

# Hemopneumothorax due to subacute right ventricular perforation by a pacemaker lead with subtle clinical presentation

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### ABSTRACT

Subacute right ventricular perforation by a pacemaker lead is a rare complication. Although occasionally asymptomatic, complicated cases are usually evidently symptomatic. Here, we report a 70-year-old man presented with mild left-sided chest pain three days after permanent pacemaker implantation. Suspected of ventricular perforation by the pacemaker lead on chest X-ray, device interrogation revealed non-corroborative parameters. This warranted a computed tomography (CT) scan, which confirmed the diagnosis, detected hemopneumothorax, and helped plan surgical intervention. The patient underwent surgical management with the placement of an epicardial pacemaker lead and was discharged after five days. Our case illustrates a rare report of subtle clinical presentation in a patient with subacute right ventricular perforation by a pacemaker lead complicated by hemopneumothorax. It further recapitulates the role of CT scan in providing definitive diagnostic information in managing such a patient. Anticipation of such a presentation is essential for primary care physicians, who are often a first contact point for a patient in the community. This requires a high index of suspicion in such patients presenting with minimal symptoms. Early recognition and timely referral by a family physician may prevent untoward consequences of device-related complications.

**Keywords:** Hemopneumothorax, pacemaker lead, perforation, subacute, ventricular

### Background

Cardiac perforation by a pacemaker lead, although serious but is an infrequent complication with an incidence of approximately 0.1–0.8%.<sup>[1,2]</sup> Acute presentation (within 24 hours) is usually more dramatic than sub-acute (within one month) and chronic

presentation (after one month).<sup>[3]</sup> However, any perforation associated with adjacent tissue injury tends to be evidently symptomatic. Likewise, reports of subacute ventricular perforation presenting with symptomatic hemothorax<sup>[4]</sup> and hemothorax with shock<sup>[5]</sup> have been published. In contrast, we report a case of hemopneumothorax due to subacute right ventricular perforation by a pacemaker lead with subtle clinical presentation.

### Case Presentation

A 70-year-old man presented with exertional dyspnea and dizziness for the last few months and was diagnosed as

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Received: 06-03-2021

Revised: 09-07-2021

Accepted: 10-07-2021

Published: 16-02-2022

#### Access this article online

##### Quick Response Code:



Website:  
www.jfmpc.com

DOI:  
10.4103/jfmpc.jfmpc\_448\_21

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**How to cite this article:** Otaal PS, Budakoty S, Kumar R, Singhal MK. Hemopneumothorax due to subacute right ventricular perforation by a pacemaker lead with subtle clinical presentation. J Family Med Prim Care 2022;11:780-3.

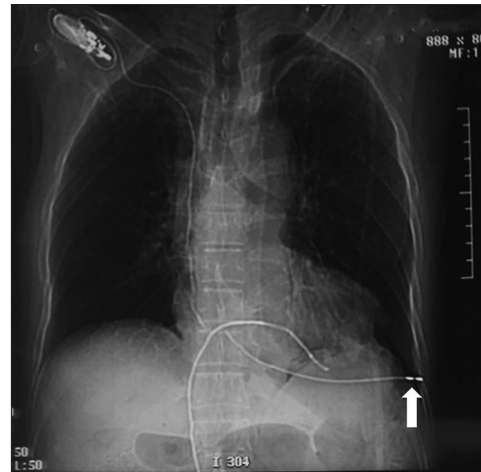
symptomatic sick sinus syndrome with intermittent junctional escape. Due to financial restrictions, a single chamber (VVIR) pacemaker was implanted using an active fixation lead (Tendril STS Model 2088, St. Jude Medical devices) at a local hospital. Three days after an uneventful procedure, he developed mild left-sided chest pain. With a cardiac monitor showing intermittent loss of capture and chest x-ray suspecting ventricular lead perforation, the patient was transferred to our hospital on a temporary pacemaker. At presentation, the patient was fully conscious and comfortable with normal blood pressure and a heart rate of 92 beats per minute (bpm). He was on Telmisartan 40 mg once a day for hypertension for the last two years.

