Pulmonary Vein Isolation in Patients With Paroxysmal Atrial Fibrillation After Direct Suture Closure of Congenital Atrial Septal Defect

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Two cases of paroxysmal atrial fibrillation (AF) first occurred 15 and 36 years, respectively, after isolated direct suture closure of an atrial septal defect (ASD) and failed to be controlled by antiarrhythmic drug therapy. In these cases, an atrial transeptal procedure was feasible and no residual iatrogenic ASD was observed, even after multiple procedures. Pulmonary vein (PV) isolation was also feasible and safe and could eliminate the AF completely. PV isolation may become an alternative to antiarrhythmic drug therapy in patients with paroxysmal AF occurring late after an isolated direct suture closure of an ASD. (Circ J 2007; 71: 1989 – 1992)

Key Words: Atrial fibrillation; Atrial septal defect; Pulmonary vein isolation; Radiofrequency catheter ablation

Atrial arrhythmias, particularly atrial fibrillation (AF) and atrial flutter (AFL) are common in patients with atrial septal defects (ASDs) and are related to the age at the time of surgical repair and to coexisting heart disease.1-3 Several previous studies suggested that in order to reduce the morbidity associated with late onset AF or AFL, closure of the ASD at a younger age is warranted, and for the high-risk group of patients who are older than 40 years old and have had prior AF episodes, an additional 'maze' procedure may be required at the time of surgical closure of the ASD.1-5 However, AF may newly develop in the low-risk group of patients who have undergone an isolated surgical repair of an ASD. When antiarrhythmic drug therapy fails to control the AF in those patients, catheter ablation to eliminate the AF may be preferred. However, to the best of our knowledge, there have been no reports describing this.

Case Reports

Case 1
A 58-year-old woman with drug-refractory paroxysmal AF was referred for electrophysiologic study (EPS) and radiofrequency catheter ablation. She had undergone direct suture closure of an ASD at the age of 31 years and had complained of palpitations because of AF for the past 2 years. The echocardiographic left atrial (LA) dimension was 33 mm and left ventricular ejection fraction was 0.73.

Written informed consent was given and an EPS was performed after all antiarrhythmic drugs had been discontinued for at least 5 half-lives prior to the study. At baseline, AF persisted. While positioning the mapping catheter in the coronary sinus (CS), the AF terminated spontaneously and thereafter neither atrial premature beats (APBs) nor spontaneous AF were observed. A transseptal procedure was then performed under intracardiac echocardiography (ICE) guidance (Fig 1). Catheterization into the LA was performed with a 1-puncture, 2-sheath technique (1×8-French sheath for the ablation catheter and another 8.5-Fr sheath for the mapping catheter). Intravenous heparin was administered to maintain an activated clotting time >300 s after the atrial transseptal procedure. Selective angiography revealed that the ostial diameter was 22 mm for the left superior pulmonary vein (PV), 20 mm for the right superior PV, 18 mm for the left inferior PV, and 16 mm for the right inferior PV. PV mapping and segmental PV isolation were performed by the same technique as previously reported6 (Fig 1). The superior PVs and left inferior PV were successfully isolated using an 8-mm tip catheter with the guidance of a 31-mm multielectrode basket catheter (MBC), computerized 3-dimensional (D) mapping system and non-fluoroscopic 3-D navigation system. The right inferior PV was successfully isolated using the same ablation catheter with a 20-pole circular catheter because the MBC could not be deployed in the PV. However, AF recurred soon after the procedure and antiarrhythmic drugs still could not control the AF attacks. A second procedure was then performed 6 months later, using the same transseptal procedure and PV mapping as in the first procedure. ICE revealed spontaneous closure of the previous transseptal puncture hole (Fig 1). PV mapping revealed recovery of conduction in the left PVs and right inferior PV. Successful PV isolation was achieved by the same technique as we previously reported? Thereafter, cavo-tricuspid isthmus dependent AFL could be induced by programmed electrical stimulation with isoproterenol infusion. After successful cavo-tricuspid isthmus linear ablation, atrial arrhythmias could not be induced with the same protocol that was used before the ablation. During more than...
1 year of follow-up, this patient has been free of any symptomatic atrial arrhythmias without any antiarrhythmic drugs. Transthoracic cardiac echocardiography at 3 months and 1 year after the second procedure revealed no shunt flow or thrombus formation at the transseptal puncture site of the interatrial septum. No complications occurred.

