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INFECTIVE ENDOCARDITIS DUE TO A CARDIAC PACEMAKER INFECTION: A CASE REPORT

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RESUMO

Introdução: A endocardite infecciosa (EI) relacionada a dispositivos cardíacos eletrônicos implantáveis (DCEI) é uma complicação potencialmente fatal que pode comprometer o gerador, os eletrodos ou as valvas cardíacas. A maioria dos casos ocorre em pacientes com múltiplas comorbidades e é frequentemente causada por *Staphylococcus aureus* ou *S. epidermidis*. **Relato de caso:** Um paciente idoso com marcapasso bicameral implantado quatro anos antes foi admitido com sepse, febre e lesão renal aguda. Ao exame físico, observou-se exposição da unidade geradora com secreção purulenta. A ecocardiografia evidenciou vegetações no eletrodo ventricular e na parede do átrio direito, e as hemoculturas foram positivas para *S. aureus*. A tomografia computadorizada revelou múltiplos nódulos cavitados compatíveis com êmbolos sépticos. Foi realizada a extração do dispositivo, seguida de antibioticoterapia dirigida ao agente etiológico por quatro semanas, com evolução favorável e alta hospitalar sem sequelas. **Conclusão:** A EI relacionada a DCEI requer diagnóstico rápido e manejo agressivo. A confirmação microbiológica, a detecção precoce de complicações e a remoção do dispositivo associada à antibioticoterapia adequada foram determinantes para o desfecho favorável. Descritores: endocardite infecciosa; marcapasso artificial; dispositivo cardíaco eletrônico implantável.

Palavras-chave: endocardite infecciosa; marcapasso artificial; dispositivo cardíaco eletrônico implantável.

ABSTRACT

Introduction: Infective endocarditis (IE) related to cardiac implantable electronic devices (CIED) is a potentially fatal complication that may compromise the generator, leads, or cardiac valves. Most cases occur in multimorbid patients and are frequently caused by *Staphylococcus aureus* or *S. epidermidis.*
Case report: An elderly patient with a dual-chamber pacemaker implanted four years earlier was admitted with sepsis, fever, and acute kidney injury. On examination, exposure of the generator unit with purulent discharge was noted. Echocardiography showed vegetations on the ventricular lead and the right atrial wall, and blood cultures were positive for *S. aureus*. Computed tomography revealed multiple cavitary nodules compatible with septic emboli. Device extraction was performed, followed by pathogen-directed antibiotic therapy for four weeks, with favorable progression and hospital discharge without sequelae.
Conclusion: CIED-related IE requires rapid diagnosis and aggressive management. Microbiological confirmation, early detection of complications, and device removal combined with appropriate antibiotics were decisive for the favorable outcome.

Keywords: infective endocarditis; artificial pacemaker; cardiac implantable electronic device

RESUMEN

Introducción: La endocarditis infecciosa (EI) relacionada con dispositivos cardíacos electrónicos implantables (DCEI) es una complicación potencialmente fatal que puede comprometer el generador, los electrodos o las válvulas cardíacas. La mayoría de los casos ocurre en pacientes con múltiples comorbilidades y es frecuentemente causada por *Staphylococcus aureus* o *S. epidermidis*. **Caso clínico:** Un paciente anciano con marcapasos bicameral implantado cuatro años antes fue admitido con sepsis, fiebre e injuria renal aguda. Al examen físico, se observó exposición de la unidad generadora con secreción purulenta. La ecocardiografía evidenció vegetaciones en el electrodo ventricular y en la pared de la aurícula derecha, y los hemocultivos fueron positivos para *S. aureus*. La tomografía computarizada reveló múltiples nódulos cavitados compatibles con émbolos sépticos. Se realizó la extracción del dispositivo, seguida de antibioticoterapia dirigida al agente etiológico durante cuatro semanas, con evolución favorable y alta hospitalaria sin secuelas. **Conclusión:** La EI relacionada con DCEI requiere diagnóstico rápido y manejo agresivo. La confirmación microbiológica, la detección precoz de complicaciones y la remoción del dispositivo asociada a la antibioticoterapia adecuada fueron determinantes para el desenlace favorable.

