OMCR

Oxford Medical Case Reports, 2015;3, 222–225

doi: 10.1093/omcr/omv014
Case Report

CASE REPORT

Cardiac device-associated lead infection: a diagnosis not to be missed

Malcolm Marquette[1,*], Sanjay Budhdeo[2], Vivek Rajagopal[3], and Mirela Marinescu[3]

[1]Peterborough City Hospital, Peterborough PE3 9GZ, UK, [2]Cambridge University, Addenbrooke's Hospital, Cambridge CB2 0QQ, UK, and [3]West Suffolk Hospital, Bury St Edmunds IP33 2QZ, UK

*Correspondence address. Tel: +44-7713-158-166; E-mail: malcolm.marquette@gmail.com

Abstract

A 66-year-old gentleman was admitted to hospital with a history of general malaise for 5 months. His symptoms worsened 2 weeks prior to presentation. He experienced swinging pyrexia, night sweats and shortness of breath on exertion. Initial evaluation did not reveal any source of infection. Subsequent investigation revealed infection with vegetation affecting the intra-cardiac leads of cardiac resynchronization therapy device (CRT-D). The patient was treated with prolonged intravenous antibiotics and removal of the device and indwelling leads. The patient made a full recovery and a new device was implanted.

INTRODUCTION

Pyrexia of unknown origin is a common clinical problem where the aetiology can be difficult to identify. Meticulous clinical evaluation is very important in approaching such patients. This case illustrates the complexity and pitfalls, which might be encountered when evaluating such patients. Cardiac device-associated deep infection is a rare complication following both pacemaker and internal cardiac defibrillator insertion. If left untreated, it may result in a catastrophic outcome. A high index of suspicion is required when a patient presents with fevers of unknown source and a cardiac device *in situ*. It is important not to miss this diagnosis of an eminently treatable condition.

CASE REPORT

A 66-year-old male patient gave a 5-month history of general malaise typified mainly by fluctuating upper airway symptoms consistent with rhino sinusitis. He reported multiple visits to primary care, which resulted in recurrent courses of oral antibiotics, which resulted in minimal relief of his symptoms. Approximately, 2 weeks prior to admission, he reported shortness of breath on exertion, which was unusual for the patient. For this reason, the patient was referred to the respiratory outpatients clinic. On closer enquiry, the patient gave a history of intermittent fevers and night sweats, which were getting progressively worse over the previous 2 weeks. The patient was admitted via this respiratory clinic. Other than dyspnoea, clinical examination was unremarkable, he had a longstanding soft pan-systolic murmur in the mitral area, and there was no evidence of peripheral stigmata of infective endocarditis. The patient was apyrexial. The CRT-D site was clean and non-tender to palpation. No infective focus was evident.

Past medical history was significant for cardiac arrest 2 years prior to this presentation. CRT-D placement was carried out post-arrest. Prior to the cardiac arrest, his dilated cardiomyopathy (DCM) was undiagnosed. He had no history of alcohol excess or tobacco smoking, and there was no previous history of ischaemic heart disease. Family history was devoid of cardiac pathology. The patient was also known to have mitral regurgitation

Received: October 9, 2014. **Revised:** January 29, 2015. **Accepted:** February 4, 2015

(secondary to DCM), hypertension, congestive cardiac failure and gout. At the time of initial diagnosis, the patient had good exercise tolerance with no symptoms suggesting cardiac disease—NYHA Class I. Cardiac ECHO following cardiac arrest (2 years prior to his presentation) confirmed DCM with a bulbous appearance of the left ventricle, measuring 8.6 cm in systole (normal 2.1–3.3 cm). Left ventricular contractility was reported to be severely hypokinetic. Mitral regurgitation was reported as mild and the mitral valves showed restricted motion secondary LV impairment/dilatation. Ejection fraction was reported to be 35%. The patient was retired and lived with his wife.

Multiple blood cultures were consistently positive for *Staphylococcus aureus*. These consisted of three separate sets of blood culture bottles, taken and sent for analysis within the first 24 h of admission. No antibiotic therapy was started at this stage. Two sets of blood culture bottles were positive. CT pulmonary angiogram showed segmental emboli with a small area of pulmonary infarction. Trans-thoracic echocardiography did not identify any new pathology. Subsequently, trans-oesophageal echocardiography was carried out which showed vegetations affecting the CRT-D leads (Fig. 1).

