CLINICAL VIGNETTE

High-density bipolar voltage mapping for substrate-guided ablation of atrial fibrillation

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A 64-year-old diabetic man (body mass index 28 kg/m^2; enlarged left atrial diameter of 45 mm and left ventricular ejection fraction of 67% on echocardiography) with an eight-year history of symptomatic (score 2b according to the modified European Heart Rhythm Association symptom classification for atrial fibrillation [AF]), drug-resistant, long-standing persistent AF was referred for elective AF ablation. After performing transseptal puncture, sinus rhythm was restored with direct current cardioversion, and high-density three-dimensional mapping of the left atrium was performed with a circular diagnostic catheter (Advisor™ FL Sensor Enabled™, Abbott, St. Paul, MN, USA). We collected 8571 points, and 2207 points were used (EnSite Precision™, Abbott; best-duplicate algorithm marked by small yellow dots, Fig. 1) for a final bipolar voltage map, which revealed low-voltage areas (LVAs; defined as 0.2–0.5 mV) within the left atrium. The diagnostic catheter was exchanged with the ablation catheter (TactiCath™, Abbott), and AF was reinduced with burst pacing. We used our standard radio-frequency energy settings (45°C, 30 W, and 25 W on the posterior wall only). Following our standard stepwise ablation protocol at that time (pulmonary veins isolation [PVI] > roof line > mitral isthmus line) we could not terminate AF after completing all procedural steps. After reconfirming LVA on the anterior wall with a contact-force catheter (Fig. 2) we ablated there, reaching a successful endpoint with sinus rhythm restoration (Fig. 3). The next day the patient was discharged home (on a β-blocker and non-vitamin K antagonist oral anticoagulant only) with sinus rhythm documented in electrocardiogram (ECG). He has been followed-up for 18 months and there have been no symptoms of AF or recurrence of left atrial arrhythmia since the procedure. No arrhythmia was documented in seven-day Holter ECG monitoring (at the 3rd, 6th, 9th, and 12th month) or in ECG recordings presented by the patient at follow-up visits. Previous reports showed that LVA substrate modification in addition to PVI was more effective than PVI alone or PVI plus additional empirical lesion ablation in patients with non-paroxysmal AF. Moreover, LVA ablation has lower pro-arrhythmic potential (demonstrated by reduced occurrence of post-ablation atrial tachycardia) as compared to PVI plus conventional wide empirical ablation. Nevertheless, the detailed identification of the substrate, i.e. ultra-high-density substrate mapping, is crucial in LVA ablation.

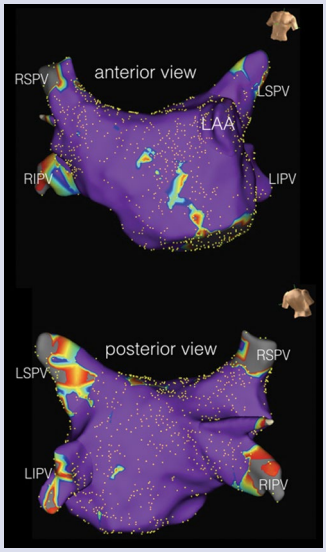

Figure 1. High-density bipolar voltage mapping of the left atrium: anterior (upper panel) and posterior (lower panel) view; LAA — left atrium appendage; LIPV — left inferior pulmonary vein; LSPV — left superior pulmonary vein; RIPV — right inferior pulmonary vein; RSPV — right superior pulmonary vein

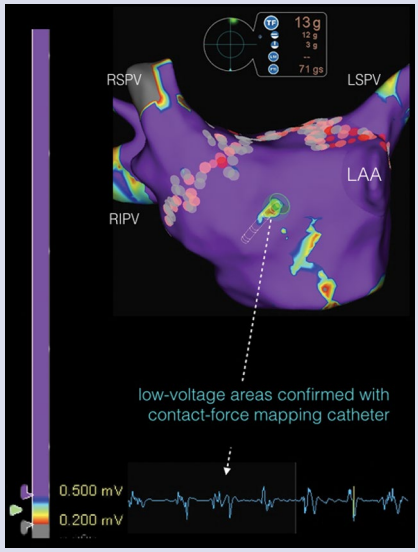

Figure 2. The confirmation of a low-voltage area (the anterior wall of the left atrium) with contact force ablation catheter (stable catheter — tissue contact of 13 g); low-voltage areas (0.2–0.5 mV) marked in yellow/red/green/blue, healthy tissue (> 0.5 mV) in purple; abbreviations — see Figure 1

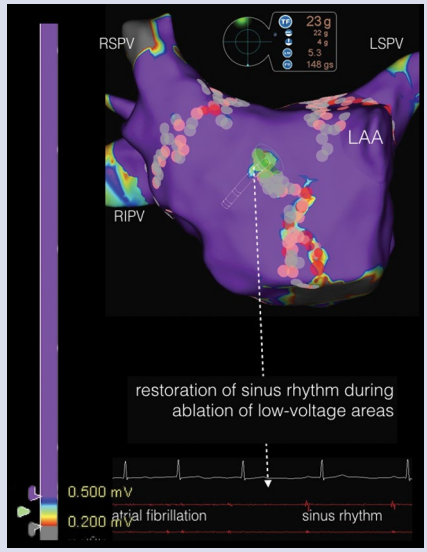

Figure 3. Restoration of sinus rhythm during ablation of low-voltage area; abbreviations — see Figure 1

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Conflict of interest: *Przemysław Zając is an Abbott employee.*