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SUBACUTE RIGHT VENTRICULAR PERFORATION FROM A PASSIVE FIXATION PACEMAKER LEAD – A MULTIDISCIPLINARY DIAGNOSTIC AND MANAGEMENT WORK-UP

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ПОДОСТРА ПЕРФОРАЦИЯ НА ДЯСНА КАМЕРА ОТ КАМЕРЕН ЕЛЕКТРОД С ПАСИВНА ФИКСАЦИЯ – МУЛТИДИСЦИПЛИНАРЕН ДИАГНОСТИЧЕН ПОДХОД

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Abstract.

Cardiac implantable electronic devices (CIEDs) implantation procedure has a complication rate of 5-6% according to most studies. Lead perforation is a possible and serious adverse event which can present with a spectrum of symptoms from asymptomatic to sudden death. Diagnostic tools in case of suspected lead perforation are X-ray, transthoracic echocardiography, pacemaker interrogation and computed tomography with the last one being the gold standard. Lead extraction could be done endovascularly or surgically. Transvenous removal is a possible option for active fixation leads, while removal of passive fixation leads is preferably done surgically, because of the bulky tip of the lead, which could damage the heart chambers and the vessels. In this article, we present a case of a massive ventricular perforation from a passive fixation lead, further complicated by a cardiac tamponade. Surgical removal was the treatment of choice with subsequent implantation of a permanent dual-chamber pacemaker.

Key words:

pacemaker, lead extraction, perforation, surgery

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Резюме.

Процедурата за имплантиране на сърдечни имплантируеми електронни устройства (CIEDs) има процент на усложнения от около 5-6% според повечето проучвания. Перфорацията от електрод е възможно и сериозно нежелано събитие, което може да се прояви със спектър от симптоми – от липса на такива до внезапна сърдечна смърт. Средствата за диагностика при съмнение за перфорация са рентгеново изследване, трансторакална ехокардиография, изследване на пейсмейкърната функция и компютърна томография, като последната е златен стандарт. Екстракцията на електрода, довел до перфорацията, може да се извърши ендоваскуларно или хирургично. Трансвенозното отстраняване е възможна опция за електродите с активна фиксация, докато отстраняването на електродите с пасивна фиксация е за предпочитане да се извърши хирургично, поради обемистия връх на електрода, който може да увреди сърдечните кухини и съдовете. В тази статия представяме случай на масивна вентрикуларна перфорация от камерен електрод с пасивна фиксация, допълнително усложнена от сърдечна тампонада. Хирургичното отстраняване беше лечението на избор в нашия случай, с последващо имплантиране на постоянен двукухинен електрокардиостимулатор.

Ключови думи:

пейсмейкър, екстракция на елетрод, перфорация, операция

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INTRODUCTION

Cardiac implantable electronic devices (CIEDs) implantation procedure has a complication rate of 5-6% according to most studies [1]. Even though the procedure could have a potentially fatal development, death related to the CIED implantation is uncommon [2]. Some of the most common perioperative complications are clinically relevant perforation, pneumothorax, pocket haematoma, lead dislodgment and infection. Lead perforation is a serious adverse event with rates reported up to 1.5% and it can present ranging from no clinical manifestation to pneumothorax and tamponade. Also, perforation can be divided into acute (< 24 h) or sub-acute (< 1 month), and very rarely late complication (detected years after the initial procedure) [2, 3]. To prove or either rule out lead perforation an echocardiography, pacemaker interrogation, chest radiography and computed tomography (CT) can be helpful. Although all of these can point to this complication, the gold standard for the diagnosis of lead perforation is the CT [4, 5]. The management of a patient with lead perforation is still a debate, on one hand when there is haemodynamic instability the open heart surgery seems to be the best option, but on the other hand in a stable patient the right decision (doing nothing, transvenously extracting the lead or surgery) should be weighed carefully [4]. Dealing with a complication of this nature in a mostly elderly and polymorbid patient group could be very tricky, because of that we will present a case of pacemaker passive lead fixation perforation through the right ventricle in an elderly lady, leading to a cardiac tamponade.

CASE PRESENTATION

An 83-year-old female presented to the emergency department of our hospital with shortness of breath and presyncope started two days earlier, immediately after a single chamber permanent pacemaker implantation (VVIR) procedure with a passive lead fixation, because of a third-degree atrioventricular block. Since, she was directed from other hospital, they have already done a CT scan showing the ventricle lead tip traversing intramyocardially through the right ventricular apex and lying near the left ventricular apex in the pericardial cavity (Figure 1).

Upon admission, the patient was feeling sick, she was pale with blood pressure of 90/60 mm Hg and regular pulse rate of ~ 40 bpm., respiratory rate of ~ 20/min and absent breathing in the base of the left lung. An emergent echocardiography revealed a cardiac tamponade with a diffuse pericardial effusion leading to compression of the right atrium and right ventricle. Because of the threatening condition of the patient an informed consent was signed and an immediate open-heart surgery was undertaken.