Palabras clave: endocarditis infecciosa; marcapasos artificial; dispositivo cardíaco electrónico implantable.

INTRODUCTION

Infective endocarditis (IE) associated with cardiac implantable electronic devices (CIED) is a severe and potentially life-threatening complication. Although the exact rate of CIED infections is difficult to determine, most studies report an incidence of approximately 1-2%, and only a subset of these cases correspond to CIED-IE (1,2). Nevertheless, with the substantial increase in the number and complexity of CIED implantations over recent decades, the incidence of CIED-IE appears to be rising (1, 2).

CIED infections may occur early or late after implantation and may involve the generator pocket, the leads, or both, with or without concomitant valvular involvement. Two main mechanisms have been described. The most common is contamination of the device during implantation or subsequent manipulation, leading to pocket infection that may extend contiguously along the intravascular portion of the leads and progress to systemic infection (3, 4). Late device erosion may also either result from or contribute to pocket infection. The second mechanism is hematogenous seeding of the leads during bacteremia originating from a distant infectious focus, such as septic thrombophlebitis, osteomyelitis, pneumonia, surgical site infection, contaminated vascular catheters, or bacterial translocation from the skin, oral cavity, gastrointestinal tract, or urinary tract (2).

Most cases occur one year after implantation (5), usually in multimorbid patients over 40 years of age or those with more complex devices (6). The usual pathogens are *Staphylococcus aureus* or Staphylococcus epidermidis (7), with variable presentation, commonly fever and pulmonary involvement (8). Standard management includes CIED replacement and parenteral antibiotic therapy (9, 10).

METHODOLOGY

This article was written in accordance with the CARE guidelines (11).

