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ORIGINAL PAPER

A combination of rare complications 3 years after a dual-chamber pacemaker implantation

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Abstract
Late perforation of the atrial wall after pacemaker implantation frequently remains asymptomatic but may cause chest pain, dyspnea or syncope. Perforation can also lead to rarer complications such as hemoptysis and pneumopericardium. We present the case of a patient who developed progressive hemoptysis 3 years after a dual-chamber pacemaker implantation. Pacemaker interrogation showed stable impedance of the right atrial lead and stable pacing threshold values. CT revealed perforation of the right atrial wall by the RA-lead with consecutive pneumopericardium and diffuse lung bleeding of the right middle lobe. The patient was hemodynamically stable at all times. The right atrial lead was transvenously extracted and replaced without any further complications.

Keywords Pacemaker implantation · Atrial perforation · Hemoptysis · Pneumopericardium

Introduction

The reported incidence for complications after pacemaker implantation varies between 3 and 13% [1]. Late perforation of the atrial wall often remains asymptomatic and therefore unrecognized. Possible symptoms include dyspnea, hemoptysis, chest pain, syncope, and hiccups in case of diaphragm stimulation [2]. Lead perforation among patients with similar symptoms should be ruled out via a combination of pacemaker interrogation and echocardiography, CT scans or chest radiography [2].

Case report

A 87-year-old female patient was referred to our department because of progressive hemoptysis for 2 days without fever, angina or any other concomitant symptoms. Physical examination was normal apart from a systolic murmur (3/6) with transmission to the carotid arteries. Vital signs were stable and within normal limits. ECG and laboratory tests revealed no abnormalities.

In June 2015, the patient underwent a dual-chamber pacemaker implantation (Medtronic Sensia SEDR01) with active fixation leads [CapSureFix Novus 4076 with a length of 52 cm (atrial lead) and 58 cm (ventricular lead)] because of third-degree AV-block. Other relevant diagnoses were: a known severe aortic valve stenosis, combined mitral valve stenosis (II°), and insufficiency (II°), and arterial hypertension. In 2009, the patient had been successfully treated for a cervical lymphoma with complete remission. Medication on admission was an angiotensin receptor blocker (Valsartan 160 mg) twice a day and a proton pump inhibitor (Pantozol 40 mg) once daily.

Transthoracic echocardiography showed no pericardial effusion. CT showed a dislocation of the right atrial lead with perforation of the lateral atrial wall, a pneumopericardium of 8 mm maximal width and diffuse opacities of the right middle lobe, most likely due to bleeding because of

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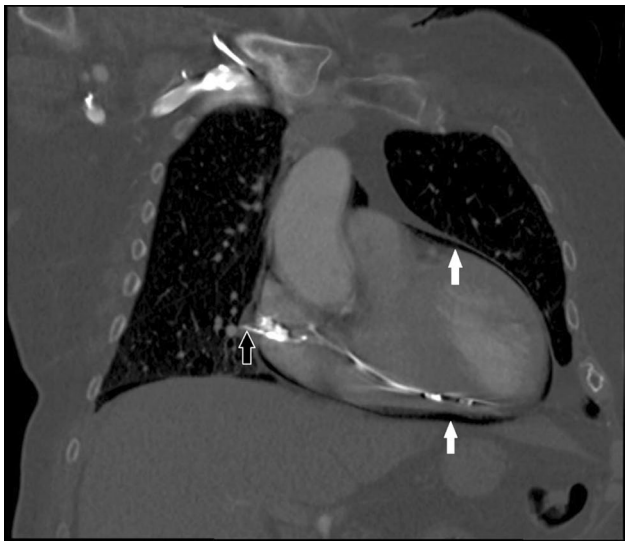

Fig. 1 CT was performed shortly after admission. This paracoronary view (bone window) shows perforation of the lateral right atrial wall (black arrow with white borders) and distinct signs of pneumopericardium (white arrows)

