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CASE REPORT

Chest pain following permanent pacemaker insertion... a case of pneumopericardium due to atrial lead perforation

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SUMMARY

Permanent pacemaker (PPM) implantation is an increasingly common procedure with complication rate estimated between 3% and 6%. Cardiac perforation by pacemaker lead(s) is rare, but a previous study has shown that it is probably an underdiagnosed complication. We are presenting a case of a patient who presented 5 days after PPM insertion with new-onset pleuritic chest pain. She had a normal chest X-ray (CXR), and acceptable pacing checks. However, a CT scan of the chest showed pneumopericardium and pneumothorax secondary to atrial lead perforation. The pain only settled by replacing the atrial lead. A repeat chest CT scan a few months later showed complete resolution of the pneumopericardium and pneumothorax. We believe that cardiac perforation can be easily missed if associated with normal CXR and acceptable pacing parameters. Unexplained chest pain following PPM insertion might be the only clue for such complication, although it might not always be present.

BACKGROUND

It is estimated that the average rate of new permanent pacemaker (PPM) insertion per annum is around 610 per million population (pmp) in the UK.¹ For implanted cardioverter defibrillators (ICD), the rate is around 90 pmp.¹

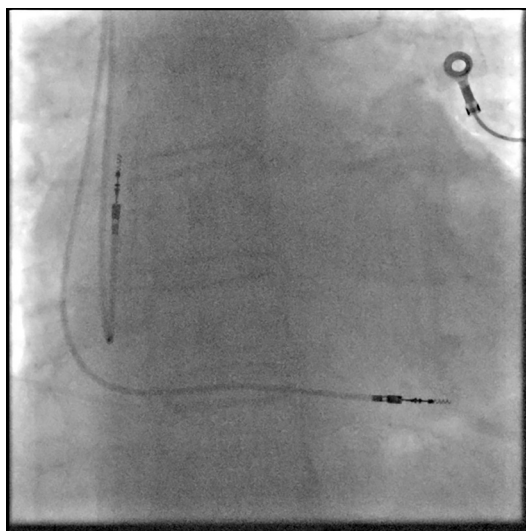


Figure 1 Fluoroscopy image of the initial active fix right atrial lead.



Figure 2 Chest CT scan showing pneumothorax and pneumopericardium (arrows).

The incidence of procedural complications is reported between 3% and 6% with around 50% of these complications being serious or requiring further treatment.²⁻⁴ Cardiac perforation is a recognised but rare complication of cardiac devices implantation. It is estimated that the rate of cardiac perforation is between 0.1% and 6% in data from both PPM⁵ and ICD⁶ insertions. High threshold has been linked with atrial lead perforation in previous cases.⁷⁻⁹

However, a study of around hundred patients with cardiac devices who underwent chest CT scans has shown that lead perforation could be seen in up to 15% of the cases. All of these patients were asymptomatic with normal electrophysiology parameters, which suggest that lead perforation can be a silent complication of cardiac devices implantation.¹⁰

In our case, cardiac perforation was diagnosed because the patient had a CT chest to rule out pulmonary embolism. Her symptoms started 5 days after the pacemaker insertion, and a repeat chest X-ray (CXR) and pacing checks were acceptable. This case raises the question whether similar cases are missed because of lack of symptoms and/or normal initial investigations.

CASE PRESENTATION

We are presenting a case of a 76-year-old woman who was seen in the outpatient clinic with shortness of breath on exertion limiting her physical activities. Investigations revealed chronotropic incompetence and sinus node disease. Her left



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Table 1 Device features and electrophysiology readings

Position	Right prepectoral
Access	Axillary approach
RA lead	Active fix 45 cm (7Fr) bipolar Threshold PSA 1.60 @ 0.50 Impedance Pacing System Analyzer (PSA) 753
RV lead	Active fix 52 cm bipolar Threshold PSA 0.70 @ 0.50 Impedance PSA 641

RA, right atrial.

ventricular systolic function was normal on transthoracic echocardiogram (TTE), and her rhythm was sinus.

Her medical history comprised of mild asthma and previous left-sided breast cancer which was treated with lumpectomy, lymph nodes clearance and radiotherapy. The patient agreed to have a PPM insertion. Therefore, she was referred for outpatient dual chamber pacemaker insertion (DDDR) on the right side.

The implant procedure was uneventful; the leads were positioned via the right axillary vein using fluoroscopic guidance (figure 1) following a single pass of a needle over the first rib. The right atrial (RA) lead was successfully positioned at first attempt, and the patient was discharged on the same day after normal anteroposterior and lateral CXR, and normal pacemaker checks (table 1).

