Estimation of Recurrent Areas of Fast Activation in AF from ECGI

C Fambuena-Santos[1,2], C Herrero-Martín[1], I Hernández-Romero[1], AM Climent[1,2], MS Guillem[1,2]

[1]ITACA Institute, Universitat Politècnica de València, Valencia, Spain
[2]Corify Care SL, Madrid, Spain

Identifying fast activation areas during AF is still challenging. Endocardial mapping only can provide sequential measurements that do not capture AF variability and take a long time to record. Recently, ECGI has been proposed as an alternative technology to measure the atrial activation frequency through the instantaneous Fourier transform. This technique allows a fast identification of the fastest activation area (FAA). Yet, artifacts from signal acquisition and the intrinsic variability of AF challenge the accuracy of the FAA location. This study evaluates a methodology to identify recurrent areas with fast activation patterns (RAFA). We compared this technique with the traditional highest dominant frequency (HDF) computed from Welch`s periodogram using time variant AF simulations and realistic electrical noise conditions.

Our findings reveal that RAFA significantly outperforms the traditional HDF area. While the HDF method's sensitivity and specificity fluctuated with signal to noise ratios—showing mean sensitivities of 48.2% ± 44.3% at 20 dBs, 46.8% ± 63. 5% 10 dBs, and 31.1% ± 68.0% 3 dBs —the RAFA approach demonstrated robustness with higher and more consistent mean sensitivities of 60.7% ± 33. 2%, 55.0% ± 40. %5, and 51.0% ± 19.5%, with similar sensitivity values. These results demonstrate how RAFA can identify areas driving AF episodes robustly and more accurately than HDF.

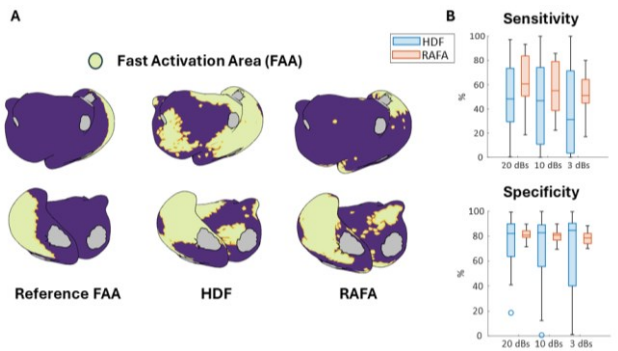

Figure 1. A) Example comparison of fast activation area (FAA) estimation in one simulation. B) Global sensitivity and specificity comparison between the traditional HDF and RAFA methods in all the simulations.