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Article type: Clinical vignette

Received: October 11, 2019.

Accepted: January 15, 2020.

Published online: January 16, 2020.

ISSN: 0022-9032

e-ISSN: 1897-4279

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

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Cryoballoon ablation for flat pulmonary veins

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Conflicts of interest: AG has received compensation for proctoring and speaking duties from Medtronic and Abbott. Other authors: No disclosures.
Cryoballoon ablation (CBA) has become a standard approach in atrial fibrillation (AF) treatment [1]. The ovality index (OI) of the pulmonary veins (PVs) is one of the factors which may affect the efficiency of the CBA. It is defined as a ratio of maximum and minimum diameter of 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 male with persistent AF and extremely flat PVs (mean OI = 1.675) referred for pulmonary vein isolation (PVI).

Pre-procedural computerized tomography revealed typical configuration of four PVs with the diameters: left superior PV (LSPV) 22 x 10 mm, left inferior PV (LIPV) 22 x 13 mm, right superior PV (RSPV) 27 x 18 mm and right inferior PV (RIPV) 23 x 18 mm; LA volume: 250 ml; LA appendage - cauliflower type and normal coronary arteries. In transthoracic echocardiography, the left ventricular ejection fraction was 52% and LA diameter 36 mm.

Cryoballoon PVI was performed under conscious sedation. After a single transseptal puncture (BRK-1XS needle, Abbott, MN, US) performed under fluoroscopic guidance, a 28 mm cryoballoon (AF Advance ST, Medtronic, MN, US) was introduced into the LA using a steerable sheath (FlexCath, Medtronic, MN, US). The occlusion of each vein was confirmed with contrast injection. Remarkably, with proper occlusion, the ostia were altered to more circular shape (compliant to cryoballoon) which was more prominent in the right-sided veins (25% vs 10.2%). The applications’ sequence was LSPV-LIPV-RSPV-RIPV. Single cryoapplication (180 s) was delivered to isolate each vein. The nadir temperature was -49°C at 151 s of freeze in LSPV (OI - 2.2), -48°C at 134 s in LIPV (OI - 1.7), -45°C at 155 s in RSPV (OI - 1.5) and -54°C at 146 s in 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, MN, US) advanced to 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 decapolar mapping catheter (Inquiry, Abbott, MN, US).

The left-sided PVs have typically higher OI compared to right-sided PVs [3], which was confirmed in our case. High OI impedes adequate vein occlusion and may lead to worse short and long-term outcome. This relationship is clearly defined for LSPV [4]. More oval pulmonary veins are associated with frequent AF recurrence [5]. In our patient’s case the pulmonary veins (except for RIPV) were extremely flat; in spite of this we managed to achieve good occlusion and adequate temperatures, additionally confirmed with bidirectional isolation after a single 180 s cryoapplication in each vein. In 3-months follow-up the patient remains free of arrhythmia.

Conclusion: pulmonary veins with high ovality index can be effectively isolated with third-generation cryoballoon catheter.
References:


Figure 1. A-D. Cryoballoon adhesion in pulmonary vein’s ostia. E-F. Three-dimensional computerized tomography. RSPV - right superior pulmonary vein, RIPV - right inferior pulmonary vein, LSPV - left superior pulmonary vein; LIPV - left inferior pulmonary vein, LAA - left atrial appendage.