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MINI-FOCUS ISSUE: COMPLICATIONS

BEGINNER

CASE REPORT: CLINICAL CASE

The Subtle Journey of a Right Atrial Lead

Hemopneumothorax Due to Subacute Pacemaker Lead Perforation

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ABSTRACT

We report an unusual case of subacute right atrial perforation by a screw-in pacemaker lead that migrated into the right lung causing hemopneumothorax 2 weeks after the procedure. After transvenous simple manual traction and minithoracotomy repair of the right atrial wall, the lead was repositioned without any complications. (**Level of Difficulty: Beginner.**) (J Am Coll Cardiol Case Rep 2020;2:902-6) © 2020 The Authors. Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

HISTORY OF PRESENTATION

A 53-year-old woman presented to the emergency department (ED) for recurrent right-sided, sharp pain that radiated to the right shoulder and was associated with shortness of breath. Of note, she was evaluated 2 weeks before for an episode of self-limiting, as well as 2 h of long, retrosternal oppressive chest pain with no radiation but associated with shortness of breath.

LEARNING OBJECTIVES

- To understand that a high clinical index of suspicion and chest CT scan are needed to make the correct diagnosis of lead perforation.
- To understand that this complication can be managed by a minimally invasive approach, comprising transvenous repositioning of the lead and minithoracotomy repair of the atrial wall.

PAST MEDICAL HISTORY

Two days before the first ED evaluation, the patient was implanted with a dual-chamber pacemaker (Assurity DR, St. Jude Medical, St. Paul, Minnesota) for symptomatic sinus node dysfunction. The atrial and ventricular leads were bipolar silicone-polyurethane active-fixation leads (Tendril STS 2088TC-46 and 2088TC-52, respectively, St. Jude Medical). The implant procedure was uneventful, and the patient was discharged the following day.

DIFFERENTIAL DIAGNOSIS

The differential diagnosis included myocardial ischemia, pulmonary embolism, and pneumothorax (see next section).

INVESTIGATIONS

At the time of the first evaluation in the emergency department, cardiac workup (serial electrocardiogram

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and cardiac enzymes; recent stress test) excluded myocardial ischemia. A contrast-enhanced chest computed tomography (CT) was performed to exclude pulmonary embolism: no acute abnormalities were noted (Figure 1, top), and the patient was discharged home. At the time of the second ED evaluation, a chest x-ray (CXR) showed a small right-sided pneumothorax along with an ipsilateral small pleural effusion, although the leads appeared to be in a normal position, albeit changed from 2 weeks prior (Figure 2). A repeat chest CT scan confirmed the presence of hemopneumothorax, showing the culprit: a right middle lobe perforation secondary to migration of the atrial lead (Figure 1, bottom). No pericardial effusion was noted, and interrogation of the device revealed right atrial lead dysfunction (undersensing and loss of capture with maximal pacing output).

