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Case Report
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A Unique Occurrence of Pulmonary Vein Occlusion Following AF Ablation: A Case Report

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Abstract

Pulmonary vein stenosis (PVS) is a rare but potentially serious complication of atrial fibrillation (AF) ablation. We present a case of a 30-year-old male with a history of multiple radiofrequency ablations for AF who developed complete occlusion of the left superior pulmonary vein (LSPV) and near-complete stenosis of the left inferior pulmonary vein (LIPV). The patient presented with palpitations and dyspnea, and imaging revealed marked post-ablation narrowing and collateral formation. Pulmonary venous stenting of the LIPV was successfully performed, resulting in symptomatic and anatomical improvement. This case highlights the importance of maintaining high clinical suspicion for PVS following AF ablation and demonstrates the role of timely imaging and intervention in preventing irreversible pulmonary damage.

Keywords: Pulmonary Vein Occlusion, Atrial Fibrillation Ablation, Pulmonary Vein Stenosis, Radiofrequency Ablation, Cardiac Computed Tomography.

Introduction

Pulmonary vein stenosis (PVS) is a rare but serious iatrogenic complication of atrial fibrillation (AF) ablation, with post-2000 incidence rates estimated between 0.29–3.4% [1]. While most cases are mild and clinically silent, severe stenosis or occlusion can cause significant hemodynamic and respiratory consequences. The onset is often insidious, with symptoms such as dyspnea, cough, chest discomfort, and hemoptysis occurring weeks to months after the procedure. The underlying mechanism involves thermal injury from radiofrequency ablation (RFA), leading to endothelial damage, inflammation, and fibrotic narrowing of the pulmonary vein ostia. Redo procedures and ablation close to the vein ostium increase the risk. We present a rare case of complete LSPV occlusion with collateral formation and near-complete LIPV stenosis in a young patient following multiple RFAs, successfully managed with stenting.

Case Presentation

A 30-year-old male with a history of AF status post multiple RFAs, an implantable loop recorder (ILR), congestive heart failure (LVEF 35%), and hypertension underwent redo RFA targeting the left pulmonary vein (LPV), LPV carina, and anterosuperior right pulmonary vein (RPV). Within weeks post-procedure, he developed intermittent palpitations described as "skipped beats," which progressively worsened and were accompanied by exertional dyspnea. He presented to the emergency department for evaluation. Examination: Vitals were stable.

Cardiopulmonary examination revealed left basilar crackles without peripheral edema. Investigations: - ECG: Sinus rhythm with occasional premature atrial contractions. - Laboratory work-up: Unremarkable. - Chest X-ray: Left lower lobe atelectasis. - ILR interrogation: Two recent AF episodes. - Echocardiography: LVEF 35%, pulmonary artery systolic pressure 15 mmHg, no significant valvular pathology.

Contrast-enhanced cardiac CT with 3D reconstruction: Normal right superior and inferior pulmonary veins. Left superior pulmonary vein (LSPV) ostium not visualized (complete occlusion). Left inferior pulmonary vein ostium (LIPV) measured 2.3 × 2.4 mm (near-complete occlusion) compared to pre-ablation measurements of LSPV 14 × 14 mm and LIPV 15 × 19 mm. Collateral vessels draining into the left atrium were noted. Intervention: The patient underwent pulmonary venous stenting of

the LIPV under general anesthesia. An 11 mm bare-metal stent was deployed with no residual gradient. Follow-up: Post-procedure CT confirmed patent LIPV stent (10 × 9 mm) and persistent LSPV occlusion with mature collateral channels. The patient remained asymptomatic on follow-up, with no recurrence of AF episodes.

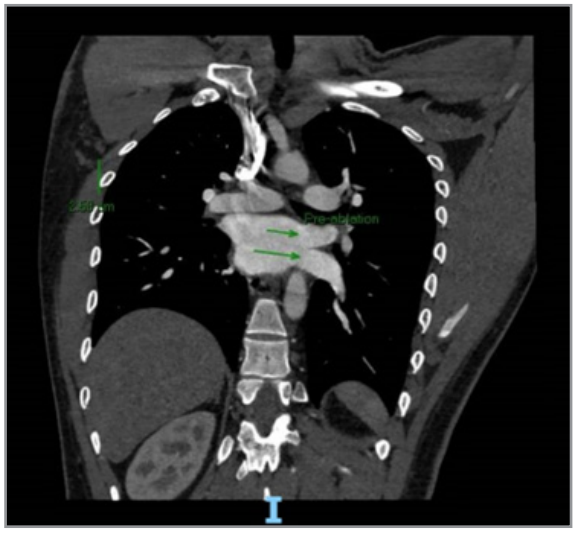

Figure 1: Contrast-enhanced coronal CT cardiac image showing normal pulmonary venous anatomy prior to ablation. Left superior pulmonary vein ostium: 14 × 14 mm. Left inferior pulmonary vein ostium: 15 × 19 mm.

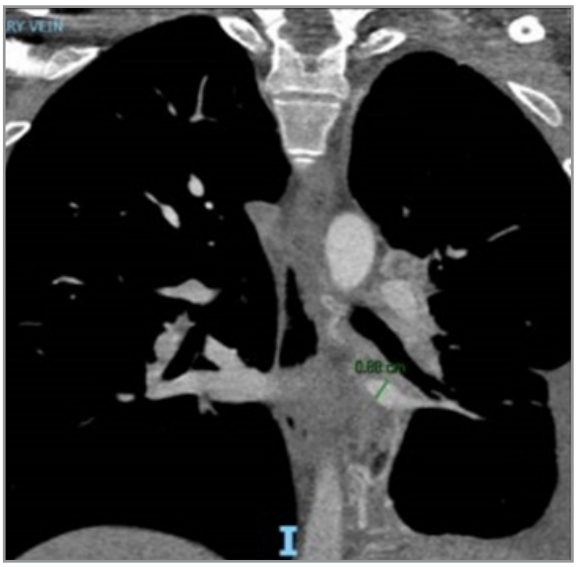

Figure 2: Pre-ablation, coronal view, CT image of the Left inferior pulmonary vein ostium before ablation.Left inferior pulmonary vein ostium diameter: Approximately 14–15 mm, with no evidence of narrowing or flow limitation.

