Common veins, common freezes

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Introduction

Pulmonary vein (PV) isolation by means of the second-generation cryoballoon (CB-A, Arctic Front Advance, Medtronic, Minneapolis, MN) has emerged as a valid alternative to traditional point-by-point radiofrequency ablation, and is currently an established treatment for drug-resistant atrial fibrillation (AF). Recently, high acute effectiveness was reported for CB-A ablation in the setting of left common PVs, with similar clinical outcome compared to normal PV anatomy.[1,2] We present a case of a patient with both a left- and a right-sided common PV trunk who underwent PV isolation by the CB-A.

Case report

A 68-year-old woman was referred for PV isolation by CB-A owing to drug-refractory early persistent AF. Preprocedural computed tomography scan of the heart showed a PV drainage pattern characterized by a common trunk on both the left and right side of the left atrium (Figure 1A). Antero-posterior left atrial diameter was 43.3 mm. Ostial diameters (maximum/minimum) of the left and right common PV trunk were 28.2 mm / 25.1 mm and 25.8 mm / 25.3 mm, respectively. On both sides, full occlusion with the CB-A was obtained by positioning of the inner lumen mapping catheter (Achieve, Medtronic, Minneapolis, MN) distally in an inferior venous branch (Figure 1B), at the expense of real-time recordings during the freeze. Balloon inflation during a more superior positioning of the Achieve systematically showed an incomplete occlusion in these veins with an inferior "leak" after contrast injection. Moreover, retracting the Achieve toward a more ostial level against the inflated balloon was unfavorable for device stability. Before ablation of the right-sided PV trunk, a standard decapolar catheter was placed in the superior vena cava cranial to the right superior PV in order to pace the right phrenic nerve (20 mA/1 ms pulse width at a cycle length of 1200 ms) (Figure 1B, left panel). Nervous capture was achieved when contraction of the right hemidiaphragm could be observed under fluoroscopic imaging and by manual palpation of the abdomen. A single 3-minute cryoapplication was delivered to both veins with achievement of $\leq$ -40°C within 60 seconds and a minimal temperature of -47°C and -53°C left and right, respectively. Compared to the clear ostial PV signals before the freeze, electrical isolation could be obtained as evaluated by retracting the Achieve at the ostial/antral level directly post cryoapplication and by revisiting the PVs at the end of procedure, as well as after administration of adenosine. The need for only 2

KEY TEACHING POINTS

- Preprocedural anatomic assessment is useful in evaluating the pulmonary vein (PV) drainage pattern in the context of PV isolation by the second-generation cryoballoon (CB2). The occurrence of both a left- and a right-sided common PV trunk in the same patient is rare.
- Positioning of the inner lumen mapping catheter (Achieve, Medtronic, Minneapolis, MN) distally in an inferior branch of the common PV trunk might offer better device stability in order to obtain full occlusion with the CB2.
- Single-shot application of the 28-mm CB2 might be effective to isolate electrically the entire common PV trunk. This freeze strategy is more likely to occur in longer PV trunks with relatively small venous dimensions.

KEYWORDS Anatomic variation; Atrial fibrillation; Common pulmonary vein trunk; Cryoballoon ablation; Second-generation cryoballoon
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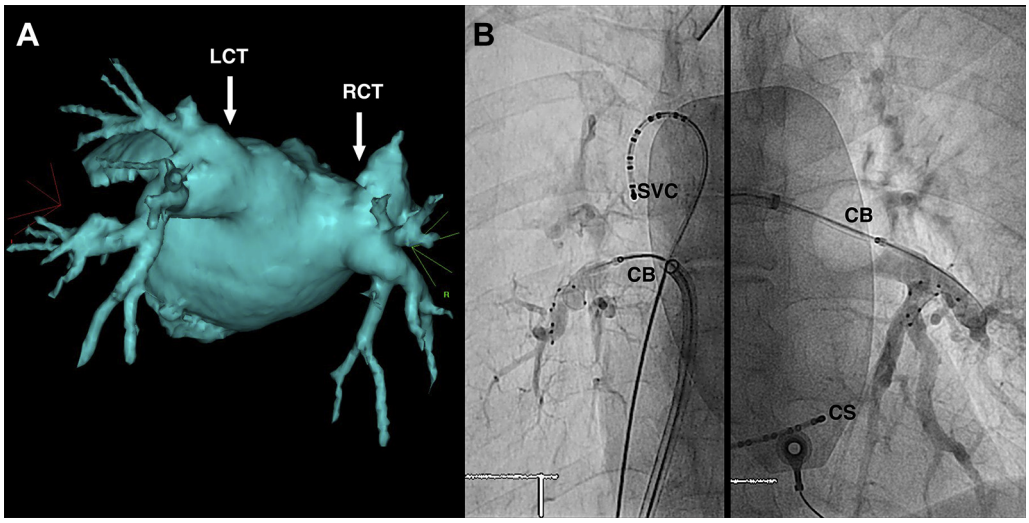

Figure 1 Computed tomography analysis of left common pulmonary vein anatomy. **A:** Posterior view of a 3-dimensional computed tomography reconstruction of the left atrium rendered in an electroanatomic mapping system (CARTO, Biosense Webster). **B:** Merged image of an anteroposterior fluoroscopic projection during the left- and right-sided freezes with the cryoballoon (right and left panel, respectively). A decapolar catheter was positioned in the coronary sinus during the left-sided freeze (partially visible) and in the superior vena cava during the right-sided freeze for phrenic nerve monitoring. CB = cryoballoon; CS = coronary sinus; LCT = left common trunk; RCT = right common trunk; SVC = superior vena cava.

single-shot freezes resulted in relatively shorter procedural/fluoroscopy times (33 minutes / 4 minutes, respectively). The procedure was uneventful, without any signs of phrenic nerve injury or pericardial effusion. Esophageal temperatures were not monitored and esophageal thermal lesions not evaluated; however, based on clinical grounds the patient presented no gastrointestinal symptoms following the procedure. After 1 year of follow-up, the patient remains free from AF without antiarrhythmic drugs.

Discussion

The prevalence of left- and right-sided common ostia is around 35% and 2%, respectively.[3,4] For long common trunks, the prevalence must be presumably much lower, and the occurrence of both a left and right common trunk in the same patient is rare. In our patient, a left- and right-sided single application was delivered, with positioning of the Achieve distally in an inferior branch for device stability. Based on previous findings showing association of phrenic nerve injury with CB-A ablation of right common trunks,[4] we aimed to occlude the right vein at the most proximal level in order to prevent this complication. The single-shot freezes proved to isolate the veins entirely. Both trunks were associated with relatively small venous dimensions, preventing the 28 mm cryoballoon from freezing too distally. Therefore, we believe that a sufficient antral freeze was obtained in our patient by this method.

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