Received: 4 December 2018 | Revised: 4 May 2019 | Accepted: 8 June 2019

DOI: 10.1002/ccr3.2304

CASE REPORT

Clinical Case Reports Open Access WILEY

Successful cryoballoon ablation of a focal atrial tachycardia in a patient with situs inversus and dextrocardia

Ersan Akkaya | **Korkut Sözener** | **Johannes Rixe** | **Damir Erkapic**

Department of Cardiology and Electrophysiology, Jung Stilling Hospital Siegen, Siegen, Germany

Correspondence
Ersan Akkaya, Department of Cardiology and Electrophysiology, Jung Stilling Hospital Siegen, Wichernstr. 40, 57074 Siegen, Germany.
Email: Ersan.Akkaya@diakonie-sw.de

Funding information
There was no funding for this study.

Abstract

Cryoballoon ablation of an arrhythmogenic focus alongside a pulmonary vein as an alternative to radiofrequency ablation may be feasible and safe in patients with situs inversus and dextrocardia.

KEYWORDS

catheter ablation, cryoballoon, dextrocardia, focal atrial tachycardia, situs inversus

1 | INTRODUCTION

A 53-year-old woman presented with recurrent, drug-refractory atrial tachycardia. Situs inversus with dextrocardia was diagnosed in childhood. Catheter ablation with a second-generation cryoballoon guided by an EnSite™ NavX™ system was performed successfully with termination of the atrial tachycardia, which originated from the carina inferior to the lateral superior pulmonary vein. This favorable outcome suggests that cryoballoon ablation of an arrhythmogenic focus alongside a pulmonary vein may be feasible and safe in patients with situs inversus and dextrocardia.

Cryoballoon (CB)-based isolation of pulmonary veins (PVs) and left atrial substrate modification is increasingly being used in patients with paroxysmal[1] and persistent atrial fibrillation.[2] In contrast, focal atrial tachycardia typically responds well to radiofrequency (RF) ablation. However, catheter ablation of an arrhythmogenic focus by means of the second-generation CB (CB-Adv; Arctic Front Advance™, Medtronic) in a patient with situs inversus and dextrocardia has not been reported to date. Herein, we report the successful ablation of a focal atrial tachycardia (AT) originating from the carina inferior to the lateral superior PV in a patient with complete situs inversus.

2 | CASE REPORT

A 53-year-old woman with drug-refractory AT and a history of situs inversus and dextrocardia presented for catheter ablation. Preinterventional computed tomography imaging confirmed the abnormal anatomy and ruled out possible malformation of the left atrium and PVs (Figure 1). Written informed consent was obtained after all the potential risks of ablation were discussed with the patient.

Cryoballoon ablation was performed during AT (cyclus length, 423 ms) under conscious sedation. Biplane fluoroscopy with 30° left and 60° right anterior oblique views was used, and diagnostic mapping was conducted with two 6-Fr decapolar catheters (ViaCath, Biotronik) via the left femoral vein: one catheter in the coronary sinus (CS) and one in the right ventricular apex. The electrical propagation in the CS suggested a left atrial origin of the AT. The tachycardia was incessant and unresponsive to overdrive pacing.

Akkaya and Sözener are contributed equally

A single transseptal puncture via the right femoral vein was performed under the guidance of transesophageal echocardiography (Philips iE33 system, Philips Medical Systems) with an 8.5-Fr SL-1 sheath (Abbott) by means of the modified Brockenbrough technique (BRK-1, Abbott). Selective PV angiography was performed to identify the PV anatomy. Once transseptal access was obtained, heparin boluses were repeatedly administered to maintain the activated clotting time between 300 and 350 seconds. Three-dimensional mapping was performed with a circular mapping catheter (Advisor™ FL, Abbott) via a SL-1 sheath under the guidance of the NavX system (EnSite™ NavX™, Abbott). The local activation time map showed a focal propagation from the carina inferior to the lateral superior PV as the origin of the AT (Figure 2).

