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Point-of-care ultrasound in the assessment and management of circulatory shock: an integrative review

Ultrassonografia à beira do leito na avaliação e no manejo do choque circulatório: revisão integrativa

Ecografía a pie de cama en la evaluación y el manejo del choque circulatorio: revisión integradora

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Abstract:
Objective: to synthesize evidence on the use of point-of-care ultrasound (POCUS) for etiologic identification, hemodynamic assessment, therapeutic guidance, and monitoring of patients with circulatory shock or hypotension suggestive of shock. Method: an integrative review conducted through problem identification, literature search, data evaluation, data analysis, and presentation. SciELO, LILACS, PubMed/MEDLINE, and SpringerLink were searched using DeCS/MeSH descriptors and free-text terms related to ultrasonography, echocardiography, shock, and hypotension. Original quantitative human studies published from 2020 to September 2026 in Portuguese, English, or Spanish were eligible. Selection was managed in Rayyan and reported according to PRISMA 2020. Methodological quality was assessed with Joanna Briggs Institute tools appropriate to each study design, without using appraisal as an automatic exclusion criterion. Results: 2,314 records were identified electronically and one additional study through reference searching. After removing 312 duplicates, screening, and full-text assessment, 15 studies were included. Evidence supported POCUS for hemodynamic characterization, fluid responsiveness and tolerance assessment, pulmonary monitoring, and support within integrated protocols. Clinical and methodological heterogeneity, small samples, and reliance on surrogate outcomes reduced confidence in the findings. Only one trial directly assessed diagnostic improvement over conventional evaluation and found no statistically significant improvement in overall accuracy; no study supported a consistent reduction in time to diagnosis. Conclusion: POCUS is a promising complementary tool, but its contribution depends on the protocol, operator training, and integration with clinical data. Evidence remains insufficient to establish overall superiority, mortality reduction attributable to ultrasound alone, or shorter diagnostic time.

Keywords:
Ultrasonography. Shock. Echocardiography. Hypotension. Integrative review.

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Resumo:
Objetivo: sintetizar evidências sobre ultrassonografia à beira do leito (POCUS) na identificação etiológica, avaliação hemodinâmica, orientação terapêutica e monitorização de pacientes com choque circulatório ou hipotensão com suspeita de choque. Método: revisão integrativa pelas etapas de identificação do problema, busca, avaliação, análise e síntese. Consultaram-se SciELO, LILACS, PubMed/MEDLINE e SpringerLink, com descritores DeCS/MeSH e termos livres. Incluíram-se estudos originais quantitativos humanos, publicados entre 2020 e setembro de 2026, em português, inglês ou espanhol. A seleção foi gerenciada no Rayyan e relatada conforme PRISMA 2020. A qualidade foi examinada com instrumentos do Joanna Briggs Institute por delineamento, sem exclusão automática. Resultados: identificaram-se 2.314 registros eletrônicos e um estudo nas referências. Após remoção de 312 duplicatas, triagem e avaliação integral, incluíram-se 15 estudos. As evidências indicaram utilidade na caracterização hemodinâmica, avaliação da responsividade e tolerância a fluidos, monitorização pulmonar e protocolos integrados. Heterogeneidade, amostras pequenas e desfechos intermediários reduziram a certeza. Apenas um ensaio avaliou diretamente o ganho diagnóstico sobre a avaliação convencional, sem melhora significativa da acurácia global; nenhum sustentou redução consistente do tempo diagnóstico. Conclusão: o POCUS é complementar e promissor, mas depende de protocolo, treinamento e integração clínica. Não há evidência suficiente de superioridade global, redução de mortalidade atribuível isoladamente ao exame ou menor tempo diagnóstico.

Palavras-chave:
Ultrassonografia. Choque. Ecocardiografia. Hipotensão. Revisão integrativa.

