

Contralateral pneumothorax and pneumopericardium after dual-chamber pacemaker implantation: Mechanism, diagnosis, and treatment



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Introduction

Approximately 180,000 patients undergo permanent pacemaker (PPM) implantation in the United States each year.¹ Although pacemaker implantation usually is considered a safe procedure, it can be associated with potential complications such as pocket hematoma, infection, lead dislodgment, pneumothorax, and cardiac tamponade. Pneumothorax, which has been reported to occur in 1% of pacemaker implantations,² usually is caused by needle injury while gaining entry to the axillary or subclavian vein. As such, pneumothorax almost always is ipsilateral to the pacemaker. Pneumothorax of the contralateral lung is uncommon unless attempts for vascular entry were made on that side as well. We present a rare case of concomitant contralateral pneumothorax and pneumopericardium after pacemaker implantation.

Case report

An 83-year-old man with a history of coronary artery disease and paroxysmal atrial fibrillation presented with syncope due to tachycardia-bradycardia syndrome. He underwent dual-chamber PPM implantation via the left axillary vein. A right atrial (RA) lead (Ingevity 7740 active fixation lead, Boston Scientific, Marlborough, MA) was positioned at the anterolateral RA free wall. A right ventricular lead was positioned at the apical septum. At implantation, the RA lead pacing threshold was 0.5 V at 0.5 ms, sensing was 8.0 mV, and impedance

was 668 Ω . Right ventricular lead pacing threshold was 0.4 V at 0.5 ms, sensing was 12.2 mV, and impedance was 915 Ω . Postprocedure chest radiography showed normal lead position and no evidence of pneumothorax.

Approximately 24 hours later, the patient developed sudden onset of severe neck and jaw pain that radiated to the anterior chest and worsened with inspiration. His vital signs at that time were blood pressure 157/91 mm Hg, heart rate 79 bpm, respiratory rate 16/min, temperature 98.3°F, and oxygen saturation 98%. On physical examination, no subcutaneous crepitus was noted. Lungs were clear with equal breath sounds. Heart rhythm was regular, without distant heart sounds or pericardial friction rub. Chest radiography showed no pneumothorax and normal lead position (Figure 1). Device interrogation demonstrated no significant change in sensing, pacing threshold, or impedance. Echocardiography showed no pericardial effusion. However, computed tomography (CT) of the chest, performed to exclude pulmonary embolus, revealed that the atrial lead tip had perforated the RA free wall (Figure 2) and caused a small right-sided pneumothorax and pneumopericardium (Figure 3). There was no evidence of pericardial effusion, chronic lung disease, or bullae on CT.

After a multidisciplinary discussion, conservative treatment strategy was pursued because of the small size of the pneumothorax/pneumopericardium and stable hemodynamics. The patient was hospitalized and given oxygen supplementation to facilitate reabsorption of the pneumothorax. Repeat CT after 2 days of observation showed resolution of the pneumothorax and pneumopericardium. The patient was discharged home and has been free of symptoms during 1-year follow-up.

KEYWORDS Contralateral; Pacemaker; Perforation; Pneumopericardium; Pneumothorax

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Discussion

A large number of patients undergo pacemaker implantation for various indications.³ This case demonstrates that contralateral pneumothorax and pneumopericardium may occur after pacemaker implantation as a result of RA lead perforation

KEY TEACHING POINTS

- Contralateral pneumothorax and pneumopericardium commonly present with pleuritic chest pain and/or shortness of breath. Less commonly, patients may report syncope, diaphragmatic stimulation, hypotension, or they may be asymptomatic.
- Electrocardiography, echocardiography, chest radiography, and device interrogation can be normal. Computed tomography is the test of choice to detect contralateral pneumothorax, pneumopericardium, or lead perforation.
- Management of contralateral pneumothorax and pneumopericardium should be guided by the amount of air leakage, the patient's hemodynamics status, and lead parameters. Conservative treatment may be sufficient in patients with stable vital signs, stable lead parameters, and small pneumothorax and pneumopericardium.
- The anteromedial tip of the right atrial appendage and the medial right atrial wall have a thicker wall and might be safer locations for lead implantation.

and can be managed conservatively in a hemodynamically stable patient. Concomitant contralateral pneumothorax and pneumopericardium after device implantation is an extremely rare complication, with only 2 previous cases reported in the literature (Table 1).

