ELECTROPHYSIOLOGY
Case Report
https://doi.org/10.24207/jca.v34i1.3438

Left-Sided Pulmonary Isolations After Complete Right-Sided Pneumonectomy: Technical Challenges to Clinical Success

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ABSTRACT

Male patient, 76 years old, presented symptomatic paroxysmal AF for almost 2 years. Long submitted to total right pneumonectomy and having a major cardiac rotation. The use of tomography and intracardiac ultrasound were fundamental for a better anatomic comprehension and optimization of the safety procedures for AF ablation in these patients, due to the difficulty in accessing the left atrium and the consequent manipulation of catheters. In this case, electrical signals have not yet been detected in the stumps on the right side, with only the left veins being isolated. This approach constitutes a new approach in this clinical situation, with clinical success in a 3-year follow-up.

KEYWORDS: Atrial fibrillation; Pneumonectomy; Ablation; Pulmonary vein stumps.

INTRODUCTION

Catheter ablation, trough the electric isolation of the pulmonary veins (PV) is considered the cornerstone for the treatment for atrial fibrillation (AF)[1,2]. The access of the left atrium and the isolation of the PV in a pneumonectomy patient is a challenge, due to uncommon cardiac rotation, which increases the procedure complexity[3,4]. Described in the present report is a right-sided pneumonectomy patient with PV stumps in an unusual way.

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Received: Dec 14, 2020 | **Accepted:** Feb 24, 2021

CASE PRESENTATION

Male patient, 76 years old, presents symptomatic paroxysmal AF for almost 2 years, despite the antiarrhythmic treatment (sotalol, propafenone and amiodarone). Forty years earlier, patient underwent complete right-sided pneumonectomy, due to a traffic incident. The patient also uses apixaban 5 mg b.i.d., without the interruption pre procedure. Before the procedure, the anatomy of the left atrium (LA) was evaluated via computed tomography (CT) and, subsequently, a three-dimensional reconstruction was made. The reconstruction showed the presence of small diverticula in the anterior superior position in the LA, with 8.9 mm in base and 3.2 mm of length. Left atrium appendix has 6.9 × 14 mm in ostium diameter in a chicken wing morphology. The left superior vein has an outfall in the LA with 15.7 mm of length and 19.2 × 13.7 mm in diameter and the left inferior vein with 24.4 mm of length and 18.9 × 14.5 mm in diameter. Surgical exclusion of the right PVs, with 8.1 mm long superior stump and no visualized inferior stump (Fig. 1), was assessed.

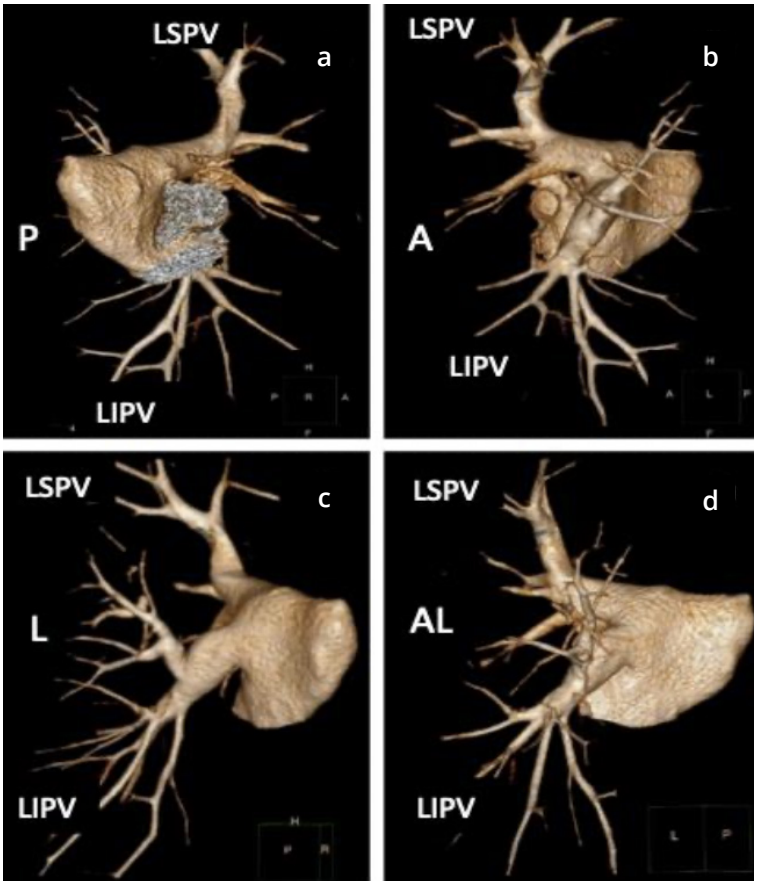

Figure 1. Three-dimensional reconstruction of the LA and PV.
LSPV: left superior pulmonary vein; LIPV: left inferior pulmonary vein.

