HANDS ON

Safety and feasibility of transseptal puncture for atrial fibrillation ablation in patients with atrial septal defect closure devices

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Introduction

AF is often found in association with an ASD.[1–4] There are an increasing number of patients undergoing transcatheter closure of an ASD who subsequently develop AF in clinical practice.[2–4] Catheter ablation has emerged as an effective treatment strategy for drug-refractory symptomatic AF.[5] While transseptal access to the left atrium (LA) is a prerequisite for AF ablation, it may prove difficult in the presence of an ASD closure device.[6,7] Anticipating technical difficulties and potential complications may discourage operators from considering catheter ablation of AF in this particular patient population. Herein, we describe our experience with TSP in patients with prior implantation of an ASD closure device.

Procedure details

From September 2008 to October 2012, we performed catheter ablation in 9 patients (6 men; mean age 52.7 ± 8.0 years) with drug-refractory symptomatic AF and percutaneous ASD closure device. In all patients, the indication for the placement of a septal occluder device was an ASD demonstrating a significant left-to-right shunt. Preprocedural transesophageal echocardiography was performed in all patients to rule out LA thrombus. Antiarrhythmic medication was discontinued at least 5 half-lives before ablation. Warfarin was discontinued 3 days before ablation and replaced by intravenous heparin to maintain a partial thromboplastin time of 2–3 times normal value.

Electrophysiological study and TSP

All patients provided written informed consent. The ablation procedure was performed under sedation with continuous infusion of propofol. A 7-F multipolar electrode catheter (Biosense Webster, Inc, Diamond Bar, CA) was placed in the coronary sinus via the left subclavian or right jugular vein. TSP using a Brockenbrough needle was guided by fluoroscopy in 8 patients and additional transesophageal echocardiography in 1 patient. TSP was attempted initially at a site posteroinferior to the ASD occluder, advancing two 8.5-F SL1 sheaths (St. Jude Medical, Inc, St Paul, MN) into the LA. If unsuccessful, direct TSP was performed through the occluder device posteroinferior to its waist (Movies 1–5). Once the transseptal needle traversed the device, LA access was confirmed by contrast injection. The inner dilator of the 8.5-F SL1 sheath was pushed across the ASD occluder device, and the transseptal needle was removed. A PCI balloon was advanced over a guide wire positioned in the left superior pulmonary vein (PV) and placed distal to the inner dilator along the puncture site within the septal occluder device. Sequential dilatation was then performed by using a 2.5-, 3.0-, 4.0-, and/or 5.0-mm noncompliant PCI balloon (NC Sprinter RX, Medtronic Inc, Minneapolis, MN) and an inflation pressure of 12 atm until a transseptal sheath could easily be advanced into the LA.

After successful TSP, intravenous heparin was administered to maintain an activated clotting time of 250–300

KEYWORDS Atrial fibrillation; Catheter ablation; Atrial septal defect closure device; Transseptal puncture

ABBREVIATIONS AF = atrial fibrillation; **ASD** = atrial septal defect; **ICE** = intracardiac echocardiography; **LA** = left atrium/atrial; **PCI** = percutaneous coronary intervention; **PV** = pulmonary vein; **PVI** = pulmonary vein isolation; **TSP** = transseptal puncture (Heart Rhythm 2014;11:330–335)

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Table 1 Clinical and procedural data

Patient no.	Age (y)	AF type	AF duration (mo)	LA diameter (mm)	LVEF (%)	ASD occluder device/ diameter (mm)	Fluoroscopy time for TSP (min)	Total fluoroscopy time (min)	Procedure duration (min)
1*	58	Pers AF	38	51	46	Lifetech/26	22	33	270
2	52	PAF	21	41	56	Amp/26	5	13	144
3*	42	PAF	110	52	45	Amp/30	27	39	246
4	42	PAF	21	50	57	Amp/28	23	35	252
5	45	PAF	8	48	52	Amp/20	14	22	132
6	50	PAF	12	51	50	Amp/34	21	34	228
7	61	PAF	13	44	61	Amp/26	5	14	192
8*	64	PAF	28	49	56	Amp/24	6	11	186
9*	60	PAF	48	47	55	Amp/24	17	24	210

AF = atrial fibrillation; Amp = Amplatzer; ASD = atrial septal defect; LA = left atrial; LVEF = left ventricular ejection fraction; PAF = paroxysmal atrial fibrillation; Pers = persistent; TSP = transseptal puncture.
*Diagnosis of AF before the implantation of the ASD closure device.

seconds. In addition, the transseptal sheaths were continuously flushed with heparinized saline (flow rate of 10 mL/h) to avoid thrombus formation or air embolism.

