

Section 2

Clinical case

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PERFORATION OF THE RIGHT ATRIUM WITH THE DEVELOPMENT OF RIGHT-SIDED PNEUMOTHORAX AND PNEUMOPERICARDIUM IN A PATIENT WITH AN IMPLANTED DUAL-CHAMBER PACEMAKER

Development of pneumothorax after pacemaker implantation is an uncommon complication. Pneumothorax, contralateral to venous access site, due to atrial lead perforation is a more rare complication. The most frequently reported predictors of lead perforation are active fixation leads, low body mass index, older age, female gender and concomitant anticoagulation therapy.

We described a clinical case of a 69-year-old patient who had undergone radiofrequency ablation of atrial fibrillation several years earlier. Several years later, the patient developed sick sinus syndrome (chronotropic incompetence) and bifascicular block, as a result of which he was implanted with a dual-chamber pacemaker, which was subsequently complicated by perforation of the right atrial appendage with damage to the middle lobe of the right lung with the development of pneumothorax and pneumopericardium. Described cases illustrates that if right pneumothorax symptoms occur in a patient where the device was placed from a left subclavian approach, perforation of the atrial appendage should be excluded. By far the preferred method of diagnosing this complication today is chest CT scan.

Key words: perforation of the appendage of the right atrium, pneumopericardium, right-sided pneumothorax.

Introduction

Development of pneumothorax after pacemaker implantation is an uncommon complication and occurs in 1% of pacemaker implantations [1, 2].

Contralateral to implantation site pneumothorax is an infrequent complication [3].

We present a case of concomitant right-sided pneumothorax and pneumopericardium following left-sided pacemaker implantation due to atrial lead perforation 12 hours after procedure.

Materials. Case report

A 69-year-old man presented with recurrent episodes of palpitations for six months. There was

no history of syncope. The electrocardiogram and Holter monitoring shown bifascicular block, intermittent chronotropic incompetence. The dual chamber pacemaker implantation was performed using left subclavian venous access. A right atrial lead (active fixation) was positioned in the RA appendage, and right ventricular lead (active fixation) was positioned at the interventricular septum. Leads sensing, pacing threshold, and impedance were within the expected normal ranges (RA lead: pacing threshold – 0.6 V/0.4 ms; sensing – 3.9 mV; impedance – 520 Ω; RV lead: pacing threshold – 0.5 V/0.4 ms; sensing – 8 mV; impedance – 750 Ω). The chest radiographic examination performed after the procedure did not reveal any abnormalities, suitable lead position and no signs of pneumothorax (Figure 1).

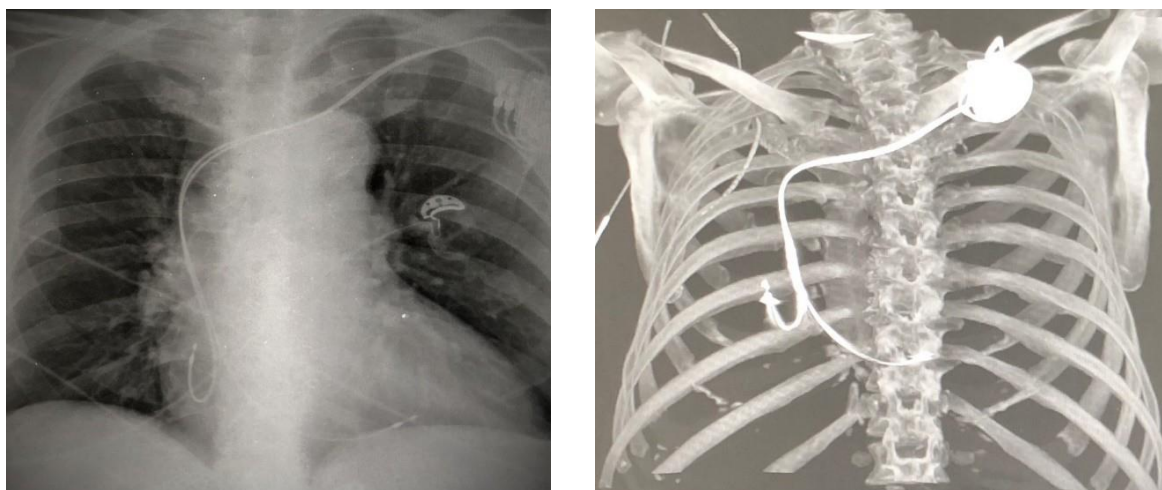


Figure 1 – Chest radiographs (left) and CT scan (right) in the anteroposterior views illustrate right atrial lead in the anterolateral position of the right atrium appendage and the right ventricular lead in the interventricular septum. There were no signs of pneumothorax or hemothorax.