FIGURE 1 Chest radiogram demonstrating dextrocardia

Then, the SL-1 sheath was exchanged over a guide wire in the lateral superior vein with a 12-Fr steerable sheath (FlexCath Advance™, Medtronic). The latter was constantly flushed with heparinized saline. Through the steerable sheath, a 20-mm-diameter Achieve™ inner-lumen-mapping catheter (Medtronic) was placed in the lateral superior PV to record baseline signals. The 28-mm CB-Adv was advanced over the Achieve catheter, inflated, and positioned at the PV ostium. To assess the exact position of the inflated balloon in relation to the PV, contrast medium diluted with saline 0.9% (1:1 ratio) was injected from the distal lumen of the CB catheter. Selective contrast injection showed no backflow into the atrium and therefore a total vessel occlusion (Figure 3A). The first attempt at cryoablation, for 240 seconds at a maximum temperature of −51°C, led to immediate deceleration and termination of the tachycardia within 30 seconds of the initiation of cryoenergy application (Figure 3B). During cryoenergy application, diaphragm movement was assessed by intermittent fluoroscopy. No PV activity was noticed within the PVs during AT or sinus rhythm. After 30 minutes of waiting, tachycardia was not inducible in the basal state or under pharmacologic stimulation. A bonus freeze was not performed. Total procedure and fluoroscopy times were 105 and 18 minutes, respectively. Pericardial effusion was excluded by echocardiography immediately after ablation. Venous access site closure was achieved by subcutaneous temporary suture closure after removal of the venous sheaths.[3] Preserved phrenic nerve function was documented through diaphragmatic tone by X-ray examination before discharge. During short-term

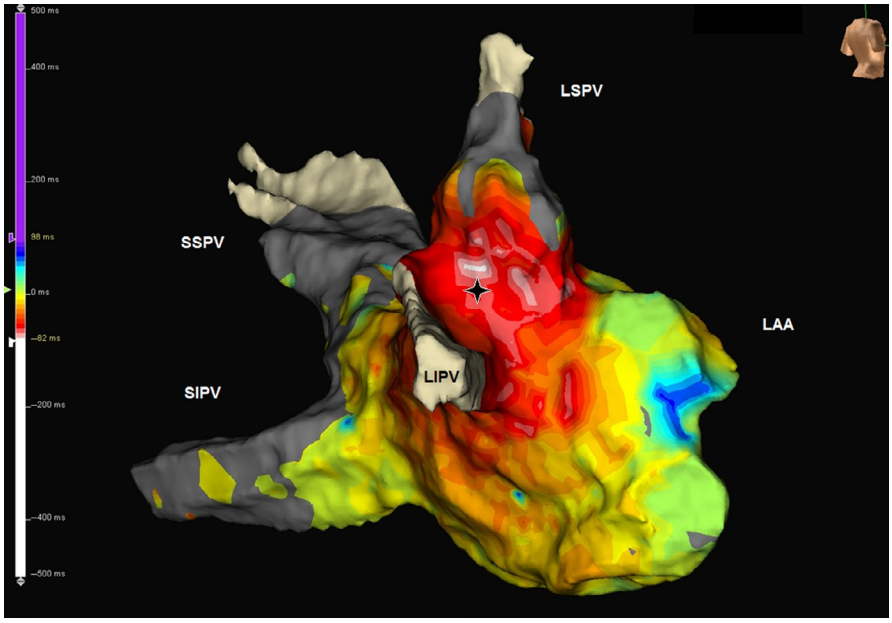

FIGURE 2 Local activation time map demonstrating the earliest activation of the atrial tachycardia (black star). LAA, left atrial appendage; LIPV, lateral inferior pulmonary vein; LSPV, lateral superior pulmonary vein; SIPV, septal inferior pulmonary vein; SSPV, septal superior pulmonary vein

