

Impact of anatomical factors on cryoballoon pulmonary vein isolation

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Introduction: Electrical isolation of the pulmonary veins (PV) is the cornerstone of atrial fibrillation catheter ablation. Balloon-mounted cryoablation devices have been recently introduced as an alternative to radiofrequency catheters. We aimed to assess the impact of anatomical factors on feasibility of PV isolation using such devices.

Methods: We included 18 consecutive patients (88,9% Males, 56±9 years old) who underwent PV isolation. A CT scan was performed before the procedure, and 3-D models of the left atrium were reconstructed and analyzed. PV antrum was considered to be oval when the longest diameter was at least twice the shortest one. Through a single transeptal puncture a cryoballoon (Cryocath, 4x23 mm, 14x28 mm) was advanced into the antrum of every PV and frozen twice over 5 minutes. In patients with a common left pulmonary ostium (CO), the 2 main branches were consecutively isolated. Electrical isolation was then checked with a multipolar circular catheter and additional focal cryoablations were performed when needed (Cryocath).

Results: Two patients (13,3%) presented with a left CO and another 3 with 1 or 2 supplementary right-sided veins. PV isolation was achieved with the balloon in 63 of the 72 targeted veins (87,5%). Oval-shaped PV (8/72, 11,1%) could be primarily isolated in 62,5% of the attempts, whereas round-shaped ones were isolated in 90,6% of the cases ($p=0,023$). The mean diameter of primarily isolated PV was slightly larger than the one of the not isolated ones (19,1±3,0 mm vs. 17,0±2,2 mm, $p=0,05$). The following PV could not be isolated: 5 right lower, 3 left lower and 1 left upper. Superior PV were more often successfully isolated than the inferior ones ($p=0,013$). After 2,7±1,1 focal applications, all 72 targeted PV could be successfully isolated at the end of the procedure.

Conclusions: Despite complex anatomical substratum (CO, supplementary PV), PV isolation could be safely performed with the combined use of a cryoballoon and punctual cryoablation applications in all patients. The shape and size of the PV antrum were predictive factors in the primary achievement of electrical isolation with the balloon, and should be taken into account in the design of new devices.