PA24 Alterations in atrial excitation patterns revealed by wavelet analysis a year after successful ablation for paroxysmal atrial fibrillation

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Introduction: Atrial fibrillation (AF) is the most frequently encountered cardiac arrhythmia, affecting about 2% to 3% of the population. Pulmonary vein (PV) electrical isolation is a therapeutic option for patients with drug refractory paroxysmal AF (PAF).

Purpose: P-wave morphology analysis can reveal information regarding abnormal propagation of the electrical activity on the atrial substrate. The aim of this study is to investigate mid-term changes in atrial excitation patterns following PV ablation.

Methods: We studied 31 patients (17 male, mean age 56.3 ± 8.1 years) who underwent PV ablation (20 with radiofrequency ablation, 11 with cryoablation) due to drug refractory PAF. Electrocardiographic (ECG) recordings were obtained during sinus rhythm before and several months (10.2 ± 1.97) after PV ablation with a 3-channel digital recorder for 10 minutes at a sampling rate of 1000 Hz. The Morlet wavelets analysis was applied over the P wave ECG recordings using a custom made software. Wavelet parameters expressing the mean and maximum energy (μV^2) of P wave were calculated in the three orthogonal leads (X, Y, Z) and in the vector magnitude (VM), in three frequency bands (high: 161-200 , mid: 91-160 and low: 50-90 Hz). Wilcoxon signed-rank test was used for comparing continuous variables, while $p<0.05$ was considered significant.

Results: Ten months post PV ablation, both mean and max energies at high frequency band were significantly lower in all axes, while wavelet energies where also lower at mid range band in X and Y axes. No significant changes were noted at low band. Furthermore, P wave duration was shorter in all axes (X: 120.7 ± 7.3 vs $113,5\pm7.2$, p: 0.024, Y: 130.4 ± 7.0 vs 109.5 ± 5.3, p: 0.014, Z: 125.8 ± 7.2 vs 109.2 ± 6.1, p: 0.009, VM: 125.3 ± 5.9 vs 115.6 ± 7.5, p: 0.030).

Conclusion: P-wave wavelet analysis identifies spectrotemporal alterations in atrial excitation patterns, remaining several months after successful PV ablation.

High freq. band	Before PV Ablation	Follow-up	p	Mid freq. band	Before PV Ablation	Follow-up	p
mean (X)	11.0±7.9	3.5±1.9	0.001	mean (X)	17.5±11.5	9.7±4.2	0.030
mean (Y)	7.9±3.9	3.3±1.2	<0.001	mean (Y)	14.8±7.2	8.4±3.8	0.017
mean (Z)	6.2±3.5	3.7±0.9	0.016	mean (Z)	13.1±6.4	10.5±4.0	0.129
mean (VM)	4.4±1.1	2.4±0.4	<0.001	mean (VM)	7.7±2.0	6.6±1.8	0.098
max (X)	14.9±3.1	10.2±2.1	0.002	max (X)	19.4±3.9	16.3±2.8	0.019
max (Y)	13.7±2.9	11.0±1.8	0.003	max (Y)	19.3±4.0	16.2±3.0	0.021
max (Z)	15.2±5.0	12.3±1.7	0.007	max (Z)	18.8±3.7	18.6±3.3	0.525
max (VM)	11.3±1.3	9.2±0.8	0.003	max (VM)	15.4±1.9	14.3±1.7	0.262

Wavelet parameters before and ten months post PV ablation