Resumen:
Objetivo: sintetizar las evidencias sobre POCUS en la identificación etiológica, evaluación hemodinámica, orientación terapéutica y monitorización de pacientes con choque circulatorio o hipotensión con sospecha de choque. Método: revisión integradora mediante identificación del problema, búsqueda, evaluación, análisis y presentación. Se consultaron SciELO, LILACS, PubMed/MEDLINE y SpringerLink con descriptores DeCS/MeSH y términos libres sobre ecografía, ecocardiografía, choque e hipotensión. Se incluyeron estudios originales cuantitativos humanos de 2020 a septiembre de 2026, en portugués, inglés o español. La selección se gestionó en Rayyan y se presentó según PRISMA 2020. La calidad se evaluó mediante herramientas del Joanna Briggs Institute por diseño, sin exclusión automática. Resultados: se identificaron 2.314 registros electrónicos y un estudio adicional en referencias. Tras eliminar 312 duplicados, cribar y evaluar textos completos, se incluyeron 15 estudios. Las evidencias indicaron utilidad para caracterización hemodinámica, respuesta y tolerancia a líquidos, monitorización pulmonar y protocolos integrados. La heterogeneidad, las muestras pequeñas y los desenlaces intermedios redujeron la certeza. Solo un ensayo evaluó directamente el beneficio diagnóstico frente a evaluación convencional, sin mejora significativa de exactitud global; ninguno respaldó reducción consistente del tiempo diagnóstico. Conclusión: POCUS es complementario y prometedor, condicionado por protocolo, formación e integración clínica. No hay evidencia suficiente de superioridad global, reducción de mortalidad atribuible exclusivamente a la exploración ni menor tiempo diagnóstico.

Palabras clave:
Ecografía. Choque. Ecocardiografía. Hipotensión. Revisión integradora.

1 Introduction

Circulatory shock is a syndrome of acute circulatory failure in which oxygen delivery or utilization becomes inadequate to meet tissue needs. It may result from hypovolemic, cardiogenic, obstructive, or distributive mechanisms, which often coexist and modify the clinical presentation. Rapid assessment is decisive, but blood pressure, heart rate, and peripheral signs alone neither establish the etiology nor fully describe the hemodynamic state (Vincent; De Backer, 2013).

Point-of-care ultrasound (POCUS) adds anatomical and functional information to the clinical examination without requiring patient transport. Focused echocardiography, lung ultrasound, inferior vena cava assessment, carotid Doppler, and multiorgan protocols have been used to recognize ventricular dysfunction, congestion, probable hypovolemia, obstructive causes, and pulmonary abnormalities. Recent guidelines recommend echocardiography as the initial imaging modality for characterizing shock type and emphasize dynamic assessment of fluid responsiveness (Monnet et al., 2025).

Availability of the method, however, does not automatically translate into clinical benefit. Measurements depend on the operator and may be influenced by mechanical ventilation, intra-abdominal pressure, arrhythmias, cardiopulmonary interactions, and acoustic window quality. Moreover, protocols incorporating POCUS often combine several interventions, making it difficult to attribute changes in mortality or fluid use exclusively to ultrasound.

Recent publications include clinical trials, accuracy studies, cohorts, cross-sectional studies, and feasibility investigations, with different populations and outcomes. Integrative reviews are suitable for bringing together this methodological diversity, provided that selection, critical appraisal, and synthesis preserve the distinctions between diagnostic, prognostic, monitoring, and treatment questions (Whittemore; Knafl, 2005; Souza; Silva; Carvalho, 2010).

The following question was therefore formulated: what evidence published between 2020 and 2026 describes the contribution of POCUS to etiologic identification, hemodynamic assessment, therapeutic guidance, and monitoring in patients with circulatory shock or hypotension suggestive of shock? The objective was to synthesize this evidence, identify the modalities and protocols used, examine clinical and diagnostic results, and analyze their methodological limitations.

2 Method

2.1 Review design and stages

This is an integrative literature review, a method that synthesizes studies with different designs and allows experimental and nonexperimental evidence to be examined together. Five stages were followed: problem identification; literature search; data evaluation; analysis and synthesis; and presentation of results (Whittemore; Knafl, 2005). Reporting of identification and selection followed PRISMA 2020 (Page et al., 2021). There was no prospective protocol registration.