She presented to the emergency department (ED) 5 days later with a sudden-onset severe pleuritic sounding chest pain.

INVESTIGATIONS

A CXR did not show any abnormalities and was later reported by a radiologist as normal. However, the blood test showed a positive d-Dimer. Therefore, an urgent CT pulmonary angiography (CTPA) was arranged only a couple of hours after the CXR.

The CTPA did not show any pulmonary embolisms (PEs), but revealed a moderate-sized right-sided pneumothorax with presence of air within the pericardial sac (figure 2). There was evidence of atrial wall perforation with the tip of the RA lead embedded within the adjacent lung tissue (figure 3). A TTE was performed and did not show any pericardial effusion or gross abnormalities. Pacemaker checks showed only slight changes with P wave of 0.9, PSA of 1.75 @ 0.4 and impedance of 380. Patient was A-paced around 84% of the time.

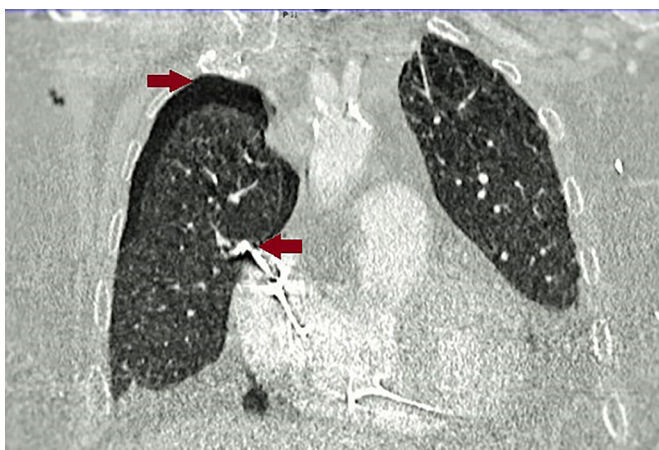


Figure 3 Chest CT-scan showing pneumothorax and right atrial lead perforation (arrows).

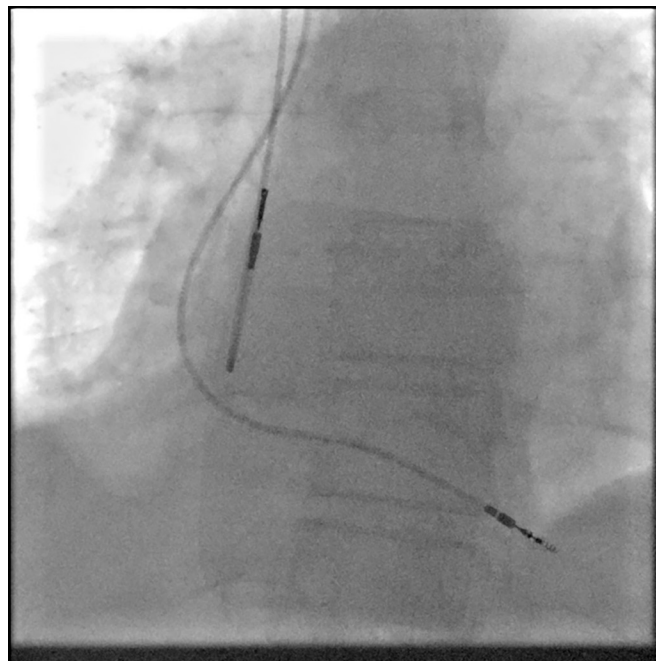


Figure 4 Fluoroscopy image of the new passive fix right atrial lead.

DIFFERENTIAL DIAGNOSIS

The ED doctors were concerned about pneumothorax or PE. Hence, the above investigations were arranged in the ED. However, following the CTPA results, it was clear that the patient’s pain was due to cardiac perforation.

TREATMENT

The patient was subsequently admitted to the cardiology ward. She experienced ongoing pain, so after team discussions, a decision was made to remove the RA lead and to replace it with a passive one (figure 4). Passive lead was chosen to avoid recurrence of perforation with the repositioning of the existing lead as the rate of this complication has been reported to be higher with active fix leads.¹¹

The procedure was performed 4 days later without any complications, and the pain settled after removing the lead.

OUTCOME AND FOLLOW-UP

The patient was pain-free postprocedure, and was observed for 2 days on the ward. A repeat CXR and TTE were normal. Pacing parameters were within normal (table 2). A repeat CT scan of the chest a few months later showed complete resolution of the pneumothorax and pneumopericardium.