Before the transseptal puncture, the presence of thrombus in the LA was excluded by the intracardiac ultrasound (ICU) (Viewflex XTRA, St Jude Medical Inc., St. Paul, MN, USA). Then, the decapolar catheter was set up in the coronary sinus, which allowed the identification of the important rotation of the heart. The catheter of ablation (4 mm – Flexability, St Jude Medical Inc., St. Paul, MN, USA) was initially positioned in the region of His bundle, to serve as an anatomic marker of the root of the aorta. Two transseptal punctures were made, guided by the ICU and fluoroscopy, using BRK curved needle (St. Jude Medical Inc., St. Paul, MN, USA) and Swartz curve type SL1 (St Jude Medical Inc., St. Paul, MN, USA) (Fig. 2).

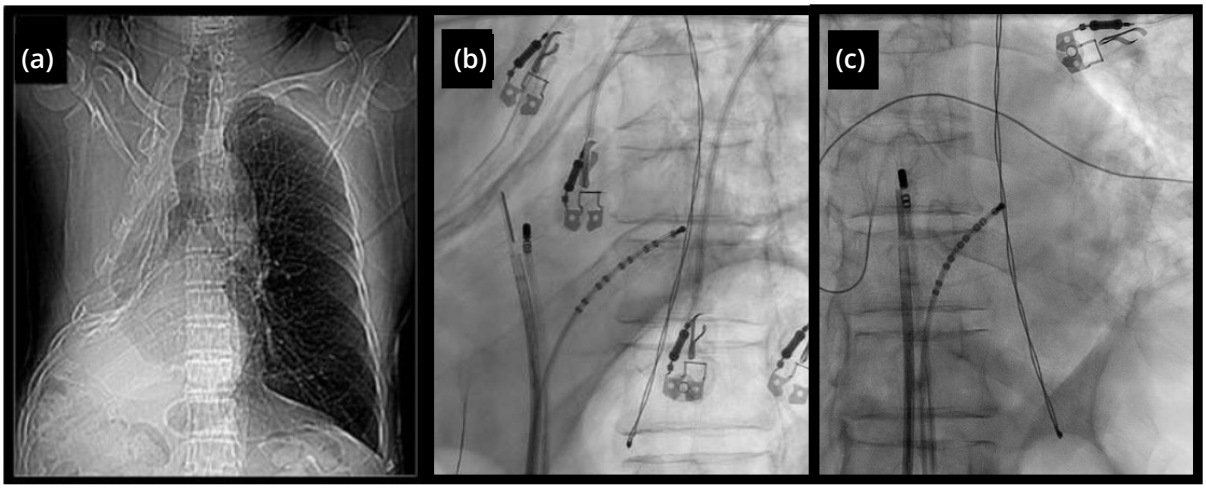

Figure 2. (a) Aspect of the chest X-ray after right pneumonectomy; (b, c): B: Presence of catheter in intracardiac ultrasound, catheter of ablation positioned in the region of the bundle of His; and decapolar catheter in the interior of the coronary sinus (B – left anterior oblique projection 35° and C – right anterior oblique projection 35°).

Mapping (Inquiry AFocus Catheter) and ablation catheters were then introduced into the left atrium, a three-dimensional anatomical map (EnSite Velocity, St Jude Medical Inc., St. Paul, MN, USA) of this chamber was performed. In this reconstruction, it was identified the ostia of the PV (Fig. 3).

