Spatiotemporal Behaviour of Human Persistent Atrial Fibrillation from Long-duration Recordings

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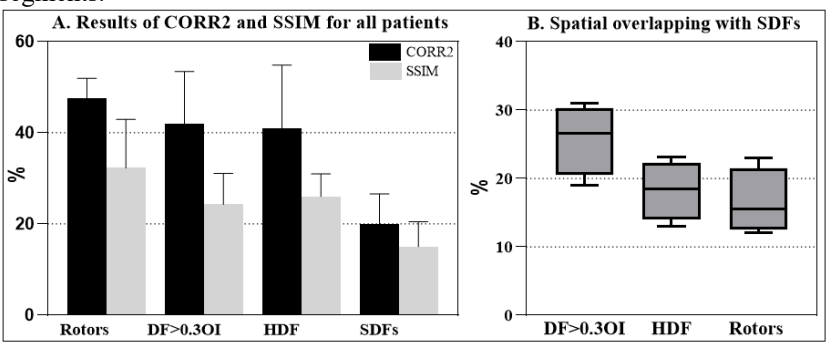
Aims: Identifying ablation targets in persistent atrial fibrillation (persAF) remains challenging. This study aims to investigate the spatiotemporal stability of AF drivers within 5 min recordings of virtual atrial electrograms (VEGMs).
Methods: 2048-channel VEGMs (EnSite Array, Abbott) were analysed for 5 patients undergoing persAF substrate-guided catheter ablation. Following QRST subtraction, dominant frequency (DF, 4-10 Hz) and organization index (OI) were identified using fast Fourier transform (4 s windows; 50% overlap). Areas with DF within 0.25 Hz of the absolute maximum out of the 2048 points were defined as highest DF (HDF). Stable DFs (SDFs) were defined as DF patterns with the highest recurrence over consecutive time windows. Rotors were defined as phase singularities (PSs) which last for at least 100 ms. The 5 min VEGMs were divided into segments of 30, 60, 90 and 120 s. Two indices - 2D correlation coefficients (CORR2) and structural similarity index (SSIM) - were used to measure the similarity among maps (SDFs, DF selected by certain OI > 0.3, HDF and Rotors) at different time segments.
Results: Rotor density maps were found to have the highest level of similarity over time, thereby higher temporal stability, followed by DF> 0.3 OI, HDF and SDFs, respectively (Figure 1A). DF > 0.3 OI are the most spatially overlapped with the SDFs sites (Figure 1B). Both similarity and spatial overlapping of individual density maps for all AF driver tested increase with longer segments.



Conclusions: There is spatial overlapping between persAF drivers density maps, therefore combining ablation strategies might lead to better identification of ablation targets for persAF. For all AF drivers tested, as time duration increases temporal stability improves.