Received: 9 May 2018 | Accepted: 26 June 2018

DOI: 10.1002/joa3.12096

CASE REPORT

WILEY Journal of Arrhythmia Open Access

Trans-aortic pulmonary vein isolation using magnetic navigation system for paroxysmal atrial fibrillation in a patient with dextrocardia, situs inversus, and inferior vena cava continuity with azygos vein

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Abstract

A 51-year-old male with dextrocardia and situs inversus underwent catheter ablation for paroxysmal atrial fibrillation. Because the procedure through the trans-septal approach was impossible due to the inferior vena cava continuity with azygos vein, we performed pulmonary vein isolation using magnetic navigation system through the retrograde trans-aortic approach. Superior and inferior left-sided and superior right-sided pulmonary veins could be isolated which was confirmed by the ablation catheter. The patient was free from atrial fibrillation episode at the 12 months follow-up except only one palpitation episode lasting nearly 12 hours at 9 months after the ablation.

KEYWORDS

ablation, atrial fibrillation, dextrocardia, inferior vena cava continuity with azygos vein, magnetic navigation

1 | INTRODUCTION

Catheter ablation in patients with dextrocardia and situs inversus may be challenging. Successful pulmonary vein isolation for atrial fibrillation in such patients by the usual trans-septal catheterization through the femoral veins has been reported.[1,2] We experienced a case with additional venous access limitation due to the inferior vena cava continuity with azygos vein.

2 | CASE REPORT

A 51-year-old male with dextrocardia and situs inversus presented palpitation due to paroxysmal atrial fibrillation episodes lasting a few days nearly twice or three times a month. Transthoracic echocardiography revealed normal left ventricular function; the left atrial diameter was 34 mm, and the left ventricular ejection faction was 78%. He was referred for catheter ablation. However, the usual trans-septal approach for the left atrium through the femoral vein was not available because a three-dimensional computed tomography (3D CT) revealed the inferior vena cava (IVC) continuity with azygos vein which was connected to the superior vena cava. Because an atrial septal defect or a patent foramen ovale had not been detected by the trans-esophageal echocardiography, trans-femoral left atrial catheter ablation was considered to be impossible in this patient. After the informed consent was obtained, we attempted pulmonary vein isolation through the retrograde trans-aortic approach using the magnetic navigation system (Niobe II™, Stereotaxis Inc., St Louis). One venous access was achieved in the left femoral vein, and an intracardiac echocardiography (AcuNav™,

Biosense Webster® Inc., Diamond Bar, CA) was introduced and positioned in the azygos vein at the level of middle atrium to monitor the cardiac tamponade during the procedure. Another venous access was achieved in the left carotid vein, and a diagnostic 20-polar catheter was positioned in the coronary sinus. The arterial access was gained through the left femoral artery using an 8.5-Fr steerable introducer (Agilis™, St. Jude Medical, MN) to manually introduce the ablation catheter to an ascending aorta easily, and the ablation procedure was guided by CARTO™ (Biosense Webster® Inc.) electroanatomical mapping system. A magnetically enabled, steerable tip irrigated ablation catheter (Navistar RMT Thermocool, Biosense Webster®) was introduced through the femoral artery and was controlled by magnetic navigation. This catheter could reach the left atrium passing through both the aortic and mitral valve (Figure 1), and a fast anatomical map of the left atrium and the pulmonary veins (PVs) were made using the CARTO system. A circumferential catheter ablation of the PVs ostia was tried by radiofrequency energy applications (20-40 W), and the superior and inferior left-sided and the superior right-sided (=appendage side) pulmonary vein could be successfully isolated which were confirmed by the disappearance of PV potentials in each PV and noncaptured left atrium by intra PV pacing (20 V) by the Navistar RMT ablation catheter itself. Inferior right-sided PV could not be isolated due to the difficult catheter manipulation by the magnetic navigation because the distal tip of the ablation catheter repeatedly dropped into the left ventricle which may be due to short distance between mitral annulus and that PV orifice (Figure 2). Total procedure time and fluoroscopy time were 240 minutes and 23 minutes, respectively. There was no complication. After the procedure, the patient was free from atrial fibrillation episode at the 12 months follow-up without antiarrhythmic agents except only one palpitation episode lasting nearly 12 hours at 9 months after the ablation.

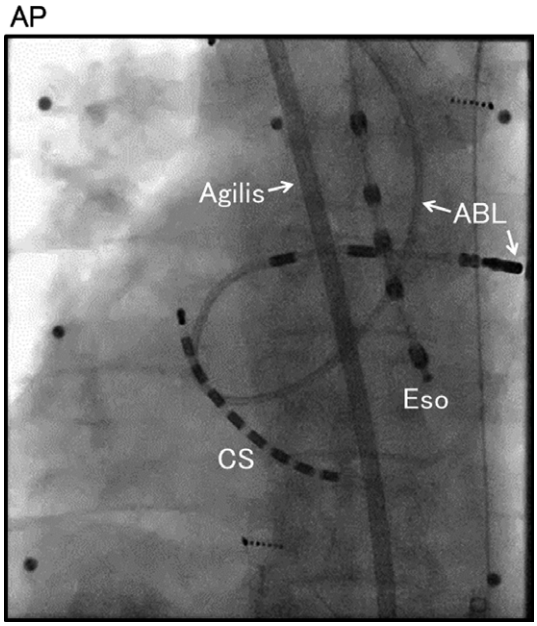

Figure 1 Fluoroscopic catheter positioning. ABL, ablation catheter; CS, coronary sinus; Eso, esophageal temperature monitor

