

Pneumopericardium: an uncommon complication of atrial lead perforation following pacemaker implantation

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Abstract Cardiac perforation is an infrequent but potentially life-threatening complication of pacemaker implantation. We report a case of right atrial lead perforation complicated by pneumopericardium shortly after pacemaker lead insertion. Transthoracic echocardiography revealed no evidence of pericardial effusion and pacemaker lead displacement, but a thoracic computed tomography scan illustrated the lead course and confirmed the diagnosis. This case suggests that computed tomography is a sensitive modality to confirm the diagnosis at the early stage of this complication.

Keywords *Pneumopericardium – complication – pacemaker – atrial – lead – perforation.*

INTRODUCTION

Cardiac perforation is a rare but potentially fatal complication of pacemaker implantation which can lead to pericarditis, pericardial effusion, tamponade, pneumothorax and haemothorax¹⁻³. These conditions require rapid recognition. We describe hereafter a case of pneumopericardium induced by an active fixation screw-in atrial lead, which represents an exceptional complication after pacemaker implantation.

CASE REPORT

A 66-year-old man with a history of syncope and paroxysmal complete heart block underwent implantation of a dual-chamber pacemaker with Medtronic active fixation screw-in atrial (model 5076-52) and ventricular (model 4074-58) leads. The tip of the atrial lead was easily positioned on the right atrial free wall. No procedural complications were described. At the time of the

insertion, the pacemaker interrogation revealed normal atrial parameters with a P wave of 4.94 mV, capture threshold of 0.25 V with 0.5 ms pulse width, and pacing impedance of 493 Ω . Ventricular parameters were favourable with a R wave of 11.29 mV, capture threshold of 0.25 V with 0.5 ms pulse width, and pacing impedance of 903 Ω . A chest radiogram performed 24 hours after the implantation demonstrated adequate position of the right atrial and ventricular leads. No cardio-pulmonary abnormality was detected. The post-operative recovery was uneventful and the patient was discharged home after three days.

Five days after the implantation, the patient presented to the cardiology outpatient clinic with complaints of dry cough, fluctuating retrosternal pain and chest discomfort increased by deep inspiration. His pulse rate was 98/min, blood pressure 130/70 mmHg, respiratory rate 20/min, oxygen saturation 98% on room air and temperature 37.1°C. The cardio-pulmonary examination was unremarkable. Friction rub was not detected. Electrocardiography revealed a sinus rhythm with a right ventricular paced rate of 98/min. The chest X-ray showed no cardiac or pulmonary disorder. A transthoracic echocardiography was immediately performed but did not demonstrate pericardial effusion or evidence of pacemaker lead displacement. The pacemaker device interrogation revealed complete atrial undersensing and failure to capture. The ventricular lead sensed and paced normally on interrogation. Finally, we decided to perform a thoracic computed

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tomography which confirmed that the atrial lead perforated the right atrial free wall. There was no significant pericardial effusion but the lead tip crossed the right lung to the anterior mediastinum resulting in pneumopericardium (figure 1, figure 2). As a result, extraction of the atrial migrated lead was decided 5 days after the first implantation. The patient underwent at the same time a new lead positioning to the right atrial appendage under fluoroscopic guidance. Good sensing and atrial capture were obtained. Adequate atrial lead position was confirmed by fluoroscopy. The patient recovered uneventfully and was discharged from the hospital in a stable condition on the third post-operative day.

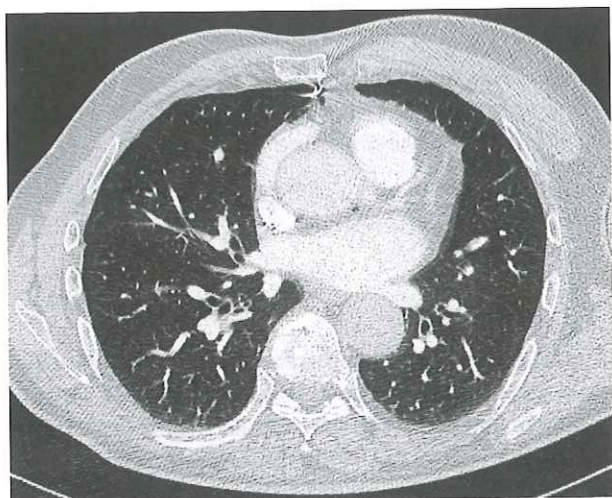


Fig. 1 Thoracic computed tomography realized without intravenous contrast: the tip of the lead penetrates through the anterior mediastinum after perforation of the right atrium and the right lung.

