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Case Report

Massive Air Embolism in the Left Atrial Appendage During Radiofrequency Atrial Fibrillation Ablation: A Case Report

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ABSTRACT

Background: Air embolism is a complication of electrophysiological procedures, including atrial fibrillation (AF) ablation. Despite the benign course of air embolism in most patients, it can be a life-threatening event due to systemic air embolism to the coronary or brain circulation. Interruption of blood to vital organs may lead to serious damage.

Case: A 77-year-old woman with a history of AF in the preceding 8 years was a candidate for AF ablation due to symptomatic persistent AF following the discontinuation of flecainide. Massive air embolism during catheter ablation developed in the left atrial appendage (LAA). Aspiration with a pigtail catheter through the trans-septal sheath was not successful, but the air was evacuated using the Judkins right catheter without any permanent complications.

Conclusions: An operator must be au fait with all technical aspects of air embolism management. End-hole catheters may be more effective for the aspiration of aeroembolism in the LAA than multi-orifice pigtail catheters. ***(Iranian Heart Journal 2023; 24(2): 100-103)***

KEYWORDS: Atrial fibrillation, Air embolism, Aspiration, Catheter ablation

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Air embolism is a complication of electrophysiological procedures. including atrial fibrillation (AF) ablation. [1] Most cases have benign outcomes; nonetheless, life-threatening events may occur due to systemic air embolism to the coronary or brain circulation. [2] Interruption of blood to vital organs may lead to serious damage. [3] Here, we present a complication of massive air embolism during the catheter ablation of a woman with AF rhythm.

Case Presentation

A 77-year-old woman with a history of AF in the preceding 8 years was a candidate for AF ablation due to symptomatic persistent AF following the discontinuation of flecainide. The patient had a history of hypertension and cerebrovascular accident

treated with rivaroxaban, bisoprolol, and antihypertensive drugs.

On the day of the ablation procedure, transesophageal echocardiography confirmed a mildly enlarged left atrium (LA) with no left atrial appendage (LAA) thrombus.

The patient was transferred to the electrophysiology lab in a fasting state and AF rhythm with an average heart rate of 80 beats per minute. After the usual sterile preparation, conscious sedation, and local anesthesia, 3 access points were obtained from the right and left femoral veins. One 8-F sheath in the right femoral vein was exchanged with a long sheath positioned in the LA. Additionally, 6-F and 7-F sheaths were placed in the left femoral vein, in which right ventricle and coronary sinus catheters were positioned, respectively, and a 6-F sheath was placed in the left femoral artery for invasive hemodynamic monitoring. Following a successful trans-septal puncture under fluoroscopic guidance, a steerable long sheath (Agilis; St Jude Medical) was introduced in the LA. After the trans-septal puncture, a single bolus of 7000 IU (100 IU/kg) heparin was administered, and the activated clotting time was titrated into a range of 300 to 350 seconds by tests every 20 minutes. The AF rhythm was converted into sinus rhythm by synchronized electrical DC cardioversion. LA geometry with 4 pulmonary veins (PVs) was created using an Adviser HD Grid mapping catheter in sinus rhythm. PV potentials were seen in all PVs; then, the HD Grid catheter was removed, and an irrigated-tip ablation catheter was inserted. During left PV circumferential ablation, a large amount of air was seen inside the LAA, followed by decreased blood pressure and bradycardia (Fig. 1). Electrocardiography showed ST elevation in the inferior leads. Atrial pacing and epinephrine infusion were started immediately. The ablation catheter was removed, and a pigtail catheter was advanced into the LA through the Agilis sheath. Aspiration was performed, but no changes were seen in the visualized air mass in fluoroscopy. Accordingly, the catheter was changed with a Judkins right catheter, and the air mass was aspirated successfully with the first 20 mL aspiration. The ST elevation was resolved within the first 3 minutes, and blood pressure and heart gradually increased immediately. The procedure was terminated and was postponed for the next session if needed. Coronary angiography was not performed due to the resolution of ST-T changes, and no air mass was seen in fluoroscopy. The patient was monitored until she fully regained consciousness in the operating room. Fortunately, no neurological deficits were observed upon her awakening. She was transferred to the recovery room with stable hemodynamics, obedience, and orientation and without any ST changes in the electrocardiogram. Transthoracic echocardiography revealed no wall motion abnormalities and a normal LV function.