The clinical team kept a wide differential diagnosis. They considered cardiac causes (specifically, a high clinical suspicion of device infection), respiratory causes (rhinosinusitis and tracheitis), rheumatological causes (vasculitis) and malignancy.

The patient was referred for specialist advice on day 2, and on the basis of the results from the initial investigation and clinical presentation, a working diagnosis of sub-acute bacterial endocarditis was made. It was decided at this stage that further investigation with trans-oesophageal echocardiography was necessary.

The patient received a prolonged course of intravenous antibiotics. Following British Society for Antimicrobial Chemotherapy (BSAC) guidelines, antibiotic sensitivities were tested by disc diffusion, and results interpreted using BSAC criteria. This failed to resolve patient's symptoms and did not result in any improvement of clinical situation within the first 3 weeks. (Repeat blood cultures remained consistently positive after two weeks of IV antibiotic therapy.) The case was discussed with the regional cardiothoracic centre and following this, a decision to remove the CRT-D device was made.

Removal of the device was achieved via a percutaneous approach on week 3 following admission. Following removal, IV antibiotics where continued for a total of 6 weeks, and the infection resolved.

Regular cardiology follow-up was instigated, and insertion of a new device was arranged. The new device was implanted 2 months following completion of the complete course of intravenous antibiotics.

DISCUSSION

This case illustrates the complexity of diagnosing, investigating and managing patients with cardiac device associated infection. As previously stated, one requires a high index of suspicion to make the diagnosis. The incidence of such a complication post

