



## Case Report

## False positive result of positron emission tomography in a patient with suspected defibrillator system infection

Francis Bessi re (MD)<sup>a,b</sup>, Nicolas Girerd (MD, MSc)<sup>a,b</sup>, Philippe Chevalier (MD, PhD)<sup>a,b,\*</sup><sup>a</sup> Department of Rhythmology, Louis Pradel Cardiovascular Hospital, Hospices Civils de Lyon, Lyon, France<sup>b</sup> Lyon Reference Center for Inherited Arrhythmias, Louis Pradel Cardiovascular Hospital, Lyon, France

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## ABSTRACT

The infection of an implanted pacemaker or defibrillator is often difficult to diagnose. Positron emission tomography–computerized tomography (PET–CT) has recently been shown to be of great interest in this difficult clinical setting. We report the case of a patient with suspected implantable cardioverter–defibrillator (ICD) infection. Because of <sup>18</sup>F–fluorodeoxyglucose (FDG) uptakes on different portions of the ICD, complete extraction of the ICD generator and lead was performed. Bacteriological samples remained sterile. FDG PET–CT, which appears to be a promising tool for the management of patients with suspected pacemaker/ICD infection, does not have a perfect specificity to detect lead infection, and should not be used alone to diagnose difficult cases of implantable cardiac device infection.

**<Learning objective:** The aim of this case is to bring to light the necessity of specifying the place of PET–CT and its limits for the diagnosis of endocarditis on pacemaker/ICD devices.>

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## Introduction

The infection of an implanted pacemaker or defibrillator is often difficult to diagnose. [<sup>18</sup>F]–fluorodeoxyglucose positron emission tomography–computerized tomography (FDG PET–CT) has recently been shown to be of great interest in this difficult clinical setting [1,2]. We report the case of a false positive of FDG PET–CT in a patient with suspected implantable cardioverter–defibrillator (ICD) infection.

## Case report

A 72-year-old female patient with a history of idiopathic dilated cardiomyopathy was admitted to our institution for suspected ICD infection. The ICD was implanted 8 years earlier after the patient experienced cardiac arrest (Guidant VENTAK PRIZIM 2VR, Indianapolis, IN, USA). The ICD generator was replaced 6 months earlier for battery depletion (Boston Scientific TELIGEN, Natick, MA, USA). The patient was treated 7 years earlier for breast cancer with radical mastectomy and adjuvant radiotherapy.

Four weeks after the ICD generator replacement, the patient noticed an inflammation of the skin near the ICD generator. There was no externalization of the ICD, or discharge from the scar. The initial clinical examination revealed enlarged axillaries of right lymph nodes. The chest X-ray showed a left pleural effusion. The patient had not experienced fever in the previous few weeks. Laboratory tests suggested the presence of inflammation (C-reactive-protein was measured at 53 mg/L and neutrophil count was 4.3 giga/l). Blood cultures were sterile. A fluid collection was identified next to the ICD generator, and was punctured prior to the admission in our hospital. Cytological examination of this liquid showed a large amount of leukocytes (1500/mm<sup>3</sup>) and few erythrocytes (20/mm<sup>3</sup>). Surprisingly, despite the cloudy nature of the fluid, culture was sterile. Antibiotic treatment was started. IV gentamicin treatment was initially associated with IV oxacillin. At the admission to our institution, oxacillin was changed to vancomycin.

The trans-esophageal echocardiography did not show valvular or lead vegetation. Ventricular ejection fraction was estimated at 20%. Body CT revealed multiple right axillary lymph nodes and bilateral pleural effusion. Multiple blood cultures were performed. All remained sterile.

The mammogram was unremarkable. A breast ultrasound confirmed the presence of right axillary lymph nodes, but found no evidence of breast tumor or fluid collection near the ICD generator. Eventually, anatomopathological examination of the echo-guided biopsies of the axillary lymph nodes was consistent with human epidermal growth factor receptor 2 (HER2)

\* Corresponding author at: Service de Rythmologie, H pital Cardiologique Louis-Pradel, 59 bd Pinel, 69677 Bron Cedex, France. Tel.: +33 4 72 68 49 46; fax: +33 4 72 35 73 41.

