Dominant Frequency Variability Mapping for Identifying Stable Drivers during Persistent Atrial Fibrillation using Non-Contact Mapping

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Introduction – Dominant frequency (DF) mapping has been shown to be spatiotemporally unstable in persistent AF (persAF). DF variability (DFV) has been shown to correlate with the spectral organisation index (OI). We aim to assess DFV at ablation sites between patients who terminated persAF and non-terminating patients.

Methods – 10 persAF patients undergoing LA ablation were enrolled. 4 patients terminated (3 flutter, 1 sinus rhythm) after ablating highest DFs, but before PVI. 2048-channel virtual electrograms (Ensite Array) were analysed in Matlab. After QRST subtraction, fast Fourier transform was used to calculate DF and organisation index (OI) with sliding 2-second windows (0.1-second step). DF variability index (DFVI) was proposed to quantify DF temporal stability. Mock ablation targets were identified (DFVI < 0.15) and the percentage of region actually ablated were computed.

Results – 1500 and 1970 lesion nodes were ablated in termination patients (N=4) and non-termination (N=6). The lesion DFs were lower in termination than non-termination (5.54 ± 0.32 vs 6.19 ± 0.41 Hz, p< 0.0001). The OIs in lesions were slightly higher in termination (0.48 ± 0.07 vs 0.45 ± 0.07, p<0.0001). Lesion DFVIs were significantly lower in termination (0.25 ± 0.21 vs 0.45 ± 0.20, p< 0.0001). The percentage of regions defined as mock targets that were ablated was higher in termination 17.9% [IQR 15.0 - 27.4%] than in non-termination 8.2% [IQR 3.9-14.0%] (p=0.04).

Conclusions – Ablation sites in termination patients showed higher OI and DF spatiotemporal stability, with more DFVI targets ablated in the termination group. Atrial regions with higher temporal stability and organisation may offer more precise locations of stable focal drivers and may lead to higher success in AF termination following ablation.