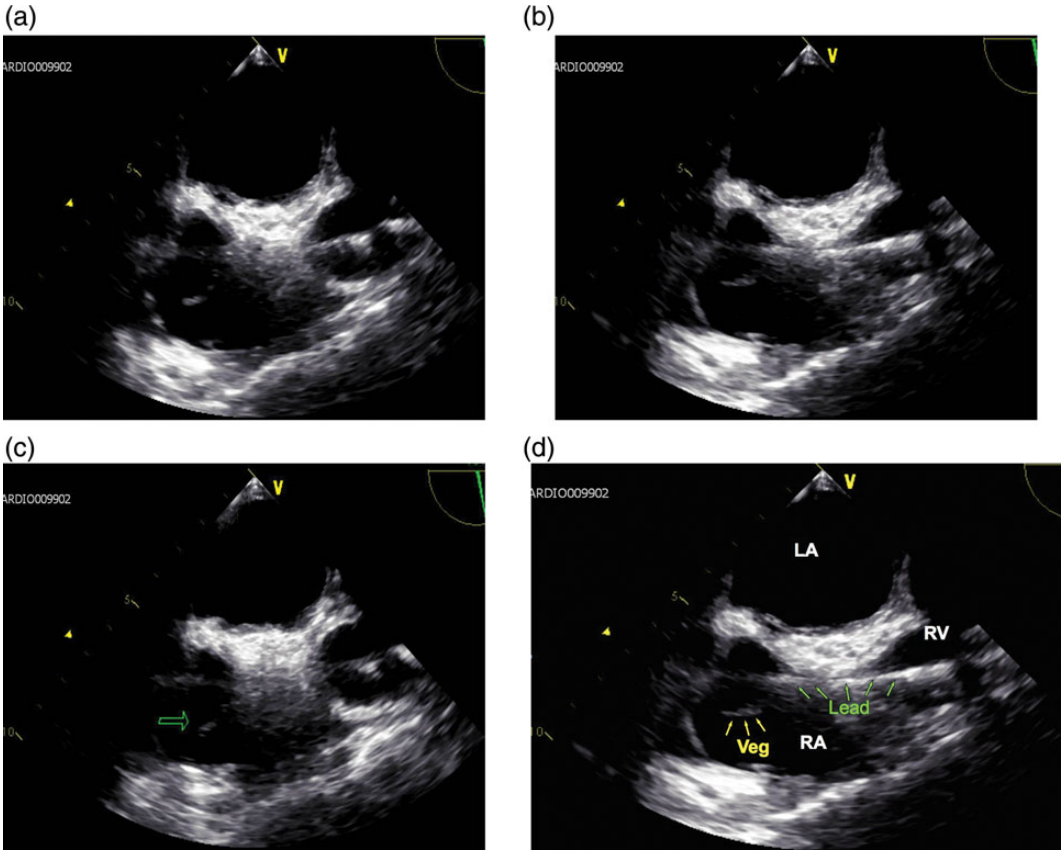

Figure 1: (**a–d**) Transoesophageal echocardiogram images which show a hypoechogenic linear structure which represents the vegetation and not a loop of the pacemaker lead, which would be hyperechogenic. The vegetation is attached to the atrial segment of the pacemaker lead and is distant from other heart structures. The vegetation is indicated with an arrow in (c) and is labelled in (d).

insertion of a cardiac device is difficult to determine. Superficial device-related infections are commoner than deep infection—by definition lead associated endocarditis. Review of the literature resulted in a range of values reported. In a systematic review by Baddour *et al.* the incidence of pacemaker-associated infection was reported to be between 0.13 and 19%. Pacemaker endocarditis was reported to be ~10% of all pacemaker-associated infection [1]. In an observational retrospective study of 8303 pacemaker insertions, 0.5% of all insertions were associated with pacemaker endocarditis [2]. In another retrospective study of residents of Olmsted County, Minnesota 1975–2004, it was observed that the incidence of infection was higher for an ICD device, than for a pacemaker: 8.9 versus 1.0 per 1000 device-years [3]. Nery *et al.*, in their prospective study in a Canadian tertiary centre between 2005 and 2007, reported that out of 2417 patients who had a cardiac device inserted, 24 patients (1%) developed device-related infection, and this was again noted to be more common with the use of more complex devices [4].

Cardiac device-related infection is also associated with certain risk factors. These include [1, 4, 5]

- Recent manipulation of the device, particularly elective secondary manipulations such as generator exchange
- Temporary pacing prior to permanent device placement
- Diabetes mellitus
- Underlying malignancy
- Operator inexperience
- Patient age
- Prior treatment with anticoagulants or glucocorticoids
- Heart failure
- Renal dysfunction
- Complex device insertion (e.g. CRT-D), and method of insertion
- Female gender

The absence of risk factors does not preclude the possibility of device-related infective endocarditis. From the list above, our patient had heart failure, CRT-D insertion and advanced age.

The greatest challenge in management is definitive treatment with regards to the cardiac device and its indwelling lead. Review of the literature suggests that transoesophageal echocardiography (TOE) is still the best method of imaging and characterizing the intracardiac lesion [6, 7]. However, a negative result on TOE does not exclude the diagnosis. TOE is much more sensitive than transthoracic echocardiography (TTE), but TOE is still associated with a number of false-negative results. For this reason, it is inappropriate to refute a diagnosis of device-related infection based on TOE imaging alone, and this is clearly documented in both European and American guidance for the management of such patients. This same guidance strongly urges early consideration for device removal with or without confirmatory imaging [8, 9]. In 2003, a prospective cohort study published by del Rio *et al.* outlines the importance of early surgical treatment in patients diagnosed with cardiac device endocarditis. During this study, 31 patients (out of 669) were diagnosed with device-related pathology. All of the patients in this study were initially treated with conservative/medical measure, and the relapse rate was observed to be 100%. Also, the only treatment measure associated with failure of treatment and/or death was the absence of surgical explantation of the device [10].

A recently published case report of pacemaker-lead endocarditis, further illustrates the complexity in making such a diagnosis. Merinopolous *et al.* report a case of a man presenting with worsening breathlessness and a rash. The authors report inconclusive findings with regards to TTE and TOE [11]. Another case report, by Natarajan *et al.*, also illustrates the importance of early recognition of the possible pathology, but most importantly, it illustrates the need for early explantation of the infected device given the catasthrophic consequences this might have [12].

Staphylococcus aureus is an organism known to cause device-associated endocarditis. In a case series of 118 patients with device-associated endocarditis, 14.3% grew *S. areus* from cultures of their leads. While drug resistance in device-associated endocarditis is common, this is seen more in infections from other Gram-positive flora [13]. A limitation of this study is that disc diffusion results have been used to test antibiotic sensitivities for this patient, there was a risk of false-positive results. While penicillinase testing would provide a gold standard in terms of specificity, testing for antibiotic sensitivities as carried out for this patient is in accordance with British Society for Antimicrobial Chemotherapy guidelines.

