A QT Interval Inaccuracy Index for Highly Automated TQT Studies

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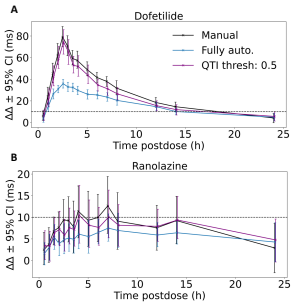
Aims: Thorough QT studies (TQT) evaluate the QT prolonging effect of drugs and consequently their potential proarrhythmic risk. These studies require meticulous ECG analysis; automatic QT interval measurements are usually overread by experts and adjusted if necessary. Our study aimed to provide a QT Interval Inaccuracy index (QTI) to automatically identify inaccurate automated QT interval estimations. **Methods**: 12-lead ECG recordings and their manual interval measurements were obtained from 2 TQT study databases in PhysioNet (ECGDMMLD and ECGRDVQ). We derived 268 single-lead features that might relate to the accuracy of automatic QT intervals computed by convolutional neural network (CNN) based QT estimators previously trained on our own ECG database. Using these features (inter-estimator QT variability metrics, CNN-derived ECG characteristics, estimator confidence levels), classification of accurate and inaccurate automatic QT intervals was performed with a regularized logistic regression algorithm trained on the ECGDMMLD database. The QTI was then defined for each ECG recording as the average probability of the QT being inaccurate across the 12 leads ($0 \leq \text{QTI} \leq 1$). **Results**: With a QTI threshold of 0.5, 44% inaccurate automatic QT intervals were identified in the ECGRDVQ database. Better estimates of the drug-induced QTc changes were obtained by correcting these QT intervals. The QTc prolongation obtained with this semi-automated method differed from the manual one by on average 2.9 ms (std = 1.2 ms) across the 4 drugs studied, compared to 23.2 ms (std = 20.0 ms) for the fully automated method. **Conclusion**: The QTI allows a more accurate and robust analysis of ECG signals from TQT studies. The proposed QTI technique is closely linked to the performance of the CNN-based QT estimator; improvement of the latter would require retraining of the QTI.



Drug-induced placebo-corrected QTc changes estimated with 3 QT measurement methods.