Approximately 12 hours later, the patient complained of sudden onset of shortness of breath. His vital signs at that time were blood pressure 130/80 mm Hg, heart rate 60 bpm, respiratory rate 18/min, and oxygen saturation 98%. Device interrogation demonstrated changes in the RA lead parameters (right atrial pacing was ineffective – pacing threshold more than 7 V/0.4 ms; sensing threshold, 0.7 mV; lead impedance, 410 Ω). Chest

radiography showed right-sided pneumothorax and normal leads position. Drainage of the right pleural cavity was performed with the installation of the right intercostal drainage until the signs of pneumothorax disappeared. CT-scan showed a small right-sided pneumothorax with perforation of the right atrium appendage, right pleural cavity and right lung with the development of mild pneumopericardium (Figure 2).

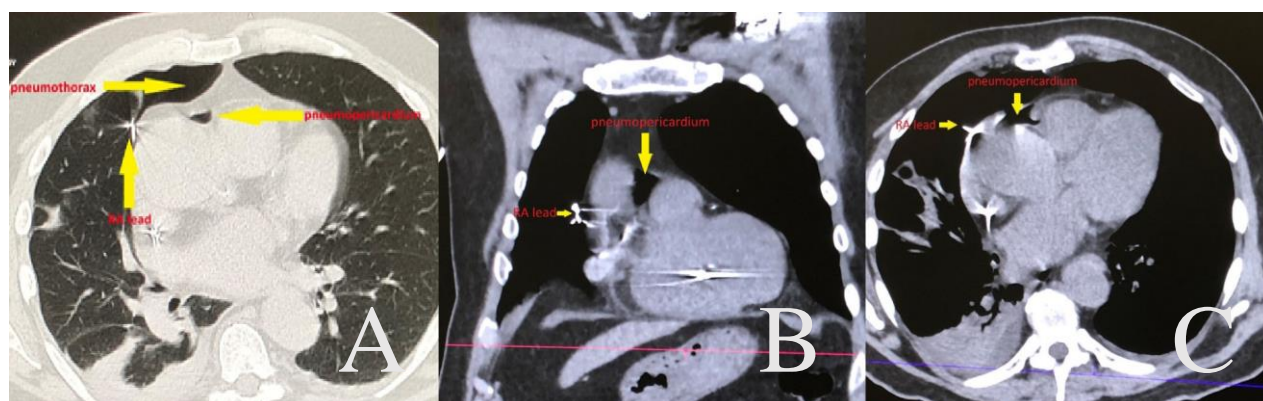


Figure 2 – Chest CT scan image 1 day after pacemaker implantation. A) and B) Axial CT image shows the right-sided pneumothorax, right atrial appendage perforation by atrial lead, and pneumopericardium. C) Coronal CT image showing the atrial lead perforation through the right atrial appendage, pneumopericardium.

Taking into account the dislocation of the right atrial lead into the right pleural cavity, with perforation of the appendage of the right atrium, right lung, and the lack of adequate right atrial stimulation, we decided to perform a right-sided minithoracotomy with suturing of the right atrial defect, and reimplan-

tation of the RA lead using a endocardial electrode with passive fixation.

In the left subclavian region, an incision was made along the previous suture, and the subcutaneous tissue was dissected. The pacemaker was pulled out and the right atrial electrode was disconnected.

An introducer was introduced through the electrode into the lumen of the left subclavian vein for explanation of the previous one and further implantation of a new endocardial electrode of the right atrium with passive fixation.

After that, a right-sided minithoracotomy was performed. When examining the pleural cavity, 2 centimeters of the distal tip of the endocardial electrode with damage to the pericardial cavity and pleural cavity are visualized (Figure 3-4).



Figure 3 – Perforation of the right atrium, pericardium, right pleural cavity with the right atrial lead.