Etiology and mechanism

All cases listed in Table 1 could possibly be explained by one common mechanism, in which the lead and/or helix perforated through the RA free wall, pericardium, and right pleura, resulting in contralateral pneumothorax.

Both the pneumothorax and the pneumopericardium in our case seemed to result from the RA free wall perforation, with air from the pleural space tracking along the lead back to the pericardial space. No pericardial effusion was seen in the patients listed in Table 1, likely because the lead tip plugged the small perforation and prevented blood leaking out of the RA into the pericardial space.

Signs, symptoms, and diagnosis

Patients with contralateral pneumothorax commonly present with pleuritic chest pain and/or shortness of breath. Less commonly they present with syncope, diaphragmatic stimulation, hypotension, or they may be asymptomatic. In published reports, symptoms mostly occurred within 1–4 days after device implantation.

Electrocardiography may show loss of atrial sensing or capture. Echocardiography may reveal new pericardial effusion or the pacemaker lead in the pericardial space. Chest radiography could demonstrate pneumothorax, pneumopericardium, or lead tip seen out of cardiac silhouette. Device interrogation may reveal a change in sensing, pacing threshold, or impedance. However, not all tests are equally sensitive. In a report by Srivathsan et al,⁴ device interrogation was unchanged despite pneumothorax and pneumopericardium. In another report by Sebastian et al,⁵ electrocardiogram, echocardiogram, and device interrogation were all normal. The sensitivity of chest radiography in detecting pneumothorax is approximately 46%.⁶ Abnormal lead parameters on device interrogation also depend on whether the protruded helix is active (serves as a cathode) or passive. If the helix is not active, lead

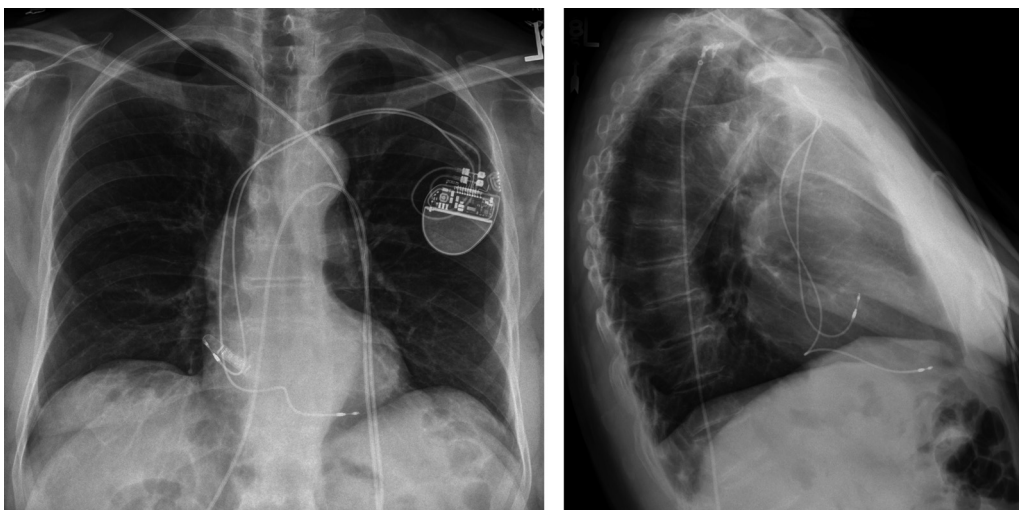


Figure 1 Chest radiographs in the anteroposterior (left) and lateral (right) views show the right atrial lead in the anterolateral position of the right atrium and the right ventricular lead in the apical septum. No pneumothorax or hemothorax is seen. The implantable loop recorder is in an unusual position.

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