What Is the Role of AI in Cardiac Imaging and Echocardiography?

Rasit Dinc

Rasit Dinc Digital Health & AI Research

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Abstract

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Introduction

The integration of artificial intelligence (AI) in clinical medicine is revolutionizing the healthcare industry, rapidly reshaping the standards for patient-centered care and medical research. In cardiovascular medicine, AI has significantly influenced the standards for diagnosing diseases, delivering treatments, and predicting future risks. The technological advancements in various cardiac imaging modalities make the field ripe for AI integration. Specifically, point-of-care ultrasound (POCUS) has rapidly expanded into various clinical settings due to the improvements in probe size and functionality. The portability of POCUS devices offers real-time imaging results that can facilitate immediate diagnosis and management of many pathologic conditions. However, a significant barrier limiting POCUS use is the need for operator expertise in image acquisition and interpretation, which is critical for accurate and efficient medical decision-making. Artificial intelligence-enabled POCUS has the potential to assist clinicians in the acquisition and interpretation of diagnostic echocardiogram images to mitigate the variability in operator proficiency [1].

AI-Powered Image Acquisition

Proficiency in image acquisition requires time and resources for extensive training and practice. The demand for experienced cardiac sonographers far exceeds the supply of trained personnel. Consequently, regions with limited echocardiogram availability suffer from healthcare disparities that impact patient outcomes. To address these challenges, advancements in AI-assisted image acquisition have aimed to reduce operator dependency and expand access to ultrasonography. For instance, a deep learning algorithm trained on ultrasound probe movements has been shown to guide nurses with limited ultrasound training to successfully obtain standard echocardiographic images of diagnostic quality [1]. Similarly, a machine learning algorithm has been developed to assist first-year medical students in acquiring key echocardiographic views for left ventricular ejection fraction (LVEF) estimation. With real-time feedback provided by the AI-enabled device, students could obtain images of sufficient quality for accurate LVEF assessment [1].

Enhanced Image Interpretation and Diagnostics

Several key studies also addressed inter-observer variability in echocardiographic measurements. The left ventricular ejection fraction, a defining parameter in echocardiography, conventionally requires manual tracing of the ventricular endocardial borders or, less reliably, visual estimation for quantitative assessment. These methods are prone to diagnostic inaccuracies, which makes it challenging to rely on LVEF to guide management. Several deep learning algorithms have proven to be highly accurate and precise in LVEF measurements. For example, one machine learning algorithm, AutoLV, was able to generate automated EF measurements with similar accuracy to manual counterparts, with no variability in the computerized measurements and in a fraction of the time [1].

Deep learning algorithms have also been applied to highly complex challenges, including disease detection. Cardiac amyloidosis, a life-threatening condition where an abnormal protein builds up in the heart, is often missed because its symptoms and imaging features can be similar to other heart conditions. An AI model developed by Mayo Clinic and Ultromics has shown high accuracy in screening for cardiac amyloidosis, with 85% sensitivity and 93% specificity [2]. This AI model performed better than traditional clinical and transthoracic echo-based screening methods, providing clinicians with stronger insights on which to base decisions for further confirmation tests [2].

Workflow Optimization and Challenges

Beyond image acquisition and interpretation, AI is also being leveraged to optimize the entire workflow of cardiac imaging. Large language models, trained on extensive medical literature and structured reports, can generate coherent and standardized content, potentially streamlining echocardiogram reporting and reducing clinician workload [1]. However, the widespread adoption of AI in cardiac imaging faces significant challenges. These include concerns around algorithm generalizability, bias, explainability, clinician trust, and data privacy. Addressing these issues through standardized development, ethical oversight, and clinician-AI collaboration will be critical to safe and effective implementation [1].

The Future of AI in Cardiac Imaging

Looking ahead, emerging innovations such as autonomous scanning, real-time predictive analytics, tele-ultrasound, and patient-performed imaging underscore the transformative potential of AI-enabled POCUS in reshaping cardiovascular care and advancing equitable healthcare delivery worldwide. The continued development and validation of AI tools will undoubtedly lead to more accurate, efficient, and accessible cardiac imaging for patients everywhere.

References

[1] East, S., Wang, Y., Yanamala, N., Maganti, K., & Sengupta, P. P. (2025). Artificial Intelligence-Enabled Point-of-Care Echocardiography: Bringing Precision Imaging to the Bedside. *Current Atherosclerosis Reports*, *27*(1), 70. https://pmc.ncbi.nlm.nih.gov/articles/PMC12234643/

[2] Mayo Clinic. (2025, July 9). *AI-enhanced echocardiography improves early detection of amyloid buildup in the heart*. Mayo Clinic News Network. https://newsnetwork.mayoclinic.org/discussion/ai-enhanced-echocardiography-improves-early-detection-of-amyloid-buildup-in-the-heart/