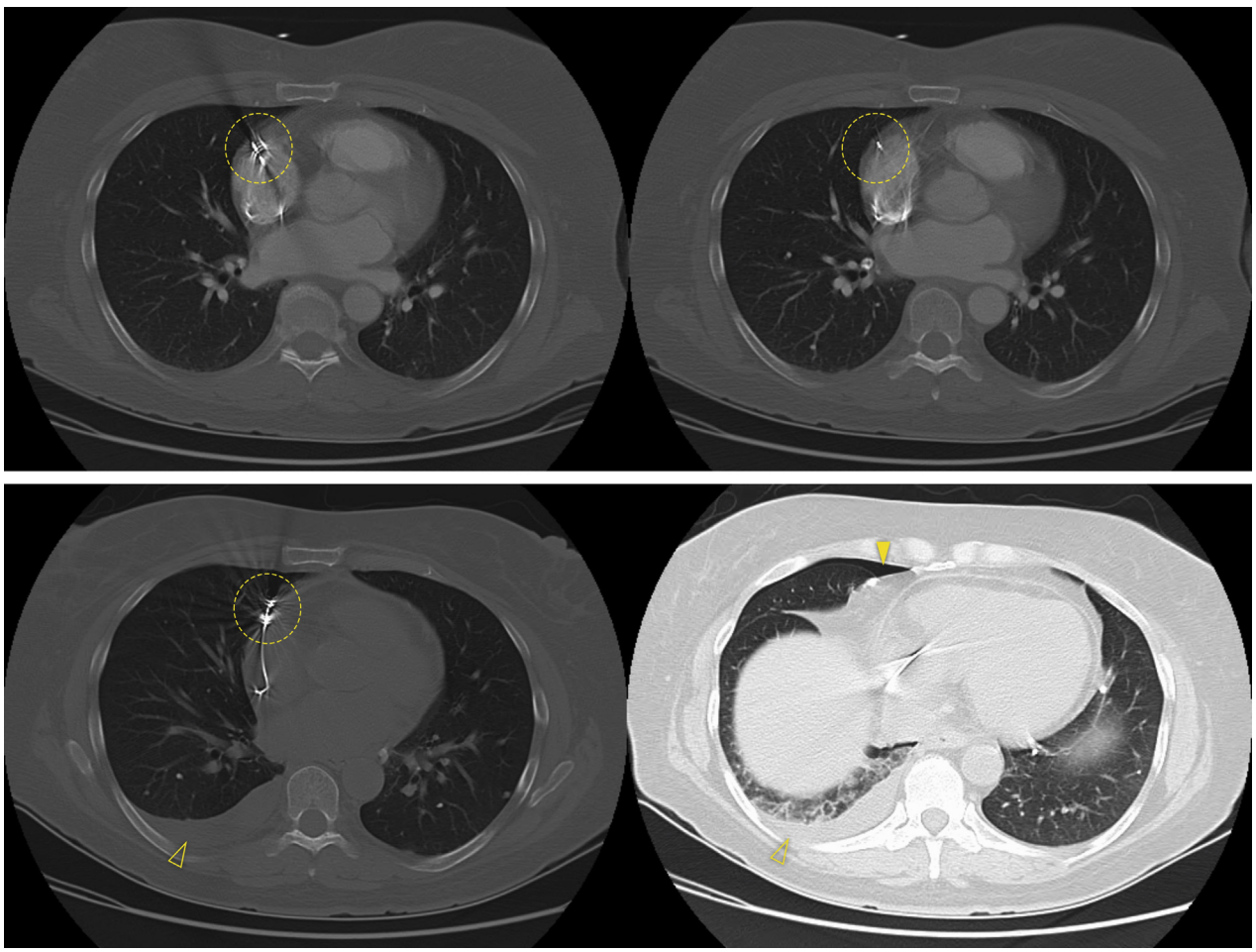
MANAGEMENT

Due to significant lead migration, its revision was performed with a combined cardiothoracic-electrophysiological approach. After identifying the proper rib space with fluoroscopy, the right side of the heart was exposed with a right anterior mini-thoracotomy, revealing the lead tip through the myocardium and pericardium (Figure 3), and no sign of active bleeding from either the myocardium or any pulmonary vessel. A purse-string suture was placed around the exit site of the right atrial lead; this was pulled back with simple manual traction through the

ABBREVIATIONS AND ACRONYMS

CT = computed tomography
CXR = chest x-ray
ED = emergency department

FIGURE 1 Chest CT Images



Chest computed tomography (CT) images 2 days **(top)** and 2 weeks **(bottom)** after the implant. **(Top)** The atrial lead appears to be within the right atrial chamber **(dashed circles)**. **(Bottom)** The atrial lead migrated into the right middle lobe **(dashed circle)**, causing hemothorax **(open arrowhead)** and pneumothorax **(solid arrowhead)**.