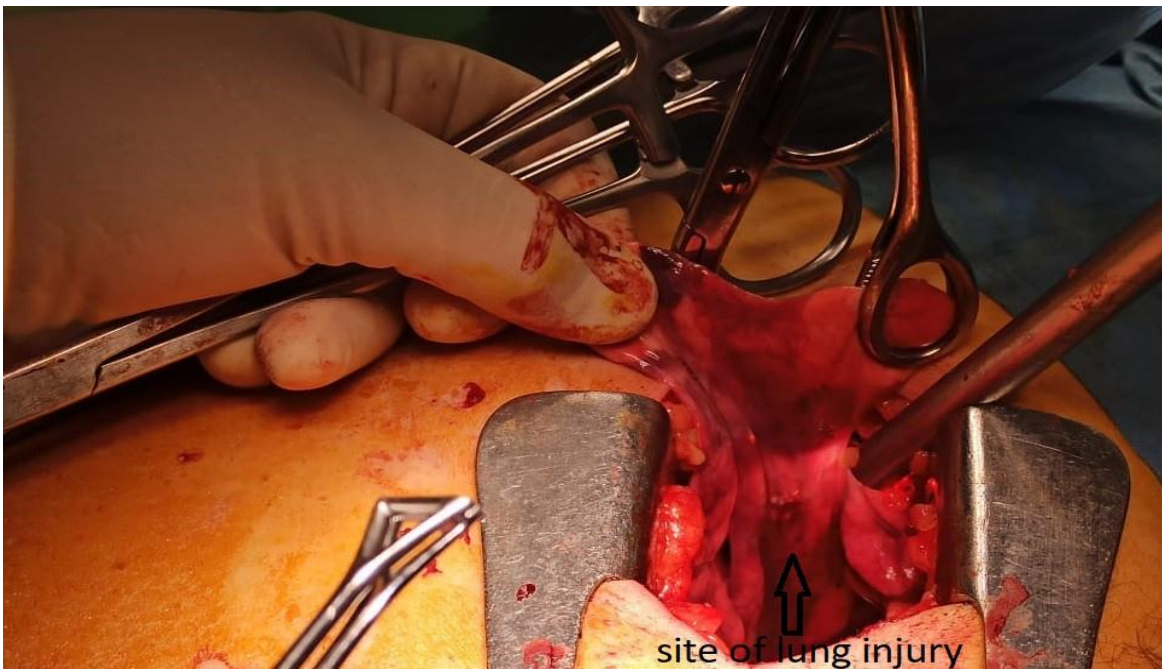


Figure 4 – Damage site of the middle lobe of the right lung.

There was an insignificant volume of blood in the pleural cavity. After pericardiectomy, the site of perforation was verified – it was the apex of the right atrial appendage (Figure 5). No liquid blood was found in the pericardial cavity.

A purse-string suture was applied around the electrode, after which the electrode was inserted into the cavity of the right atrium, additional sutures were applied to the wound area.

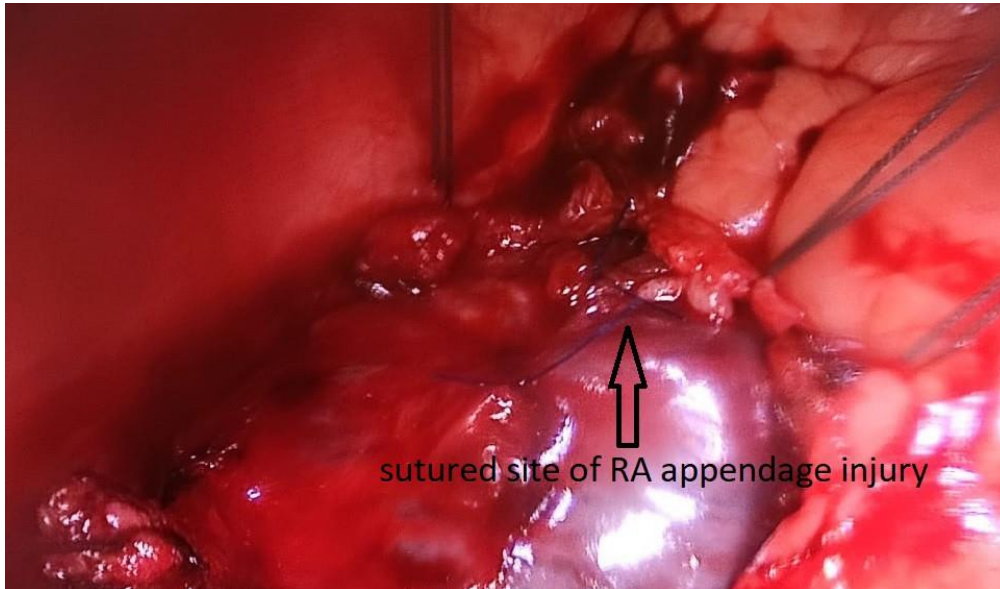


Figure 5 – Sutured site of damage to the right atrial appendage.

After thorough hemostasis and suturing with single sutures of the pericardium with the installation of a drainage tube into the right pleural cavity, the chest was closed. Immediately after that, the second stage was performed explanation of the previous (active fixation) and implantation of a new (passive fixation) RA-lead. The patient recovered without complications. The patient was discharged 3 days later with an appointment for a planned outpatient visit 3 weeks after surgery.

