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From Exposure to Expertise: Rethinking POCUS Competency in Nephrocritical Care

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Point-of-care ultrasound (POCUS) has rapidly transitioned from a niche skill to a widely discussed tool in nephrocritical care. What began as an aid for procedures has evolved into a comprehensive bedside framework for hemodynamic assessment, encompassing cardiac, pulmonary, and venous evaluation, among other applications.[1,2] This expansion reflects both clinical need and technological advances that have made ultrasound more portable and easier to deploy at the bedside. However, the pace of adoption is outpacing the development of structured pathways to ensure competency. Across institutions and countries, the meaning of being "POCUS-trained" varies considerably, ranging from limited procedural guidance to more advanced multiparametric assessment. This variability is not merely academic. In a field where clinical decisions are often nuanced and physiologically complex, inconsistency in training translates directly into variability in care. This gap is further compounded by a degree of "new toy" enthusiasm, whereby ease of access may promote use without a corresponding emphasis on training and competency development.

The appeal of POCUS is undeniable. It offers immediacy, integration, and a sense of autonomy that traditional consultative imaging pathways cannot match. A clinician can move from question to answer within minutes, often at the bedside. For example, in acute kidney injury, a good quality handheld device can function as a surrogate for multiple imaging modalities that would otherwise need to be ordered separately, including kidney ultrasound, chest radiography, echocardiography, and abdominal Doppler. Yet this accessibility creates a subtle but important misconception. Having an ultrasound device at the bedside does not, by itself, improve decision-making. Its value depends on the operator's ability to obtain reliable images, interpret them correctly, recognize both technical limitations of the equipment being used and patient-related constraints, and integrate the findings within the appropriate clinical context. Without this foundation, POCUS risks becoming another source of diagnostic uncertainty rather than a solution.

Short-format workshops have played an important role in introducing clinicians to POCUS. These sessions are often engaging and serve as effective entry points, allowing clinicians to develop initial familiarity with image acquisition and common findings. They build confidence and stimulate interest, both of which are necessary for adoption. However, "confidence" acquired in a short course should not be mistaken for "competence". The skills required for consistent image acquisition, nuanced interpretation, and clinical integration cannot be developed over a few hours or even a few days. Like other aspects of clinical examination, these abilities require longitudinal practice, expert

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feedback, and clinical experience. The notion that a brief training course can produce independent proficiency is not unique to POCUS, but the visual immediacy of ultrasound can make this misconception particularly convincing.

Attempts to define competency have often relied on numerical thresholds, with scan counts serving as a proxy for experience. While minimum numbers are important, they are not synonymous with expertise. Two clinicians may perform a similar number of scans yet demonstrate markedly different levels of skill depending on the quality of supervision, feedback, and their prior exposure to ultrasound during earlier stages of training. Repetition alone without expert supervision can reinforce errors rather than resolve them. Competency in POCUS extends beyond the act of image acquisition. It includes the ability to recognize limitations, identify technical pitfalls, and avoid overinterpretation. For example, a dilated inferior vena cava does not automatically suggest the need for fluid removal, nor does a small collapsible IVC necessarily indicate a need for intravenous fluids.[3] Acting on such findings without a broader understanding can lead to inappropriate management decisions.