3 | DISCUSSION

Dextrocardia with situs inversus is the most common type of dextrocardia in the general population (1-2/20 000),[3] and the IVC continuity with azygos vein is seen in 0.6% of patients with congenital heart disease.[4] In such patients, ordinary trans-femoral approach for pulmonary vein isolation must be limited and there were only a few reports about the catheter ablation using trans-jugular approach. Recently, Kato et al. reported the technic for trans-septal puncture and catheter ablation via the superior vena cava for atrial fibrillation in a patient with polysplenia syndrome and interruption of the inferior vena cava.[5] They successfully performed trans-septal puncture through the right jugular vein using manually curved Brockenbrough needle and intracardiac echocardiographic guidance, and accomplished pulmonary vein isolation using deflectable guiding sheath and a contact force-sensing ablation catheter. Their method has a few

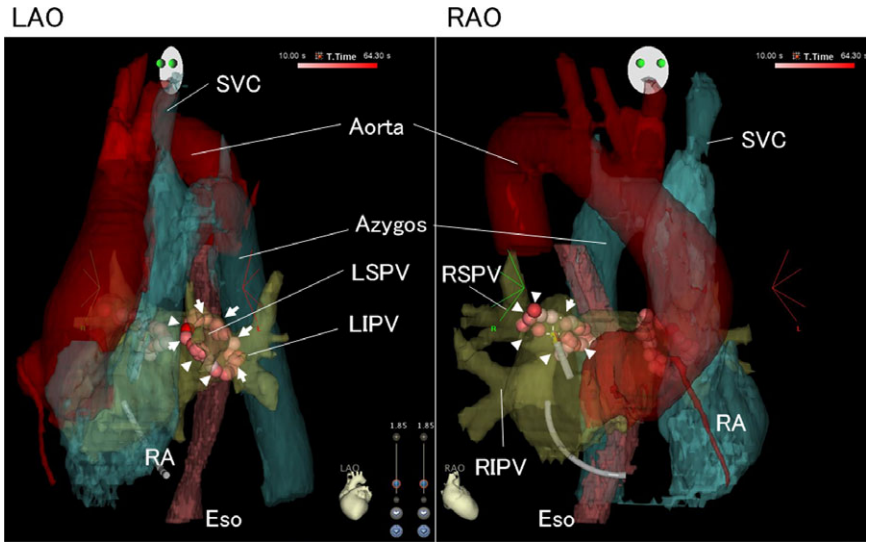

Figure 2 Anatomical re-construction using 3D CT and ablation site. SVC, superior vena cava; Azygos, azygos vein; RA, right atrium; LPV, left-sided pulmonary vein; RPV, right-sided pulmonary vein. White triangles indicate the ablation line around the PVs. Collar range of ablation tags was dependent on the RF time

advantage compared to our trans-aortic pulmonary vein isolation using magnetic navigation system. First, they could use contact force-sensing system which was not available in magnetic navigation. Second, they could confirm the complete pulmonary vein isolation using a ring catheter which was introduced through the trans-septal sheath. However, the procedure time and fluoroscopy time were not shown in this report. In addition, this technic for the patients with dextrocardia has not been reported and considered to be much difficult. Magnetic navigation system is useful for such a patient without using complicated trans-septal puncture technique and catheter manipulation nearside the radiation source and is expected to reduce physicians' physical stress and both patients' and physicians' radiation exposure during the procedure. One palpitation episode during 12 months follow-up may be the recurrence of atrial fibrillation, but at least the symptomatic episode must be much decreased after the ablation.

Finally, we had a limitation in this case. Electrophysiological data such as left atrial voltage map and induction of AF triggers using isoproterenol before and after PV isolation were not evaluated. If this patient had AF trigger from superior vena cava (SVC), SVC isolation via an azygos-SVC root may be possible.

4 | CONCLUSIONS

To the best of our knowledge, this is the first case report of trans-aortic pulmonary vein isolation using magnetic navigation system for paroxysmal atrial fibrillation in a patient with dextrocardia, situs inversus, and inferior vena cava continuity with azygos vein. Magnetic navigation system is a useful tool to treat patients with arrhythmia who have limited vascular access and congenital heart disease.

CONFLICT OF INTEREST

Authors declare no conflict of interests for this article.

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How to cite this article: Okajima K, Nakanishi T, Ichibori H, et al. Trans-aortic pulmonary vein isolation using magnetic navigation system for paroxysmal atrial fibrillation in a patient with dextrocardia, situs inversus, and inferior vena cava continuity with azygos vein. *J Arrhythmia*. 2018;34:583–585. https://doi.org/10.1002/joa3.12096