Effective isolation of pulmonary veins with extremely high ovality index using a third-generation cryoballoon catheter

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Cryoballoon ablation has become a standard treatment in the management of atrial fibrillation (AF).[1] The ovality index (OI) of the pulmonary veins (PVs) is one of the factors that may affect the efficiency of cryoballoon ablation. It is defined as a ratio of the maximum to the minimum diameter of the PV ostium. Veins are usually classified as circular (OI <1.2), oval (OI, 1.2–1.4), or flat (OI >1.4).[2]

We report a case of a 53-year-old man with persistent AF and extremely flat PVs (mean OI, 1.675) who was referred to our department for PV isolation.

Preprocedural computed tomography revealed a typical configuration of 4 PVs with the following diameters (longitudinal × transverse): left superior PV (LSPV), 22 × 10 mm; left inferior PV (LIPV), 22 × 13 mm; right superior PV (RSPV), 27 × 18 mm; and right inferior PV (RIPV), 23 × 18 mm (FIGURE 1A and 1B). Furthermore, it showed left atrial volume of 250 ml, the cauliflower-like left atrial appendage, and normal coronary arteries. On transthoracic echocardiography, left ventricular ejection fraction was 52%, and the left atrial diameter, 36 mm.

Cryoballoon PV isolation was conducted under conscious sedation. After a single transseptal puncture (with the BRK-1XS needle [Abbott, St. Paul, Minnesota, United States]) performed under fluoroscopic guidance, a 28-mm cryoballoon (AF Advance ST, Medtronic, Minneapolis, Minnesota, United States) was introduced into the left atrium using a steerable sheath (FlexCath, Medtronic). The occlusion of each vein was confirmed after contrast injection (FIGURE 1C–1F). Remarkably, due to proper occlusion, the ostia were altered to a more circular shape (compliant with the cryoballoon), which was more prominent in the right veins compared with the left ones (25% vs 10.2%). The application sequence was LSPV–LIPV–RSPV–RIPV. A single cryoapplication (180 s) was delivered to isolate each vein. The temperature nadir was –49 °C at 151 s of freeze in the LSPV (OI, 2.2), –48 °C at 134 s in the LIPV (OI, 1.7), –45 °C at 155 s in the RSPV (OI, 1.5), and –54 °C at 146 s in the RIPV (OI, 1.3). In order to avoid phrenic nerve palsy, diaphragmatic stimulation from the right subclavian vein was performed during right-sided cryoapplications. Considering the high OI, a dedicated guidewire (PV-tracker, Medtronic) advanced to the distal part of the vein was used for the cryoballoon positioning to obtain optimal stability. Consequently, bidirectional electrical isolation in all PVs was confirmed with a decapolar mapping catheter (Inquiry, Abbott, Minneapolis, Minnesota, United States).

Typically, left PVs have higher OI compared with the right ones,[3] which was observed in our case. A high OI impedes adequate vein occlusion and may lead to worse short- and long-term outcomes. This relationship was clearly defined for the LSPV.[4] More oval PVs are associated with frequent AF recurrence.[5] In our patient, the PVs (except for the RIPV) were extremely flat, but we achieved good occlusion and adequate

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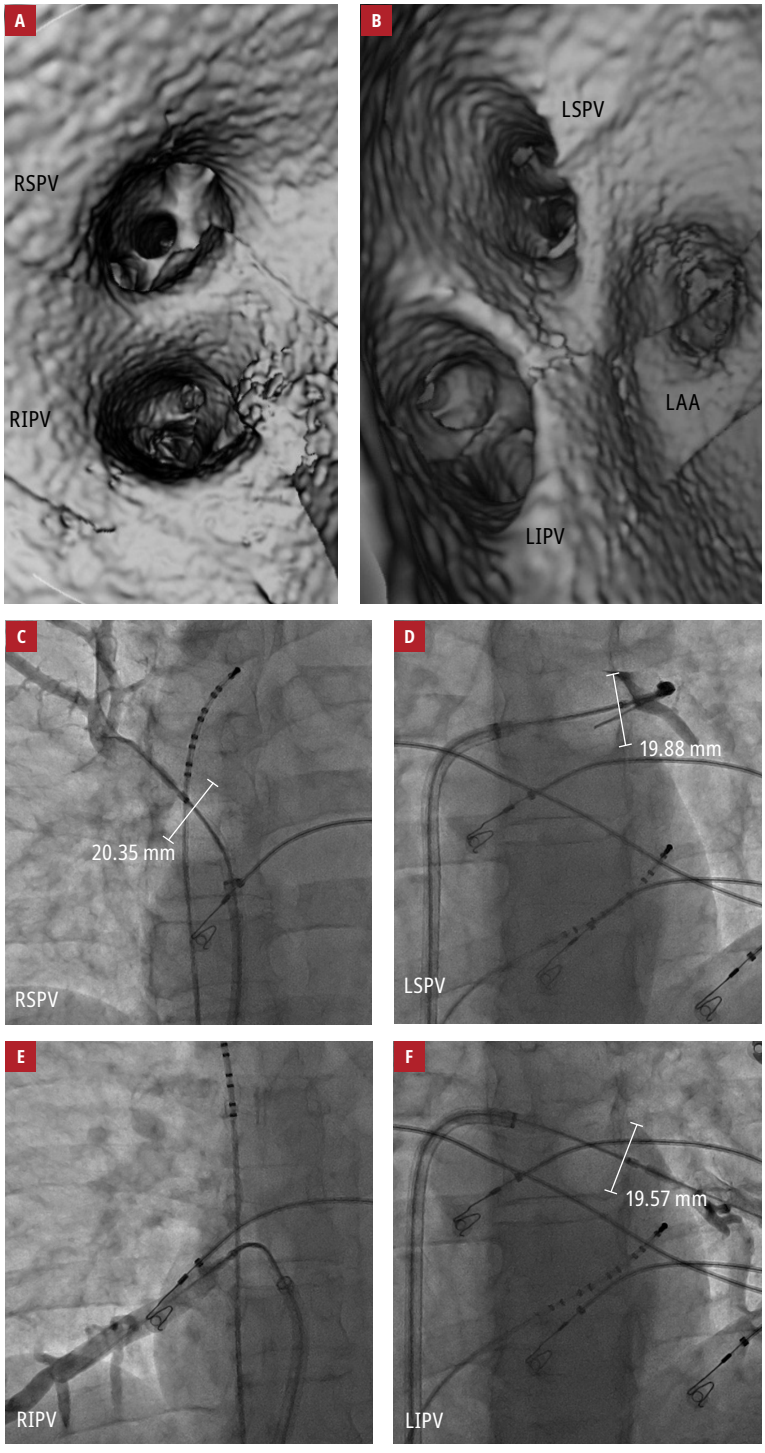

FIGURE 1 **A**, **B** – 3-dimensional computed tomography showing the reconstruction of the right (**A**) and left (**B**) pulmonary veins; **C**–**F** – cryoballoon adhesion in the pulmonary vein ostia assessed with contrast venography
Abbreviations: LAA, left atrial appendage; LIPV, left inferior pulmonary vein; LSPV, left superior pulmonary vein; RIPV, right inferior pulmonary vein; RSPV, right superior pulmonary vein

temperatures, which was confirmed with bidirectional isolation after a single 180-second cryoapplication in each vein. After 3-month follow-up, the patient remains free of arrhythmia.

Our case shows that PVs with a high OI can be effectively isolated with a third-generation cryoballoon catheter.

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