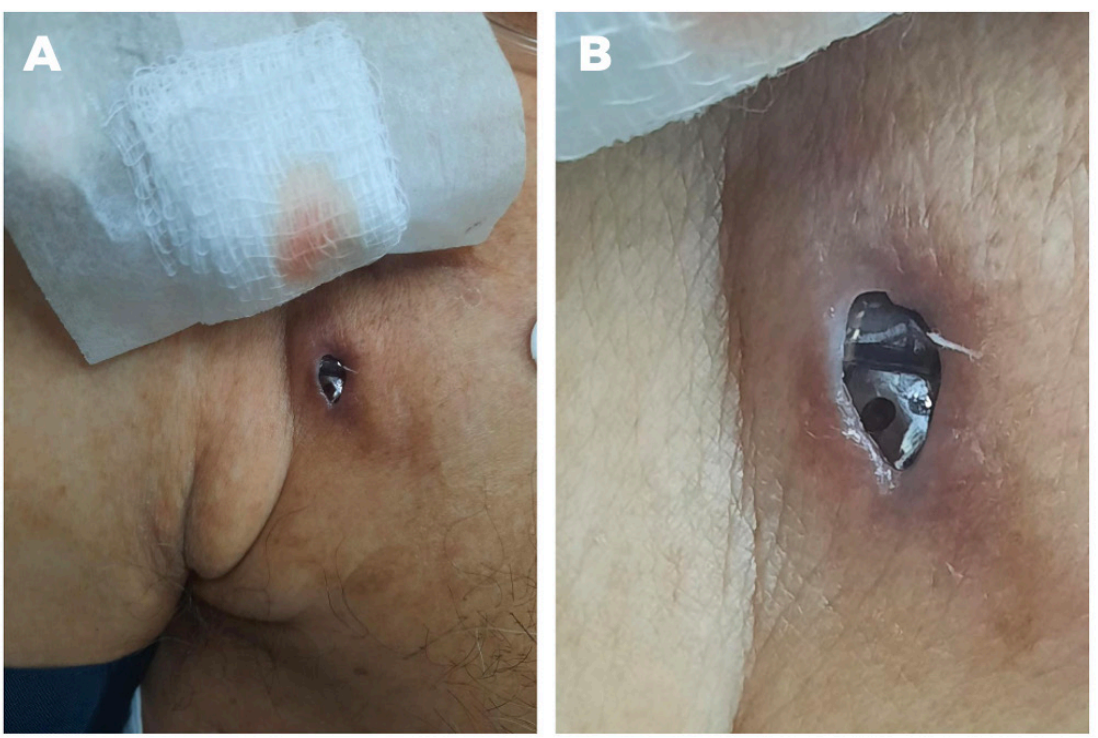
CASE REPORT

A 71-year-old man with a dual-chamber pacemaker implanted four years earlier for complete atrioventricular block was admitted with sepsis and stage 3 acute kidney injury according to KDIGO criteria. His medical history included hypertension, type 2 diabetes mellitus requiring high-dose insulin therapy, chronic kidney disease stage 3bA2, hypothyroidism, peripheral arterial disease, and chronic osteomyelitis, which had been treated with left hallux amputation two years earlier.

On initial evaluation in the emergency department, he reported renal colic, and abdominal computed tomography (CT) revealed left ureteral obstruction and pyelonephritis of the left kidney. He was transferred to our ward two days later, after initial stabilization, ureteral decompression, and initiation of empiric piperacillin-tazobactam.

At admission, he was disoriented and febrile (40°C). Physical examination revealed generator exposure with local inflammatory signs and purulent discharge at the pacemaker pocket site (Figure-1), a finding that had not been reported by the emergency care team. Because of his confusion, the patient was unable to provide information regarding the duration of the lesion. Cardiac auscultation revealed a holosystolic regurgitant murmur, best heard at the apex and intensified with the handgrip maneuver. Abdominal examination was unremarkable, with no organomegaly, and no other peripheral stigmata suggestive of IE were observed.

Figure 1 - Patient's cardiac pacemaker at admission.