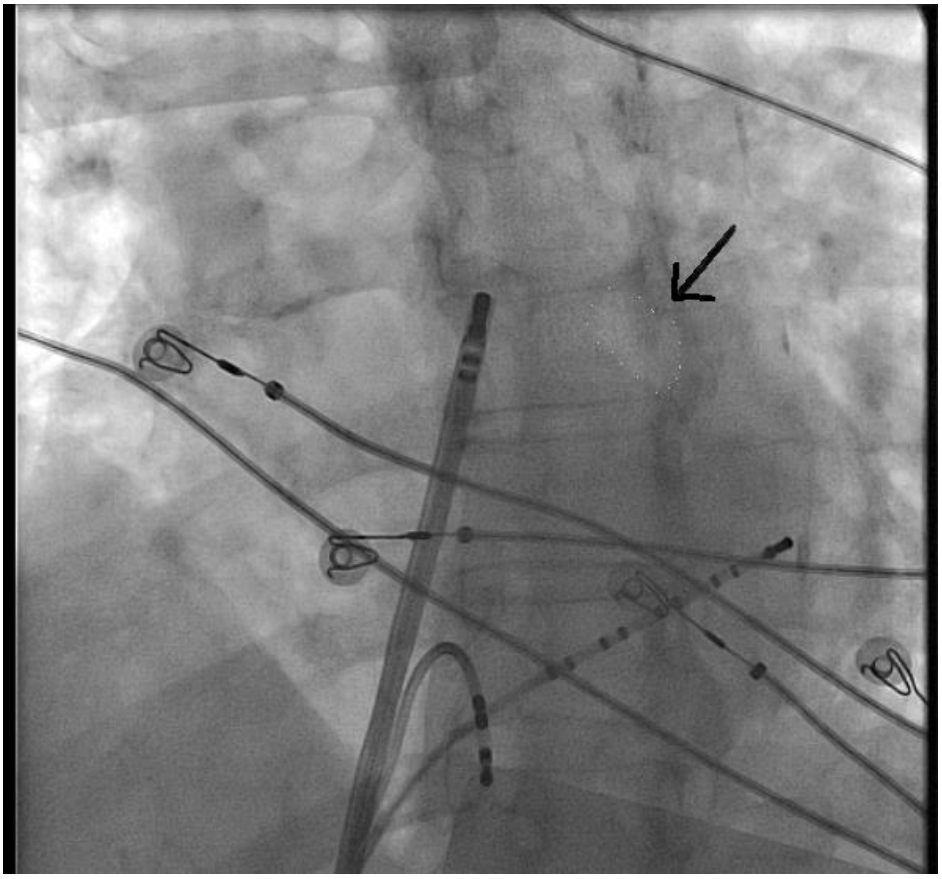

Figure 1: The LAO view shows an area of radiolucency caused by air in the left atrial appendage (dotted line).

DISCUSSION

Iatrogenic air embolism is a complication of interventional cardiac procedures, including ablation and electrophysiological studies. [4] Transient ST-elevation (5 min) in the inferior leads with hypotension and bradycardia due to right coronary artery occlusion is the most common manifestation. [5] Rarely, air embolization leading to hemodynamic instability and cardiac arrest due to the obstruction of blood flow or complete right coronary artery occlusion may occur. [6]

Several mechanisms have been reported for this complication, including damage to the sheath diaphragm, improper saline irrigation systems, prolonged apnea periods during conscious sedation, and negative intrathoracic pressure. Air bubbles may also be introduced during catheter exchange. An upright position may also increase the risk. [3,6-8]. Due to the large amount of air in our patient, damage to the sheath diagram may be the most possible reason. The goal of treatment strategies is to improve hemodynamics, reduce air volume, and avoid systemic embolization. [9] Recommended initial management strategies in the literature include 100% oxygen therapy, inotrope administration, and high atrial rate pacing, which was not successful in our patient. [3-9] It has also been reported that multi-orifice catheters, such as the Bunegin-Albin, can aspirate the air. [10] Consequently, we used a pigtail catheter through the trans-septal sheath. Unfortunately, aspiration could not diminish the LA mass size in fluoroscopy. Subsequently, we exchanged the catheter and advanced a right Judkins catheter into the LAA. The first 20 mL aspiration resulted in a reduction in the visible air mass in fluoroscopy. As previously reported, it seems

that due to the orientation of the LAA orifice, which is in the right posterior oblique direction, much more selective engagement using end-hole catheters may be more effective than multi-orifice catheters, such as pigtail catheters. [2, 6]

Careful methods to prevent air embolism are necessary during catheter ablation. Proper functional saline irrigation systems, constant saline flushing during catheter exchanges, and slow catheter removal to avoid vacuum effects are recommended to decrease air bubble introduction in the heart chambers. Meticulous conscious sedation and preventing prolonged episodes of apnea may be beneficial. [3,7,11]

CONCLUSIONS

We herein described a female candidate for AF ablation. Massive air embolism during catheter ablation was developed in the patient's LAA. Aspiration using a pigtail catheter was not successful, but the air was evacuated using a Judkins right catheter without any permanent complications. An operator needs to be expert in all technical aspects of air embolism management. End-hole catheters seem to be more effective for the aspiration of aeroembolism in the LAA than multi-orifice pigtail catheters.

Conflict of Interest: The authors declare that they have no conflicts of interest to disclose.s

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