Case Report

Acute massive pulmonary embolism after radiofrequency catheter ablation: A rare complication after a common procedure

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Abstract

A 41-year-old man received an electrophysiological study (EPS) and radiofrequency catheter ablation (RFCA) for atrioventricular reentrant tachycardia (AVRT) in our hospital. Massive pulmonary embolism (PE) with hypotension developed 9 hours after these procedures. After emergent pulmonary angiography and catheter-directed intrathrombus urokinase infusion and clot breaking, the patient recovered well. This case suggests that life-threatening PE may occur in patients who receive EPS, RFCA, or both. An adequate observation time after RFCA and clinical alertness are necessary for immediate diagnosis and treatment. Emergent catheter-directed therapy may be of benefit in some patients with acute massive PE.

Keywords: catheter-directed therapy; electrophysiological study; pulmonary embolism; radiofrequency catheter ablation

1. Introduction

Radiofrequency catheter ablation (RFCA) is a common procedure for the management of arrhythmias and is considered to be safe, with a major complication rate of 0.61%—3% and a mortality rate of 0%—0.3%. The complication rate was significantly higher in RFCA than in electrophysiologic study (EPS) in a previous study (3.1% vs. 1.1%, respectively). Although pulmonary embolism (PE) is a rare complication of RFCA, it can be fatal. Prompt diagnosis and management can result in a good outcome. Herein, we report a case of acute massive PE with shock, complicated by RFCA. The patient was successfully treated with catheter-directed pharmacologic thrombolysis and clot breaking.

2. Case report

A 41-year-old man without any systemic diseases and without past or family histories of thromboembolic events had experienced intermittent palpitation for more than 20 years. One month before admission, sudden onset of one episode occurred while he was playing basketball. Electrocardiography (ECG) showed a regular narrow QRS-complex tachycardia. After admission, physical examination showed normal heart sound without heart murmurs. There were no signs of deep venous thrombosis (DVT). Echocardiography before EPS showed normal left ventricle (LV) systolic wall motion and minimal tricuspid regurgitation, with peak systolic pressure gradient of 29.4 mmHg. For EPS, a coronary sinus (CS) multipolar electrode catheter was introduced through a sheath...
in the right internal jugular vein. Three other multipolar electrode catheters were introduced through sheaths in the right femoral vein and placed in the right atrium, the right ventricle (RV), and the bundle of His. During EPS, orthodromic atrioventricular reentrant tachycardia (AVRT) was easily induced, with the earliest retrograde atrial activation recorded at the distal CS electrode. Using a transaortic approach via an 8-French sheath (Terumo Corp., Tokyo, Japan) in the right common femoral artery, RFCA was applied over the anterior aspect of the mitral annulus, successfully eliminating the accessory pathway. The total procedure time was 95 minutes. The postprocedure echocardiogram was unremarkable (i.e., no pericardial effusion or intra-cardiac thrombus). The ECG showed normal sinus rhythm (Fig. 1A). The punctured sites in the right inguinal area were manually compressed for hemostasis, followed by a 3-kilogram sandbag compression for 6 hours. The patient was observed under bed rest condition in the cardiac care unit after EPS and RFCA.

Sudden onset of bradycardia with a heart rate of 40 beats per minute (bpm) occurred 9 hours after the end of RFCA. Cold sweating, drowsy consciousness, and involuntary movement of bilateral arms were accompanied with blood pressure of 60/30 mm Hg. The follow-up ECG (Fig. 1B) showed sinus rhythm with a heart rate of 72 bpm; ST depression over V2 to V6, leads I and II; T-wave inversion over V3 to V6, leads I, II, III, and aVF; and an S1Q3T3 pattern. Emergent bedside echocardiogram showed marked dilatation of the RV. To rule out the possibility of acute coronary syndrome, emergent coronary angiography (CAG) was performed, and it showed normal coronary arteries. However, pulmonary angiography revealed bilateral massive PE (Fig. 2A and B), especially on the right side (Fig. 2A). Urokinase was first infused slowly via a 6-French Judkins Right 4 coronary diagnostic catheter (Cordis Corp., Miami, FL) in the right pulmonary artery. Afterwards, the catheter was advanced more distally and inserted into a thrombus in the right upper pulmonary artery. Catheter-directed therapy, including pharmacologic thrombolysis with intrathrombus urokinase infusion and clot breaking during catheter manipulation and rotation, was performed. The pulmonary flow was thereafter much improved (Fig 2C). A total of 300,000 IU of urokinase was given during the above procedures. Further systemic intravenous urokinase, 180,000 IU/hour, was infused for 8 hours. Enoxaparin (60 mg, subcutaneous injection, twice daily) was subsequently administered for 2 days. The medication was then shifted to warfarin therapy (2.5 mg/day). This patient recovered well and was discharged home 5 days later. Thrombophilic workup, including anticardiolipin antibodies, homocysteine, antinuclear antibodies, antithrombin-III, antiphospholipid antibodies, lupus anticoagulant, protein S, protein C, and cryoglobulin, all showed negative findings. The patient took warfarin (2.5 mg/day) for 1 month and was event-free in the subsequent 6-month follow-up period.