E-mail address: [philippe.chevalier@chu-lyon.fr](mailto:philippe.chevalier@chu-lyon.fr) (P. Chevalier).

– positive breast cancer metastasis. The cytologic examination of the pleural fluid was also consistent with breast cancer recurrence.

At this point, there was no definitive evidence of lead or pocket infection. Local inflammation near to the generator tended to fade. The antibiotics were consequently stopped in order to enable further bacteriological samples.

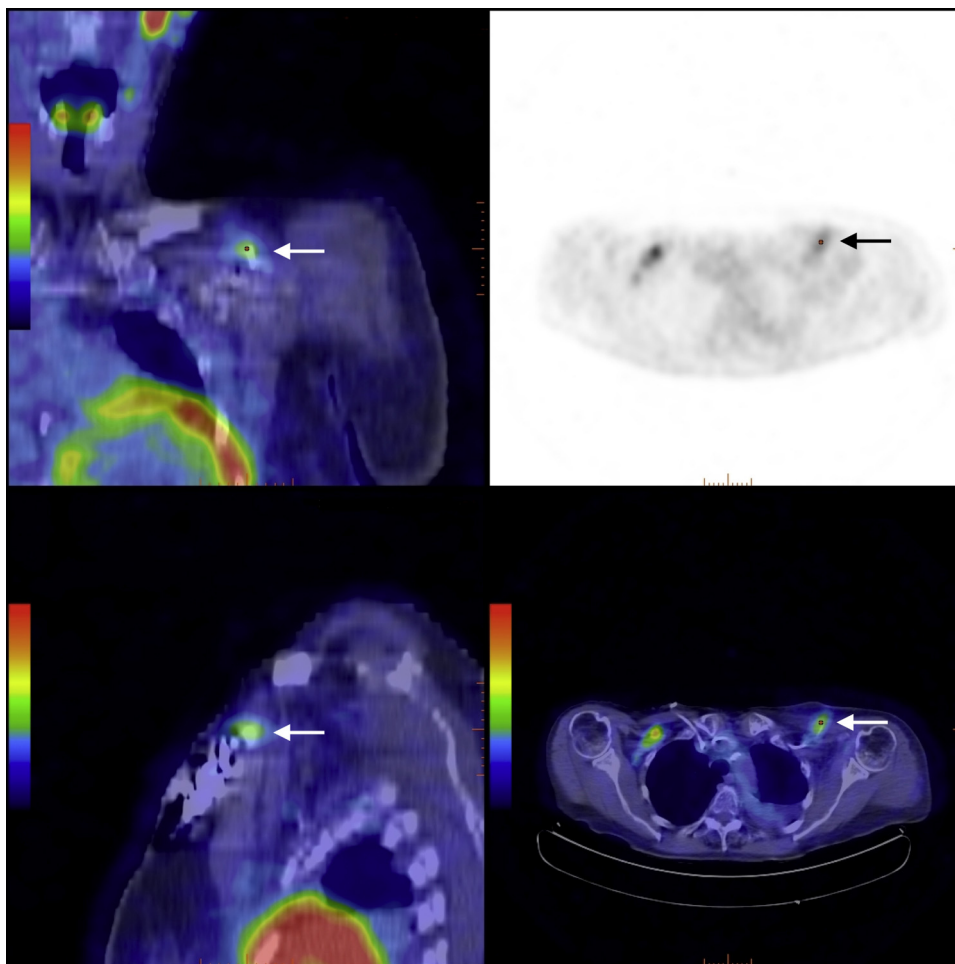
In this difficult situation of suspected ICD infection, we performed a FDG PET–CT. Increased FDG uptakes were identified on the second anterior rib and in lymph nodes in neck and axillary region. Interestingly, increased FDG uptakes were identified in the superior vena cava portion of the ICD lead. An increased FDG was also identified on the ICD generator (Figs. 1–3).

Complete extraction of the ICD generator and lead was performed one week after discontinuing antibiotics. The extraction was uneventful. Because bacteriological culture of the removed material remained sterile after seven days of culture, the medical team considered that infection was excluded. The patient did not experience fever just after extraction, which could be observed in cases of device infection.

