

# Device infection mimicry: Physical examination characteristics and procedural technique for pacemaker-associated skin cancer



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## Introduction

One of the most serious complications of pacemaker and implantable cardioverter defibrillator implantation is device infection, especially when there are chronic indwelling leads that would need to be fully extracted. Identifying a pocket infection is not always straightforward, as the signs and symptoms of infection can overlap with those produced by noninfectious causes, such as hematoma, allergic reaction, or neuropathy. Here we present a case of suspected device infection with an alternate diagnosis, highlighting the enduring importance of the physical examination in the era of telemedicine health care.

## Case report

A 90-year-old man was referred for pacemaker system extraction owing to a suspected device infection. A dual-chamber pacemaker with a His bundle ventricular lead had been implanted 2 years earlier for sinus node dysfunction and a markedly prolonged PR interval that resulted in pseudo-pacemaker syndrome. His quality of life improved after pacemaker implantation, and the pocket healed well. A few months prior to presentation, the patient noticed an ulceration of the skin directly over the pacemaker pocket. The ulceration failed to heal, and it gradually became an exophytic mass that drained yellow, purulent fluid. His local electrophysiologist started him on oral cephalexin and referred him for consultation, forwarding a photograph of the nonhealing wound, which was immediately contiguous with the pacemaker pocket (Figure 1A). Blood cultures were negative, there were no fevers or leukocytosis, and there were no reported clinical symptoms or signs of systemic infection. A video telemedicine consultation was conducted

## KEY TEACHING POINTS

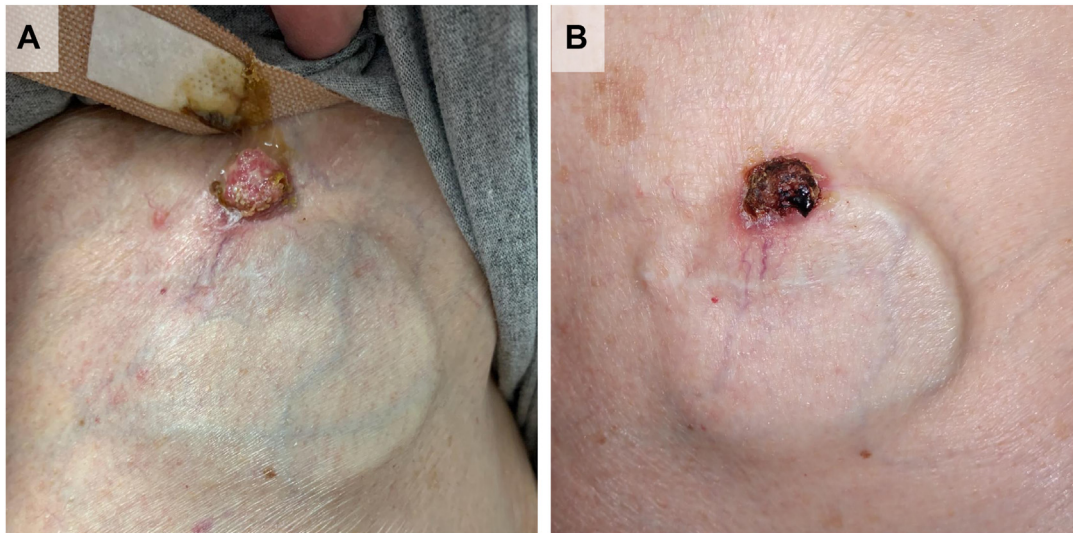
- Pocket infection is a serious complication involving cardiovascular implanted electronic devices, typically managed with complete extraction of the device and leads.
- It is important to recognize that mimickers of infection exist, which warrant different clinical management.
- The physical examination can help distinguish true device infection from other mimickers of pocket infection, and can thereby direct appropriate management strategy.
- It is possible to surgically address superficial skin processes over a device pocket without entering the pocket itself, even when minimal subcutaneous fat is present.

rather than an in-office visit because of the patient's age, a transportation barrier owing to a 3-hour commute, and his responsibility as the caregiver at home for his wife with dementia. Owing to the chronic, nonhealing wound over the pacemaker pocket, along with the proximity of the pocket to the skin surface, a device infection was presumed. The patient was scheduled for pacemaker system extraction after the risks of lead extraction were discussed, including the possibility of conduction system injury with the removal of a His bundle pacing lead. His pacemaker was reprogrammed locally to VVI 30 ppm to assess pacing burden and symptoms with minimal backup pacing, in order to anticipate the post-extraction necessity and timing of pacemaker reimplantation.

On the day of presentation for pacemaker and lead extraction, device interrogation revealed a ventricular pacing burden of less than 0.1%, but the patient reported feeling