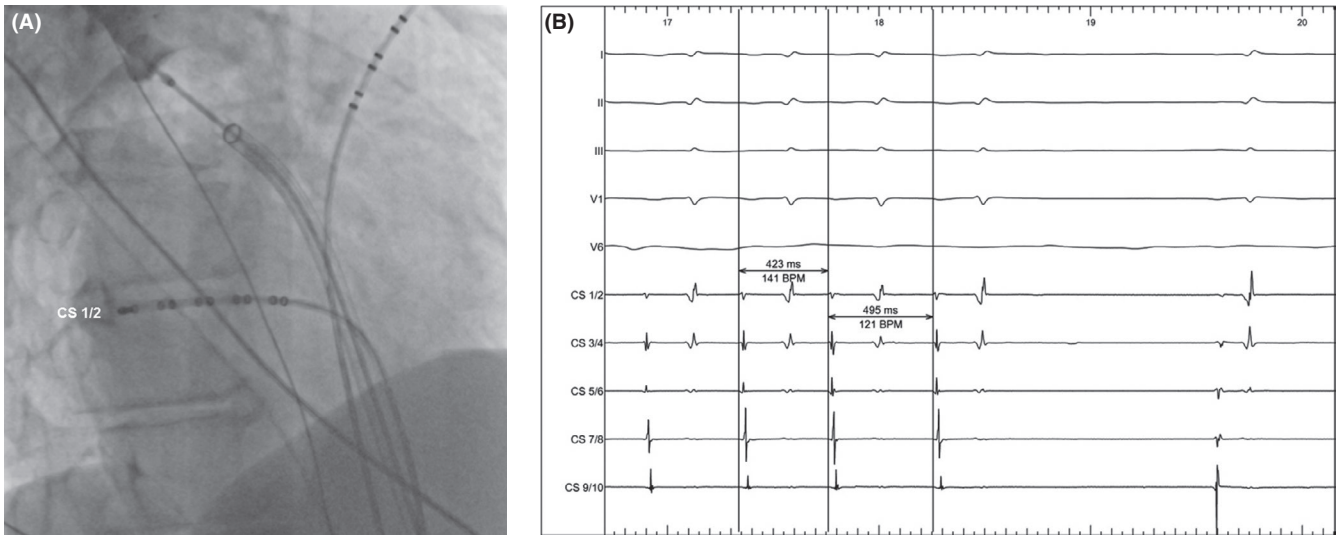

FIGURE 3 A-B (A), Visualization of the LSPV with selective contrast injection before starting CB ablation. (B), Electrogram showing the termination of the atrial tachycardia (activation pattern beginning from the distal CS, corresponding number 1/2 on the CS catheter) during CB ablation in the LSPV. CB, cryoballoon; CS, coronary sinus; LSPV, lateral superior pulmonary vein

follow-up (90 days), stable sinus rhythm was maintained without any complications or arrhythmia recurrences.

3 | DISCUSSION

Cryoballoon ablation is the preferred method for isolation of PVs, especially in patients with ATs originating inside the PVs. In addition, CB-based isolation of the left[4] and right atrial appendages[5] for treatment of focal ATs has been reported previously. Furthermore, CB-based isolation of PVs has been shown to be a feasible approach in patients with situs inversus.[6] However, ours is the first report illustrating successful CB ablation of a focal AT originating from the carina inferior to the lateral superior PV in a patient with both situs inversus and dextrocardia. The brief deceleration and immediate termination of the tachycardia as well as the three-dimensional mapping characteristics were consistent with the automatic nature of the focal AT in this patient.

Radiofrequency ablation of ATs shows high success rates and acceptable long-term outcomes when compared with the CB technique, as reported by Wei et al[7] They compared the focal ablation and unilateral PV isolation using RF energy with the CB-based ablation of ATs originating inside PVs. Nevertheless, the small number of patients (60 RF and 23 CB patients) is a limitation of this trial. Furthermore, there is no evidence for patients with anatomical variations like a situs inversus. However, a recent study found that the low-voltage area was larger after CB ablation than after RF ablation, and the unexcitable tissue along ablation lines was wider after CB ablation than after RF ablation.[8] Additionally, the CB technique reportedly results in larger lesions and fewer lesion gaps in the anterior-superior segments of the lateral PVs compared with the RF technique.[9] In this context, the involvement of greater areas in the ablation maybe important in the case of ATs originating alongside the PVs like in the present report. Furthermore, a large register study showed that the complication rates with CB ablation are lower than those with point-per-point RF ablation.[10] The ability to perform ablation with the CB as a "single-shot" device without the needing of more than one transseptal puncture in patients with an unusual left atrial anatomy is an additional argument for performing this ablation procedure empirically in CB technique.

The possibility of mapping by means of a three-dimensional mapping system combining ablation via CB technique can be crucial especially in patients with difficult handling and maneuvering of the sheaths and catheters inside the left atrium due to situs inversus and dextrocardia.

The RF as well as the CB technique seems to be an acceptable method for ablation of focal ATs inside or alongside the PVs. Nevertheless, the choice between both approaches depends on the operators' preference and experience. In the authors' opinion, the results reported herein suggest that the CB technique may be an efficient and safe alternative for point-per-point ablation of refractory focal ATs inside and between the PVs, especially in patients with situs inversus. More data and experience are necessary to evaluate the role and safety of the CB technique combined with a three-dimensional mapping system, but equally difficult due to limited number of patients with this anatomical peculiarity.

ACKNOWLEDGMENTS

No individuals other than the named authors played any role in this study.

CONFLICTS OF INTEREST

All authors declare no conflict of interest related to this study.

AUTHOR CONTRIBUTIONS

EA: conceived the data, analyzed the data, drafted the manuscript, and approved the manuscript; KS: critically revised the article and approved the manuscript; JR: contributed to imaging; DE: conceived the data and critically revised the article.

ORCID

Ersan Akkaya https://orcid.org/0000-0002-2731-9885

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How to cite this article: Akkaya E, Sözener K, Rixe J, Erkapic D. Successful cryoballoon ablation of a focal atrial tachycardia in a patient with situs inversus and dextrocardia. *Clin Case Rep*. 2019;7:1903–1906. https://doi.org/10.1002/ccr3.2304