Abstract: 541

Turning novices into experts: can artificial intelligence transform echocardiography training?

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BACKGROUND
Developing new training tools for TransThoracic Echocardiography (TTE) is more important than ever, as the use of ultrasound expands with the advent of mobile devices, both reducing costs and increasing the number of sites and operators. Two major challenges are the lack of experts to meet the growing demand for training and the risk of unnecessary examinations and misdiagnosis by users who lack proper training.

PURPOSE
To evaluate Artificial Intelligence (AI)-assisted TTE for assessing and improving novices' echocardiography skills.

METHODS
AI-assisted TTE relies on real-time analysis of the ultrasound stream by AI algorithms (e.g. for automated view recognition) to provide adaptive feedback to the user. It was compared to standard TTE in a prospective study including 40 medical students with no prior ultrasound experience ("novices") and 40 healthy volunteers of varying echogenicity. Novices received a standardized 10-minute presentation of the basic machine controls and requirements of an apical 4-chamber (AP4) acquisition. They were then asked to perform three consecutive AP4 acquisitions on a randomly assigned healthy volunteer: 1) "initial" standard TTE, 2) AI-assisted TTE and 3) "repetition" standard TTE, with a maximum of 3 minutes per acquisition. Additionally, for reference purposes, an AP4 acquisition was performed by an expert. Both the performance over time and the final acquisition performance were assessed by an AI-based AP4 quality score and expressed relatively to the reference score. The suitability for clinical use was assessed by an expert on a 0-3 semi-quantitative scale.

RESULTS
Kaplan-Meier analysis of the probability to match reference performance over time (see left part in figure below) validated the positive and significant contribution of AI-assisted TTE wrt initial TTE (median time = 16.1s vs. 45.7s, p=0.026). There was also a positive, though non-significant, contribution wrt repetition TTE (median time = 25.7s, p=0.20), while the difference between standard TTEs was non-significant (p=0.24). A majority of novices (70%, resp. 72.5%) improved their final acquisition with AI-assisted TTE wrt initial TTE, resp. repetition TTE. The final performance gain (81.7 ± 29.7% vs. 60.8 ± 40.4%, resp. 70.4 ± 33.9%, see right part in figure below) was shown to be significant by Wilcoxon matched-pair signed-rank test (p<0.001, resp. p=0.003). There was no significant difference between standard TTEs (p=0.34). AI-assisted TTE was also associated with improved suitability for clinical use (2.53 ± 0.79 vs. 2.00 ± 1.03, resp. 2.08 ± 0.98). Among these acquisitions, 50% were found fully suitable for clinical use (vs. 22.5%, resp. 27.5%).

CONCLUSION

AI-assisted TTE can assess and improve novices' echocardiography skills. Developing and embedding AI-assistance in ultrasound devices could be a cost-effective way to support the training of novices and key to acquisition standardization.
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