DISCUSSION

The majority of pacemaker implants are now performed as a day case and some of these procedures involve the use of active fixation leads. This case demonstrates that an RA lead can indeed perforate beyond 24 hours after deployment. It also indicates that acute chest pain post pacemaker implant secondary to cardiac perforation should be investigated with a CT scan of the chest. A CXR could not exclude in our patient a late perforation causing pneumothorax and pneumopericardium.

The presence of the pneumopericardium indicates that the right-sided pneumothorax was unrelated to axillary vein puncture on that side. Interestingly, despite this perforation, the lead’s pacing parameters were acceptable suggesting the proximal part of the helix was still in contact with the myocardium.

Table 2 Final checks of the device after lead exchange

New RA lead	Tined passive lead (7Fr) Threshold PSA 0.50 @ 0.50 Impedance PSA 536
RV lead (unchanged)	Active fix 52 cm bipolar Threshold PSA 0.70 @ 0.50 Impedance PSA 641

RA, right atrial.

Consequently, the frequency of cardiac perforation secondary to lead perforation can be easily missed. The decision to remove the lead and place a tined one was dictated by the ongoing pain. This case report highlights the additional morbidity associated with active fixation leads.

Learning points

- ▶ A careful approach should be considered in patients with new chest pain following a cardiac device insertion including CT imaging of the chest. Chest X-ray and pacing checks might be misleadingly normal.
- ▶ Slight alteration in pacing checks can sometimes be useful indicator of certain pathologies. High pacing threshold has been particularly linked with atrial lead perforation in previous cases.⁷⁻⁹ Special attention should, therefore, be paid to such subtle changes especially in the context of unexplained symptoms.

Contributors SA: second operator in the first procedure, reviewed patient during admission, wrote the case up. KF: performed the provisional report of the CT chest highlighting the findings. CG: reviewed the CT chest and finalized the report. HW: Responsible consultant for the patient.

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REFERENCES

- 1 The 11th annual report for the National Cardiac Rhythm Management Devices Audit, April 2015 – March 2016, published on 14th February, 2017. http://www.ucl.ac.uk/nicor/audits/cardiarrhythm/documents/annual-reports/crm-devicesnational-audit-report-2015-16_v2.
- 2 Atwater BD, Daubert JP. Implantable cardioverter defibrillators: risks accompany the life-saving benefits. *Heart* 2012;98:764–72.
- 3 Dodson JA, Lampert R, Wang Y, et al. Temporal trends in quality of care among recipients of implantable cardioverter-defibrillators: insights from the National Cardiovascular Data Registry. *Circulation* 2014;129:580–.
- 4 Russo AM, Daugherty SL, Masoudi FA, et al. Gender and outcomes after primary prevention implantable cardioverter-defibrillator implantation: Findings from the National Cardiovascular Data Registry (NCDR). *Am Heart J* 2015;170:330–8.
- 5 Dai Y, Chen KP, Hua W, et al. [Retrospective analysis on the clinical features and management of acute and subacute right ventricular perforation by pacemaker lead]. *Zhonghua Xin Xue Guan Bing Za Zhi* 2013;41:862–5.
- 6 Hsu JC, Varosy PD, Bao H, et al. Cardiac perforation from implantable cardioverter-defibrillator lead placement: insights from the national cardiovascular data registry. *Circ Cardiovasc Qual Outcomes* 2013;6:582–90.
- 7 Ishizue N, Kishihara J, Niwano S, et al. Subacute pneumothorax contralateral to the venous access site associated with atrial lead perforation in a patient who was receiving corticosteroid therapy. *J Arrhythm* 2017;33:335–7.
- 8 Dilling-Boer D, Ector H, Willems R, et al. Pericardial effusion and right-sided pneumothorax resulting from an atrial active-fixation lead. *Europace* 2003;5:419–23.
- 9 Sriwathsan K, Byrne RA, Appleton CP, et al. Pneumopericardium and pneumothorax contralateral to venous access site after permanent pacemaker implantation. *Europace* 2003;5:361–3.
- 10 Hirschl DA, Jain VR, Spindola-Franco H, et al. Prevalence and characterization of asymptomatic pacemaker and ICD lead perforation on CT. *Pacing Clin Electrophysiol* 2007;30:28–32.
- 11 Sterliński M, Przybylski A, Maciag A, et al. Subacute cardiac perforations associated with active fixation leads. *Europace* 2009;11:206–12.

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