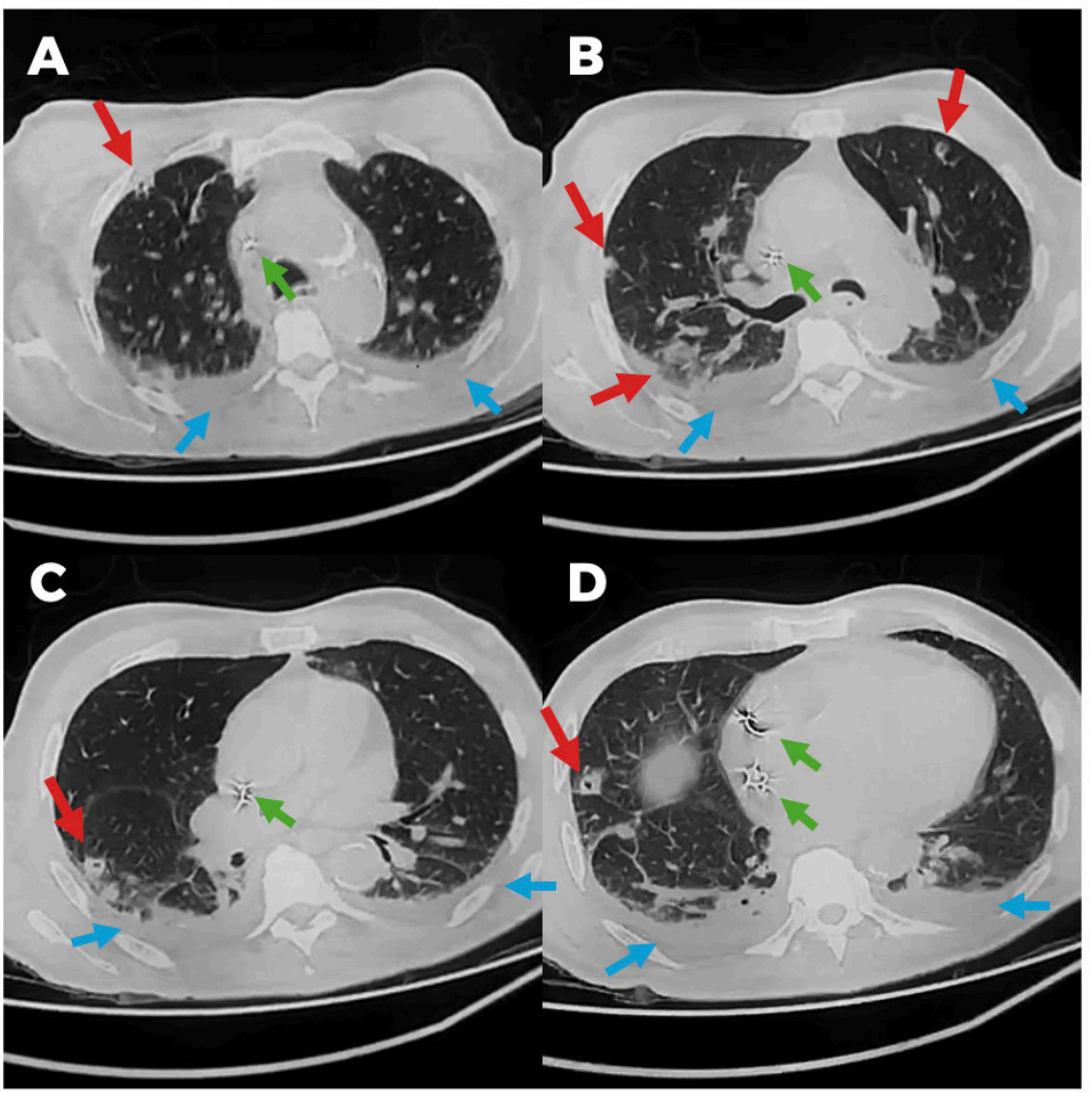


Source: patient photograph

Continuity lesion with skin near the patient's right shoulder, exposing the generator unit of the pacemaker and perilesional hyperemia. The lesion was warm and showed purulent discharge on initial inspection. The photo was taken after cleansing.

Given the suspicion of IE, empirical vancomycin and meropenem were started. Repeated abdominal CT showed mild interval improvement of the previously documented left ureteral obstruction and pyelonephritis, with no evidence of complicated pyelonephritis or abdominal septic emboli. Chest CT revealed multiple pulmonary septic emboli and mild bilateral pleural effusions (Figure-2), despite the normal pulmonary auscultation on physical examination.

Figure 2 - Patient's chest computed tomography at admission.



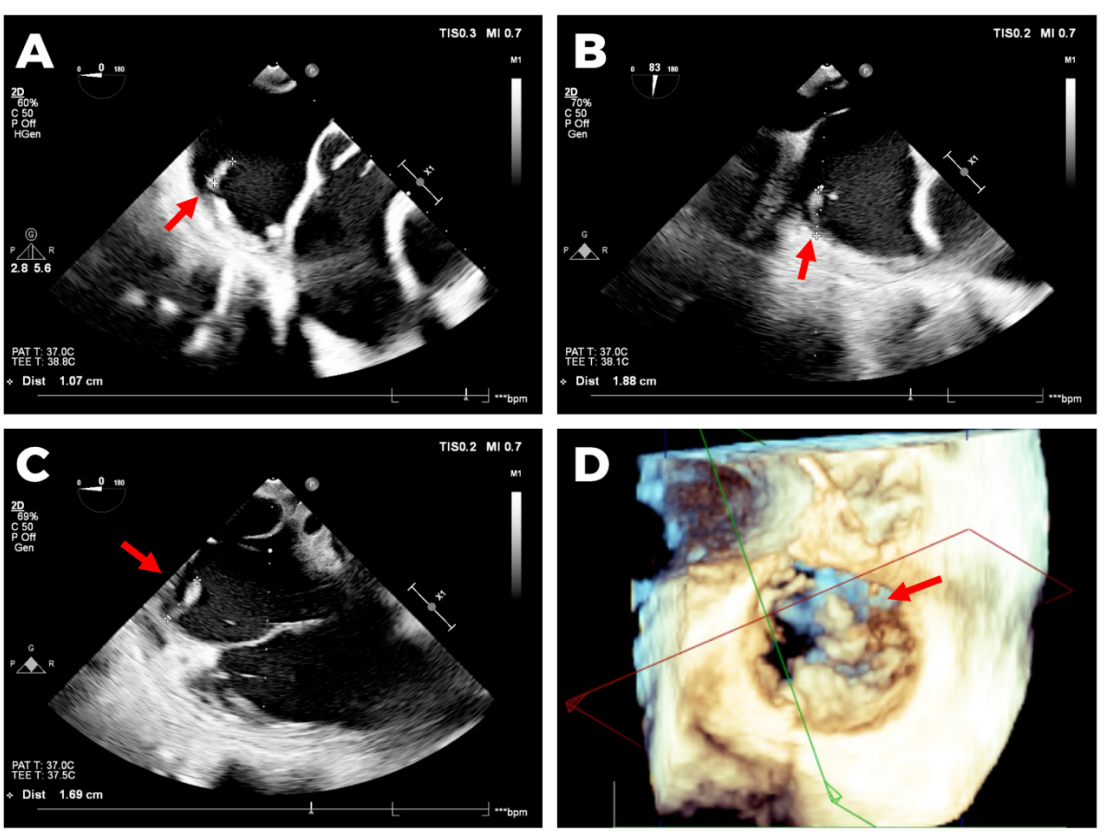
Source: patient CT scan (lung parenchyma window).