His hemoglobin level was 11.4 gm/dL with no significant fall from preoperative values. ECG at presentation to us revealed a normal sinus rhythm at 96 bpm. Chest X-ray revealed permanent pacemaker lead tip just outside the cardiac silhouette at right ventricular apex, highly suspicious of ventricular perforation. No evident hemothorax or pneumothorax was observed [Figure 1]. Echocardiography revealed a structurally normal heart with pacemaker lead *in situ* with its tip not clearly discernible. Pacemaker interrogation revealed grossly altered parameters from the implant time with the change in pacing threshold from 0.7 V at 0.4 ms to 6.5 V at 1.5 ms, a very high lead impedance of >3000 ohms, although only a marginal decrease in sensed R wave amplitude from 2.7 to 2.5 mV. These parameters were not classically suggestive of a perforating lead which is usually associated with a decrease in lead impedance and significantly reduced R-wave amplitude. So a contrast-enhanced computed tomogram (CECT) was done, which revealed the pacemaker lead perforating the right ventricle (RV) near the apex and its tip getting lodged in the left pleura with resultant hemopneumothorax [Figure 2]. Later during the hospital stay, the patient developed hypotension, possibly due to vasovagal phenomenon, which responded to atropine and intravenous fluids. The patient was taken up for an urgent surgical exploration in view of a ventricular perforation associated with adjacent tissue injury causing hemopneumothorax and borderline blood pressure.

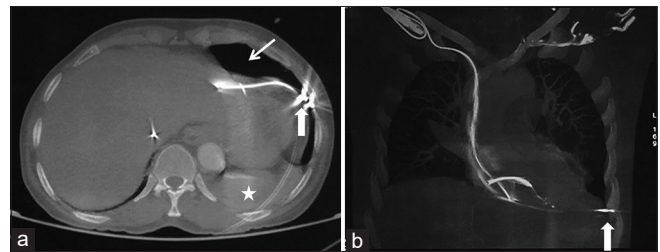
Surgical exploration revealed the pacemaker lead perforating the right ventricular acute margin near the apex and was lying in the left pleural cavity [Figure 3A]. Intraoperatively, approximately 90 ml of blood was drained from the left pleural cavity, and a chest tube was inserted. The RV rent was repaired with the implantation of epicardial pacemaker lead [Figure 3B]. The patient recovered well, chest tube removed after two days, and was discharged home with normal parameters on pacemaker interrogation. The patient is doing well on follow-up for the last two years.

## Discussion

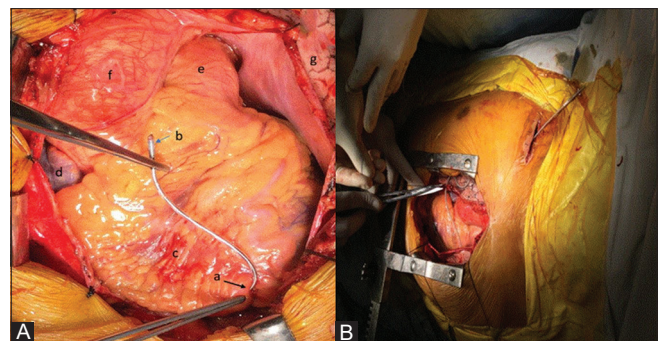
Our case illustrates that subacute right ventricular perforation by a pacemaker lead can present with minimal symptoms despite a serious complication like hemopneumothorax. Symptoms of



**Figure 1:** Frontal chest radiograph shows tip of pacemaker lead outside the cardiac contour (arrow)



**Figure 2:** (a) Axial contrast enhanced CT image shows tip of pacemaker lead outside the free wall of RV in the lung parenchyma (thick arrow), however no contrast extravasation seen. Note high density left pleural effusion in keeping with hemothorax (asterisk) and pneumothorax (thin arrow). (b) Maximum intensity projection (MIP) coronal CT image showing tip of pacemaker lead perforating free wall of RV to lie in the lung (arrow)



