The self-extracted pacemaker system

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Introduction

Cardiac implantable pacemakers became available to treat bradyarrhythmias in the late 1950s.[1] What followed was over half a century of remarkable developments and refinements, with technological advances to both the pacemaker and the transvenous lead we implant today.[2] Transvenous pacemaker systems are not without their risk of complications, such as pocket infection, venous stenosis, and lead malfunction. Lead extraction has become a mainstay service for the management of these device- and lead-related complications. Nonetheless, lead extractions may be high risk and not readily accessible at all implanting centers.[3–5] Two previous case reports have described partial lead self-extractions by cognitively impaired elderly patients.[6,7] Here we present what we understand to be the first documented full pacemaker system self-extraction. This patient's experience highlights the challenges of recognizing and managing device infections promptly in cognitively declining aged care populations distant to nonspecialized centers.

Case report

The patient first presented at age 74 with permanent atrial fibrillation and a slow ventricular rate associated with syncope. The patient was transferred 3 hours via road ambulance to their tertiary implanting center. A single-chamber Medtronic EN1SR01 Ensura SR MRI and a Medtronic 5076 CapSureFix Novus active fixation lead were fitted in the left prepectoral region and right ventricular apex via left cephalic access. It seems prudent at this point to report the patient had no medical training in their professional working life. The patient was routinely followed by visiting device outreach clinics at their local hospital. Overall, the patient's general health remained poor, with declining cognition related to advanced small-vessel ischemic changes and multiple cerebral infarcts. The patient was moved into a dementia-level care nursing facility.

Two years postimplant the patient presented to routine clinic with fluctuant swelling overlying the pacemaker site.

KEYWORDS Pacemaker; Atrial fibrillation; Lead extraction; Wound infection; Pacemaker erosion
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KEY TEACHING POINTS

- There are unique challenges to managing device infections in patients living remotely from specialist cardiac centers.
- Prompt recognition and referral of device infections to specialist centers that can offer surgical management may prevent subsequent device erosions.
- Exclusive remote monitoring poses new challenges for infection management.

Pocket drainage with needle aspiration was initially performed locally, with samples confirming *Staphylococcus epidermidis*. They were then managed with long-term flucloxacillin antibiotic suppression.

Five years postimplant the patient presented with a recurrent collection (Figure 1), again managed by needle aspiration at the local center. *Staphylococcus hominis* was cultured and the patient was placed on tetracycline. Fourteen months later the patient presented to their local hospital with a partial can erosion (Figure 2). While awaiting specialist cardiac outreach review, the dementia care nurse who performed a daily dressing change could no longer see the partially eroded pacemaker. Perplexed, the nurse conducted an inspection of the patient's bathroom, which revealed the pacemaker and lead on the floor. As a limited historian, the patient had no recollection and could not explain the mechanism of self-extraction. The time frame from erosion to self-extraction was 12 days.

While Figure 3 shows an intact suture sleeve, tissue on the superior vena cava portion of the lead, and an extended helix, the patient had no adverse events following the self-extraction. There was no requirement for a wound debridement, as the incision closed itself within 6 weeks. The patient has remained systemically well, and antibiotics have subsequently been stopped. The device site has completely healed and there appears to be no ongoing pacemaker requirement.

Discussion

We present a case of total system self-extraction of an infected pacemaker. To our knowledge this has not been previously reported.

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Figure 1 Five years postimplant. Large abscess overlying left-sided pacemaker.

Figure 2 Pocket erosion 7 years postimplant.

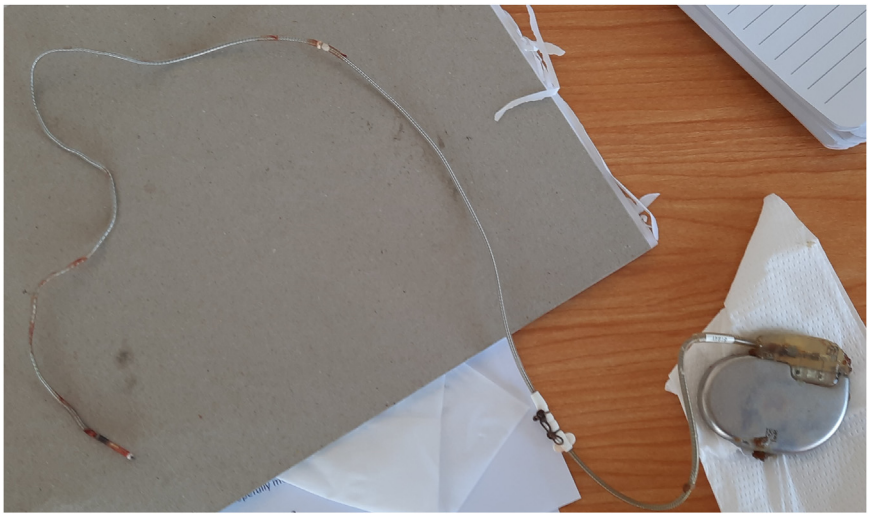

Figure 3 Self-extracted single-chamber pacemaker system.

This patient presented multiple management challenges. They lived remotely to a cardiac center, and this, combined with their advanced cognitive decline, made the conventional management of their infected pacemaker system with lead extraction and device removal difficult. Although long-term antibiotics initially suppressed the infection, the device ultimately eroded, and they were referred for assessment with a view to extraction at a providing center. Before they were assessed, the patient self-extracted the device devoid of adverse clinical outcomes. One question outstanding is the exact mechanism in which this patient performed their self-extraction. Was the patient an active participant in the device and lead extraction or did the pacemaker erode from the pocket, becoming a weighted pendulum, as in the early reports of lead extraction by weight and pulley system?[8]

This case highlights the difficulties of managing implanted devices in locations isolated from an implant center. Decisions around the ongoing medical management pathway over surgical management were heavily influenced by the remoteness of the patient's living situation and their cognition. The confusion that comes with new environments is disruptive and unsettling to dementia patients. While removal of an infected cardiac device is conventional management, it is not always feasible, and thus long-term oral antibiotic management may be considered as an option.[9]

Although device function can be monitored remotely, this does not allow for management of complications such as infection. Medical staff in remote centers and nursing homes may not be familiar with the features and management of cardiac device wound infections, thus delaying prompt recognition and referral to specialist centers. As the clinical practice of exclusive remote monitoring evolves into routine patient care and digital health initiatives are adopted more widely in the heart rhythm community, collaboration with primary health care and nursing home staff will become even more critical to navigate and prevent the experience we report here. Technological advances and market competition with leadless pacemakers may be another solution to the challenges of wound care in an aging remote device population.[10,11]

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