ICU
MANAGEMENT & PRACTICE

AI-Guided Lung Ultrasound Performed by Non-Experts

Lung ultrasound (LUS) is increasingly used for diagnosing and monitoring shortness of breath due to its portability, low cost, and lack of radiation exposure. It provides real-time lung assessments and is more accurate than chest radiography in detecting conditions such as pneumonia, pneumothorax, pleural effusion, and pulmonary oedema. LUS is particularly useful in emergency departments, intensive care units, and outpatient settings but requires hands-on training and technical skills.

Artificial intelligence (AI), especially deep learning, has shown promise in improving ultrasound image acquisition and interpretation, similar to its application in cardiac ultrasound. While current AI research has focused on expert users, there is a need for AI tools to assist non-expert users in obtaining diagnostic-quality LUS images.

A new study evaluates AI's ability to guide trained healthcare professionals (THCPs) with limited LUS experience in acquiring high-quality images compared to expert users. In this study, participants aged 21 and older with shortness of breath were recruited from four clinical sites. Each participant underwent two LUS exams: one performed by a THCP using AI guidance and the other by a LUS expert without AI. THCPs, including medical assistants, respiratory therapists, and nurses, received standardised AI training for LUS image acquisition before the study.

Lung Guidance AI software utilises deep learning algorithms to guide the acquisition of LUS images and annotate B-lines. It follows an 8-zone LUS protocol and automatically captures diagnostic-quality images.

The primary endpoint of the study was the proportion of THCP-acquired LUS exams deemed diagnostic-quality, as determined by a panel of five masked expert LUS readers who conducted remote reviews and ground truth validation.

The intention-to-treat analysis included 176 participants (46.0% female, mean age 63 years, mean body mass index 31). Overall, 98.3% of THCP-acquired LUS studies were of diagnostic quality, with no statistically significant difference compared to LUS expert–acquired studies.

When assisted by AI guidance software, the THCP group acquired high-quality LUS studies 98.3% of the time, exceeding the 80% benchmark for clinical assessment. This suggests that LUS users with varying levels of experience can produce diagnostic-quality images with the help of AI, which was consistent across diverse patient demographics and BMIs. The AI guidance did not reduce the performance of ultrasound-trained physicians. Although the median acquisition time for AI-aided LUS (15 minutes) was longer than that reported in previous studies (6–8 minutes), the difference may be less significant in resource-limited settings.

The THCP group acquired high-quality images comparable to the expert group in 7 of 8 zones, performing better than experts in zone 6, a region traditionally difficult to image. The study highlights that AI can enhance visualisation and improve lung examination, especially for conditions like lingular pneumonia. While much of the current literature on AI in LUS focuses on artifact identification, this study emphasises AI's role in image acquisition guidance, addressing a key challenge in LUS practice.

Unlike more complex robotic systems, AI-assisted image capture can be implemented on existing ultrasound machines, providing a cost-effective, faster solution with human oversight. This AI solution could significantly improve diagnostic accuracy and patient care by enabling healthcare professionals at all levels to perform LUS examinations.

In conclusion, THCPs using AI guidance achieved performance comparable to expert LUS users in acquiring diagnostic-quality images after brief training. This technology could expand diagnostic capabilities to underserved areas with limited access to expert personnel. Future research should focus on integrating AI algorithms for image guidance and auto-capture, along with advanced capabilities to detect B-lines, pleural effusions, consolidations, and pleural line abnormalities. Validation of these integrated guidance and interpretation algorithms in clinical practice settings is crucial to assess their real-world effectiveness and usability.

Source: JAMA Cardiology
Image Credit: iStock

Published on : Mon, 27 Jan 2025