2.2 Review question

The question was structured using PICo adapted for an integrative review: population (P), patients with circulatory shock or hypotension suggestive of shock; interest (I), POCUS use; and context (Co), diagnostic, hemodynamic, therapeutic, or monitoring assessment in emergency and intensive care services. A comparator was not required because feasibility, accuracy, and association studies were relevant to the scope; where present, the comparator was conventional assessment or another hemodynamic method.

2.3 Information sources and search strategy

SciELO, LILACS, PubMed/MEDLINE, and SpringerLink were searched for publications from January 2020 through September 2026. The search combined controlled DeCS/MeSH vocabulary and free-text terms in Portuguese, English, and Spanish. Concepts within the same domain were combined with OR, while ultrasound and shock domains were joined with AND. In PubMed, descriptors were searched in MeSH and free-text terms in title and abstract fields. In LILACS, subject descriptors and free-text terms were searched in title, abstract, and subject fields. In SciELO, the combination was applied to all indexes. In SpringerLink, the strategy used the platform's general search with scientific articles selected. No design filters were applied during searching. The exact date of each export was unavailable in the management file; consequently, only the month of the last search was reported, and this absence was acknowledged as a reproducibility limitation.

Source	Recorded strategy
PubMed/ MEDLINE	(("Ultrasonography"[Mesh] OR "Echocardiography"[Mesh] OR ultrasound[tiab] OR sonography[tiab] OR echocardiograph*[tiab] OR POCUS[tiab] OR "point-of-care ultrasound"[tiab] OR "bedside ultrasound"[tiab]) AND ("Shock"[Mesh] OR "Hypotension"[Mesh] OR shock[tiab] OR hypotension[tiab] OR "circulatory failure"[tiab] OR "circulatory collapse"[tiab]))
LILACS/BVS	(ultrassonografia OR ultrassom OR ultrasonography OR ultrasound OR sonography OR ecografia OR ecocardiografia OR echocardiography OR POCUS OR "point-of-care ultrasound") AND (choque OR shock OR hipotensão OR hypotension OR hipotension OR "falência circulatória" OR "circulatory failure")
SciELO	(ultrassonografia OR ultrassom OR ultrasonography OR ultrasound OR sonography OR ecografia OR ecocardiografia OR echocardiography OR POCUS) AND (choque OR shock OR hipotensão OR hypotension OR hipotension OR "circulatory failure")
SpringerLink	(ultrasonography OR ultrasound OR sonography OR echocardiography OR POCUS OR "point-of-care ultrasound" OR "bedside ultrasound") AND (shock OR hypotension OR "circulatory failure" OR "circulatory collapse")

2.4 Eligibility criteria

Original quantitative human research articles published in Portuguese, English, or Spanish from 2020 through September 2026 were included if they assessed POCUS in patients with circulatory shock or hypotension suggestive of shock and reported results on etiology, diagnostic performance, hemodynamic assessment, fluid responsiveness or tolerance, therapeutic guidance, monitoring, or prognosis. Clinical trials, accuracy studies, and observational studies were accepted. Reviews, editorials, letters, protocols, case reports, abstracts, dissertations, theses, chapters, animal or simulation studies, studies of electric shock or shock waves, and publications without relevant results were excluded. Free full-text availability was not treated as a methodological property; reports not retrieved after access attempts were counted separately.

2.5 Selection, extraction, and synthesis

Records were imported into Rayyan for deduplication and title and abstract screening. Full texts were then examined against eligibility criteria. Reference lists of relevant articles were checked, yielding an additional trial directly related to the question. Extracted data included authorship, year, country or setting, design, sample, ultrasound modality, comparator,

outcomes, and main findings. Heterogeneity precluded meta-analysis. Narrative synthesis was organized into four domains: diagnosis/feasibility; hemodynamic assessment; fluid management and resuscitation; and monitoring/prognosis.