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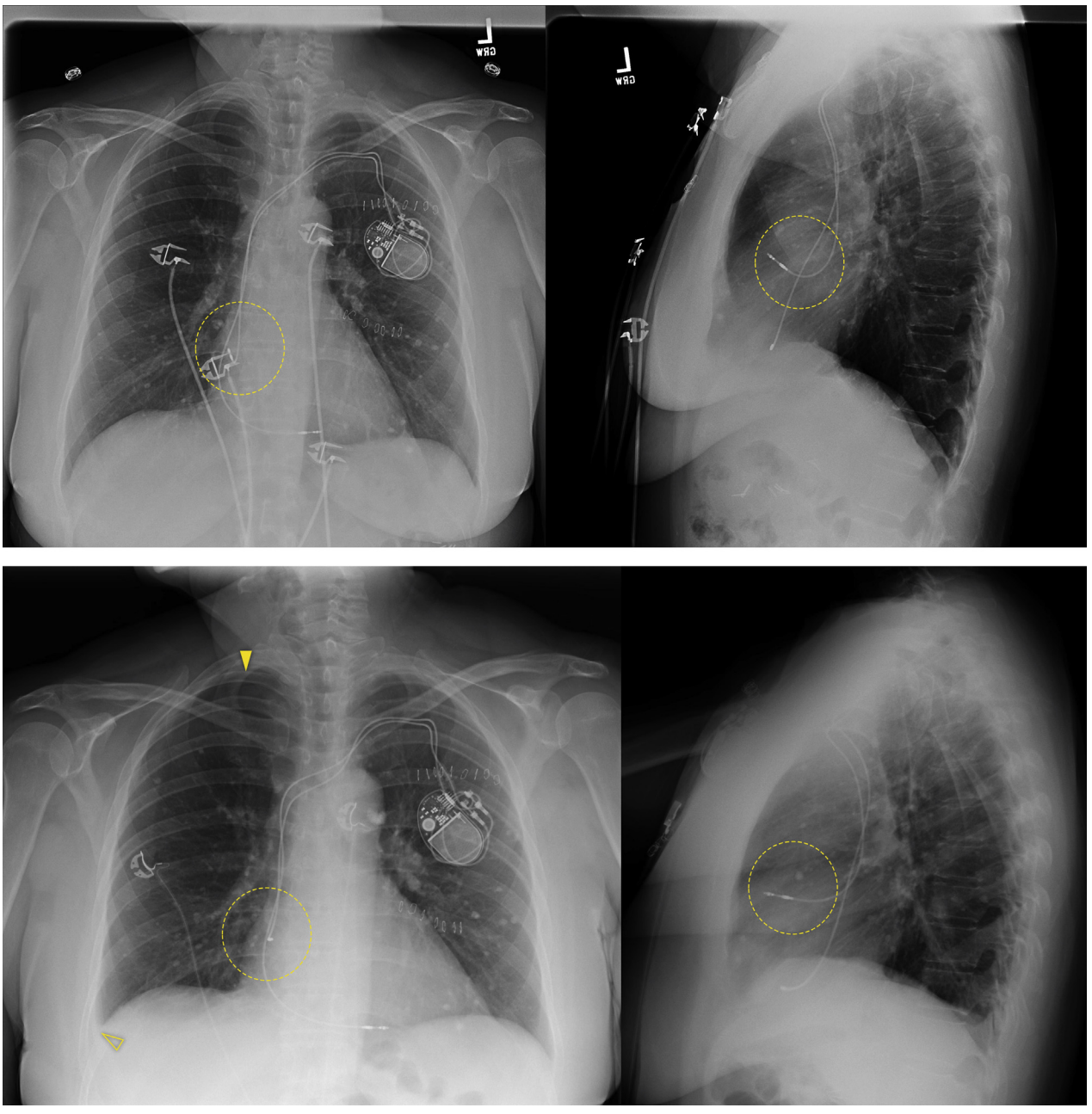
FIGURE 2 **CXR**



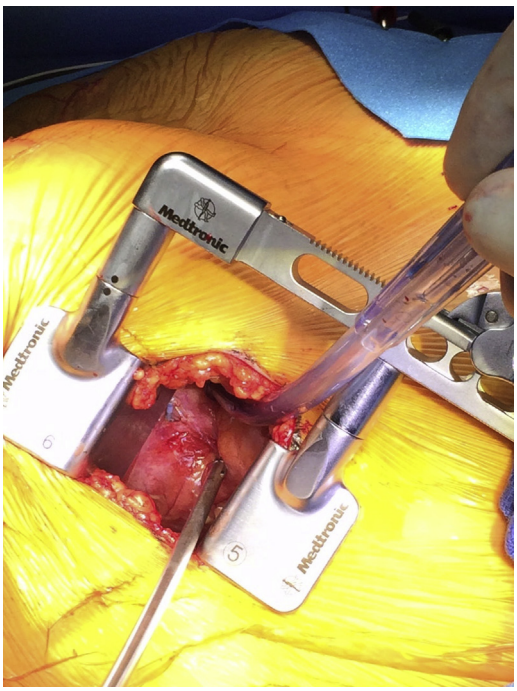
Chest x-ray (CXR) 2 days **(top)** and 2 weeks **(bottom)** after the implant. Compared with the post-implant CXR, the atrial lead appears straighter (more evident in the lateral projection; **dashed circles**). **Solid and open arrowheads** indicate pneumothorax and hemothorax, respectively.

