

New individualized strategy instructs cryoballoon energy ablation

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Atrial fibrillation (AF), as one of the most common cardiac arrhythmias, is associated with significant morbidity and mortality (1). Pulmonary vein isolation (PVI) remains the cornerstone treatment for paroxysmal atrial fibrillation (PAF) (2). The second generation of cryoballoon (CB2, Arctic Front Advance, Medtronic, Inc., MN, USA) has proven high success rate in PVI for patients with PAF (3,4). The “Fire and Ice trial” confirms cryoballoon ablation is equivalent to radiofrequency ablation with respect to efficacy for the treatment of patients with PAF (5).

Currently 2 bonus freeze cycles were performed at each target PV to enhance the lesion depth during cryoballoon procedure (6). However, previous study presented that 2 bonus freeze cycles were associated with a higher complication rate but similar success rate when compared to 1 freeze–thaw cycle following CB PVI (7). Another study demonstrated that a single 3-minute freeze was equally effective at 1-year follow-up (8). Further studies were necessary to determine the ideal number of bonus application. In order to record left atrium–pulmonary vein disconnection during cryoballoon procedure, an 8-pole circular mapping catheter (Achieve™, Medtronic Inc., MN, USA) is advanced through the lumen of the CB catheter. Faster time to pulmonary vein isolation (TTI) recorded by Achieve™ was an independent predictor for durable PVI (9). It seems that TTI could instruct the CB2 ablation time and optimize the CB2 dosing strategy. On this purpose, K.R. Julian Chun launched the “ICE–T” Trial (Individualized Cryoballoon Energy pulmonary vein isolation guided by real Time pulmonary vein recordings) (10).

The “ICE–T” Trial was the first randomized study to

investigate the safety and efficacy of individualized PVI guided by real-time PV recordings. A total number of 100 patients were randomized into 2 groups: ICE-T group (if TTI <75 s then no bonus freeze) and Control group (acute PVI followed by one bonus freeze). PVI was successfully performed in all patients and 79% of PVs TTI were visualized. The Primary endpoint was not different between 2 groups, but procedure and fluoroscopy time were significantly shorter in the ICE-T group. What’s more, the control group has higher complication rate. A mean TTI >43 s was an independent predictor of recurrent atrial tachyarrhythmia (ATa) when using multivariate analysis.

The “ICE–T” Trial demonstrated the importance of real-time recordings during CB2 ablation and the ICE-T CB2 ablation strategy allowed a faster PAF ablation with no influence of PVI rate. No significant difference was observed on complications between ICE-T group and control group. However, the ICE-T group seemed to have less complication. It is encouraged that the present study firstly confirmed the feasibility of individualized dosing strategy based on TTI.

Pulmonary vein potential (PVP) visualization was prerequisite to develop strategies based on TTI. However, the rate of PVP visualization might be varied among centers. Several studies had suggested that real-time PVI assessment during cryoablation was only observed in <50% of patients (11) because the Achieve™ catheter was remote from PV antrum to offer catheter stability during CB ablation. What’s more, shaft extended 1 cm beyond the balloon tip creating a distance between the Achieve™ catheter and ablation site. Medtronic developed the third-

generation Cryoballoon Advance Short-tip (Cryoballoon Advance Short Tip; Medtronic, Minnesota, USA) (CB-ST) to increase the detection rate of TTI. Giacomo Mugnai's study showed that the rate of visualization of real-time recordings was significantly higher during third-generation CB-ST ablation if compared to the CB2 device. Real-time recordings could be visualized in about 85.7% of PVs with CB-ST (12).

Multivariate analysis illustrated a mean TTI >43 s as an independent predictor of recurrent ATa in "ICE-T" Trial. However, the variety of CB temperatures during ablation were not collected, the relation between CB temperature and recurrent ATa remained unknown in this trial. Giuseppe Cicon's research indicated that achievement of -40 °C within 60 s could independently predict durable PVI (12). Furthermore, an increased time taken for the balloon to warm following ablation was associated with durability of PVI (13). The result might be more meaningful if the trial adjusted CB temperatures variety.

In general, the "ICE-T" Trial suggested that ICE-T CB ablation strategy made CB2 ablation faster without impacting the clinical outcome. TTI as a predictor of recurrent ATa might be more persuasive if the trial adjusted the CB temperatures variety. Most importantly, TTI was based on PVP visualization during CB2 ablation, how to guarantee the relatively high PVP visualization rate needed further investigations to determine.

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Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

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