2.6 Methodological quality assessment

Formal appraisal used Joanna Briggs Institute (JBI) tools for randomized trials, cohorts, analytical cross-sectional studies, and accuracy studies, as appropriate to each design. Items were rated “yes,” “no,” “unclear,” or “not applicable.” Consistent with the integrative purpose, results were not converted into an automatic exclusion threshold; they were used to weigh interpretation. Appraisal identified greater confidence in trials and cohorts with clearly described methods and follow-up, and lower confidence in pilot studies, convenience samples, single-center analyses, and investigations without an independent comparator.

2.7 Ethical aspects

The review used only published documentary data, without direct human participation or collection of identifiable data. Ethics committee review was therefore unnecessary. Authorship, citation integrity, and faithful reporting of primary study findings were respected.

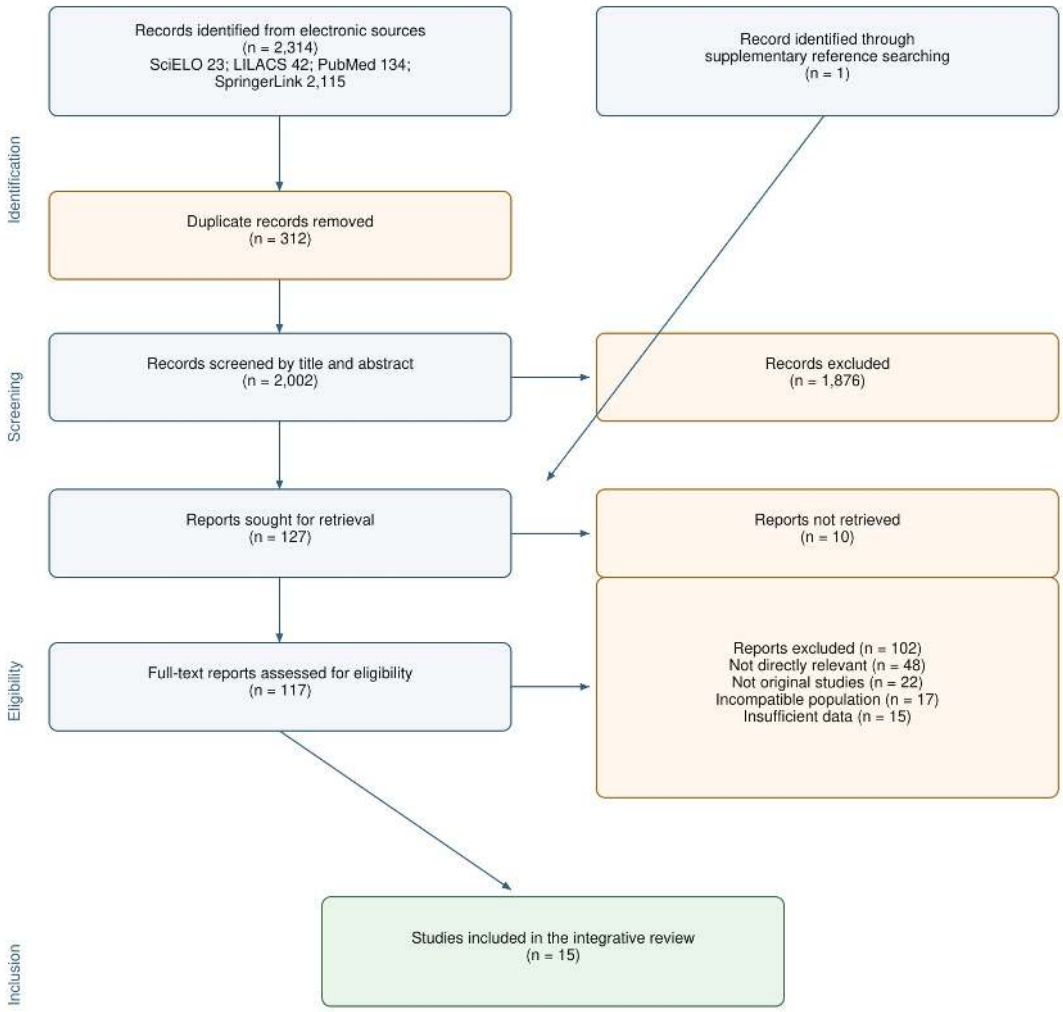
3 Results

3.1 Study selection

Electronic searches identified 2,314 records: SciELO (n = 23), LILACS (n = 42), PubMed (n = 134), and SpringerLink (n = 2,115). After removal of 312 duplicates, 2,002 records were screened, of which 1,876 were excluded by title and abstract. Retrieval was sought for 126 full texts from electronic sources; ten were not retrieved and 116 were assessed in full. Supplementary reference searching identified one additional article, which was not part of the initial 2,314 records. Thus, 117 full texts were assessed overall, of which 102 were excluded, yielding 15 studies in the synthesis. Reasons for exclusion were no direct relevance to the topic (n = 48), nonoriginal publication (n = 22), incompatible population (n = 17), and insufficient data (n = 15).

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Figure 1 – Study selection flowchart



Source: prepared by the authors, adapted from PRISMA 2020 (Page et al., 2021).

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3.2 Characteristics and findings

Table 1 – Characteristics of included studies

Study	Design and population	POCUS application	Findings and editorial interpretation
Accorsi et al. (2022)	Observational; n=11; adults	Remotely guided multiorgan POCUS	All obtained jugular, lung, and IVC images; adequate cardiac window in 36%; mean time 22.7 min. Feasibility evidence, not efficacy.
Deley-Muñoz; González-Andrade (2021)	Cross-sectional; n=110; neonates	SVC/IVC flows and clinical parameters	Associations between ultrasound measurements and hemodynamic state; design does not allow causal inference.