Discussion

Complications associated with pacemaker implantation occur in a variable percentage of

cases, ranging from 3.2% to 7.5% [4, 5]. Pneumothorax is typical complication of subclavian venous access [2]. Contralateral pneumothorax and pneumopericardium is a rare complication after pacemaker implantation and may not be revealed on chest radiography and device testing [6, 7, 8]. Several risk factors may be responsible for the increased complication rate such as an extremely thin-walled atrial appendage, stiffness of the atrial lead helix, over-screwing, and the experience of the operator.

To the best of our knowledge, only some few cases have been described, the details of which have been summarized in Table 1.

Table 1 – M – Male; F – Female; AV – Atrioventricular; A/L – Anterolateral; RA – right atrium.

Authors	Age/sex	Diagnosis	Atrial lead (Site of implantation, Position, Type)	Symptoms/signs	Chest X Ray	Change In lead param.	Treatment
Sebastian et al.	73 (M)	Mobitz type II AV block	Left subclavian, A/L RA; Active fixation	Sudden chest pain; 2 days.	50% pneumothorax. Pneumopericardium	No	Intercostal drainage tube

Table continuation

Srivathsan et al.	77 (F)	Sick sinus syndrome	Left subclavian, A/L RA; Active fixation	Shortness of breath 8 hours.	30% pneumothorax. Pneumopericardium (Moderate sized)	No	Intercostal drainage tube, Atrial lead extraction
Nantsupawat et al.	83 (M)	Tachy-brady syndrome	Left subclavian, A/L RA; Active fixation	Chest pain, neck pain; 1 day.	10% pneumothorax. Pneumopericardium (Small sized)	No	Observ, oxygen inhalation
Parashar et al.	62 (M)	Mobitz type II AV block	Left subclavian, A/L RA; Active fixation	Chest pain; 7 hours.	50% pneumothorax. Pneumopericardium (Small sized)	No	Intercostal drainage tube
Chryssagis et al.	65 (F)	Unknown	Right subclavian, A/L, in the middle of RA; Active fixation	Chest pain, Shortness of breath, Hypotension; 1 week	Pleural and pericardial effusions	Yes	Median sternotomy
Present case	69 (M)	Bi-fascicular block	Left subclavian A/L RA; Active fixation	Shortness of breath, chest pain; 12 hours.	30% pneumothorax. Pneumopericardium (Small sized)	Yes	Intercostal drainage tube, Minithoracotomy

Patients with contralateral pneumothorax commonly present with chest pain and/or shortness of breath. In published in Table reports, symptoms typically occurred within 1–7 days after device implantation.

Attention is drawn to pneumopericardium revealed by CT data in almost all cases was described, but there is no sings of the presence of fluid in the pericardium. This is most likely due to the fact that the atrial lead itself may have plugged the defect.

The most frequently reported predictors of lead perforation are active fixation leads, low body mass index, older age, female gender and concomitant anticoagulation therapy [9]. In our opinion, the cause of perforation in our case may be a combination of excessive screwing of the atrial lead helix during placement and the presence of a thin atrial wall.

According to published data of CT scan, cardiac perforation occurs in about 0.3% of all implantations of pacing devices, of which approximately 15% of atrial perforations and 6% of ventricular perforations are asymptomatic [10,11]. According autopsy study myocardial perforation or penetration by an electrode was recognized in 5.3% cases of patients 60 years of age or over with an implanted pacemaker. The perforation rate was 27.3% in active-fixation atrial leads, and 0% in 10 passive leads [12].

CT scan allowed to verify complications in all cases of contralateral pneumothorax, pneumopericardium, and/or lead perforation after device implant [13, 14].

Therefore, it is obvious that computed tomography of the chest is the diagnostic method of choice when there is clinical concern of cardiac lead perforation.

As for the treatment, the insertion of intercostal tube should be considered when pneumothorax includes more than 10% of pleural space [6, 7, 8]. With unchanged parameters on the atrial lead during interrogation, and the absence of clinical symptoms of perforation, electrode repositioning most authors was not considered.

Conclusion

Contralateral pneumothorax with or without pneumopericardium is an infrequent complication and may not be verified on chest radiography and device interrogation. Awareness about the possibility of this complication is important. An augmented degree of attention should exist for all physicians dealing with similar patients.

If a right pneumothorax develops in a patient where the pacemaker was positioned from a left subclavian approach, perforation of the right atrium should be considered and immediately investigated. By far the preferred method of diagnosing this complication today is chest CT scan.

Treatment, in turn, depends on symptoms, hemodynamic status, size of pneumothorax, and device parameters.

Conservative management without the use of a drain tube or atrial lead extraction may be sufficient in patients with stable vital signs, stable lead parameters, and mild pneumothorax and pneumopericardium.

Remember to use caution when screwing the atrial lead during insertion in patients with enlarged and most likely thinned atrial walls.

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