e-Cardiology/Digital Health, Public Health, Health Economics, Research Methodology – e-Cardiology/Digital Health, Artificial Intelligence (Machine Learning, Deep Learning)

Comparison of QT interval readings between smartwatch ECG combined with artificial intelligence and 12-lead ECG in subjects hospitalized for antiarrhythmic drug initiation and follow-up

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Background/Introduction: Class III antiarrhythmic drugs (AADs) are effective for the maintenance of sinus rhythm (SR) in subjects with atrial fibrillation (AF). However, several require initial hospitalization for QT interval monitoring using the 12-lead ECG.
Purpose: The purpose of this study was to evaluate the feasibility of using a smartwatch single lead ECG combined with a deep learning algorithm for routine QT interval determination in the context of AAD initiation.
Methods: A deep learning model was developed using smartwatch and Holter ECG recordings to estimate corrected QT intervals. To evaluate the performance of this model, we carried out a prospective study on subjects hospitalized for initiation of sotalol and/or dofetilide. Subjects recorded near simultaneous (maximal 2 minutes apart) smartwatch ECGs (Apple Watch Series 6) and 12-lead ECG (Mac 5500 HD ECG or GE Carescape B450) right before and 2-3 hours after drug administration twice a day for 2-3 days. Blinded double annotation followed by adjudication of disagreement provided a reference heart rhythm (NSR or AF) and QTc interval. The tangent method was used for QTc interval determination. Bland-Altman analysis was performed to assess the agreement between QTc measures.
Results: Fifty subjects (mean age 67.4±10.9 years, 64% male) were enrolled in the study from February 2022 to October 2022. Out of 386 monitoring visits, 321 near simultaneous pairs of ECGs were collected with a mean delay of +15.0±41.1s for the smartwatch ECG compared to the 12-lead ECG. Overall, a mean QTcF reference value of 419.9±34.0 ms was observed (435.2±38.4 ms for QTcB, r=0.83 between annotators[BL2]). Among the 139 pairs with 12-lead ECG found in NSR, we observed a mean QTcF difference of +19.7 ms and limits of agreements equal to -21.5 ms and 60.8 ms, with AI-facilitated measurement. In comparison, a mean QTcF difference of +22.5 ms and limits of agreements equal to -23.8 ms and 68.8 ms were observed for manual readings of smartwatch ECGs instead.
Conclusion(s): Our findings suggest that a smartwatch ECG deep learning approach can estimate the QT interval with a fair agreement compared to standard 12-lead monitoring during AAD initiation. This measurement method appears to be at least as accurate as manual measurements on smartwatch ECGs. With further validation, the smartwatch-based automatic detection of QT interval prolongation, could be used for a faster, safe, and extended outpatient QT interval monitoring.

Bland-Altman plots