Zhou et al. (2022)	Randomized pilot; n=83	Serial echocardiography; ventricular–arterial coupling	Greater Ea/Ees reduction and lactate clearance; mortality showed only a nonsignificant trend.
Peach et al. (2023)	Multicenter randomized; undifferentiated hypotension	POCUS protocol + standard assessment versus standard assessment	No statistically significant improvement in overall diagnostic accuracy; POCUS was more useful as a confirmatory test.
Serna Guerrero; Sosa Medellín (2023)	Comparative cross-sectional; n=17	LVOT VTI variation	Correlation with stroke volume variation (rho=0.785); very small sample.
Wang et al. (2023)	Retrospective; n=22; cardiogenic shock on VA-ECMO	Lung ultrasound score	72-hour score associated with survival (AUC=0.964); high risk of overfitting and small-sample bias.
Ghosh et al. (2024)	Randomized trial; septic shock	IVC-guided fluid therapy	Lower positive fluid balance at 72 h; no significant difference in 30-day mortality.
ANDROMEDA-SHOCK-2 (2025)	Multicenter randomized; n=1,467	Personalized resuscitation with responsiveness assessment and echocardiography	Benefit in hierarchical outcome and lower fluid volume; effect belongs to the composite protocol, not POCUS alone.

Study	Design and population	POCUS application	Findings and editorial interpretation
Assies et al. (2025)	Prospective; n=30; children	p-RUSH	Examination completed in all; 92.3% interpretable windows; demonstrates feasibility and reliability, not clinical outcomes.
Chanthawatthanarak et al. (2025)	Prospective; n=40	Carotid versus LVOT cardiac output	Moderate agreement and wide percentage error; methods not interchangeable for individual decisions.
Kaymakçı et al. (2025)	Prospective; n=51	Carotid Doppler, IVC, and CVP	Association with mortality; prognostic performance requires external validation.
Li et al. (2025)	Multicenter cohort; n=540	Adherence to OPACCUS protocol with critical care ultrasound	Greater adherence associated with lower mortality and costs; residual confounding and care bundle effect.
Moussa et al. (2025)	Prospective; n=50	Lung ultrasound; BLUE/FALLS; IVC	Identified lung patterns and enabled serial monitoring; lack of independent reference standard limits etiologic accuracy.
Zhang; Li (2025)	Prospective; n=24	Lung score versus extravascular water (PiCCO)	Strong correlation in serial measurements; small sample and surrogate outcome.
Innes et al. (2026)	Randomized pilot; n=19	VExUS-guided deresuscitation	Feasible strategy; imprecise clinical differences and inadequate power for efficacy or safety.