device pocket while simultaneously tying the suture to control bleeding and eventually repair the right atrium. The lead was then repositioned in the high right atrial appendage, where visual inspection confirmed the absence of perforation. At the end of the procedure, a chest tube was placed in the right chest.

DISCUSSION

Myocardial perforation is an uncommon but potentially serious complication of cardiac implantable device's procedures. Subacute or delayed perforations (i.e., occurring after 1 month) are rare and are

FIGURE 3 Surgery



Intraoperative image showing the atrial lead protruding through the pericardium.

thought to be secondary to increased lead tip pressure: the resulting forward force predisposes to migration of the lead through the myocardium, especially with a stiff active fixation lead screwed into a thin or otherwise diseased wall (1–3). Clinical presentation is heterogeneous, mainly depending on the site of migration: usually patients are stable with inflammatory chest pain, but manifestation can range widely from asymptomatic to sudden cardiac death, thus requiring a high index of suspicion (4). In our case, the atrial lead perforation was subacute, with the patient presenting 2 weeks after implant with pleuritic chest pain and dyspnea. Factors that may have contributed to perforation include location (the thin-walled right atrial appendage), fixation mechanism (active/screw-in), and perhaps, lead design: the silicone-polyurethane copolymer used for insulation (stiffer than silicone) and the small diameter (5.7-F) all tend to increase the penetration pressure (force per unit area at the tip), facilitating subacute perforation through the myocardium, as previously observed for leads with a similar design (3,5,6). The usual work-up is device interrogation, CXR, echocardiogram, and the use of chest CT, which can be helpful when leads do not migrate too far (7). In our patient, CXR was not particularly helpful in identifying this complication, because the lead did not appear to protrude outside of the cardiac silhouette. With hindsight, the atrial lead appeared different (straighter) in the CXR lateral view (**Figure 2**, bottom right) and concomitant hemopneumothorax pointed to possible lead perforation, as confirmed by device interrogation and chest CT.

The management of lead perforation is still debated, but usually entails lead revision or extraction, either transvenous or open-chest. Manual traction alone works in many cases; however, there can be risk of tamponade or, in case of significant migration, bleeding into the chest cavity. When manual traction alone is considered, it is therefore wise to have cardiac surgery backup. In this case, we opted for a combined surgical-electrophysiological approach because the lead had migrated to the lung with evidence of bleeding into the pleural cavity. An anterior minithoracotomy (vs. median sternotomy or full thoracotomy) was deemed suitable to properly expose the affected side of the heart: indeed, while simple manual traction was enough to reposition the lead, bleeding was easily controlled and the right atrial wall surgically repaired without complications. Minimally invasive, surgical-electrophysiological hybrid approaches have been described for high-risk lead extractions (large vegetations, lead thrombus, prior failed extraction, fractured/abandoned leads), showing its feasibility, with low complications and short post-operative recovery times (8–10). To our knowledge, this is the first report showing the feasibility of such a combined approach for lead migration into the lung: it is minimally invasive, yet it allows direct visualization and easy repair of adjacent structures potentially affected by the migrating lead.

FOLLOW-UP

The chest tube was removed after 2 days, with no post-operative pneumothorax or bleeding noted. The patient was discharged that day, and no further complications were observed during subsequent follow-up.

CONCLUSIONS

This case report illustrates a rare case of subacute myocardial perforation by an active fixation atrial lead into the right middle lung causing hemopneumothorax.

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