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| **Abstract:** |  |
| In this study, a linear parametric modeling technique was applied to model ventricular repolarization (VR) dynamics. Three features were selected from the surface ECG recordings to investigate the changes in VR dynamics in healthy and cardiac autonomic neuropathy (CAN) participants with diabetes including heart rate variability (calculated from RR intervals), repolarization variability (calculated from QT intervals), and respiration [calculated by ECG-derived respiration (EDR)]. Surface ECGs were recorded in a supine resting position from 80 agematched participants (40 with no cardiac autonomic neuropathy (NCAN) and 40 with CAN). In the CAN group, 25 participants had early/subclinical CAN (ECAN) and 15 participants were identified with definite/clinical CAN (DCAN). Detecting subclinical CAN is crucial for designing an effective treatment plan to prevent further cardiovascular complications. For CAN diagnosis, VR dynamics was analyzed using linear parametric autoregressive bivariate (ARXAR) and trivariate (ARXXAR) models, which were estimated using 250 beats of derived QT, RR, and EDR time series extracted from the first 5 min of the recorded ECG signal. Results showed that the EDR-based models gave a significantly higher fitting value (p <; 0.0001) than models without EDR, which indicates that QTRR dynamics is better explained by respiratory-information-based models. Moreover, the QT-RR-EDR model fitting values gradually decreased from the NCAN group to ECAN and DCAN groups, which indicate a decoupling of QT from RR and the respiration signal with the increase in severity of CAN. In this study, only the EDR-based model significantly distinguished ECAN and DCAN groups from the NCAN group (p <; 0.05) with large effect sizes (Cohen's d > 0.75) showing the effectiveness of this modeling technique in detecting subclinical CAN. In conclusion, the EDRbased trivariate QT-RR-EDR model was found to be better in detecting the presence and severity of CAN than the bivariate QTRR model. This finding also establishes the importance of adding respiratory information for analyzing the gradual deterioration of normal VR dynamics in pathological conditions, such as diabetic CAN. | |