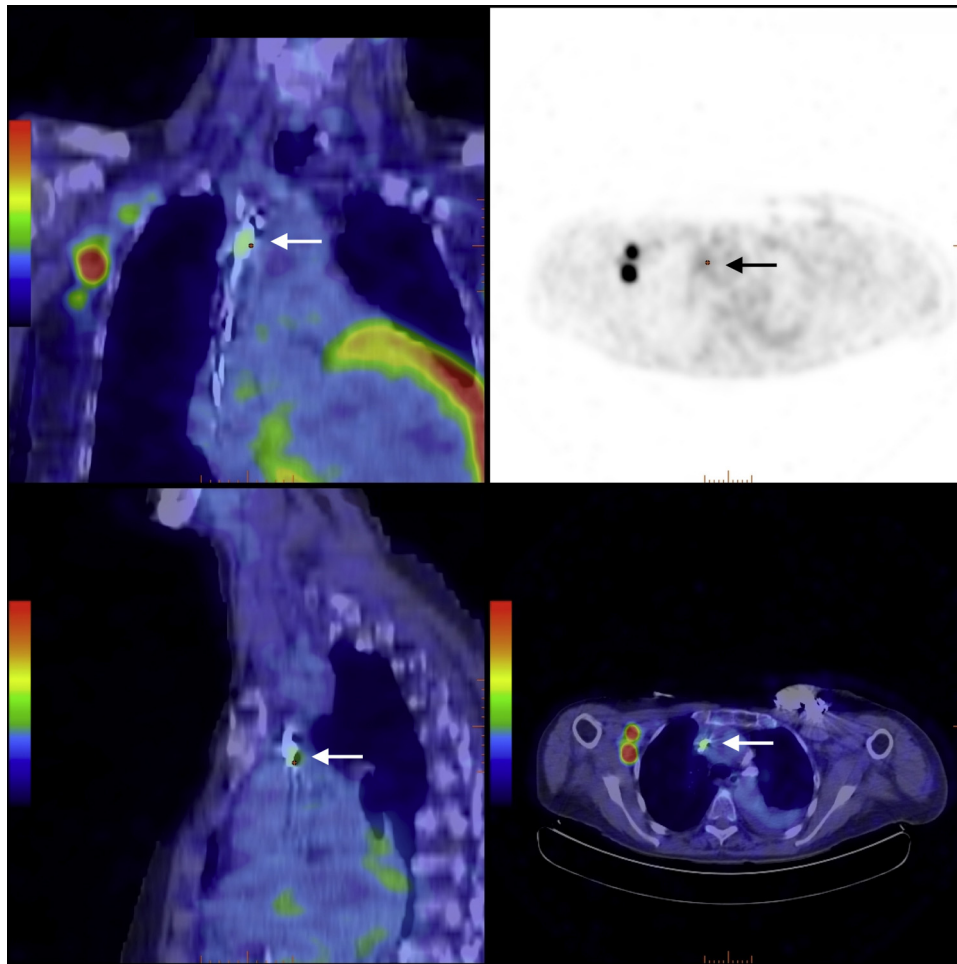
## Discussion

Pacemaker and ICD infection is a severe complication of implantable devices. Several studies suggest that pacemaker lead related systemic infections are due to the progression of an infection from the pacemaker/ICD pocket to the device lead [3,4].

