Durable Single Shot Cryoballoon Isolation of the Left Atrial Appendage Followed by Percutaneous Left Atrial Appendage Closure

Stefano Bordignon, MD; Laura Perrotta, MD; Alexander Fürnkranz, MD; Fabrizio Bologna, MD; Boris Schmidt, MD; K.R. Julian Chun, MD

Case Description
A 73-year-old paroxysmal atrial fibrillation (AF) male patient (CHADSVASC, 3; HASBLED, 3) was referred to our center for staged AF ablation and left atrial appendage (LAA) closure. Previously, the patient had experienced gastric bleeding on Apixaban. Therefore, we agreed with the patient on additional LAA isolation during AF ablation if electric triggers from the LAA were present. After a single transseptal puncture, selective pulmonary veins (PVs) and LAA angiographies were performed. The 28 mm second generation cryoballoon (CB2; Arctic Front Advance, Medtronic, USA) was advanced into the left atrium. The inner lumen circumferential multipolar catheter (Achieve 20 mm, Medtronic, USA) demonstrated automatic activity in the LAA. Therefore, the CB2 was inflated and positioned at the LAA ostium aiming for complete occlusion (Figure A). During CB ablation, progressive LAA spike delay resulted in LAA isolation (time to block, 73 s; CB temperature, −48°C; Figure B). Cryoballoon freeze was limited to 180 s, reaching a minimal temperature of −57°C. The left phrenic nerve, because of its proximity to the LAA,1 was monitored by fluoroscopy during spontaneous breathing. After further conventional CB2 PV isolation, total procedure-and fluoroscopy-time were 70 and 12.0 min, respectively. Interestingly, transesophageal echo demonstrated a substantial ablation-induced acute edema of the LAA-PV ridge (Figure C and D). Discharged on low molecular weight heparin (enoxaparin 0.8 mL twice a day), the patient was rescheduled for elective percutaneous LAA closure after 6 weeks. During the LAA closure procedure, a 15 mm spiral catheter (Lasso, Biosense Webster) confirmed permanent LAA isolation (entrance+exit block; Figure E). The postablation LAA-PV ridge edema resolved, and a 24 mm Watchman (Boston Scientific, USA) device could be implanted without any residual LAA flow or procedural complications (Figure F). The low molecular weight heparin was discontinued and substituted by dual antiplatelet therapy (aspirin/clopidogrel) for additional 6 weeks.

Discussion
Atrial appendages have been identified as sources of atrial arrhythmias.2 The LAA has been considered an additional AF trigger site beyond the PVs3 and termed the 5th PV. LAA isolation using point-by-point radiofrequency current ablation is feasible, but there are safety concerns about ablating at the LAA ostium. To best of our knowledge, this case is the first description of single shot LAA isolation using the 28 mm CB2. Relevant findings include (1) safe LAA mapping using the intraluminal soft tip circumferential multipolar catheter, (2) straightforward LAA isolation and visualization of time to effect, and (3) proof of permanency of CB LAA isolation. These initial observations may point toward an additional anatomic target during CB AF ablation in selected patients. In our patient, we decided to perform a staged AF ablation procedure, including LAA isolation (because of spontaneous electric activity originating from the LAA as described by DiBiase et al4), followed by LAA occlusion. The optimal antithrombotic treatment in electrically isolated LAA remains unclear. It seems reasonable that either life-time intensified oral anticoagulation or mechanical LAA closure is required. Previously, feasibility of concomitant AF ablation and LAA occluder implantation has been reported.4 However, our transesophageal echo findings after ablation may rather indicate that a staged AF ablation and LAA closure approach may be preferable.

Disclosures
K.R.J. Chun, S. Bordignon, A. Fürnkranz, and B. Schmidt received speaking honoraria from Medtronic. B. Schmidt is in the advisory board for Boston Scientific. The other authors report no conflicts.

References
2. Chun KJ, Ouyang F, Schmidt B, Kuck KH. Focal atrial tachycardia originating from the right atrial appendage: first successful cryoballoon

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**Figure.** See text for description. Please note, in B and E, the surface electrocardiogram differs because of the compound motor action potential (CMAP) configuration for phrenic nerve function monitoring during the index second generation cyroballoon (CB2) procedure. LAA indicates left atrial appendage; and RAO, right anterior oblique.
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