Red arrow: multiple circular lesions with air-fluid levels in both lungs, consistent with septic emboli. Blue arrow: mild bilateral posterior pleural effusion. Green arrow: generator unit and its leads causing artifacts to imagine.

Transthoracic echocardiography (TTE) revealed vegetations attached to the right ventricular lead and the right atrial wall. Three sets of blood cultures grew oxacillin-resistant *S. aureus*, which was alsotrimethoprim sulfamethoxazole resistante. Meropenem was stopped.

Surgical CIED removal was performed within the same week. Since his escape rhythm was below 30 beats per minute, temporary pacing support was maintained using newly implanted leads connected to the previous generator, which was kept externalized. Transesophageal echocardiography (TEE) imaging obtained during the procedure are presented in Figure-3. Cultures from the purulent pocket secretion and the extracted leads grew the same pathogen. Follow-up blood cultures were negative, and a new permanent pacemaker was implanted two weeks after blood culture clearance. The patient was discharged four weeks after culture clearance without sequelae. During outpatient follow-up, the findings on CT scan and echocardiogram normalized, no further regurgitant murmurs were heard in the mitral area, and no recurrence of symptoms was observed.

Figure 3 - Transesophageal echocardiography obtained during CIED removal



Source: patient transesophageal echocardiography

Vegetation observed on the end of the right atrial lead in different views of the transesophageal echocardiogram (red arrow) and tridimensional reconstruction of the legion (image D).

DISCUSSION

In the present case, the diagnosis of CIED-related infective endocarditis was relatively straightforward because the patient had a highly typical and rich presentation, including generator exposure with purulent drainage, positive blood cultures, echocardiographic vegetations, and septic pulmonary emboli. However, establishing this diagnosis is often far more challenging in routine practice as exemplified in a case series recently reviewed in JACC (12).

Classically, IE has been diagnosed according to the Duke's criteria (13). Nonetheless, even in later updates, these criteria remained limited for the diagnosis of CIED-related infection. In many cases, the clinical presentation is nonspecific and localizing signs of infection may be subtle or entirely absent. In addition, TTE has important technical limitations in this setting, as device leads may interfere with image interpretation and reduce the sensitivity for vegetation detection. The 2023 revisited Duke-ISCVID criteria, currently used in clinical practice, introduced a more detailed and comprehensive diagnostic framework that may facilitate the evaluation of these patients; however, they were not specifically validated for CIED-related infections (14).

