The magnitude and the course of local impedance drop to guide successful AF ablation: insight from an Italian registry

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Background: It has been demonstrated that an ablation strategy based on local impedance (LI) algorithm is helpful in guiding successful ablation of atrial fibrillation (AF) cases. How the magnitude and the course of LI drop could impact the effectiveness of ablation has to be proved.

Purpose: We aimed to evaluate LI drop characteristics in predicting effective radiofrequency (RF) ablation of consecutive AF cases.

Methods: Consecutive patients undergoing AF ablation at 8 Italian centers were included in the CHARISMA registry. A RF ablation catheter equipped with mini-electrodes technology and a dedicated algorithm was used to measure LI and to guide ablation. For our purpose, we defined the time to drop (τ) as the time for the first deflection of LI drop to the plateau. RF applications were targeted to a LI drop of 10 Ω and were stopped when a maximum cut-off LI drop of <40 Ω was observed. Successful single RF ablation was defined according with a reduction of signal voltage by at least 50% and inability to capture local tissue on pacing. The ablation endpoint was PVI as assessed by entrance and exit block. Follow-up were scheduled at 3, 6 and 12 months post-ablation.

Results: 153 consecutive patients (61% paroxysmal AF, 39% persistent AF) were enrolled in the study. 3556 point-by-point first-pass RF applications of >10 s duration were performed around PVs. The mean LI drop was 13 $\pm$ 8Ω, the mean τ was 18.7 $\pm$ 13s and the median LI drop/τ was 0.67 [QI-QIII, 0.37 – 1.17] Ω/s. Both absolute drops in LI and LI drop/τ were greater at successful ablation sites (n = 3122, 88%) than at ineffective ablation sites (n = 434, 12%) (14 $\pm$ 8Ω vs 6 $\pm$ 4Ω, $p < 0.0001$ for LI; 0.73[0.41–1.25]Ω/s vs 0.35[0.22–0.59]Ω/s for LI drop/τ, $p < 0.0001$). Every 5-point increment in LI drop was associated with successful ablation, with an OR of 3.13 (95%CI: 2.7 to 3.6, $p < 0.0001$), reaching the highest point when a value larger than 15 Ω was observed (99.9% of acute success). A significant trend was observed from lower to higher LI drop/τ values and a value greater than 0.65 Ω/s (best cut-off value on the basis of the ROC analysis) was significantly associated with successful RF delivery with an OR of 5.54 (95%CI: 4.31 to 7.11, $p < 0.0001$). No complications occurred during and after procedures. At 1-year follow-up, the AF recurrence rate was 12% after the 90-day blanking period.

Conclusions: The magnitude and time-course of the LI drop during RF delivery were associated with effective lesion formation. This ablation strategy for PVI guided by LI technology proved safe and effective, and resulted in a very low rate of AF recurrence over 1-year follow-up.