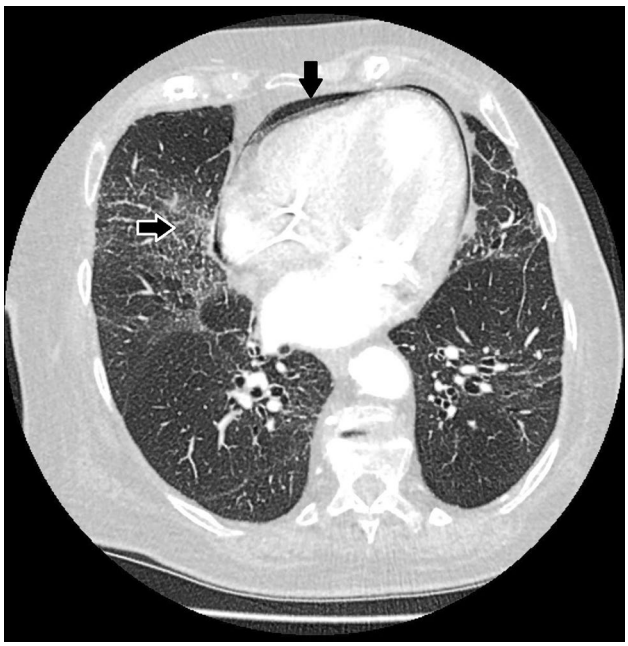

Fig. 2 Axial view in lung window revealed hemorrhage of the right middle lobe (black arrow with white borders) and pneumopericardium (black arrow)

lung laceration (see Figs. 1, 2). Pulmonary embolism und pneumothorax were excluded. Bronchoscopy showed ongoing low-volume bleeding in the right middle lobe (segment 4), which decreased under the application of local catecholamines. The patient was transferred to the ICU for further monitoring. Interestingly, pacemaker interrogation showed stable pacing threshold values of 1 V/0.4 ms as well as normal sensing (1.4 mV) and impedance values (306 Ω) of the right atrial lead (all measured in unipolar configuration). There was no significant difference when tests were performed in bipolar configuration. Compared to the values at the time of implantation (pacing threshold: 1.25 V/0.4 ms; sensing (2.0 mV); impedance (309 Ω), all tested in unipolar configuration) only minor changes could be observed.

The right atrial lead was transvenously extracted in general anesthesia under TEE monitoring and standby for immediate thoracotomy. This was performed with bronchoscopy and bronchus blocker in standby to handle a potential pulmonary bleeding. After successful extraction of the right atrial lead with the use of a mechanical bidirectional rotational extraction sheath, a new right atrial lead was placed via the right cephalic vein. No complications occurred during or after the operative procedure. Control-CT showed spontaneous resolvement of the pneumopericardium and regression of the opacities in the middle field of the right lung. No further episodes of hemoptysis occurred. In the further course, a transfemoral TAVI implantation was chosen for treatment of the patient's severe aortic stenosis. The procedure was performed as previously described [3].

6 weeks after the intervention, the patient was contacted via telephone. She did not report any symptoms possibly related to the interventions or other episodes of hemoptysis and recovered well.

Discussion

This case represents the rare combination of hemoptysis and pneumopericardium as complications of right atrial lead perforation after pacemaker implantation, which has not been described previously.

The reported incidence of right atrial perforation after pacemaker implantation varies between 0.09% and 1.2% [2, 4]. Perforation of the heart is observed more often when using active fixation leads, especially when using J-shaped leads compared to straight leads [5, 6]. However, some publications demonstrate equal risk of perforation between active and passive fixation leads [7, 8].

It is known that both perforation and dislocation occur more frequently among atrial leads [1, 4]. Predictors of atrial lead perforation include female gender, low body mass index, older age, and the use of steroids and anticoagulation [5]. Coronary heart disease and myocardial infarction can also promote perforation of the heart by means of structural remodelling [4].

In the rare case of haemoptysis after pacemaker implantation, this is most likely the result of lung laceration after difficult subclavian vein puncture, but it can also occur after axillary vein puncture [9, 10]. In the presented case,

hemoptysis developed due to lung laceration of the right atrial lead, which is a less common mechanism and has previously only been described once [11].

Pneumopericardium after pacemaker implantation is rarely seen as an exclusive complication, it is more frequently combined with pneumothorax, pneumomediastinum or pericardial effusion [12]. Usually there are few or no symptoms, except from the rare case of tension pneumopericardium, which is a life-threatening situation. Also, most cases do not require specific treatment but resolve spontaneously [13]. In this case, as well as in two other published cases of pneumopericardium after dual-chamber implantation, sensing and pacing values of the atrial lead remained normal despite perforation of the right atrium [5, 14]. This might be because the atrial lead still was in contact with myocardial tissue, therefore showing a normal function [15]. Nevertheless, the presence of normal pacing threshold values in unipolar configuration after right atrial perforation is very unusual and seems to be more likely with bipolar configuration. As demonstrated in this case, normal unipolar and bipolar sensing and pacing thresholds cannot safely exclude atrial perforation.

Conclusion

Both pneumopericardium and hemoptysis may occur as complications years after initial pacemaker implantation. Despite normal sensing and pacing values, perforation can be present and should be ruled out via CT scan.

Compliance with ethical standards

Conflict of interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

Informed consent The authors confirm that written consent for submission and publication of this case report including image(s) and associated text has been obtained from the patient in line with COPE guidance.

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