

A Moving Lead — Lead Perforation Caused by the Atrial Lead

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Abstract

An 80-year-old female patient with a pacemaker was found massive pericardial effusion, and the sagittal image of CTA revealed the atrial lead tip extended slightly beyond the atrial wall. During operation, we found the criminal lead keep going in and out of the atrial wall and appearing as a dot when penetrated. This case gives us a lesson on diagnosis of lead perforation in patients with pacemakers.

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Keywords: Perforation, Pacemaker, Pericardial effusion

Introduction

Lead perforation is a rare but serious complication of pacemaker implantation. The incidence ranges from 0% to 6.37%, with an average less than 1% [1]. Early detection and timely treatment of lead perforation are extremely important due to potential damage to vital organs and cardiac tamponade. Here we report a rare case of lead perforation with a moving atrial lead.

Case presentation

An 80-year-old female patient was admitted to our hospital due to dyspnea lasting 3 days. This patient had a dual-chamber pacemaker implantation one month earlier due to sick sinus syndrome with an active fixation lead (Medtronic 5076) in the right atrial appendage and another (Medtronic 5076) in the right ventricular apex. Her vital signs were stable after admission. Echocardiography revealed massive pericardial effusion. Pacemaker programming showed pacing parameters of two leads were both good. Chest X-ray showed that both leads were within cardiac silhouette (**Figure 1A**). Computed tomographic angiography (CTA) with sagittal multiplanar reconstruction showed the tip of the atrial lead protruded slightly beyond the epicardial fat pad (**Figure1B**), suggesting a potential atrial lead perforation. Then pericardiocentesis was performed to guard against cardiac tamponade, and hemorrhagic fluid was drained without blood clot, which deepened the suspicion of perforation. Therefore, a small incision operation was performed. During the operation, it was found that the position of the atrial lead was unfixed, and the penetrated part was so short that it appeared as a dot when penetrated, and then disappeared in the surgical field, repeatedly (**Figure 1C, D**). Afterwards, cardiac was repaired and the criminal lead was embedded. After several days of observation, pericardial effusion disappeared.

Discussion

Pacemaker implantation may lead to complications such as infection, hemorrhage, lead dislodgement, and lead perforation. Lead perforation is potentially life-threatening because of damage to adjacent tissues and organs. It is closely related to the procedure and type of leads, and the risk increases with old age (>80 years old), low body mass index (<20 kg/m²), or a history of steroid therapy.

When lead perforation happened, the pacemaker program may find abnormal changes in pacing parameters. However, in our case, the lead tip was still in good contact with the myocardial tissue, so no abnormal parameters were found. X-ray can quickly identify lead displacement and breakage, and it is the most common method for positioning the leads but with poor diagnosis sensitivity of lead perforation. CT is interfered by cardiac motion and metal artifacts, though seen as the gold standard for diagnosing lead perforation, leading to underestimation or overestimation [2]. ECG-gated CT reduces interference from cardiac motion and metal artifacts, but the diagnostic accuracy is still less than 100%. As reported in a study, when the penetrating part of the lead beyond the epicardial fat pad is less than 2 mm, misdiagnosis occurs [2]. In existing case reports, atrial leads often pass through the pericardial cavity and penetrate the lung tissue after perforation, which can be quickly diagnosed by X-ray and CT [3,4]. However, the diagnosis of perforation is not always so simple and easy. A case of lead perforation with repeated pericardial effusion during hospitalization was diagnosed not by pacemaker programming, X-ray or CT, but by angiography [5]. Another case of repeated pericardial effusion within three months with unknown cause, which was finally found lead perforation through open chest exploration, was reported [6]. In our case, it seemed that the atrial lead tip pierced the heart contour in the sagittal plane of CTA, and the part beyond the epicardial fat pad was extremely short. Later, we found the position of the criminal lead was not fixed during the operation, and the tip repeatedly went in and out of atrial wall, which increased the complexity of our diagnosis. Therefore, the penetrating moment captured by CT scan was a prerequisite for the imaging diagnosis of this case. In addition, the artifact factor should be considered.

We firstly describe the intermittent penetrating motion of the atrial lead after perforation, which has important guiding significance for diagnosis of lead perforation. For patients with cardiac pacemaker, once pericardial effusion occurs, even no evidence of perforation in programmed and imaging examinations is found, it is also necessary to consider whether the perforated part of criminal lead is too short.

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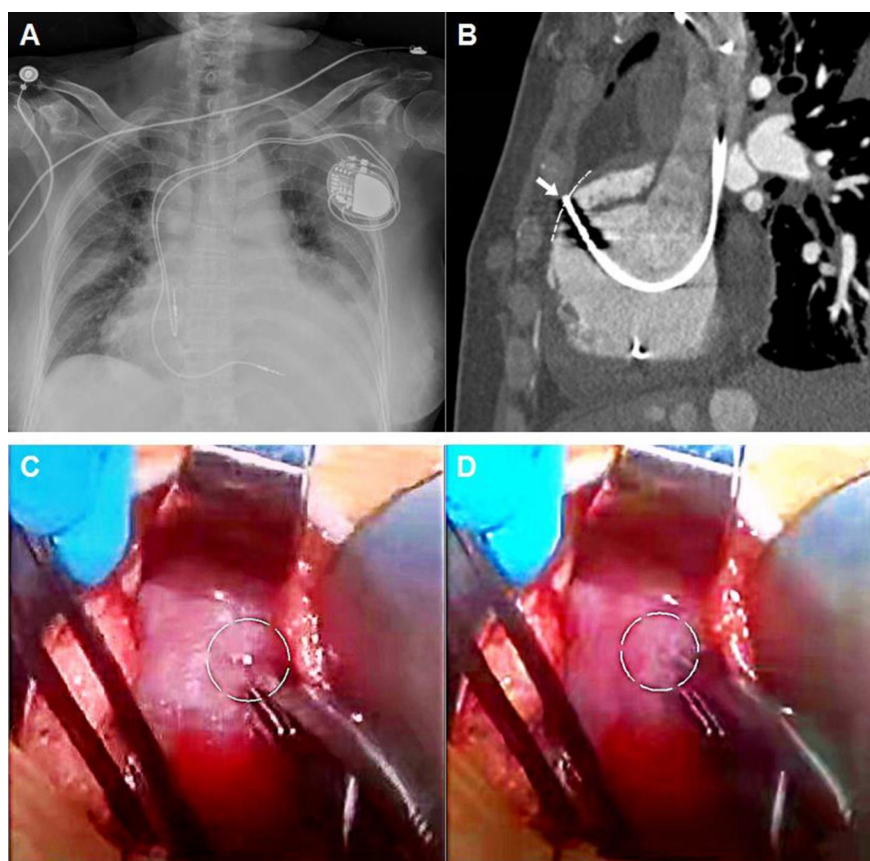


Figure 1. (A) Chest X-ray revealing the enlarged cardiac shadow, with the leads located within the range of the cardiac shadow. (B) CTA with sagittal multiplanar reconstruction showing the tip of the atrial lead displaced forward (arrow) and slightly beyond the edge of the epicardial fat pad (white dashed line). (C) Intraoperative image showing the tip of the atrial lead (in circle) protruded slightly through the atrial wall. (D) The tip of the atrial lead retracted into the atrium.