Chaotic Activity with Low Frequency Vibration in Fibrillary Waves Predicts AF Recurrence after Cardioversion in Patients with Persistent Atrial Fibrillation

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Background: We hypothesized that mathematical analysis of atrial fibrillary waves may predict recurrence of atrial fibrillation (AF) after cardioversion. Methods: We included 51 patients with symptomatic persistent AF (40 males, 57±8 years). All patients were assessed by holter and echocardiography within 3 months before cardioversion. We extracted only atrial fibrillary waves from V1 lead in holter and measured three parameters including approximate entropy (Aprx), Lyapunov-exponent (Lya) and center-frequency (Cent) to quantify entropy, chaotic activity and frequency, respectively. Recurrence was defined as AF episodes documented by EKG/holter within 30 days after cardioversion. Results: The patients with recurrence (n=25) had higher Lya than those without recurrence (n=22) (0.258±0.157 vs 0.161±0.148, p=0.036), whereas Aprx was not related to recurrence (p>0.05). The patients with Lya>=0.05 had more recurrence than those with Lya<0.05 (64% vs 18%, p=0.008), and the patients with Cent<7.0 had more recurrence than those with high Cent>7.0 (68% vs 35%, p=0.021). All patients were divided into three groups; group A, the patients with high-Lya and low-Cent; group B, those with high-Lya or low-Cent; group C, those with low-Lya and high-Cent. Group A showed more recurrence than group B, and group B did more recurrence than group C. By logistic regression, Lya and Cent scale were strong independent predictors of recurrence (OR=6.9, CI 95% 2.0–23.5, p=0.002).

Conclusions: Chaotic activity with low frequency in fibrillary waves could predict AF recurrence within 1 month after cardioversion.

Keywords: atrial fibrillation, entropy, lyapunov exponent