**Figure 3:** Intra-operative finding showing (A) Permanent pacemaker lead perforated the right ventricular apex, left pleura is opened to drain the hemorrhagic pleural fluid. a) Site of perforation on the apex of right ventricle, b) Pacemaker lead (pulled in to show details), c) Right ventricle free wall, d) Right atrium, e) Main pulmonary artery f) Ascending aorta, g) Left lung, (B) RV rent repair and epicardial lead placement done

cardiac perforation usually depend on the type of perforation, location of perforating lead tip, pacemaker dependency, and extent of injury to the adjacent tissues. Although sub-acute or delayed perforation may be minimally symptomatic or detected incidentally on CT imaging done for other indications,<sup>[1]</sup> but if associated with adjacent tissue injuries like pericardial

effusion, pneumothorax, and hemothorax, it usually presents with significant symptoms. Despite having RV perforation complicated by left hemopneumothorax, our patient presented with only mild chest pain in a hemodynamically stable state. Thus a high index of suspicion and early referral to specialist care is required in a patient on pacemaker presenting with mild symptoms warranting further evaluation for lead-related complications.

ECG, chest X-ray, echocardiography, and device interrogation are usually helpful in diagnosing perforation or its complications like hemopneumothorax caused by extracardiac migration of lead. ECG would be a useful initial tool, especially when immediate post-implant paced ECG is available. Chest radiography is helpful for comparison of the position of lead tip and curvature with the post-implant films but sometimes lead tip migration may be too subtle to discern. If the lead tip migrates outside the cardiac silhouette, the diagnosis becomes more specific. However, as in our case, it can still miss some serious complications associated with perforation like pneumothorax or hemothorax. Echocardiography is a readily available bedside tool for assessing the lead location/perforation or associated complications like pericardial effusion/tamponade. However, occasionally it fails to diagnose with certainty.<sup>[6]</sup>

Findings on device interrogation traditionally consistent with perforation include a fall in lead impedance, increased capture threshold, and reduction in sensed R-wave amplitude. In contrast to this, our patient had markedly high impedance, an increase in capture threshold, and only a marginal decrease in sensing wave amplitude compared to the implant time values. As explained by Ahmed *et al.*,<sup>[4]</sup> impedance may vary depending on the tissue components around the lead tip, such as muscle, blood, and air. If the migrated lead tip lies within the air (e.g., lung, pericardial space), the impedance will increase. If the tip lies in spaces filled with fluid or blood (e.g., hemothorax, hemopericardium), impedance may not increase significantly as blood has lower impedance than air. Non-corroborative findings on device interrogation and chest X-ray in our patient warranted further evaluation with CT scan. This visualizes the lead tip, traces its extracardiac course, and detects cardiac and extracardiac complications of perforation. In a report by Hirschl *et al.*,<sup>[1]</sup> asymptomatic cardiac perforation by a ventricular lead was detected in 3% of pacemaker patients undergoing chest CT for other medical reasons, but most of these cases were uncomplicated. CT scan in our case revealed the RV perforation with the lead tip lying in the left hemopneumothorax, which could not be recognized on chest X-ray. This explained a very high lead impedance in our patient. This also helped in the planning of corrective surgery for cardiac perforation and its associated complication, thereby reinforcing CT scan as an emerging gold standard in the diagnostic workup of cardiac perforation.

Identified predisposing factors for lead perforation include use of a temporary pacemaker, corticosteroid use, active-fixation leads, low body-mass index, older age, longer fluoroscopy

times,<sup>[6,7]</sup> use of anticoagulants, and placement of a lead in right ventricular apex<sup>[4]</sup> as in our case. Once the perforation is confirmed, transvenous lead withdrawal can be attempted in stable patients, especially if it is an active fixation lead.<sup>[3]</sup> The definitive management remains surgical removal of the lead and rent repair.<sup>[8,9]</sup> Our patient underwent RV rent repair, management of hemopneumothorax and implantation of epicardial lead during surgery.

## Conclusion

Subacute right ventricular perforation by a pacemaker lead may have a subtle clinical presentation. The attending physician's high index of suspicion and early referral to specialist care is paramount, especially in a patient with a recently implanted device. Interrogated device parameters may vary with the position of the tip of perforating lead, and further evaluation by CT scan may help in the correct diagnosis of perforation, its associated complications, and planning of operative strategy.

## Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

## Financial support and sponsorship

Nil.

## Conflicts of interest

There are no conflicts of interest.

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