Usage of Point-of-care Ultrasonography for Rapid Diagnosis of Cardiac Perforation by Pacemaker Lead

Chia-Ching Chen¹,², Sai-Wai Ho¹,²*¹Department of Emergency Medicine, Chung Shan Medical University Hospital, Taichung, Taiwan, ²Department of Emergency Medicine, Chung Shan Medical University, Taichung, Taiwan

Abstract

Cardiac perforation after pacemaker placement is a rare form of cardiovascular emergency. A case of an elderly adult undergoing hemodialysis that contributed to this emergency is presented. The history, clinical imaging findings, and surgical procedures for clinical assessment are briefly described. Point-of-care ultrasonography (POCUS) was used to identify, locate, and perform ultrasonography-guided pericardiocentesis. The role of POCUS in cases of tamponade has been emphasized in clinical settings.

Keywords: Cardiac perforation, pacemaker lead, point-of-care ultrasonography

INTRODUCTION

Cardiac perforation due to pacing lead displacement is an uncommon condition with published rates of 0.1%–0.8% for pacemakers and 0.6%–5.2% for implantable cardioverter defibrillators.[1] Perforation usually develops within 1 month of implantation. According to the onset time, perforation can be classified into three categories: acute (developed within 24 h of implantation.), subacute (onset within 1 month), and delayed.[2] Computed tomography (CT) is the gold standard diagnostic tool. However, point-of-care ultrasonography (POCUS) imaging is useful in rapid detection of pericardial effusion, ascertaining sonographic evidence of tamponade sign, and searching for displaced pacing lead for rapid diagnosis.

CASE REPORT

A 73-year-old male with end-stage renal disease undergoing regular hemodialysis for decades and sick sinus syndrome after pacemaker implantation 1 week ago presented to the emergency department (ED) with acute onset of dyspnea while undergoing hemodialysis. A low systolic blood pressure of 90 mmHg with confusion status was also noted. Neither iatrogenic blood loss nor recent signs of gastrointestinal bleeding episodes have been found. Physical examination revealed an engorged jugular vein with a distant heart sound. The nature of the shock was further studied using POCUS (GE LOGIQ-e, GE Healthcare, Milwaukee, WI). Huge heterogeneous pericardial effusion with early diastolic right ventricle (RV) collapse and free pacemaker lead protruding outside the RV free wall [Figure 1a] were present in the subxiphoid view. Apical four-chamber view also revealed discontinuation of the RV free wall [Figure 1b], suggested RV free wall rupture. Emergent pericardiocentesis was performed by draining over 200 ml of bloody fluid. Contrast-enhanced CT confirmed a pacemaker lead protruding outside the right ventricular wall with pericardial effusion [Figure 2]. The patient was shifted to the operating room, where he underwent cardiac repair. The pacemaker lead was found to be penetrating out of the RV free wall with a 1 cm lacerated, slowly bleeding wound. He had a smooth postoperative course with resolution of his symptoms, was discharged home in a stable condition, and was doing well on follow-up 1 month later.

Address for correspondence: Dr. Sai-Wai Ho, Department of Emergency Medicine, Chung Shan Medical University Hospital, No. 110, Section 1, Jianguo N. Road, Taichung, Taiwan. E-mail: hswk@ymail.com

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DISCUSSION

The reported incidence of all types of lead perforation is approximately 0.1%–0.8%.\[^3\] Symptoms of lead perforation include chest pain, dyspnea, syncope, inadequate implantable cardioverter-defibrillator (ICD) shocks, muscle or diaphragm stimulation, abdominal pain, hiccups, and pleural or pericardial effusions.\[^4-7\] This indicates that there are no specific symptoms of this rare clinical condition. The risk factors of lead perforation have not been well studied. A higher perforation rate might be related to the physician’s experience, female sex, old age, body mass index < under 20 kg/m\(^2\), corticosteroid therapy, anticoagulation, some type of lead including temporary stimulation, atrial lead, lead with active fixation system, defibrillator leads, lead with double spirals (more wires, stiffer), excessive length during implantation, lead with small diameter (increased force per unit area), and high resistance (small tip surface) lead.\[^3,6-9\]

Lead perforation is suspected when <3 mm separates the tip of the lead from the epicardial fat detected on chest X-ray (epicardial fat-pad sign).\[^10\] Although chest radiography is the initial choice of diagnostic tool, it may not be able to detect minimal lead migration. In this case, perforation was difficult to diagnose on chest radiography as the tip of the lead was outside the RV free wall and lying just above the diaphragm. While CT remains the gold diagnostic tool for precisely demonstrating the pacemaker lead position, POCUS is a timely, efficient, effective, and patient-centered alternative in the ED setting. By recognition of new-onset pericardial effusion in patients with pacemaker or ICD implantation by POCUS, emergency physicians should search evidence of displaced lead along the free wall of RV and apex because lead perforation is one of the uncommon causes of pericardial effusion that needs surgical intervention.

Declaration of patient consent

The authors certify that they have obtained appropriate patient consent form. In the form, the patient has given his consent for the images and other clinical information to be reported in the journal. The patient understands that his name and initial will not be published and due efforts will be made to conceal the identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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