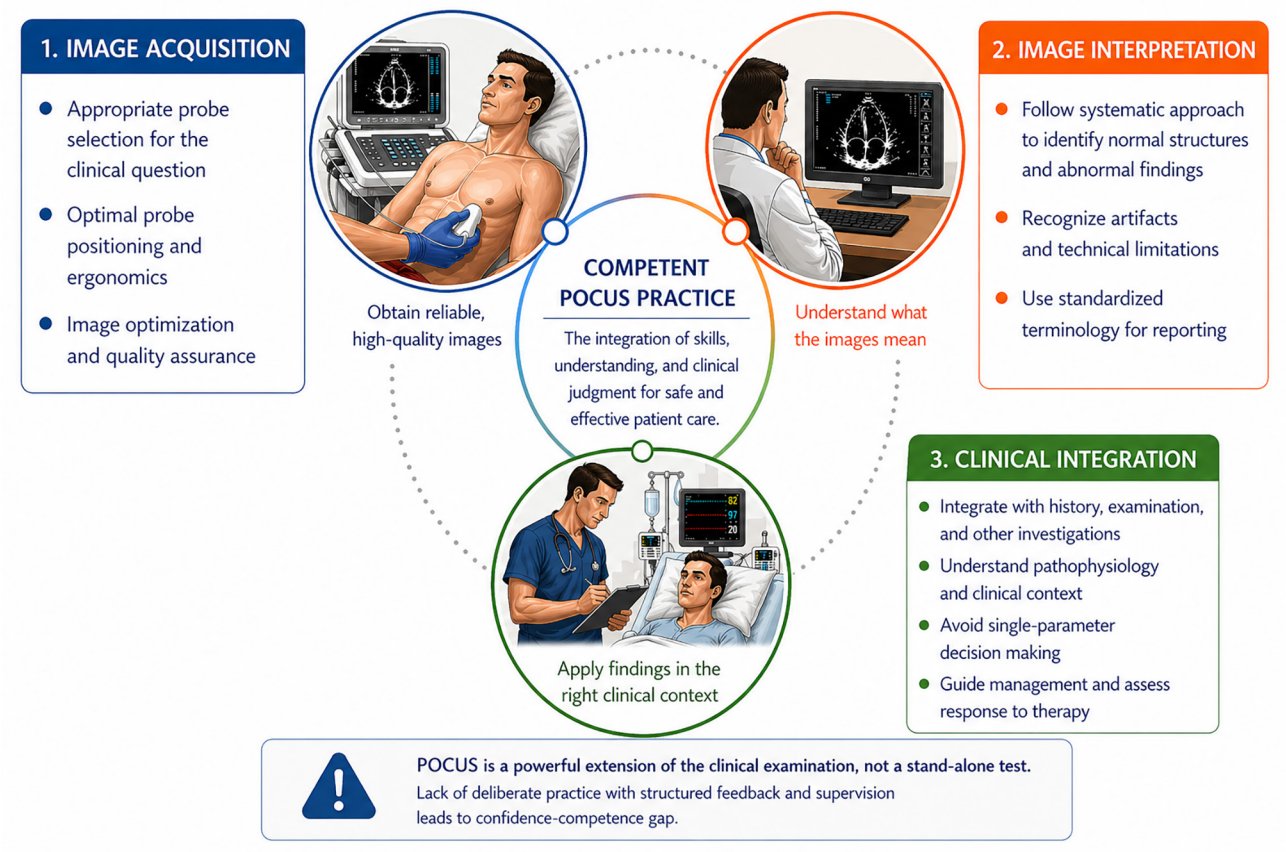
As clinicians gain exposure to POCUS, the questions they ask naturally evolve. Early on, especially in emergency settings, the focus is often on simple yes-or-no assessments, but nephrocritical care rarely presents such clear-cut scenarios. Questions surrounding fluid tolerance, venous congestion, and forward flow require integration of multiple parameters across organ systems. This progression from basic to integrative use is both expected and desirable. However, problems arise when this transition is assumed rather than achieved. For example, clinicians may begin to explore advanced Doppler applications without a sufficient grasp of waveform acquisition, machine settings, or interpretation. In such cases, the information obtained may appear sophisticated while remaining fundamentally incomplete or misleading.

This disconnect reflects a broader gap between confidence and competence that is well recognized in medical education.[4-6] Early learners often overestimate their abilities, particularly when feedback is limited. In the context of POCUS, where images provide immediate visual reinforcement, this effect can be amplified. Frameworks of skill acquisition suggest that most clinicians who complete an introductory course function at an early stage of development, relying on rules and pattern recognition rather than deeper contextual understanding. Treating this stage as equivalent to independent competence carries clinical risk, particularly in nephrocritical care where management decisions frequently involve balancing competing physiological priorities.

The implications extend beyond clinical care into research. POCUS has emerged as an attractive area for scholarly activity, particularly for early-career clinicians. While this interest is encouraging, the quality of research depends heavily on the competency of those conducting it. Studies designed without adequate understanding of POCUS principles and limitations may generate findings that are difficult to reproduce or apply in practice. Early publications in a developing field have an outsized influence, shaping both clinical perception and future research directions. When methodological rigor is lacking, misconceptions may persist and become embedded in clinical reasoning.

A global perspective further highlights both the opportunity and the responsibility associated with POCUS. In many regions, access to formal imaging is limited, and POCUS offers a means to bridge that gap. Its potential to improve diagnostic capacity and patient care in such settings is substantial.[7] At the same time, the absence of structured training programs and quality assurance systems may increase the risk of misapplication. Promoting POCUS adoption without parallel investment in education and competency assessment risks undermining its benefits.

Moving forward is not about tempering enthusiasm but channeling it into scalable and accountable training models. Competency in POCUS should be operationalized with clear expectations across three domains: acquisition, interpretation, and clinical integration (Figure). This requires moving beyond isolated workshops toward longitudinal training pathways that incorporate real-world clinical exposure and ongoing supervision. Hybrid models can help bridge this gap. Remote mentorship



Components of Competent POCUS Practice

using cloud-based image archiving, asynchronous feedback, and tele-supervision allows learners in resource-limited or geographically distant settings to access expertise that would otherwise be unavailable.[8,9] Complementing these approaches with interinstitutional POCUS case conferences and expert-led grand rounds can further enrich learning by exposing clinicians to diverse interpretations and real-world decision-making. At a broader level, nephrology and critical care professional societies, particularly those with an international reach, are well positioned to provide leadership by developing standardized, accessible online curricula, facilitating cross-institutional collaborations, and supporting short-term observerships or fellowships to promote equitable skill development across settings.

At the same time, emerging tools such as artificial intelligence offer opportunities but should be integrated cautiously.[10] AI-assisted guidance can support probe positioning and basic interpretation, lowering the barrier to entry, but current systems remain limited in handling complex hemodynamic scenarios, multimodal integration, and clinical nuance. Overreliance risks reinforcing superficial pattern recognition without true understanding. Therefore, AI should be framed as an adjunct to training rather than a substitute for competency.

POCUS has the potential to transform nephrocritical care, but its impact depends on how it is used. The goal is not simply to expand its use, but to ensure that its application reflects true understanding. In this regard, the probe itself is only a tool; its value lies in the judgment of the clinician who uses it.

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