FIBRILLATION NUMBER BASED ON WAVELENGTH AND CRITICAL MASS IN PATIENTS WHO UNDERWENT RADIOFREQUENCY CATHETER ABLATION FOR ATRIAL FIBRILLATION

Poster Contributions
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Background: It is known that characteristic length, the inverse of conduction velocity, and the inverse of refractory period determine vulnerability to fibrillation (fibrillation number) in in-silico or ex-vivo models. The purposes of this study were to validate the accuracy of the fibrillation number (FibNAF) by in silico atrial modeling and its clinical application in patients with atrial fibrillation (AF) who underwent radiofrequency catheter ablation (RFCA).

Methods: We compared the maintenance duration of AF at various FibNAF values using in-silico 2-dimensional bidomain atrial modeling. Fibrillation wave dynamics simulation was performed for 16 different values of FibNAF determined by randomly generated characteristic length, action potential duration, and conduction velocity. For clinical validation of FibNAF, we compared post-procedural AF inducibility and induction pacing cycle length (iPCL) depending on FibNAF among 60 patients (male 72%, 54±13 years old, paroxysmal AF 82%) who underwent circumferential pulmonary vein isolation (CPVI) for AF rhythm control. Clinical FibNAF was calculated by echocardiographically measured LA dimension, the inverse of conduction velocity and the inverse of atrial refractory period.

Results: Computational simulation results showed a positive correlation between AF maintenance duration and FibNAF (R=0.90, p<0.001). 2. FibNAF was higher in patients with post-procedural AF inducibility (0.296±0.038) than those without (0.192±0.028, p<0.0001). Compared to the patients with negative post-procedural inducibility of AF (n=19), positive inducibility group showed lower E/Em in echocardiography (p=0.004), slower conduction velocity (p<0.001), and higher FibNAF (p<0.001). 3. Among 41 patients with post-procedural AF inducibility, FibNAF had an excellent correlation with iPCL (R=0.94, p<0.0001).

Conclusion: FibNAF based on critical mass and wavelength correlates well with AF maintenance in computational modeling and clinical AF inducibility after CPVI. Additional clinical and computational research is needed to ensure that FibNAF is applicable to individual patients.