Fig. 1. Axial CT image of the heart showing pacemaker leads passing through the apex of the right ventricle (red arrow) and the tip of the pacemaker lead clearly seen outside (red arrow)

SURGERY PROTOCOL

Surgical management was judged clinically indicated and the patient underwent conventional median full-sternotomy and pericardiotomy showing a blood like effusion with massive adhesions. The pacemaker lead was visible in the pericardial space, perforated the apex of the right ventricle (Figure 2). The pacemaker lead with passive fixation was outside of the right ventricle with its tines up to the ring electrode and because of that it could not be removed transvenously, without firstly cutting the tip of the electrode. Otherwise the tines would further damage the myocardium of the right ventricle. After cutting the tip of the electrode, the lead body was removed transvenously, the apex of the right ventricle was repaired and a temporary pacemaker was implanted (Figure 3, Figure 4). In the postoperative period there was no pericardial effusion from transthoracic echocardiography and the patient remained in sinus rhythm for the first 24-hours. After that, she had a couple episodes of atrial fibrillation, followed by intermittent complete AV-block and AV-block 2:1. Because of the tachy-brady syndrome and the symptomatic bradycardia with high degree AV-block we decided on implantation of a permanent dual chamber pacemaker. On the sixth postoperative day a dual-chamber permanent pacemaker (PM Sphera DR MRI – SN FNC062750G, Medtronic Inc., Minneapolis, MN, USA) implantation was performed. A 7-French active fixation lead (Capsure Fix Novus 4076 52 cm – SN BBL1663141) was inserted via the left axillary vein approach and positioned in the right atrial (RA) appendage and the right ventricular lead (Capsure Fix Novus 4076 58 cm – SN

BBL1672556) was implanted in the apical septum without any complication. One-day post-implantation, the chest X-ray showed the pacemaker lead in place

with the appropriate slack. The pacemaker parameters were satisfactory and the patient was discharged home on the same day (Figure 5).

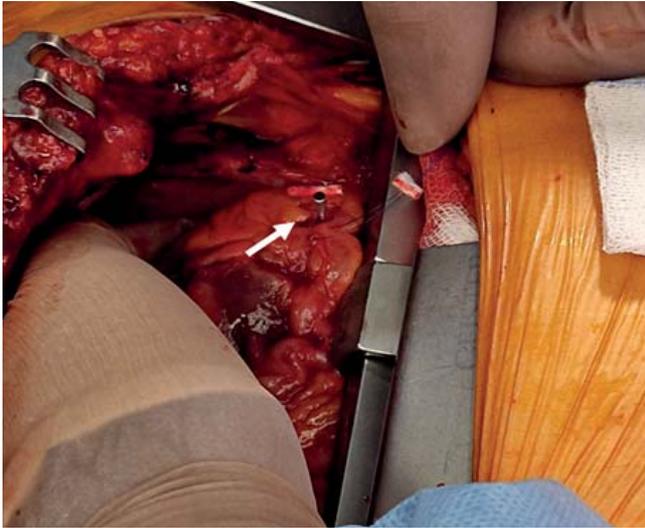


Fig. 2. Intraoperative image. Showing the pacemaker lead penetrated the right ventricular apex, reaching into the pericardium (white arrow)

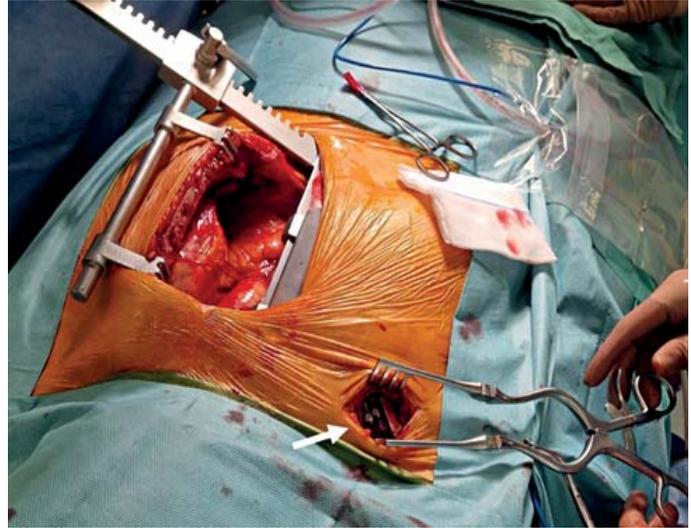


Fig. 3. Intraoperative image after cutting the tip of the electrode and opening the pacemaker pocket in order to transvenously remove the body and the lead (white arrow)