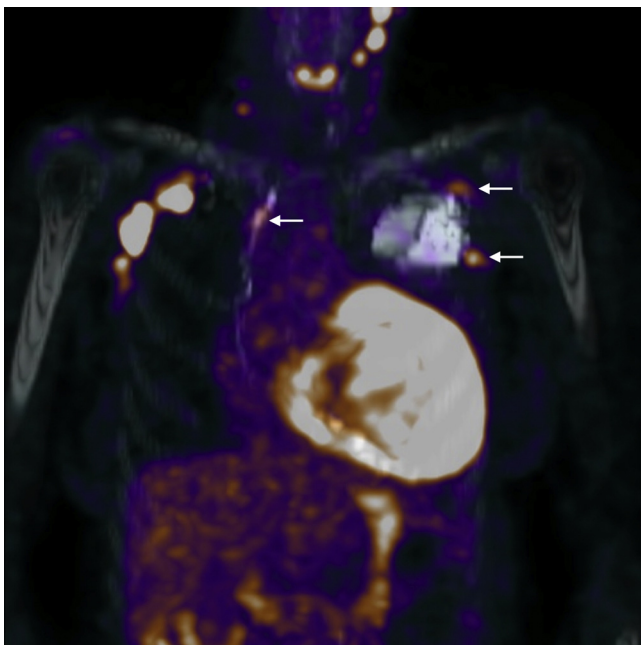
The management of suspected device infection often consists of complete extraction of both the device and the lead(s), which can be technically challenging and risky. Recently, FDG PET–CT has been reported to be critically useful in the setting of suspected implantable device infections [1]. In that study, patients with fever of unknown origin despite detailed investigations, which included transesophageal echocardiography, underwent FDG PET–CT. FDG PET–CT showed increased lead FDG uptake in six patients. These patients all underwent complete extraction of the pacing system. Cultures of the leads were positive in all six patients. In contrast, the culture of the ICD lead of our patient, despite an increased pre-operative FDG uptake along the lead, remained sterile. The clinical setting of our patient is not, per se, identical to the clinical setting described by Ploux et al. [1]. Indeed, our patient had no fever. Still, our case remains a difficult one. The presence of a local erythema near the ICD pocket usually indicates lead infection [3]. In the study by Klug et al. [3], 72% of the patients with manifestations limited to the device pocket had positive lead cultures. As reported by Baddour et al. [5], complete removal of the device is required even if there are just local signs of infection. We decided to perform a FDG PET–CT because of the unusual clinical evolution and context (decrease of local signs after a few days of antibiotics, diagnosis of a cancer recurrence), and the high procedural probability of complications in this patient with a cardiac resynchronization therapy with an ICD lead implanted for 8 years, an ejection fraction <25% and chronic low flow. Bensimhon et al. [6] stated that PET–CT sensitivity and specificity were, respectively, 80% and 100% in



**Fig. 1.** [<sup>18</sup>F]-fluorodeoxyglucose positron emission tomography–computed tomography images showing an increased uptake on the implantable cardioverter-defibrillator generator (white arrows) and on the second anterior rib.



**Fig. 2.**  $^{18}\text{F}$ -fluorodeoxyglucose positron emission tomography–computed tomography images showing an increased uptake on the defibrillator lead (white arrows) and in the right axillary region.



**Fig. 3.** Three dimensional reconstruction of  $^{18}\text{F}$ -fluorodeoxyglucose (FDG) positron emission tomography–computed tomography images showing an increased uptake of FDG in the superior vena cava portion of the implantable cardioverter-defibrillator (ICD) lead and on 2 portions of the ICD generator (white arrows).

21 patients; 100% and 100% for generator, and only 60% and 100% for leads. Contrary to that result, our case shows that PET–CT did not have 100% specificity to detect device infection. Of note, Sarrazin et al. [7] reported the case of one false positive patient with positive PET–CT but negative leukocytes scan. We do need accurate diagnostic tools to ease the clinical management of this type of high-risk patient [1], and PET–CT should be integrated into a decision-making plan.

We can argue that the administration of IV antibiotics might have favored the negative culture of the leads. We feel that, considering the short period considered (6 days) and the classical ineffectiveness of systemic antibiotics in treating device infection, the administration of IV antibiotics did not have an impact on the result of the lead culture. Of note, antibiotics were stopped 7 days before lead extraction.

Finally, in this patient with metastatic neoplasia, the false positive FDG fixation may be due to the presence of cancer cells on the lead. Metastatic graft of malignant cells on implanted orthopedic prosthesis has been described [8]. Nonetheless, as no cytological analysis was performed on the leads, we have no proof of cancer involvement.

### Conclusion

Pacemaker/ICD device infection is often difficult to diagnose. We do need new diagnostic tools to identify the presence of local infection. Our case demonstrates that FDG PET–CT, which appears to be

a promising tool for the management of patients with suspected pacemaker/ICD infection, does not have 100% specificity to detect ICD/pacemaker lead infection. Further studies should determine the influence of cancer on the yield of FDG PET–CT in the diagnosis of lead infection. In the meanwhile, special caution is requested in the interpretation of FDG PET–CT results in patients with both cancer and suspected pacemaker/ICD infection.

#### Conflict of interest

Authors have no conflict of interest that should be declared.

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