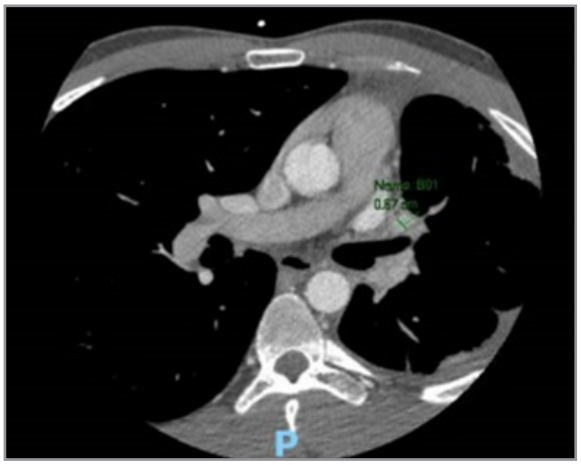

Figure 3: Post-ablation, axial view, contrast-enhanced axial CT cardiac image at the level of the left pulmonary venous ostium. Left superior pulmonary vein: Severely narrowed with residual lumen of 0.87 mm, consistent with near-total occlusion.

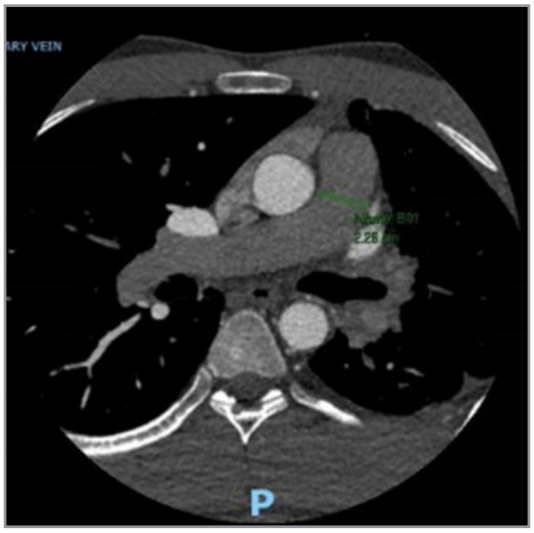

Figure 4: Post-ablation, axial view, contrast-enhanced axial CT cardiac image at the Left inferior pulmonary vein ostium after ablation. Left inferior pulmonary vein lumen (LIPV): Severely reduced to 2.26 mm, indicating >90% stenosis.

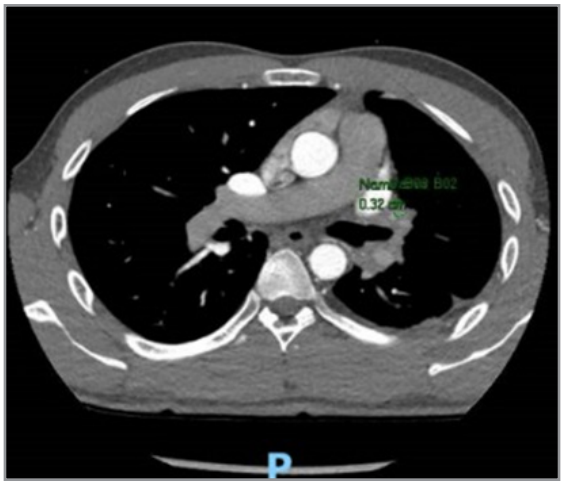

Figure 5: Post-ablation, axial view, contrast-enhanced axial CT cardiac image of the Left superior pulmonary vein ostium (LSPV) Measured at 0.32 mm, consistent with complete functional occlusion

Discussion

PVS after AF ablation is rare but clinically significant. The pathogenesis involves thermal injury to the pulmonary vein endothelium, leading to inflammatory and fibrotic remodeling. Redo ablation and aggressive energy delivery near the vein ostium significantly increase the risk [2, 3]. Clinical Presentation: Symptoms can be subtle or absent in early stages. When present, they often mimic other cardiopulmonary conditions, leading to diagnostic delays [4]. Complete occlusion may be asymptomatic if collateral circulation develops, as in our case. Diagnosis: Cardiac CT with 3D reconstruction is the gold standard for diagnosis, providing detailed anatomical assessment. Other modalities include MRI and transesophageal echocardiography [5]. Management: Treatment options depend on severity and symptomatology. Balloon angioplasty and stent implantation are the primary interventions, with stenting associated with lower restenosis rates [6]. Surgical repair is rarely performed, usually reserved for refractory cases. Prognosis: Despite intervention, restenosis can occur in up to 50% of cases within a year, necessitating long-term surveillance [7]. Our case is notable for the young age, bilateral severe involvement, and the presence of established collaterals, emphasizing the need for early post-ablation screening even in asymptomatic individuals.

Conclusion

This case highlights the importance of early detection of pulmonary vein stenosis/occlusion after AF ablation. Regular imaging follow-up, especially in patients undergoing multiple ablations, can prevent irreversible complications. Prompt endovascular intervention can restore pulmonary venous flow and improve clinical outcomes.

Patient Consent

Written informed consent was obtained from the patient for publication of this case report.

Conflict of Interest

The authors declare no conflicts of interest related to this publication.

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