Characteristics of pulmonary vein gaps through a novel local impedance algorithm at repeat AF ablation procedures: preliminary results from the CHARISMA registry

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Background: A high incidence of pulmonary vein (PV) reconnection has been reported in patients with clinical recurrences of AF. Detailed characterization of PV gaps in terms of local impedance (LI) is still lacking.

Purpose: to characterize PV gaps with a novel local impedance algorithm during redo PV ablation in AF patients (pts).

Methods: Consecutive pts undergoing repeated AF ablation from the CHARISMA registry with complete characterization of PV gaps through local impedance at 6 Italian centers were included. A complete map of the left atrium and PVs was performed prior and after ablation through the Rhythmia mapping system. A novel RF ablation catheter with dedicated algorithm (DirectSense) was used to measure LI at the distal electrode of this catheter. Each gap was characterized in terms of LI and its variations during ablation procedure according to different ablation sites around the PVs. 7 sites around the left and right pair of PV for LI evaluation during ablation were defined: 2 for posterior sites (PS) (posterior inferior and posterior superior), 2 for anterior sites (AN) (anterior inferior and anterior superior), 1 for interior site (INF), 1 for superior site (SUP) and 1 for the carina (CAR). Ablation endpoint was PVI as assessed by entrance and exit block.

Results: Eighteen cases of redo AF ablation were analyzed (9 after prior RF ablation, 9 after prior cryoablation). A total of 41 PV gaps were detected (20 after RF ablation, 21 after cryoablation; mean number of gaps per pt = 2.3 ± 1.1): one gap was identified In five (27.8%) pts, 2 gaps were present in 7 (38.9%) pts, 3 gaps were detected in 2 (11.1%) pts and 4 gaps were identified in the remaining 4 (22.2%) pts. PV gaps were most common at AN sites (17, 41.5%), followed by PS sites (12, 29.3%) and CAR sites (11, 28.6%). The mean LI at gap sites was $113.9 \pm 15\Omega$ prior to ablation: it was significantly higher than LI at scar tissue closer to gap ($99.7 \pm 8\Omega$, $p < 0.0001$) but was significantly lower than LI at healthy tissue ($120.2 \pm 12\Omega$, $p < 0.0001$). LI parameters did not differ between prior ablation approach (RF vs Cryo: $115.5 \pm 13\Omega$ vs $112.2 \pm 16\Omega$ for LI at gap, $p = 0.4739$; $102.2 \pm 6\Omega$ vs $97.3 \pm 10\Omega$ LI at scar tissue, $p = 0.0591$; $16.4 \pm 4\Omega$ vs $15.8 \pm 13\Omega$ for LI drop at gap, $p = 0.6647$). In 14 cases (34.1%) the difference between LI at healthy tissue and LI at gap was lower than 5Ω, suggesting that this spot was not treated by RF or Cryo delivery in the previous ablation session (13 out 21 after Cryo ablation vs 1 out 20 after RF ablation, $p < 0.0001$). No complications during the procedures were reported. The acute procedural success was 100%, with all PVs successfully isolated in all study patients.

Conclusion: In our preliminary experience, PV gaps after failed PVI were most common at anterior, followed by posterior and carina sites. LI characteristics at PV gaps significantly differ from both scar and healthy tissue and could be used to target ablation deliveries.