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CASE REPORT

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Insights into guidewire related complication during HotBalloon ablation in patients with atrial fibrillation: What should we know?

Yoshinori Nakamura MD | Hiroshi Sohara MD | Minoru Ihara MD

The Heart Rhythm Center, Tokyo Heart Center, Osaki Hospital, Tokyo, Japan

Correspondence
Yoshinori Nakamura, The Heart Rhythm Center, Tokyo Heart Center, Osaki Hospital, Tokyo, Japan.
Email: nakamurayoshi2004@yahoo.co.jp

Abstract

A 78-year-old woman with drug-resistant persistent atrial fibrillation was referred for catheter ablation by HotBalloon. All pulmonary veins were successfully ablated by the HotBalloon. During the additional roof ablation by the HotBalloon, sudden hemoptysis developed. It was observed that a guidewire advanced far distal to the left superior pulmonary vein (LSPV) branch. The pulmonary vein angiography demonstrated LSPV branch injury. After activated clotting time control, the hemoptysis disappeared spontaneously. The patient was discharged 6 days after the procedure without any sequela.

KEYWORDS
atrial fibrillation, guidewire, hemoptysis, HotBalloon, pulmonary hemorrhage

1 | INTRODUCTION

HotBalloon ablation is a novel technology for the treatment of atrial fibrillation (AF).[1] HotBalloon is considered technically simpler, quicker, and easier than conventional radiofrequency ablation for achieving pulmonary vein (PV) isolation and a further advantage of HotBalloon is its ability to adapt to roof and floor line ablation. Here, we report a case with guidewire injury during roof line ablation and review the available literature about this urgent issue.

2 | CASE REPORT

A 78-year-old woman with drug-resistant persistent AF was referred for HotBalloon ablation. She had histories of coronary stenting and aortic dissection surgery. Apixaban was initiated added to aspirin 3 months before the procedure. Aspirin was continued through and apixaban was discontinued from the procedure day. The patient was anticoagulated with intravenous heparin and the activated clotting time (ACT) was kept at >350 seconds after a transseptal puncture. The right superior pulmonary vein (RSPV), the right PV carina, the right inferior pulmonary vein (RIPV), the RIPV bottom, the left superior pulmonary vein (LSPV), the left PV carina, the left inferior pulmonary vein (LIPV), and the LIPV bottom were targeted using the setting of 70°C. Next, the roof side of the LSPV was targeted using the setting of 70°C to achieve a Box lesion set (the isolation of the posterior left atrium (LA) including all pulmonary PVs). The HotBalloon was stabilized utilizing the action-reaction law that the balloon gradually shifted from the left to the right at the top of each contralateral PV by pushing the guide wire in LSPV. During the roof line ablation, sudden hemoptysis developed. The patient desaturated to 89% and her blood pressure decreased to 86/50 mm Hg. The guidewire position was checked and it was observed that the guidewire had advanced far distal to the LSPV. The guidewire was removed from the injured PV after the detection of hemoptysis and the PV angiography demonstrated LSPV branch injury (Figure 1). ACT was reversed from 353 seconds to 115 seconds after protamine injection. After ACT control, the hemoptysis disappeared spontaneously, and her saturation and blood pressure gradually improved. A CARTO system was used for the identification of the ablation site. All PV potentials were successfully ablated and the roof line was confirmed using a 3D