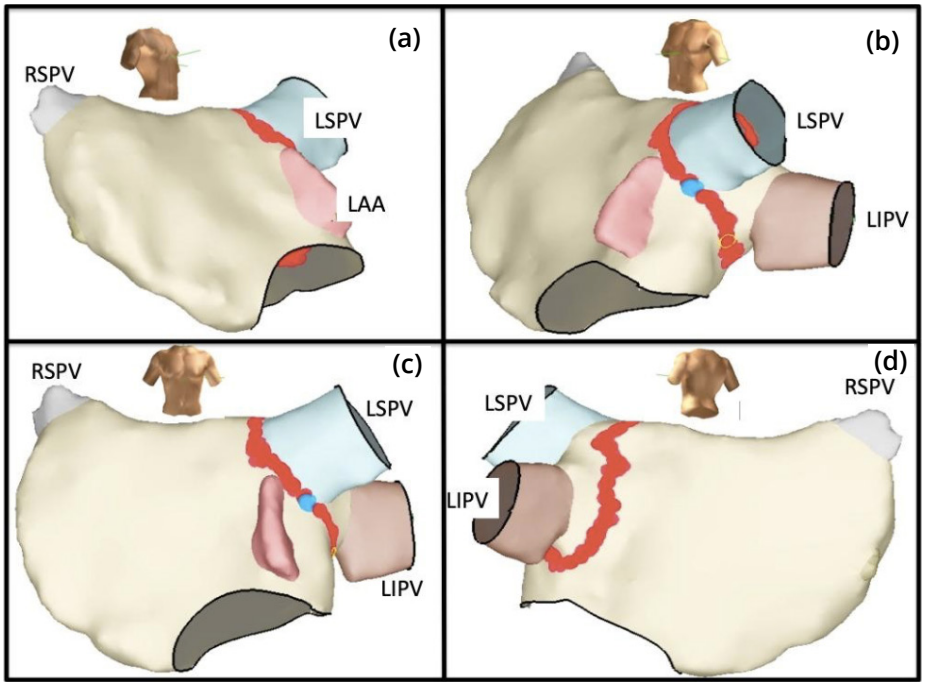

Figure 3. Three-dimensional LA reconstruction (EnSite Velocity, St Jude Medical Inc., St. Paul, MN, USA).
RSPV: right superior pulmonary vein; LSPV: left superior pulmonary vein; LIPV: left inferior pulmonary vein; LAA: left atrial appendage.

The mapping catheter was inserted in the PVs to identify the venous anatomy and PV potentials. The PVs in the left registered electrical activity with PV potentials, which were then isolated through the application of circumferential radiofrequency. Entrance and exit blocks were achieved following ablation. In accordance with the CT, stump in the right superior vein were documented and, therefore, electric potentials of PV were not registered. With that in mind, the team decided not to perform the ablation. After 36 months of monitoring, the patient remained asymptomatic, without antiarrhythmic medication and no documentation of new AF events.

DISCUSSION

The PVs present an important role in the trigger of the AF, its electric isolation is the cornerstone of the invasive treatment. Patients with cardiac rotational distortion and pulmonary vein disorders become particularly challenging to electrically isolate the PVs[1,2]. These complications are often identified in postoperative pneumonectomy[1,2]. Previous thoracic operations, including pneumonectomy, can increase AF risk[5]. In addition to the anatomic distortion of the mediastinum, creating cardiac rotation, the presence of PV stumps makes ablation difficult, since the access of the LA and the manipulation of the trans-procedural catheters are both compromised[3,4,6]. To minimize the complications of transseptal puncture (such as puncture of the aorta or cardiac free wall), it is very important the utilization of ICU in order to correctly orientate the procedure, such as used in the case described. Another important detail is the center's experience in AF ablation procedures, seeing that it minimizes the difficulties related to the transseptal puncture. Dixit et al. were the first authors to show that PV stumps can be a source of electrical activity responsible for AF and should be checked during ablation, other publications confirm that finding[7]. Kanmanthareddy et al. related a medium extension of 28 (10–36) mm venous stumps, that in the majority of cases there is the anatomic preservation of the arrhythmogenic potential post-surgery. When uncommon anatomy is confirmed, the electrical activity was confirmed in 100% of the stumps[8]. Furthermore, following surgical truncation, the remaining stumps could have undergone fibrotic changes, resulting in complex anisotropy and, consequently, increase in the risk of AF[8]. In our report, we recorded venous stumps of small extension, in the lower right being even harder to identify, that may explain the absence of electrical potentials detected in their region of the procedure. The conduct of not performing the anatomical isolation of this region was apparently correct, due to the absence of arrhythmia recurrence. Knowledge of cardiac anatomy with pre-procedure tomography and associated three-dimensional mapping can identify venous stumps and can recognize stumps of prolonged extension with identified electrical activity, that are targets for possible ablation. The absence of these characteristics perhaps constitutes stumps that are not targets for ablation, as chosen in our case.

CONCLUSION

In spite of the technical challenges, AF ablation in patients with pneumonectomy is feasible and safe. The utilization of additional tools, such as tomography and ICU, are fundamental for a better anatomic comprehension and optimization of procedure safety. Association of unidentified anatomically or reduced size (< 10 mm) stumps are probably not empiric targets for ablation, provided they are proven not to have electrical activity.

ACKNOWLEDGMENTS

Not applicable.

FUNDING

Not applicable.

AUTHORS' CONTRIBUTION

Conceptualization: Bertoldi G. H. S., Ronsoni R. M. and Silvestrini T. L.; **Methodology:** Bertoldi G. H. S., Ronsoni R. M. and Silvestrini T. L.; **Investigation:** Bertoldi G. H. S., Ronsoni R. M. and Silvestrini T. L.; **Writing – Original Draft:**

Bertoldi G. H. S., Ronsoni R. M. and Silvestrini T. L.; **Writing – Review and Editing:** Bertoldi G. H. S., Ronsoni R. M. and Silvestrini T. L.; **Funding Acquisition:** Bertoldi G. H. S., Ronsoni R. M. and Silvestrini T. L.; **Resources:** Bertoldi G. H. S., Ronsoni R. M. and Silvestrini T. L.; **Supervision:** Bertoldi G. H. S., Ronsoni R. M. and Silvestrini T. L.

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