Clinical Feasibility and Reliability of Automated Cardiac Interval Assessment from Smartwatch Electrocardiogram in Lung Cancer Patients

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Aims: Cancer therapies are increasingly associated with cardiovascular complications, including atrial fibrillation, which may remain clinically silent while increasing morbidity and mortality. Wearable devices acquiring single-lead electrocardiograms (ECGs) offer an opportunity for continuous remote monitoring; however, the reliability of derived cardiac interval measurements remains insufficiently validated in the context of cardiotoxicity monitoring. We develop and evaluate a deep learning framework for the automated estimation of PR and QTc intervals from single-lead smartwatch ECG recordings in oncological patients.

Methods: Single-lead ECG recordings acquired daily for 12 weeks with a commercially available smartwatch were analyzed in 40 patients with lung cancer. ECG segmentation was performed using a U-Net–based deep learning architecture. Performance was compared with the publicly available NeuroKit2 algorithm. Preliminary external validation was performed using four paired recordings acquired in close temporal proximity from smartwatch single-lead ECG and standard 12-lead ECG.

Results: The proposed approach demonstrated superior accuracy for PR and QTc interval estimation compared with NeuroKit2 (mean absolute error (MAE) 14.3 ms vs 24.5 ms and 13.6 ms vs 19.1 ms). This analysis was performed on only four paired recordings, in which the 12-lead ECG signals used as reference were collected in close temporal proximity with the corresponding single-lead acquisitions. For a more general evaluation across all the patients, Pearson's correlation coefficients between single-lead and 12-lead ECG-derived intervals were computed without enforcing temporal proximity between recordings. For the PR interval the correlation was 0.205 for the proposed model and 0.539 for Neurokit2, while for QTc interval it was 0.467 and 0.344, respectively.

Conclusions: Deep learning–based segmentation of smartwatch ECG signals enables accurate and clinically meaningful estimation of PR and QTc intervals. These findings support the feasibility of automated interval quantification from wearable ECG devices and highlight their potential in scalable remote cardiotoxicity monitoring in oncology populations at increased arrhythmic risk.