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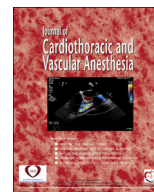


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## Case Report

## Acute Pulmonary Hemorrhage Following Radiofrequency Ablation of Atrial Fibrillation

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PULMONARY HEMORRHAGE IS a rare but serious complication of atrial fibrillation ablation. Cryotherapy and radiofrequency are the 2 approved forms of catheter ablation. The efficacy rates of the 2 procedures are similar although reported complications differ slightly.<sup>1-3</sup> To the authors' knowledge, pulmonary hemorrhage immediately following a radiofrequency ablation has never been reported in the literature. This case report describes a patient who developed pulmonary hemorrhage immediately following an elective radiofrequency ablation for paroxysmal atrial fibrillation. Written informed consent was obtained from the patient.

### Case Report

A 40-year-old male smoker with symptomatic paroxysmal atrial fibrillation presented for an elective radiofrequency ablation and pulmonary vein isolation after failing medical management. Notable medical history included implantation of a loop recorder for arrhythmia monitoring, transient ischemic attack, and a Nissen fundoplication for gastroesophageal reflux disease. Home medications included dabigatran stopped

4 days before the procedure, aspirin, losartan, colestipol, and atenolol. Preoperative coagulation studies showed a prothrombin time of 12.5 and international normalized ratio of 0.9, and type and cross was performed. Preprocedure transesophageal echocardiography demonstrated normal biventricular function without significant valvular disease. Pulmonary vein computed tomography showed 2 left pulmonary veins draining into the left atrium by a common trunk and 2 right pulmonary veins draining separately into the left atrium.

In the electrophysiology laboratory, after induction of general anesthesia and intubation, the patient underwent successful double transseptal puncture utilizing intracardiac echocardiography followed by three-dimensional mapping of the left atrium and pulmonary veins. He received heparin (24,000 U total) to ensure an activated clotting time > 350 sec during the procedure. Radiofrequency ablation and pulmonary vein isolation were performed. Entrance and exit blocks were confirmed using a Lasso catheter in each of the pulmonary veins followed by ablation at the superior vena cava junction. After the completion of the procedure, 25-to-50 mL of frank blood were noted in the endotracheal tube. The attending cardiothoracic anesthesiologist then performed bronchoscopy through the endotracheal tube, which revealed bright red blood appearing to originate in the left lower lobe bronchus. The patient's lungs were suctioned, saline irrigation was performed, yet no improvement in bleeding occurred; then topical

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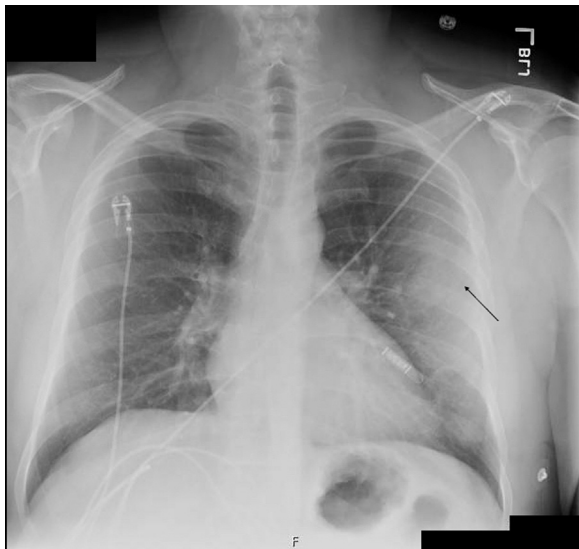


Fig 1. Postoperative day 1 chest radiograph, posterior-anterior view. Arrow indicates patchy airspace density in left lung periphery.

endobronchial epinephrine (1:10,000) 5-to-10 mL was utilized and the bleeding appeared to decrease. Protamine (50 mg) was given to reverse heparinization to an activated clotting time of 153 sec. The multipurpose catheter then was reintroduced into the left atrium and selective pulmonary venous angiogram with the use of adenosine was performed in order to slow the heart rate and survey for extravasation of contrast. No evidence of contrast extravasation or acute pulmonary vein stenosis was seen. Bronchoscopy then was repeated, which showed no further active bleeding and the patient was extubated. During the event, the patient's hemodynamics and airway pressure remained stable; however, his SpO<sub>2</sub> dipped to a minimum of 95% but quickly recovered to 99% following intervention.