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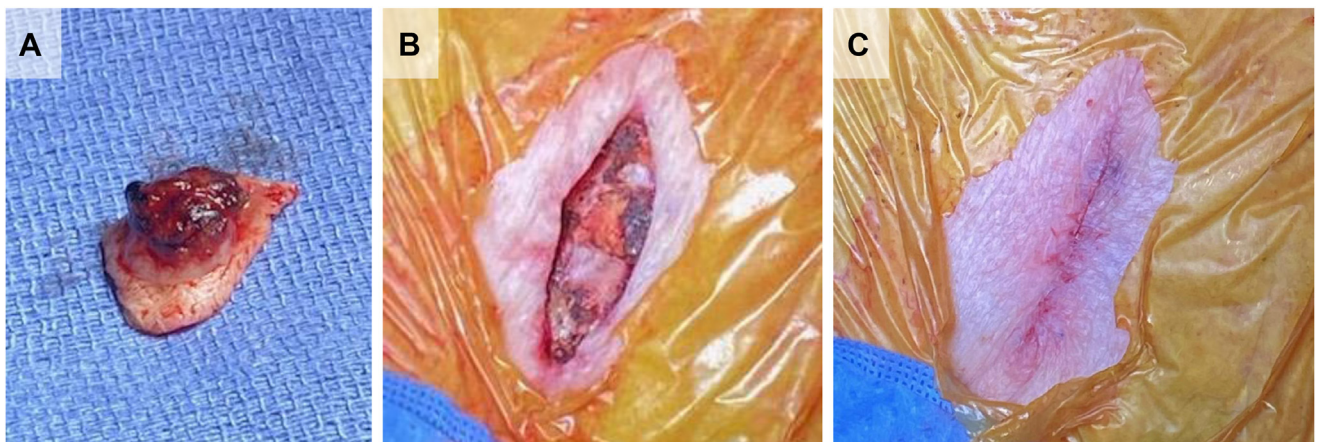
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**Figure 1** **A:** Photograph of purulent, protruding skin lesion over pacemaker site, taken and submitted by the patient's local electrophysiology physician at the time of referral. **B:** Photograph of skin lesion on the day of the procedure.

more fatigued since his pacemaker was reprogrammed. His sinus node function was reasonable, but his native PR interval was over 450 ms. On physical examination, the nonhealing mass now had a crusted appearance, with a small rim of skin erythema and scant drainage (Figure 1B). Surprisingly, despite only a thin layer of tissue separating the skin wound from the pacemaker pocket, the skin was freely mobile upon manipulation, without any adherence to the underlying pacemaker or leads (Supplemental Video 1). There was no erythema, pain, warmth, or fluid associated with the pacemaker pocket. Because of these findings, various procedural possibilities were discussed with the patient, including the small chance of discovering a superficial skin process that did not involve the pacemaker system, which would obviate entering of the pocket or removal of any hardware. After informed consent for all procedural possibilities was obtained, the patient was brought to the electrophysiology lab.

A generous amount of 1% lidocaine was infiltrated just deep to the lesion, serving a dual purpose of analgesia and creating a large wheal to expand the soft tissue layer between the skin and the device pocket. An elliptical incision was created with a blade around the skin lesion, incorporating the small rim of erythema, but being cautious to avoid excessive depth. Sharp dissection was used to undermine the lesion, staying in the subdermal plane, but superficial to the device pocket. The fully excised specimen was sent to pathology (Figure 2A). Careful exploration of the exposed tissue plane showed no purulence, no devitalized tissue, and no fistula tract. Instead, there was a healthy, intact layer of tissue remaining over the pacemaker pocket, with no evidence of infection or any association or communication between the excised mass and the pacemaker itself (Figure 2B). Judicious electrocautery use was employed to achieve hemostasis, and the pocket was not entered. The area was flushed with



**Figure 2** **A:** Excised skin lesion, which was sent to pathology. **B:** Elliptical skin wound, carried down to the subdermal plane, with healthy tissue seen, and without evidence of infection, fistula tract, or any association with the underlying device pocket. Black spots are iatrogenic, owing to electrocautery use for hemostasis. **C:** Closed wound, with subcuticular vicryl suture used to approximate the skin edges.

antibiotic solution and the skin was closed primarily with absorbable suture (Figure 2C).

The final pathology result was received 2 weeks later, which reported “squamous cell carcinoma without lymphovascular invasion, completely excised, with surgical margins free of tumor.” Consultation with dermatology confirmed that no further treatment was needed. The wound fully healed in the expected time frame and there was no infection or recurrence of tumor growth.

## Discussion

Device pocket infections are most commonly associated with the postoperative period, although there is a long “tail” of time, extending well beyond 1 year, when infections associated with device procedures can become manifest. The presence of swelling, pain, or cutaneous abnormalities over a device pocket should prompt a broad differential diagnosis by the physician, including infection, bleeding, allergy, or even malignancy. Current Heart Rhythm Society guidelines recommend complete cardiac implantable electronic device (CIED) system removal if there is evidence of pocket infection/erosion, making it extremely important to accurately diagnose device infection. Many CIED implantation series, including a retrospective analysis of the WRAP-IT trial,<sup>1</sup> show an increased infection risk with a greater number of procedures, and therefore unnecessary device pocket procedures should be avoided, particularly if the clinical diagnosis is uncertain.

Owing to the ongoing Covid-19 pandemic and other circumstances mentioned above, this patient was initially seen in telehealth consultation, which precluded an opportunity to perform a physical examination at the time of procedural planning. On the day of anticipated CIED system extraction, however, physical examination was performed, revealing the new and critical observation that the skin lesion was superficial and nonadherent to the underlying device and leads. Skin adherence is well described as an indicator of device infection.<sup>2</sup> This finding of freely moving skin without adherence should raise the possibility of an independent cutaneous process, which would dictate a very different operative strategy. Entering the pocket directly as a first step would pose a risk for creating a device infection if one were not already present,

especially given the infectious milieu of a draining skin lesion in the operative field. It is important to note that, despite the apparent thin nature of the tissue layer between the device and the skin surface, it is still possible to perform dissection in the subdermal plane without entering the device pocket. The generous instillation of local anesthetic in this plane can facilitate this surgical strategy.

Cutaneous malignancy over a device pocket has been described as a mimicker of pocket infection, and requires an awareness of and suspicion for this possibility in order to make the correct diagnosis and manage the problem appropriately.<sup>3–6</sup> This case highlights the importance of the physical examination and maintaining a broad differential diagnosis, to protect the patient from avoidable risks that may be associated with a delayed diagnosis or incorrect management.

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## Appendix Supplementary Data

Supplementary data associated with this article can be found in the online version at <https://doi.org/10.1016/j.hrcr.2023.07.007>.

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