Case 2
A 43-year-old woman with drug-refractory paroxysmal AF and AFL was referred for EPS and radiofrequency catheter ablation. She had undergone direct suture closure of an ASD at the age of 6 years and had complained of palpitations from AF and AFL for the past year. The echocardiographic LA dimension was 38 mm and left ventricular
Written informed consent was given and an EPS was performed after all antiarrhythmic drugs had been discontinued for at least 5 half-lives prior to the study. The baseline heart rhythm was sinus rhythm. For mapping and pacing, multipolar electrode catheters were positioned in the CS and His Bundle region. At the beginning of the EPS, AFL was induced by burst pacing from the CS and diagnosed as cavo-tricuspid isthmus dependent AFL by entrainment pacing. Cavo-tricuspid isthmus linear ablation was successfully performed and the AFL converted to an incessant form of AF. The transseptal procedure was then successfully performed under fluoroscopic guidance. Thereafter, heparin was administered to maintain an activated clotting time >400 s. Catheterization into the LA was performed with a 1-puncture, 2-catheter technique as previously reported. Selective angiography revealed that the left and right PVs had a common ostium, with diameters of 21 mm and 23 mm, respectively. Mapping of the right PV with a 20-pole circular catheter revealed that the APB triggering the AF originated from the right PV. Successful circumferential isolation of the right PV with a circular catheter (Lasso™, Biosense Webster, Diamond Bar, CA, USA) was achieved with no interruption of the AF. Cardioversion was then performed and sinus rhythm was restored. However, the AF originating from the left PV re-initiated immediately afterward. Circumferential isolation of the left PV with the circular catheter was then performed and the AF terminated before completion of the PV isolation. After isolation of the left PV was successfully achieved, no atrial arrhythmias could be induced despite programmed electrical stimulation with isoproterenol infusion. During more than 1 year of follow-up, the patient has been free of any symptomatic atrial arrhythmias without any antiarrhythmic drugs. Transthoracic cardiac echocardiography at 3 months and 1 year after the procedure revealed no shunt flow or thrombus formation at the transseptal puncture site of the interatrial septum. No complications occurred.

Discussion
These 2 cases did not have any coexisting heart diseases or prior AF episodes, and the isolated surgical closure of the ASD was performed at ages less than 40 years. However, the paroxysmal AF first occurred at 15 and 36 years, respectively, after the surgery and failed to be controlled by antiarrhythmic drug therapy. Idiopathic paroxysmal AF has been demonstrated to be triggered by APBs originating from the PVs and catheter ablation to electrically isolate the PVs from the LA has been established as an effective technique for controlling drug-refractory paroxysmal AF. However, it remains unknown whether PV isolation could be an alternative to antiarrhythmic drug therapy in patients with AF occurring late after surgical closure of an ASD. There are 2 questions to be addressed in the isolation of the PVs in those cases. One is the feasibility and safety of the atrial transseptal procedure after direct suture closure of the ASD. In the 2 present patients, the atrial transseptal procedure was feasible and no residual iatrogenic ASD was observed, even after multiple procedures. The other question is the efficacy of PV isolation in such cases because the mechanism of AF occurring late after surgical closure of an ASD remains unknown. The reason why atrial arrhythmias are common in patients with ASDs could be explained by several factors. Prolonged volume overload leading to atrial stretch may contribute to the arrhythmogenesis and, additionally, as a site of arrhythmogenic foci, PV dissection may play a role. In the 2 cases presented here, the electrophysiological and clinical findings suggested that the AF originated from the PVs.

Conclusion
PV isolation was feasible, effective and safe in 2 patients with paroxysmal AF occurring late after isolated direct suture closure of the ASD. PV isolation may be an alternative to antiarrhythmic drug therapy in such patients.
References