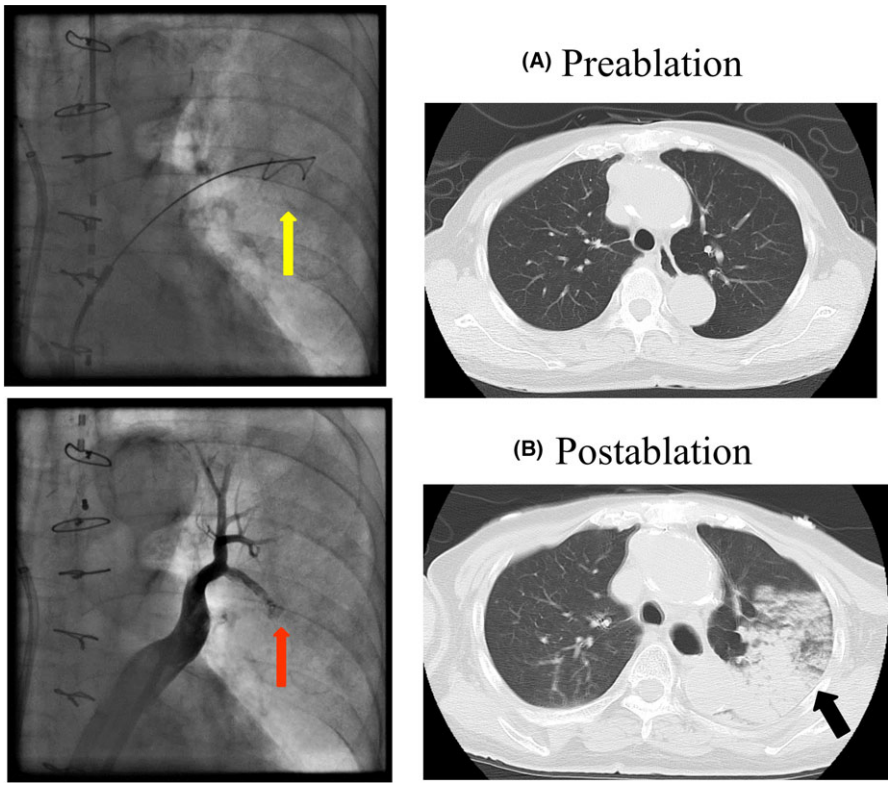

FIGURE 1 Left panel: Fluoroscopic image in the anteroposterior view. Upper panel: The guidewire soft tip forms an abrupt bending and the proximal stiff segment spearheaded. The guidewire straightened the LSPV branch (yellow arrow). Lower panel: The LSPV venography demonstrated LSPV branch injury (red arrow). The left superior pulmonary vein (LSPV). Right panel: The computed tomography of the chest. (A) Preablation. (B) Post ablation. The computed tomography confirmed that the consolidation in the left lower lobe was suggestive of a pulmonary hemorrhage after the HotBalloon ablation (black arrow)

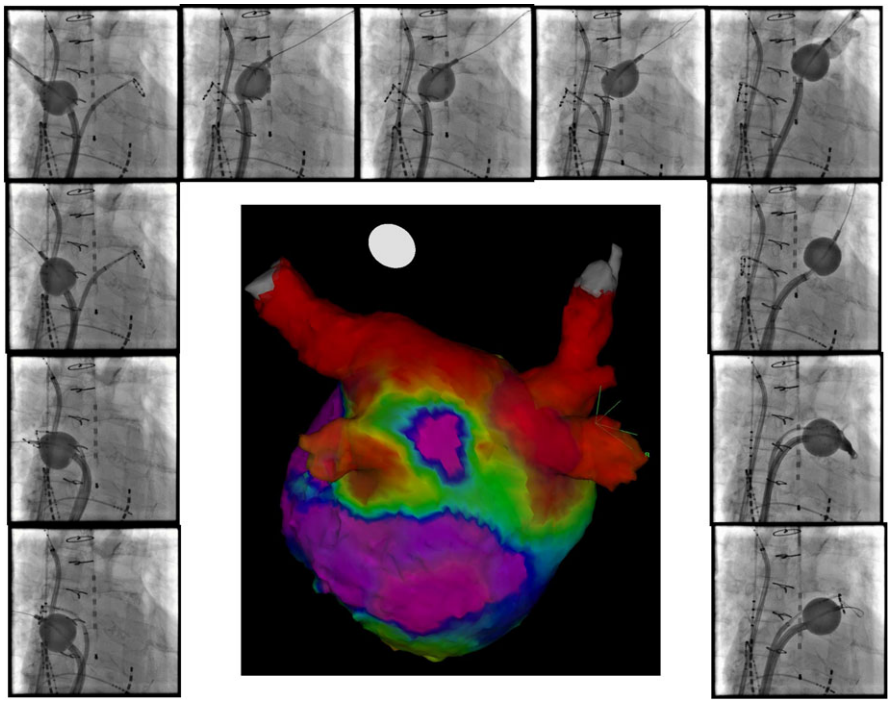

FIGURE 2 Fluoroscopic image in the anteroposterior view. The HotBalloon positioning at each site is shown. Central panel: Electroanatomic bipolar voltage mapping in the posteroanterior view after the HotBalloon ablation. Red color shows low voltage area <0.04 mV, indicating electrically silent area created by the HotBalloon ablation. Note that, all pulmonary veins and the roof line were successfully ablated