American Heart Association and the European Society of Cardiology guidelines recommend the device removal in the case of implanted electronic device infections and use of prolonged courses of intravenouse antibiotic therapy lasting up to 6 weeks [8, 9]. There are various methods of explantation—via thoracotomy, or via a trancutanous approach. Choice of the method depends on the individual case and findings and the local/regional resources—early discussion and involvement of specialist services are therefore advised.

REFERENCES

1. Baddour LM, Bettman MA, Bolger AF, Epstein AE, Ferrieri P, Gerber MA, *et al.* Nonvalvular cardiovascular device-related infections. American Heart Association Scientific Statement. *Circulation* 2003;**108**:2015–2031.
2. Arber N, Pras E, Copperman Y, Schapiro JM, Meiner V, Lossos IS, *et al.* Pacemaker endocarditis. Report of 44 cases and review of the literature. *Medicine (Baltimore)* 1994;**73**:299.
3. Uslan DZ, Sohail MR, St Sauver JL, Friedman PA, Hayes DL, Stoner M, *et al.* Permanent pacemaker and implantable cardioverter defibrillator infection: a population-based study. *Arch Intern Med* 2007;**167**:669–675.
4. Nery PB, Fernandes R, Nair GM, Sumner GL, Ribas CS, Menon SM, *et al.* Device-related infection among patients with pacemaker and implantable defibrillators: incidence, risk factors, and consequences. *J Cardiovasc Electrophysiol* 2010;**21**:786–790.
5. Klug D, Balde M, Pavin D, Hidden-Lucet F, Clementy J, Sadoul N, *et al.* Risk factors related to infections of implanted pacemakers and cardioverter-defibrillators: results of a large prospective study. *Circulation* 2007;**116**:1349–1355.
6. Dumont E, Camus C, Victor F, de Place C, Pavin D, Alonso C, *et al.* Suspected pacemaker or defibrillator transvenous lead infection: prospective assessment of a TEE-guided therapeutic strategy. *Eur Heart J* 2003;**24**:1779–1787.
7. Mascioli G, Lucca E, Bakhtadze N, Belvito C, Canevese F, Michelotti F. Cardiovascular implantable electronic device infection: diagnosis and treatment. *ESC Council for Cardiology Practice.* [Online]. 2012 [cited 20 December 2014]. Available from http://www.escardio.org/communities/councils/ccp/e-journal/volume11/Pages/infections-of-cardiovascular-implantable-electronic-devices.aspx#.VLV3bsbBf8t.
8. Baddour LM, Epstein AE, Erickson CC, Knight BP, Levison ME, Lockhart PB, *et al.* Update on cardiovascular implantable electronic device infections and their management a scientific

statement from the American Heart Association. *Circulation*. 2010;**121**:458–477.
9. Habib G, Hoen B, Tornos P, Thuny F, Prendergast B, Vilacosta I, *et al*. Guidelines on the prevention, diagnosis, and treatment of infective endocarditis. *Eur Heart J* 2009;**30**:2369–2413.
10. del Río A, Anguera I, Miró JM, Mont L, Fowler J, Vance G, *et al*. Surgical treatment of pacemaker and defibrillator lead endocarditis: The impact of electrode lead extraction on outcome. *Chest*. 2003;**124**:1451–1459.
11. Merinopoulos I, O'Toole S, Porter JN, Mistry C, Vassiliou V, Enoch DA. How sweet is the pacemaker? *J R Coll Physicians Edin*. 2014;**44**:209–211.
12. Natarajan A, Hindocha D, Kular N, Fergey S, Davies JR. Vasculitic rash: do not jump to conclusions. *Clin Med*. 2012;**12**: 179–180.
13. Anselmino M, Vinci M, Comoglio C, Rinaldi M, Bongiorni MG, Trevi GP, *et al*. Bacteriology of infected extracted pacemaker and ICD leads. *J Cardiovasc Med*. 2009;**10**:693–698.