3-Dimensional electroanatomic mapping and circumferential PVI

The method of 3-dimensional electroanatomic mapping of the LA has previously been described in detail.[5] Mapping and ablation were performed with a 3.5-mm-tip catheter (ThermoCool NaviStar, Biosense Webster, Inc) in all patients. After reconstruction of the LA, each PV ostium was identified by using selective venography and tagged on the 3-dimensional electroanatomic map. Irrigated radiofrequency current was delivered as described previously, targeting a maximum temperature of 43°C, a maximum power of 40 W, and an infusion rate of 17–25 mL/min.[2] Along the posterior wall, the maximum power was limited to 30 W. Septal and lateral continuous circular lesions around the ipsilateral PVs were deployed $\approx$1 cm posterior and $\approx$5 mm anterior from the angiographically defined PV ostia. The ablation end point was defined as (1) the absence of adenosine-provoked recovered PV potentials after successful isolation and (2) the absence of any PV potential during sinus rhythm recorded on the Lasso catheter placed within the ipsilateral PVs after at least a 60-minute waiting period after PVI. In patients with documented common-type atrial flutter, bidirectional block of the cavotricuspid isthmus was performed.

Postablation care and follow-up

After the procedure, all patients received intravenous heparin for 3 days, followed by warfarin for at least 3 months. All patients were treated with previously ineffective antiarrhythmic drugs for 3 months. One day after the procedure, a 12-lead surface electrocardiography, transthoracic echocardiography, and 24-hour Holter monitoring were performed and repeated after 1, 3, and 6 months. Transesophageal echocardiography was performed 3 months after ablation to detect the presence of an interatrial shunt.

Clinical characteristics

Catheter ablation was performed in 8 patients with paroxysmal AF and 1 patient with persistent AF (Table 1). AF was symptomatic and refractory to a median of 1.5 (interquartile range 1–3) antiarrhythmic drugs. All patients had a secundum-type ASD. None of the patients had undergone prior cardiac surgery. The ASD closure device was implanted at a median of 16 months (interquartile range 6–36 months) before the index procedure with an Amplatzer septal occluder (St. Jude Medical, Inc) in 8 patients and with a Heartr septal occluder (Lifetech Scientific Inc, Shenzhen, People's Republic of China) in 1 patient (Figure 1). AF was diagnosed in patient 1 before the implantation of the Heartr septal occluder and in patients 3, 8, and 9 before the implantation of the Amplatzer ASD closure device. In the remaining 5 patients, the diagnosis of AF was made after implantation. In addition, common-type atrial flutter was documented on the 12-lead surface electrocardiogram in 3 patients with preexistent paroxysmal AF.

Transseptal access was obtained successfully in all patients. In 6 patients with an ASD closure device and a waist diameter of $\leq$26 mm, TSP targeted an interatrial site posteroinferior to the implanted ASD device. Subsequently, two 8.5-F SL1 sheaths were advanced into the LA (Figure 2). In the remaining 3 patients with a device diameter of 28, 30, and 34 mm, the initial attempt at TSP was performed posteroinferior to the ASD occluder device, resulting in inadvertent puncture of the epicardial space (Figure 3). Consequently, direct puncture across the ASD occluder device targeted the inferior portion of the device (Movies 1–5). In the first patient, direct puncture was guided by using transesophageal echocardiography 2 days after the initial procedure and after exclusion of a pericardial effusion. In the remaining 2 patients, puncture across the device was performed immediately after failed TSP. Only the epicardial needle had entered the epicardial space while attempting to puncture posteroinferior to the ASD occluder device. The presence of a pericardial effusion was excluded using transthoracic echocardiography. In these patients, the puncture site was sequentially dilated using a 2.5, 3.0, 4.0, and/or 5.0 mm PCI balloon (NC Sprinter RX, Medtronic Inc.), respectively (Figures 4A–4D). Only a single 8.5-F SL1 sheath could be advanced after successful dilatation (Figures 4E and 4F).