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Methodological and Mechanistic Considerations in Local Repolarization Mapping

Job Stoks, MSc¹, Peter Langfield, PhD^{2,3}, and Matthijs J.M.
Cluitmans, MD, PhD¹

¹CARIM, Maastricht University Medical Center, Maastricht, the
Netherlands

²Inria Bordeaux–Sud Ouest, Talence, France

³IHU Liryc, Fondation Bordeaux Université, Pessac, France

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With interest, we read the recent publication by Yanagisawa et al, [1] on their investigation of activation and repolarization characteristics in Brugada syndrome using electroanatomical contact mapping. The authors elegantly demonstrate activation abnormalities and address interesting questions regarding the pathophysiological basis of Brugada syndrome. They also attempt to study repolarization from unipolar electrograms (UEGs), using methodology employed by others as well. However, we have fundamental methodological concerns regarding this approach.

Previous work [2] has demonstrated that applying a 2 Hz high-pass filter by the CARTO system (J&J MedTech) to unipolar contact electrograms significantly distorts local T-wave morphology, end and amplitude, and consequently corrupts derived metrics (Figure 1).

Therefore, the variability in local T-wave duration reported by Yanagisawa et al [1] is likely an artefact of inappropriate filtering rather than a pathophysiological feature of Brugada syndrome. Furthermore, the physiological rationale behind “local T-wave duration” seems unclear; the end of unfiltered local T waves coincides with all unipolar contact electrograms because unipolar UEGs capture both local and remote activity. [3] Moreover, we previously showed that only local T-wave upslope, and not downslope (as in Figure 2C of their paper [1]), reflects the end of local repolarization in the UEG. [4] Any electrographic inscription after this upslope is thus from remote origin.

As this filtering also affects the moment of local T-wave upslope, it can introduce significant inaccuracies in the determination of local repolarization time [2] (and thus also activation-repolarization interval [ARI]); see Figure 1.

It is commendable that these authors and the field of cardiac electrophysiology are exploring local repolarization mapping and its application in un-

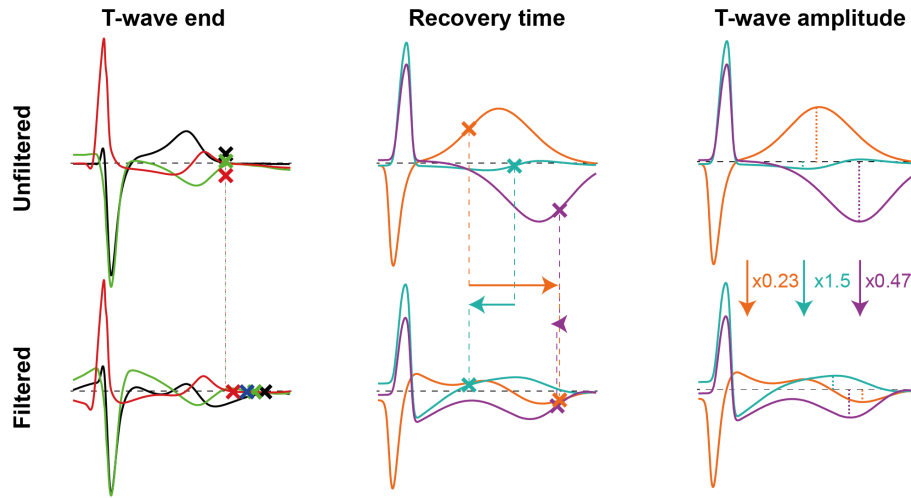


Figure 1: (Left) Effects on local T-wave end (indicated by X). (Middle) Effects on local repolarization time (indicated by X). (Right) Effects on T-wave amplitude (dotted lines). Adapted from Langfield et al. [2]

Understanding pathophysiological mechanisms, such as those underlying Brugada syndrome. Although we share enthusiasm for these promising explorations, it is crucial to emphasize the importance of rigorous physiology-based methodological considerations. Repolarization mapping requires distinct experimental/clinical protocols from those used for activation or voltage mapping.

References

- [1] Yanagisawa S, Inden Y, Goto T, et al. Visualization of repolarization heterogeneity in Brugada syndrome: a quantitative analysis of unipolar electrogram T-wave. *J Am Coll Cardiol EP*. 2023;9:2401–2411.
- [2] Langfield P, Feng Y, Bear LR, et al. A novel method to correct repolarization time estimation from unipolar electrograms distorted by standard filtering. *Med Image Anal*. 2021;72:102075.
- [3] Potse M, Vinet A, Opthof T, Coronel R. Validation of a simple model for the morphology of the T wave in unipolar electrograms. *Am J Physiol Heart Circ Physiol*. 2009;297(2):H792–H801.
- [4] Stoks J, Bear LR, Vijgen J, et al. Understanding repolarization in the intracardiac unipolar electrogram: a long-lasting controversy revisited. *Front Physiol*. 2023;14:1158003.