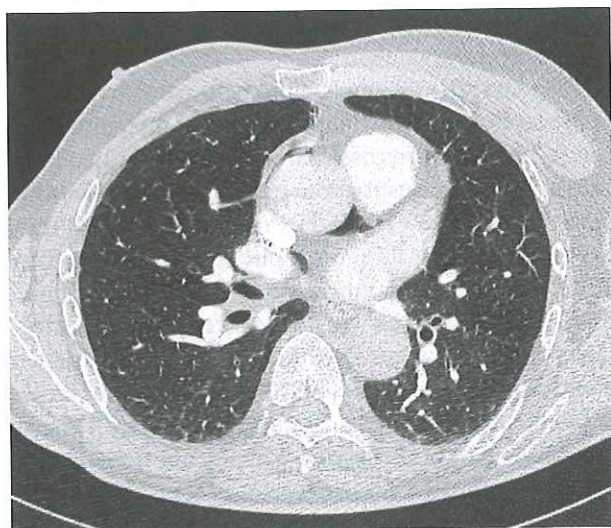


Fig. 2 Thoracic computed tomography realized without intravenous contrast: illustration of the pneumopericardium following the right atrial pacemaker lead perforation.

DISCUSSION

Cardiac perforation is an infrequent but serious and potentially life-threatening complication following pacemaker implantation. Most perforations are through the right atrium and usually occur during or shortly after the procedure^{1,3,4}. A literature review suggests that event rates vary from 0.1% to 0.8%^{5,6}. The most common manifestations of cardiac perforation include chest discomfort, pericardial pain, dyspnoea and hypotension^{4,7,8}. Diaphragmatic stimulation resulting in hiccups or chest wall muscles contraction has also been described^{4,8}.

The main recognized risk factors for cardiac perforation include older age, use of steroids and anticoagulants, low body mass index and female sex⁹. A review of the literature also suggests that the placement of the lead on the right atrial free wall confers an increased risk of cardiac perforation^{1,2}. Moreover, in comparison with passive fixation leads, the use of active fixation leads seems to be associated with an increased risk of such a complication^{1,2,6}. As a result, to avoid this complication, some authors recommend to insert the lead in the right atrial appendage or to choose a septal position². In addition, the use of passive fixation leads may help to reduce the risk of cardiac perforation.

In practice, if cardiac perforation is suspected, further investigations including chest radiography, transthoracic echocardiography and pacemaker device interrogation should be performed^{7,9}. A chest X-ray is performed in order to demonstrate a migration of the atrial pacing lead. Pacemaker dysfunction revealed by device interrogation is characterized by intermittent or complete undersensing and loss of capture⁸. Transthoracic echocardiography should be the first diagnostic test because it usually reveals pericardial effusion and pacer lead displacement⁵. However, echocardiography may sometimes not clearly visualize the course of the lead and the position of the tip. Furthermore, absence of pericardial effusion may occur at the early stage of this complication. Therefore, as illustrated in this case, when transthoracic echocardiography is not contributing, physicians should consider a computed tomography scan as diagnostic key of pacer lead perforation in all patients with cardiac devices who complain of chest symptoms after implantation^{5,7-9}.

When perforation is confirmed, extraction of the lead is recommended⁷. Two classical therapeutic options are available and the management of lead perforation depends on the haemodynamic status of the patient. In fact, alternative management options include transvenous lead removal under fluoroscopic guidance or surgical removal with sternotomy approach. In this case report, simple direct traction of the migrated atrial lead

followed by the replacement in a different location was considered because of the haemodynamic stability and the absence of pericardial effusion requiring surgical drainage^{2,3,9}. Conversely, a surgical approach is required in case of cardiovascular collapse or tamponade. Moreover, S. Hussain et al. recently reported the first case of minimally invasive robotic-assisted pacemaker lead extraction and right atrial perforation repair as an alternative therapeutic management option³. Finally, some publications have also reported successfully managed cases without extraction⁷.

In summary, atrial lead perforation after pacemaker implantation is an uncommon complication. Early recognition and urgent management is required because serious complications such as tamponade and pneumopericardium may develop. Chest discomfort shortly after the implantation should not only suggest pericardial irritation and computed tomography may be the most effective modality to confirm the location of the lead tip outside the heart when transthoracic echocardiography is not contributing.

CONCLUSION

We report a case of pneumopericardium, an exceptional complication of pacemaker implantation resulting from atrial lead perforation. Cardiac perforation is usually associated with risk factors including patient characteristics, use of active fixation leads, and implantation techniques such as lead positioning clearly illustrated in this case. Symptoms like chest discomfort, pericardial pain, friction rub and diaphragmatic stimulation should always consider lead complications. Abnormal signs in chest radiography, undersensing and failure to capture during pacemaker interrogation, and pericardial effusion on echocardiography usually confirm the diagnosis. However, this case demonstrates the usefulness of a thoracic computed tomography scan in the early diagnosis of pacemaker lead perforation. Indeed, cardiac perforation may have a subtle presentation and this report emphasizes the importance of not ruling out pacemaker lead perforation based on the absence of pericardial effusion illustrated by echocardiography.

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