mapping system (Figure 2), however, the floor line was not created due to hemoptysis. The computed tomography of the chest showed that the consolidation in the left lower lobe was suggestive of pulmonary hemorrhage (Figure 1). Her hemoglobin level decreased from 12.0 g/dL to 8.7 g/dL, however, she needed no blood transfusion. She had no recurrence of hemoptysis and apixaban was restarted the next day after the procedure. The patient was discharged 6 days after the procedure without any sequela. The abnormal shadows of the left lobe on chest X-ray gradual decreased and disappeared 3 weeks after the procedure.

3 | DISCUSSION

The advantage of HotBalloon is its ability to adapt to variable PV and posterior LA anatomy as the balloon membrane material is

elastic and compliant. A previous study showed that the Box lesion set was successfully achieved using the HotBalloon system, by wedging the balloon at each PV antrum and dragging the balloon at the roof and at the bottom of the posterior LA.[2] In this case, the voltage mapping using CARTO system confirmed that all pulmonary veins were successfully isolated and roof line area showed electrically low voltage like an "Arch" shaped. The other balloon-based ablation systems using cryogenic energy, laser is applied only for the ablation at the LA-PV junction, and extensive posterior LA has not been possible with these devices so far. During HotBalloon ablation, a sufficient balloon contact to the target tissue is very important to achieve good ablation. A JPC-SS 0.032″ guidewire (produced by Lake Region Manufacturing, Inc) which is commonly used for the HotBalloon ablation has two segments: a 4 cm distal soft segment with J-tip, a proximal stiff segment which is mainly composed of inner hard coil. A proximal stiff segment helps stabilize the HotBalloon at an optimal position, however, distal advancement of a JPC-SS guidewire sometimes forms an abrupt bending of the tip and the proximal stiff segment can spearhead. This bending of a guidewire hardly occurs in other balloon-based ablation. In this case, as her anticoagulation therapy was discontinued on the procedure day, anticoagulation drug seemed to have little influence on hemoptysis. The cause of hemoptysis was to push the bending guidewire into a small PV branch to stabilize the balloon during roof line ablation. There have been two reported cases of guidewire related complication during PV isolation using HotBalloon. Fujii et al. reported a hemoptysis case required positive pressure ventilation due to guidewire injury during the right PV carina ablation.[3] The HotBalloon and the guidewire were deeply advanced into RSPV to stabilize the balloon, which is inserted through unusual atrial septal defect. Fluoroscopic image showed spearheaded bending guidewire caused distal PV injury in the same manner of this case. Yamasaki et al. reported a cardiac tamponade case needed pericardiocentesis during the LSPV isolation. In their case, the guidewire inadvertently advanced toward the left appendage and caused roof injury.[4]

In our consecutive 300 HotBalloon ablation procedures, only one guidewire related complication occurred. While the incidence of this complication is very rare in the HotBalloon ablation, it can occur even with usual PV isolation procedure. When considering the cause of hemoptysis, the guidewire related PV injury might be an important cause and we should confirm the guidewire tip location to avoid injury. It might be useful to check the residual lengths of proximal end of the guidewire outside the balloon during the procedure. In addition, as the excessive difference of the guide wire hardness between the distal soft and proximal stiff segment might cause this problem, it should be necessary to improve the transitional part of the JPC-SS guidewire into more continuous setting at the earliest opportunity. We believe that the guidewire related complication will become less likely to occur by the improvement of guidewire.

CONFLICT OF INTEREST

Dr. Sohara belongs to the endowed department of Toray Industries. The other authors declare no conflict of interest.

ORCID

Yoshinori Nakamura http://orcid.org/0000-0002-9967-6267

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