Use of artificial intelligence for point-of-care echocardiographic assessment of left ventricular ejection fraction among COVID-19 patients

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Background: The association between COVID-19 infection and the cardiovascular system has been well described. Isolation precautions limit the use of formal echocardiography in this setting. Artificial intelligence (AI) utilization using a hand-held device in these patients can be a reliable tool for left ventricular ejection fraction (LVEF) assessment.

Aims: To prospectively investigate the accuracy of AI-base tool for LVEF assessment using a hand-held echocardiogram in patients with COVID-19.

Methods: From April-28 through July-26, 2020, consecutive patients with COVID-19 underwent a real-time LVEF assessment within 48-h of admission using a hand-held echocardiogram evaluation (Vscan Extend) equipped with LVivoEF, an AI-based tool that automatically evaluates LVEF. The examinations were further analyzed off-line by a blinded fellowship-trained echocardiographer for LVEF as a gold standard.

Results: Among 42 patients, 21 (50%) were male (aged 53.3±17.8 years, mean BMI 27.6±5.1 kg/m^2). Seven (16.7%) patients couldn't turn on their left side and three (7.1%) couldn't maintain effective communication. The mean length of each echocardiogram study was 6.8±2.2 minutes, battery usage was 13.4±4.9%, and mean operator-to-patient proximity was 64.5±9.3 cm.

A fair to good correlation was demonstrated between the AI and the echocardiographer LVEF assessment (Pearson's correlation of 0.691, $p < 0.001$). An almost perfect agreement was demonstrated between the AI and the echocardiographer for LVEF using a threshold of 45% (kappa=0.806, $p < 0.001$).

The sensitivity of focused echocardiogram for 45% LVEF threshold is 85.7%, specificity is 97.1% with a PPV of 85.7% and NPV of 97.1%.

Conclusions: An AI-based algorithm incorporated into an existing hand-held echocardiogram device can be reliably utilized as a decision support tool for automatic real-time LVEF assessment among COVID-19 patients.