Postoperatively, the patient's hemoglobin, hematocrit, and platelet function were monitored and remained stable. On postoperative day 1, a chest x-ray showed a focus of patchy airspace density in the periphery of the left lung (Fig 1). Bronchoscopy was performed on postoperative day 2 after the patient developed a bout of hemoptysis after an exercise stress test. Moderate sedation was used during the bronchoscopy at which time a potential site of hemorrhage was identified; frank blood was found in the left upper and lower lobar bronchi and the left lower lobe. No blood was found in any of the right-sided bronchi.

The patient continued to improve clinically and did not have any additional episodes of hemoptysis. A computed tomography pulmonary embolism study showed ground-glass airspace disease in the left upper lobe with a few focal dense areas in its periphery, as well as minimal ground-glass nodular changes scattered throughout the left lower lobe. No evidence of pulmonary embolism, pulmonary vein stenosis, or pulmonary vein-bronchial or pulmonary vein-esophageal fistula was found. The patient was discharged on postoperative day 3 as he was ambulating and saturating > 98% on room air.

## Discussion

Pulmonary hemorrhage is a rare complication of atrial fibrillation ablation. Acute pulmonary hemorrhage is defined as occurring during the procedure or within 2 weeks afterwards. Atrial fibrillation ablation is associated with varying complications experienced post-procedure, which include pulmonary vein stenosis and esophageal-atrial fistula. Rostamian et al<sup>4</sup> reported the incidence of pulmonary vein stenosis, encountered typically after radiofrequency type ablation, as ranging from 0% to 19%, with a mean incidence of 2%. Furthermore, Packer et al<sup>5</sup> reported that 1 out of 23 patients with pulmonary vein stenosis after ablation experienced hemoptysis. Studies also indicated that the median time to stenosis after radiofrequency ablation ranged from 7.5 weeks to 5.8 months.<sup>6,7</sup> To the authors' knowledge, acute pulmonary hemorrhage after radiofrequency type ablation has not been reported in the literature.

Several theories attempted to explain the etiology of pulmonary hemorrhage following atrial fibrillation ablation. Braun et al<sup>8</sup> postulated that hemorrhage following pulmonary vein stenosis likely is due to remodeling of pulmonary arteries, increased pulmonary venous hypertension, and decreased arborization of the pulmonary tree. As the bleeding in this case occurred in the acute setting, allowing no time for development of pulmonary vein stenosis, it was necessary to explore other possible etiologies that may mimic acute pulmonary hemorrhage following cryotherapy ablations.<sup>9,10</sup>

Bessière and Chevalier<sup>11</sup> proposed that pulmonary hemorrhage in cryotherapy ablation may be caused by either barotrauma during injection of contrast agent or mechanical trauma from the catheter. The etiology of the hemorrhage described in this case likely was similar to the mechanical trauma they described given the close proximity of the left pulmonary venous vasculature to the left-sided airway (Fig 2).

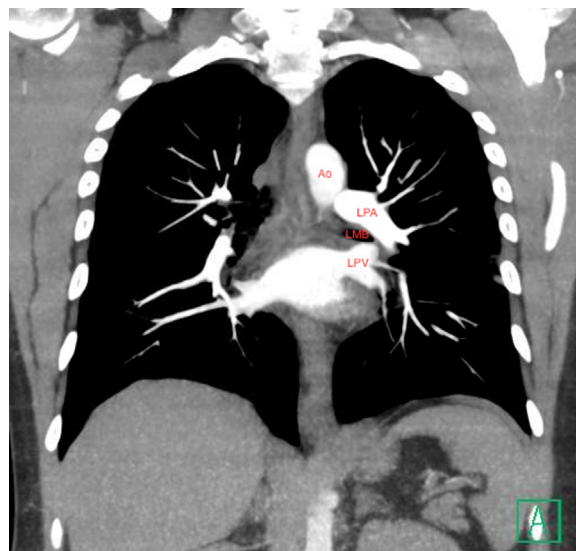


Fig 2. Postoperative day 3 computerized tomography pulmonary embolus study demonstrating the spatial relationship between vasculature and airway. Ao, aorta; LMB, left mainstem bronchus; LPA, left pulmonary artery; LPV, left pulmonary vein.

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