Practical approach to the cryoballoon-ablation mapping technique in atypical pulmonary vein anatomy

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Cryoballoon ablation (CBA) is an effective technique of treatment for atrial fibrillation (AF). This technique requires optimal circumferential contact between the cryoballoon and pulmonary vein (PV) ostium for proper occlusion to occur, so that PV electrical isolation (PVI) is achieved and good long-term outcome can be ensured.[1] Therefore, the impact of anatomy and ostial geometry of PVs on CBA efficacy is widely discussed.[2,3]

We report a case of a 78-year-old woman referred for PVI due to highly symptomatic (European Heart Rhythm Association score of 4), frequent recurrences of paroxysmal AF. The patient was otherwise healthy, except for well-controlled hypertension. Preprocedural computed tomography (CT) scan revealed 4 right-sided PVs and a common ostium of left-sided veins (the R4a/L1b pattern according to Marom et al)[4]. Transthoracic echocardiography showed left ventricular ejection fraction of 60% and left atrial diameter of 39 mm. Both CT and transthoracic echocardiography revealed no intracardiac thrombi.

Cryoballoon PVI was performed in sinus rhythm, under conscious sedation. Considering the complex PV anatomy with relatively small diameter of the accessory right-sided veins (4 × 3 mm and 5 × 4 mm), we decided to use a dedicated guidewire (PV-tracker, Medtronic, Minneapolis, Minnesota, United States) for PV cannulation, and consequently to evaluate the electrical isolation of PVs with a 6 Fr linear steerable decapolar catheter (Inquiry, Abbott, St. Paul, Minnesota, United States), initially introduced into the coronary sinus for transseptal puncture guidance. After the puncture (with the BRK-1 XS needle, Abbott), a 28-mm cryoballoon (AF Advance ST, Medtronic) was advanced into the left atrium via a steerable sheath (FlexCath, Medtronic). The occlusion of each vein was confirmed with contrast injection. The application sequence was as follows: left common PV, right superior PV, right middle PVs (upper and lower), and right inferior PV. A single cryoapplication (240 s) was delivered in each right-sided PV (with a single application covering the ostia of 2 adjacent right middle PVs) and 2 cryoapplications were delivered to the left common PV (FIGURE 1). The nadir temperature was –56°C/–44°C in the left common PV, –43°C in the right superior PV, –44°C in the right middle PVs, and –51°C in the right inferior PV. To avoid phrenic nerve palsy, diaphragmatic pacing from the right subclavian vein was applied during right-sided cryoapplications. Bidirectional electrical isolation was confirmed with a decapolar mapping catheter (Inquiry, Abbott) in all veins, and the patient remained free of arrhythmia in 6-month follow-up.

Typical PV anatomy is usually considered as a prerequisite for successful CBA. Marom et al[4] described 6 drainage patterns of the right-sided, and 2 patterns of the left-sided PVs. Evaluation of pulmonary venous anatomy in large cohorts demonstrated typical 4-vein configuration in roughly 70% of the general population. The most common anatomical variant is left common PV (32%). About 90% of people

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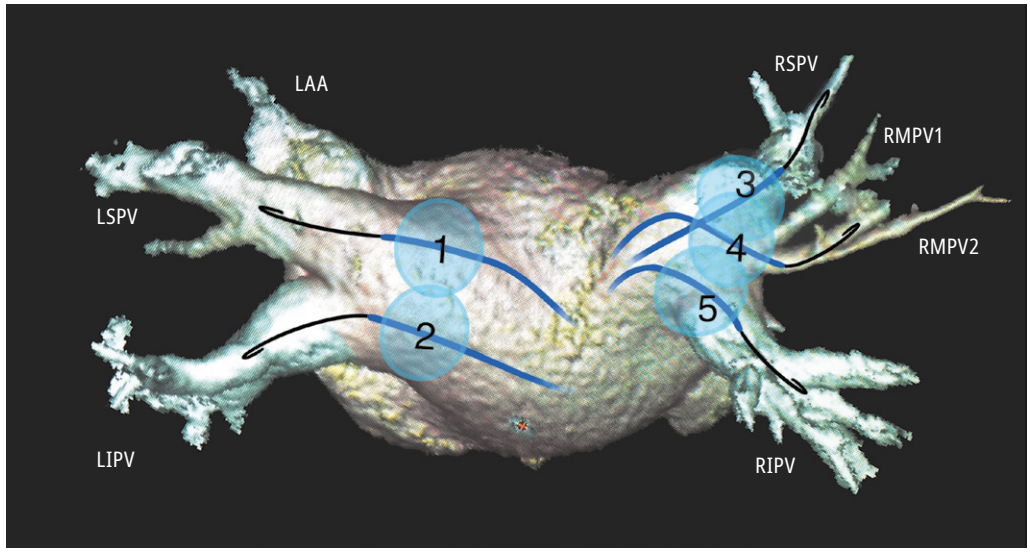

FIGURE 1 Atypical anatomy of the pulmonary veins and the sequence of cryoapplications (1–5). The common ostium of the left superior pulmonary vein (LSPV) and the left inferior pulmonary vein (LIPV), as well as 2 additional right-sided veins (upper right middle pulmonary [RMPV1] and lower right middle pulmonary [RMPV2]) are clearly visible.
Abbreviations: LAA, left atrial appendage; RIPV, right inferior pulmonary vein; RSPV, right superior pulmonary vein

have 2 right-sided PVs, however, a larger number (3–5) can be found in 6%. A single right-sided ostium occurs in 3%, and bilateral pulmonary venous ostial variation, as in the presented case, was observed in 5.67% of patients.[5] Moreover, in our patient's case the small diameter of both additional right-sided PVs impeded the use of octapolar inner-lumen catheter, and by replacing it with a dedicated guidewire we managed to achieve good occlusion and optimal temperatures.

The presented case demonstrates that PVs with atypical configuration can be effectively isolated with the third-generation cryoballoon catheter using a slight modification of the mapping technique.

ARTICLE INFORMATION

CONFLICT OF INTEREST AG received proctoring and speaking honoraria from Medtronic and Abbott. Other authors declare no conflict of interest.

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