Based on these limitations, the American Heart Association proposed, in 2024, practical clinical definitions and a dedicated diagnostic approach for CIED infection in routine practice (4). Unequivocal local findings such as device erosion through the skin, purulent drainage, fluctuance, or sinus tract formation, as observed in our patient, are considered definite evidence of pocket infection, warranting device extraction regardless of blood culture positivity. In this setting, echocardiographic evaluation with TTE and TEE becomes particularly important to determine whether infection is confined to the pocket or extends to the leads or valves. When findings are equivocal or no alternative explanation is identified, PET/CT may further support the diagnosis (4).

Treatment consists of CIED removal (15) and prolonged parenteral antibiotics. Clinical trials (16) suggest non-inferiority of partial oral step-down therapy, though further validation is needed. The optimal timing for device removal remains controversial, but early (17, 18) or immediate extraction (19) are associated with improved survival. In our patient, removal was performed within the same week of lead infection confirmation.

Depending on the presence or absence of purulent discharge, 7-10 days of therapy after device removal is recommended. In the presence of valvular or bloodstream involvement, longer treatment of at least 4-6 weeks is necessary (4).

Despite the relatively low reported reinfection rates after CIED reimplantation (15, 20–22), persistent bacteremia may still occur despite appropriate antimicrobial therapy (4). In *Staphylococcus aureus* bacteremia, prolonged bloodstream infection has been associated with higher 90-day mortality, and delayed removal of intravascular catheters in catheter-related staphylococcal bloodstream infection has been linked to higher relapse rates (23). Similarly, in CIED infections, deferred device extraction results in inadequate source control. In this context, serial follow-up blood cultures are essential to detect persistent or relapsing bacteremia and, when device removal has not yet been performed, supports prompt extraction.

Therefore, reimplantation of a new CIED should be delayed until infection resolution (2) or at least 3-14 days after negative blood cultures, depending on severity and valve involvement (4). In practice, this strategy is challenging because many patients are device-dependent and may require temporary support while awaiting safe reimplantation.

Once microbiological cure has been achieved and reimplantation becomes feasible, attention should be directed to the infectious risk associated with repeat device procedures. Recent review data indicate that generator replacements, lead or pocket revisions, and device upgrades carry a higher risk of infection than *de novo* implantation, supporting careful preventive planning at the time of reintervention. In this setting, risk stratification tools such as PADIT, RI-AIAC, and the Shariff scores may help identify patients at particularly high risk. These scores variably include risk factors for CIED infections: age, diabetes, heart failure, renal insufficiency, prior infection, hospital-acquired infection, device replacement, revision/upgrade, and procedure complexity. Of utmost importance, prevention relies on a structured peri-procedural approach that includes meticulous skin preparation, careful surgical technique, antibiotic prophylaxis and, when appropriate, adjunctive infection-reduction measures tailored to procedural risk (24).

In the present case, blood cultures remained persistently positive before device extraction, reflecting inadequate source control. Because the patient was fully pacemaker-dependent, temporary pacing support was maintained using newly implanted leads connected to the externalized generator. After two weeks of sustained blood culture clearance, a new permanent device was implanted, and antibiotic therapy was completed.

LIMITATIONS

As a single-case report, this study has inherent limitations, and its findings cannot be generalized or used to establish causal relationships. In addition, the descriptive nature of this report does not allow conclusions regarding the frequency, predictors, or comparative outcomes of CIED-IE.

CONCLUSIONS

This case highlights that, in the presence of a CIED pocket infection, clinicians should always consider the possibility of associated IE and actively investigate this diagnosis. This distinction is crucial, as the diagnosis of CIED-IE has major therapeutic implications, since management differs substantially from that of an isolated pocket infection. Furthermore, this case also acts as a reminder that patients with CIED are at increased risk of IE, reinforcing the importance of preventive measures and appropriate prophylactic strategies whenever indicated.

ABREVIATIONS

CIED = cardiac implantable electronic devices
IE = Infective endocarditis

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ETHICS APPROVAL

The manuscript was prepared in accordance with the CARE guidelines. Ethical review was obtained via Plataforma Brasil (CAAE 95778526.0.0000.5259) and approved by the HUPE–UERJ ethics committee. Written informed consent was obtained from the patient for publication of the case and images.

CONFLICT OF INTEREST

None declared.

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