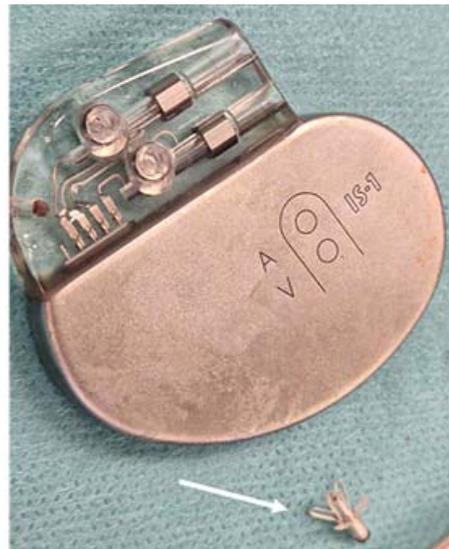


Fig. 4. The extracted permanent pacemaker. The tip with the tines (white arrow) is showed

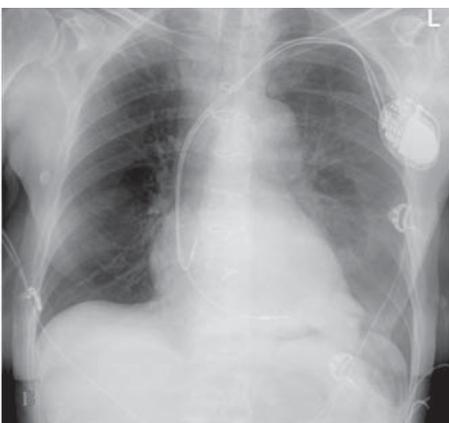
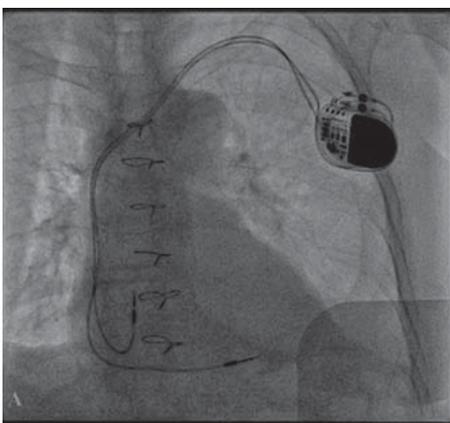


Fig. 5. Image 'A' at the end of the procedure showing the implantation side of the pacemaker body and leads. Image 'B' is the chest X-ray one-day post implantation showing the pacemaker lead in place

A B

DISCUSSION

Most of the complications associated with CIEDs implantation are usually short-lived – chest discomfort, ecchymosis and haematoma at the incision site. One of the possible major complication is cardiac perforation. Even though, active fixation leads are associated with higher perforation rates than passive leads and the atrium is more commonly perforated than the ventricle it rarely leads to a major adverse event. On the other side, perforation of the ventricle apex with a passive fixation lead could be fatal, because of the thinner myocardial wall there (compared to the intraventricular septum) and the tines of the passive fixation lead [4, 6]. Some of the risk factors associated with lead perforations are concomitant transvenous pacing, steroids within 7 days, older age, Body Mass Index (BMI) < 20, anticoagulation therapy and female gender. Our patient was a female, 83-years old, had a BMI < 20 and was on chronic anticoagulation. All of these factors had already put our patient in the risk zone of perforation [6].

Permanent pacemaker lead perforation can present with a spectrum of symptoms from asymptomatic to sudden death. This possible complication should be considered in all patients receiving CIED regardless of the time since insertion. The go to diagnostic tools in case of suspected lead perforation are X-ray, transthoracic echocardiography, pacemaker interrogation and computed tomography. Normal impedance and pacing parameters do not exclude perforation. X-ray and TTE may be of help to visualize the perforation, but in most cases, this is challenging with plain X-ray. Echocardiography could help with examination of the pericardium and pericardial space (pericardial effusion/cardiac tamponade). The gold standard for the diagnosis is the CT [3-6].

Management usually depends on the symptoms of the patient and the time of presentation. Some teams believe that a chronically perforated leads, which have not resulted in complications do not need removal [7]. This type of approach is possible only in chronically perforated inactive leads. Patients with symptoms, due to lead perforations and active perforated leads always necessitate removal. Lead extraction could be done endovascularly or surgically. Transvenous removal is possible option for active fixation leads under close visualization with transesophageal echocardiography and should be performed in an operating room with close monitoring of the vital signs in case of hemodynamic collapse. Removal of passive fixation leads is preferably done surgically, as in our case, because of

the bulky tip of the lead, which could damage the heart chambers and the vessels [4, 6, 8].

CONCLUSION

The presented case describes a patient with sub—acute passive fixation lead perforation with cardiac tamponade and hemodynamic instability. This case shows the possibility for right ventricular apex perforation by a passive fixation lead even after uneventful implantation. Our case is interesting, because it is showing a massive perforation treated surgically with subsequent implantation of a second permanent dual chamber pacemaker. This rare, but possibly fatal complication should be properly diagnosed and managed in a prompt way. Close follow-up of patients after implantation of a CIED with evaluation of postoperative pain and pacemaker lead sensing and thresholds is key for the fast diagnosis of a possible complication.

No conflict of interest was declared

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