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Journal of Cardiovascular Emergencies 2024;10(1):45-47
DOI: 10.2478/jce-2024-0005

IMAGES IN CARDIOVASCULAR EMERGENCIES

Air Lock Syndrome – an Unusual Complication of Pacemaker Implantation

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A middle-aged woman presented to the emergency with recurrent episodes of syncope of 1-week duration. History was significant for persistent dry cough, intermittent fever, and significant weight loss over the past 8 months. Cardiovascular examination revealed variable first heart sound and irregular cannon A waves in the neck. The pulse rate was 42/min, with the right arm's blood pressure of 150/90 mmHg. Chest X-ray (Figure 1 A) showed bilateral hilar prominence, and ECG (Figure 1B) showed a complete heart block with a wide complex QRS escape rhythm. Laboratory analysis revealed a raised total leukocyte count of 14,000 cells/mm3, predominantly lymphocytes, serum calcium of 11 g/dl, with a normal parathyroid hormone level. Echocardiography showed normal biventricular function, no clots, vegetations, or pericardial effusion before the procedure. After initial stabilization, the patient was taken up for permanent pacemaker implantation under mild sedation. The patient had frequent bouts of dry cough during the procedure. During atrial lead placement, after one such episode, the patient suddenly presented hypotension and desaturation. The fluoroscopy (Figure 1 C, Video 1) showed a clear delineation of the right ventricular outflow tract and pulmonary valve due to air in the system, which is otherwise not normally visible in routine fluoroscopy.

DISCUSSION

Common causes of hemodynamic deterioration during the procedure include pain-induced vasovagal syncope, pericardial effusion due to lead perforation, and tension pneumothorax or massive hemothorax. A rare cause of hypotension is air embolism, which can occur during lead insertion through the sheath into the subclavian vein.[1] Risk factors, such as snoring, sedation, hypovolemia, and sudden deep inspiration following cough, can cause rapid fluctuations in intrathoracic pressure, facilitating air suction into the circulation. The degree of impairment depends on the type of gas, the rate and volume of gas absorbed, and the patient's position. A massive air embolism can get locked in the right ventricular outflow tract (RVOT) or pulmonary trunk, as it is the highest point of the closed venous system in a supine position (Figure 1C), creating a white background that delineates the pulmonary valve opening and closure very well in

ARTICLE HISTORY

Received: January 3, 2024
Accepted: February 6, 2024

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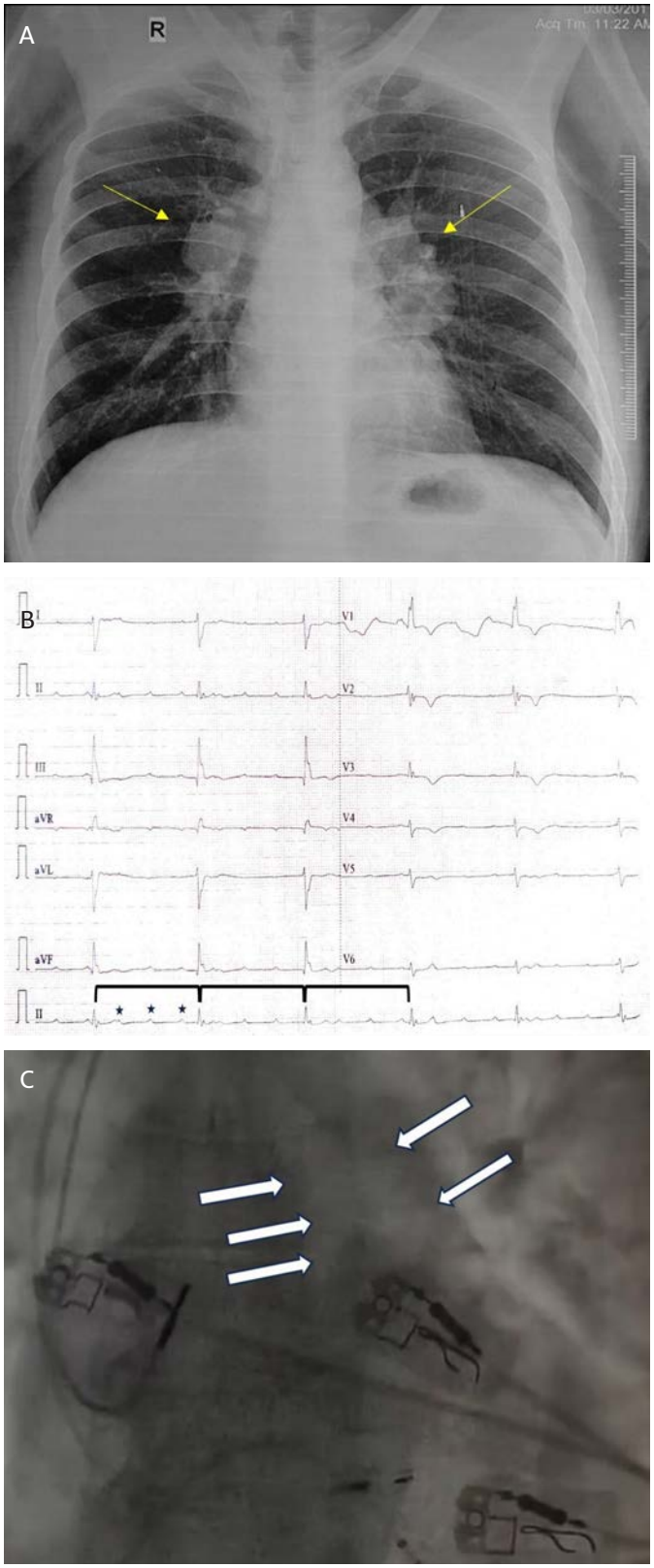

FIGURE 1. **A**, Conventional X-ray, PA view, showing bilateral hilar adenopathy (yellow arrow). **B**, 12-lead electrocardiogram showing complete dissociation of p waves (black stars) and QRS escape rhythm (black bar). **C**, Fluoroscopic image showing clear delineation of the RVOT and pulmonary tract (white arrow), which is normally not visible in fluoroscopy.

fluoroscopy (Video 1). Massive air embolism can cause a rise in right ventricular pressure, hypoxia, hypercapnia, reduction in cardiac output, and sudden cardiac death in severe cases. Prompt management involves a change in the position of the patient to the left lateral position (Durant maneuver) which displaces the air bubble ('air lock') from the RVOT into the right ventricular apex or right atrium, allowing restoration of pulmonary blood flow. The administration of high-flow oxygen promotes dissolution in the size of the air embolus and facilitates its absorption into the circulation. After stabilization, pacemaker implantation was completed and the patient was monitored in the intensive care unit for a few days, and was subsequently evaluated for sarcoidosis and started long-term treatment.[2]

CONCLUSION

Air embolism is a rare fatal cause of hemodynamic deterioration during permanent pacemaker implantation, and diligent care must be taken to avoid it in a patient with chronic cough. Untreated air embolism can cause air-lock in the RVOT, leading to ventricular arrhythmia and cardiac arrest. Prompt recognition is the key to successful management, which involves Durant's maneuver and high-flow oxygen.

DATA AVAILABILITY STATEMENT

No new data were generated or analyzed in support of this research.

CONFLICT OF INTEREST

The authors declare no potential conflicts of interest concerning the research, authorship, and/or publication of this article.

ETHICAL APPROVAL

The study was conducted in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its amendments. Written informed consent was obtained from the patient. No patient identity particulars have been disclosed.

FUNDING

The authors received no financial support for the research, authorship, and/or publication of this article.

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