Table 2 – Summary of critical appraisal

Study	JBI tool by design	Confidence	Main limitations
Accorsi et al.	Cross-sectional/ feasibility	Moderate	Small convenience sample; no comparator; implementation outcomes.
Deley-Muñoz; González-Andrade	Analytical cross-sectional	Moderate	Criteria and measurements described; limited confounder control.
Zhou et al.	Pilot randomized trial	Moderate	Randomization described; pilot study, impracticable blinding, and imprecision.

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Study	JBI tool by design	Confidence	Main limitations
Peach et al.	Multicenter randomized trial	High	Direct comparison and diagnostic reference; inherent operator blinding limitations.
Serna Guerrero; Sosa Medellín	Comparative cross-sectional	Low	n=17, single center, and correlation analysis without external validation.
Wang et al.	Retrospective cohort	Low	n=22, retrospective selection, few events, and overfitting risk.
Ghosh et al.	Randomized trial	Moderate	Comparative allocation; limitations in blinding and mortality power.
ANDROMED A-SHOCK-2	Multicenter randomized trial	High	Large sample and predefined protocol; composite intervention prevents isolating POCUS.
Assies et al.	Prospective cohort/feasibility	Moderate	Clear procedures; n=30, single center, and no control.
Chanthawattha narak et al.	Agreement study	Moderate	Paired methods and Bland–Altman; n=40 and assessment after blood pressure stabilization.
Kaymakçı et al.	Prospective cohort	Moderate	Standardized measurement; n=51 and prognostic model without external validation.
Li et al.	Multicenter prospective cohort	Moderate	Large sample and adjustment; nonrandomized adherence and residual confounding.
Moussa et al.	Prospective cohort	Low	n=50, single center, no independent diagnostic reference, and no control group.
Zhang; Li	Prospective correlation study	Low	n=24, surrogate outcome, and dependence on repeated measurements.
Innes et al.	Pilot randomized trial	Low	n=19, group imbalance, and inadequate power for clinical outcomes.

Note: “confidence” expresses the overall judgment of internal validity and precision for this review's purpose; it is neither an evidence level nor a numerical score. No study was excluded solely because of critical appraisal.

3.3 Thematic synthesis

Diagnosis and feasibility

Accorsi et al. (2022) and Assies et al. (2025) demonstrated that multiorgan protocols can be performed in resource-limited settings, including through remote guidance. These studies support feasibility and acquisition quality but do not demonstrate diagnostic superiority or improved outcomes. Moussa et al. (2025) described lung patterns useful for formulating hypotheses, but without an independent reference standard. The trial by Peach et al. (2023), the only direct comparison of structured POCUS and conventional assessment in undifferentiated hypotension, found no statistically significant improvement in overall accuracy. No study provided consistent evidence of shorter time to diagnosis.

Hemodynamic assessment

Investigations of vena cava flows, left ventricular outflow tract VTI, and carotid Doppler showed associations or correlations with hemodynamic variables. However, correlation does not imply agreement or interchangeability. Chanthawatthanarak et al. (2025) demonstrated wide variability between carotid and LVOT estimates, warning against automatically substituting one measurement for another.

Fluid management and resuscitation

Ghosh et al. (2024) observed a lower fluid balance with an IVC-guided strategy, without a significant mortality reduction. Innes et al. (2026) showed the feasibility of VExUS for deresuscitation, but the pilot sample does not establish efficacy. Zhou et al. (2022) found improved hemodynamic markers and lactate clearance with echocardiographic optimization, while ANDROMEDA-SHOCK-2 demonstrated benefit from a composite personalized strategy. In both cases, mortality effects cannot be attributed to POCUS alone.

