Reducing the burden of inconclusive smart-device single-lead ECG tracings via a novel artificial intelligence algorithm

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Introduction: Multiple smart-devices capable of automatically detecting atrial fibrillation (AF) based on single-lead electrocardiograms (SL-ECG) are presently available. The rate of inconclusive tracings by the manufacturers’ algorithms is currently too high to be clinically useful. Reliable artificial intelligence (AI) algorithms may be valuable for managing the large amount of data created by smart-devices.

Method: This is a prospective, observational study enrolling patients presenting to a cardiology service at a tertiary referral center. We assessed the clinical value of applying a smart-device agnostic AI-based algorithm for detecting AF from four different commercially available smart-devices (AliveCor KardiaMobile, Apple Watch 6, Fitbit Sense, and Samsung Galaxy Watch3). Patients underwent a nearly simultaneous 12-lead ECG and four smart-device SL-ECGs. Single-lead ECGs were exported as PDF files and converted into Scalable Vector Graphics (SVG) images for signal extraction. The novel AI-algorithm was compared with each manufacturer’s algorithm.

Results: We enrolled 206 patients (31% female, median age 64 years). AF was present in 60 patients (29%). Sensitivity and specificity for the detection of AF by the novel AI-algorithm vs. manufacturer algorithm were: 88% vs. 81% (p=0.34) and 97% vs. 77% (p<0.001) for the AliveCor KardiaMobile, 86% vs. 81% (p=0.45) and 95% vs. 83% (p<0.001) for the Apple Watch 6, 91% vs. 67% (p<0.001) and 94% vs. 82% (p<0.001) for the Fitbit Sense, and 94% vs. 80% (p<0.001) for the Samsung Galaxy Watch3, respectively. In addition, the proportion of SL-ECGs with an inconclusive diagnosis (1.2%) was significantly lower for all smart-devices using the AI-based algorithm compared to manufacturer’s algorithms (14-17%) p<0.001.

Conclusion: A novel AI-algorithm reduced the rate of inconclusive SL-ECG diagnosis massively while maintaining sensitivity and improving the specificity compared to the manufacturers’ algorithms.