3. Discussion

Although PE complicated by RFCA was rare in previous studies, with an incidence of 0%–0.25%,1–5 it can be life-threatening2,6 and underestimated.7 Primm and others7 reported that 12% of patients had new perfusion defects detected by ventilation-perfusion lung scans 1 day after right-heart catheterization. This complication might be attributed to DVT of the punctured femoral vein.4

Multiple venous sheaths inserted into a single femoral vein are required in EPS or RFCA. Chen and colleagues8 reported

![Fig. 1. (A) The postprocedure electrocardiography (ECG) shows normal sinus rhythm; (B) follow-up ECG shows acute ST-T changes with an S1Q3T3 pattern.](image-url)
that with the use of multiple (up to three) femoral sheaths in a single femoral vein during RFCA, there was a high incidence (19.2%) of nonocclusive DVT detected by duplex ultrasonography on the next day following ablation. But, none of these patients with this complication experienced symptomatic PE. In our patient, three sheaths were inserted into the right femoral vein, ipsilateral to an 8-French femoral artery sheath. A long-duration (6 hours) hemostasis procedure for the femoral artery sheath may also compress the femoral vein simultaneously, leading to venous stasis. Both venous stasis and injury of vascular endothelium caused by venous sheath placement are believed to be the possible mechanisms for the formation of DVT and subsequent PE. The application of heparinization has been suggested for catheter manipulation during left-sided RFCA in a North American Society of Pacing and Electrophysiology policy statement. However, the use of heparin should be individualized. In this particular case, systemic heparinization was not applied because of a short procedure time.

Although the time for PE to develop after RFCA varied from 8.5 hours to 14 days, it has been suggested that same-day home discharge after 4 to 6 hours of observation is safe for uncomplicated RFCA. However, in patients with potential risk for PE occurrence, a longer observation period after RFCA may be needed. Alternatively, a follow-up duplex ultrasonography before discharge, evaluating the thrombus formation at the punctured femoral veins, may be appropriate for the patients discharged under a “same-day home” policy.

Clinical alertness is important for the diagnosis and treatment of PE complicated by RFCA. In this patient, emergent follow-up ECG in shock state showed sinus rhythm with a heart rate of 72 bpm, diffuse ST-T changes, and an S_t Q_t T pattern. Although he did not experience sinus tachycardia, which is common in acute PE patients, the diagnosis of PE could not be completely excluded because of the absence of sinus tachycardia. Nevertheless, echocardiogram showed acute RV dilatation, supporting the diagnosis of acute RV dysfunction and acute PE. The ST-T changes in ECG can occur both in acute PE patients and in patients with acute coronary syndrome. The latter possibility was excluded by an emergent CAG.

Thrombolytic therapy reduced mortality in patients with PE who were hemodynamically unstable. Interventional catheterization techniques (or so-called catheter-directed therapy) for massive PE are the alternatives. They include mechanical clot fragmentation/breaking and rheolytic thrombolysis, with intra-clot thrombolytic injection if needed. When compared with historical data of systemic thrombolysis, catheter-directed therapy showed a better result, with a success rate of 86.5% and a major complication rate of 2.4%. In our patient, catheter-directed intrathrombus pharmacologic thrombolysis and clot-breaking during catheter manipulation and rotation were performed. His hemodynamic condition improved rapidly after these procedures.

In conclusion, although rare, PE may occur even in patients receiving RFCA with a short procedure time. A longer observation period after RFCA may be needed in patients with potential risk for PE occurrence. Alternatively, duplex ultrasonography before discharge, determining the presence of thrombus formation at the punctured femoral veins, may be appropriate for those patients discharged under a “same-day home” policy. Emergent catheter-directed therapy can provide immediate improvement in patients with massive PE who are hemodynamically unstable.

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