Monitoring and prognosis

Lung ultrasound and carotid or IVC parameters were associated with congestion, mortality, or survival. Wang et al. (2023), Zhang and Li (2025), and Kaymakçı et al. (2025) provide promising signals, but these rely on small samples, surrogate outcomes, or models

without external validation. Li et al. (2025) associated greater OPACCUS adherence with lower mortality, although the observational design and multifactorial protocol leave potential confounding.

4 Discussion

This integrative review identified four main functions of POCUS in shock: supporting etiologic hypotheses, describing the hemodynamic phenotype, guiding fluid decisions, and tracking congestion or therapeutic response. Taken together, the evidence favors its use as a focused, repeatable extension of clinical examination. It does not support the idea that any ultrasound protocol is superior in every setting or that isolated measurements can replace serial clinical assessment.

Distinguishing feasibility, accuracy, prognostic association, and therapeutic efficacy is central. Acquiring interpretable images demonstrates implementability but does not prove improved diagnosis. Likewise, a variable associated with mortality may mark severity without decisions based on it reducing mortality. This distinction prevents extrapolations found in parts of the literature and keeps conclusions proportionate to available designs.

The finding of Peach et al. (2023) deserves emphasis because it directly addresses POCUS versus conventional assessment. Absence of a significant difference in overall accuracy does not render the method useless; it suggests that value may concentrate on specific diagnoses, rapid hypothesis confirmation, or reclassification of selected patients. It also shows that the question “Does POCUS improve diagnosis?” is too broad unless protocol, operator, population, reference standard, and examination timing are defined.

In fluid therapy, findings were consistent with a contribution toward reducing unnecessary volume exposure or recognizing congestion. However, isolated IVC assessment has known physiological limitations, and VExUS remains dependent on training and validation in larger samples. Integrated strategies such as ANDROMEDA-SHOCK-2 and OPACCUS are clinically relevant but combine ultrasound, peripheral perfusion, and other decisions. Their results should be attributed to the care bundle rather than to ultrasound alone.

Critical appraisal changed the interpretative weight of the findings. Two studies provided higher-confidence evidence, eight moderate confidence, and five low confidence for this review's purposes. The most frequent weaknesses were small samples, single-center design, absence of an independent comparator or reference, intermediate outcomes, and insufficient confounder control. Thus, 15 articles do not equal 15 independent confirmations of efficacy.

The review has limitations. Searching included SpringerLink, a broadly covering publishing platform, and did not include Embase, Web of Science, Scopus, or CINAHL, which may have led to missed studies. Exact export dates were unrecorded. Screening and critical appraisal available in the file did not document independent duplicate review, precluding claims of interrater agreement. Heterogeneity prevented meta-analysis. Inclusion of one reference-search study was reported separately to preserve flowchart transparency.

For practice, results support POCUS as a complementary tool performed by trained professionals, with documentation of protocol, acquired windows, and technical limitations. Research requires pragmatic trials assessing patient-centered outcomes, predefined diagnostic time, decision impact, and between-operator reproducibility, alongside external validation of prognostic markers.

5 Conclusion

The integrative review of 15 studies showed that POCUS may contribute to hemodynamic assessment, fluid management guidance, lung monitoring, and implementation of integrated protocols in patients with circulatory shock. Utility was more consistent as a complement to clinical examination and a serial monitoring tool than as a standalone method for determining etiology or improving outcomes.

Evidence was insufficient to establish overall diagnostic superiority over conventional assessment, a consistent reduction in time to diagnosis, or lower mortality attributable exclusively to POCUS. Confidence ranged from low to high, with limitations predominantly involving small samples, observational designs, and intermediate outcomes. Clinical incorporation should consider training, context, protocol, and integration with other data, while more robust comparative studies are needed to define which patients and decisions gain measurable benefit.

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