

Assessment of the effect of fibrillatory waves in the analysis of spatial heterogeneity of ventricular repolarization

Javier Saiz-Vivo*, Valentina D A Corino, Massimo W Rivolta, R Sassi, Luca T Mainardi

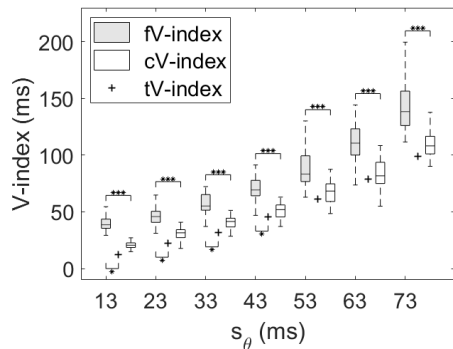
Medtronic: Bakken Research Center, Maastricht, NL

Aims: This study aimed to assess the effect the presence of f-waves may have on the \mathcal{V} -index, an ECG-based estimator of the standard deviation of ventricular myocytes' repolarization times (s_{θ}), as a preliminary process for the study of Atrial Fibrillation (AF).

Methods: 12 lead ECGs were generated using synthetic T-waves and real QRS templates extracted from clinical data. The T-waves were simulated using a re-implementation of the forward ECG model creating seven 300 T-waves bundles with increasing values of s_{θ} . The \mathcal{V} -index ($t\mathcal{V}$ -index) was preliminarily compared to the values of s_{θ} to assess the validity of the index as a measure of repolarization times. Then, the $t\mathcal{V}$ -index was compared to the \mathcal{V} -index calculated after 50 sets of real f-waves randomly extracted from AF patients were added to the ECGs ($f\mathcal{V}$ -index) and after the f-waves were removed ($c\mathcal{V}$ -index). Student's t-test was used to ensure firstly, a significant difference (p -value ≤ 0.05) between the $f\mathcal{V}$ -index and the $c\mathcal{V}$ -index as well as between the $f\mathcal{V}$ -index and the $t\mathcal{V}$ -index and secondly, a non-significant difference (p -value > 0.05) between the $c\mathcal{V}$ -index and the $t\mathcal{V}$ -index.

Results: A strong correlation ($r = 0.99$, p -value < 0.001) was shown when comparing the $t\mathcal{V}$ -index and s_{θ} , validating the \mathcal{V} -index computation method. Regarding the comparison between the $f\mathcal{V}$ -index, the $c\mathcal{V}$ -index and the $t\mathcal{V}$ -index: the $f\mathcal{V}$ -index had highly significant differences (***, p -value < 0.001) with the $c\mathcal{V}$ -index and significant differences (*, p -value < 0.05) with values of the \mathcal{V} -index below 53.3 ms, while the $c\mathcal{V}$ -index and the $t\mathcal{V}$ -index had non-significant differences for the whole range of values studied.

Conclusion: During AF the T-waves get corrupted by f-waves, typical of AF, making it meaningful to implement the cancellation of f-waves when applying the \mathcal{V} -index to ECG during AF.



\mathcal{V} -index comparison: $f\mathcal{V}$ -index, $c\mathcal{V}$ -index and $t\mathcal{V}$ -index.