Current opinion in pediatrics, 2020; 32(2): p. 216-227.
10. Nestaas, E., *Neonatologist performed echocardiography for evaluating the newborn infant.* Frontiers in Pediatrics, 2022; 10: p. 853205.
11. Pan, S., C. Lin, and B.C. Tsui, *Neonatal and paediatric point-of-care ultrasound review.* Australasian Journal of Ultrasound in Medicine, 2023; 26(1): p. 46-58.
12. Kipfmueller, F., et al., *Echocardiographic assessment of pulmonary hypertension in neonates with congenital diaphragmatic hernia using*

pulmonary artery flow characteristics. Journal of Clinical Medicine, 2022; 11(11): p. 3038.

13. Flores, S., et al. *Point-of-care-ultrasound in pediatrics: a review and update*. in *Seminars in Ultrasound, CT and MRI*. 2024. Elsevier.
14. Chan, B., S. Sieg, and Y. Singh, *Unveiling pseudo-pulseless electrical activity (pseudo-PEA) in ultrasound-integrated infant resuscitation.* European Journal of Pediatrics, 2023; 182(12): p. 5285-5291.
15. Klimek, J., M. Culcer, and S. Veerappan, *Spontaneously disappearing right atrial mass in a preterm infant: a case report.* European Heart Journal-Case Reports, 2023; 7(7): p. ytad312.
16. Bo, B., et al., *Ductus arteriosus flow predicts outcome in neonates with congenital diaphragmatic hernia.* Pediatric Pulmonology, 2023; 58(6): p. 1711-1718.
17. Potter, S.K. and M.J. Griksaitis, *The role of point-of-care ultrasound in pediatric acute respiratory distress syndrome: emerging evidence for its use.* Annals of translational medicine, 2019; 7(19): p. 507.
18. Ruiz, N.S.S., et al., *Point-of-care lung ultrasound in children with bronchiolitis in a pediatric emergency department.* Archives de Pédiatrie, 2021; 28(1): p. 64-68.
19. Fernández, L.R., et al., *Usefulness of lung ultrasound in the diagnosis and follow-up of respiratory diseases in neonates.* Anales de Pediatría (English Edition), 2022; 96(3): p. 252. e1-252. e13.
20. Bhoil, R., et al., *Signs and lines in lung ultrasound.* Journal of Ultrasonography, 2021; 21(86): p. e225.
21. Inarejos Clemente, E.J., et al., *US for evaluation of acute abdominal conditions in neonates.* Radiographics, 2023; 43(2): p. e220110.
22. Ariff, S., et al., *Diagnostic accuracy of point‐of‐care ultrasound compared to standard‐of‐care methods for endotracheal tube placement in neonates.* Pediatric pulmonology, 2022; 57(7): p. 1744-1750.
23. Pawlowski, T.W., et al., *Point-of-care ultrasound for non-vascular invasive procedures in critically ill neonates and children: Current status and future perspectives.* European Journal of Pediatrics, 2024; 183(3): p. 1037-1045.
24. Grasso, F., et al., *Ultrasound guided catheter tip location in neonates: a prospective cohort study.* The Journal of Pediatrics, 2022; 244: p. 86-91. e2.
25. Lin, S.-Y., et al., *Point-of-care ultrasound (POCUS) for tip localization of neonatal peripherally inserted central catheter (PICC): A prospective study.* Pediatrics & Neonatology, 2024; 65(4): p. 375-380.
26. Motz, P., et al., *Point-of-care ultrasound for peripherally inserted central catheter monitoring: a pilot study.* Journal of perinatal medicine, 2019; 47(9).
27. Cowan, E., et al., *Implementing point of care ultrasound in the neonatal intensive care unit: a safety study.* Journal of Perinatology, 2021; 41(4): p. 879-884.
28. Bianzina, S., et al., *Use of point-of-care ultrasound (POCUS) to monitor neonatal and pediatric extracorporeal life support.* European Journal of Pediatrics, 2024; 183(4): p. 1509-1524.
29. Kipfmueller, F., et al., *Percutaneous, ultrasound‐guided single‐and multisite cannulation for veno‐venous extracorporeal membrane oxygenation in neonates.* Pediatric pulmonology, 2023; 58(9): p. 2574-2582.
30. Elsayed, Y., et al., *Point-of-care ultrasound (POCUS) protocol for systematic assessment of the crashing neonate—expert consensus statement of the international crashing neonate working group.* European journal of pediatrics, 2023; 182(1): p. 53-66.
31. Yousef, N., Y. Singh, and D. De Luca, *"Playing it SAFE in the NICU" SAFE-R: a targeted diagnostic ultrasound protocol for the suddenly decompensating infant in the NICU.* European Journal of Pediatrics, 2022; 181(1): p. 393-398.
32. Hardwick, J.A. and M.J. Griksaitis, *Fifteen-minute consultation: point of care ultrasound in the management of paediatric shock.* Archives of Disease in Childhood-Education and Practice, 2021; 106(3): p. 136-141.
33. 33. Maddaloni, C., et al., *The role of point-of-care ultrasound in the management of neonates with congenital diaphragmatic hernia.* Pediatric research, 2024; 95(4): p. 901-911.
34. Manzoni, P., et al., *Pulse oximetry screening for critical congenital heart defects: a European consensus statement.* The Lancet Child & Adolescent Health, 2017; 1(2): p. 88-90.
35. Martin, G.R., et al., *Implementing recommended screening for critical congenital heart disease.* Pediatrics, 2013; 132(1): p. e185-e192.
36. Burton, L., V. Bhargava, and M. Kong, *Point-of-care ultrasound in the pediatric intensive care unit.* Frontiers in Pediatrics, 2022; 9: p. 830160.
37. Fraga, M.V., et al., *Neonatal point-of-care ultrasound—guidelines for training, credentialing and quality assurance.* Journal of Perinatology, 2026; 46(1): p. 113-118.