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Case report

Intractable late onset pacemaker endocarditis and complications case report

Gaelle Ghazal [a], Michel Boueiz [a], Georgio El Koubayati [a,*], Majd Khalil [b], Ziad Mansour [c], Nabil Khoury [b]

[a] Internal Medicine, Faculty of Medical Sciences, Lebanese University, Hadath, Lebanon
[b] Cardiology Department, Lebanese Geitaoui University Medical Center, Beirut, Lebanon
[c] Founder and Head of the Cardio-thoracic surgery division, Lebanese Geitaoui University Medical Center, Beirut, Lebanon

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ABSTRACT

Background: Cardiac implantable electronic devices (CIEDs), including pacemakers, have undeniably revolutionized the treatment of cardiac conditions. However, just like any other treatment or intervention some significant challenges can be encountered in CIEDs, mainly, CIED infections. With reported incidence rates ranging from 1 % to 15 % these infections can pose lead to dangerous complications. Our case report presents an occurrence of late-onset pacemaker endocarditis, which despite proper antibiotic therapy required an open-heart surgery as the only curative option.

Case presentation: Our patient is a 50-year-old female known to have a pacemaker implanted twenty years ago, she presented with fever and purulent discharge from her pacemaker site. After thorough investigations, diagnostic tests confirmed a Serratia marcescens infection and despite antibiotic treatment, the patient's symptoms persisted, an echocardiography revealed tricuspid valve involvement with vegetations. Surgical intervention, by complete removal of the old and new pacemaker leads, tricuspid valvuloplasty, and installation of an epicardial pacemaker, was performed.

Conclusion: Our case highlights the rarity and complexity of Serratia marcescens-related pacemaker endocarditis and all CIEDs in general, while emphasizing the importance of interdisciplinary management to optimize patient outcomes. Early diagnosis, prompt treatment, and comprehensive surgical approaches are essential in managing CIED infections and achieving successful outcomes.

1. Introduction

Cardiac implantable electronic devices (CIED), including pacemakers, have become integral in the treatment of various cardiac conditions, providing substantial benefits such as preventing life-threatening events, improving survival rates, and enhancing patients' quality of life by alleviating symptoms [1,2]. However, CIED infections, with reported incidence rates ranging from 1 % to 15 % [3–5], present a significant challenge in modern healthcare. These infections not only compromise patient well-being but also carry the potential for life-threatening complications [6].

* Corresponding author.
E-mail address: Koubayati@icloud.com (G. El Koubayati).

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This case report presents a compelling instance of devastating late-onset pacemaker endocarditis, caused by Serratia marcescens in an immunocompetent host that required open-heart surgery as the sole curative option.

2. Case report

2.1. A- clinical presentation

This case study focuses on a 50-year-old female patient who was admitted to the Lebanese Hospital Geitaoui-UMC on June 27th for persistent fever of 38.5 °C along with drenching night sweats. Her medical history revealed a previous implantation of a permanent pacemaker dual-chamber rate-modulated (DDDR), approximately 20 years ago, to address a complete AV block. The patient has no relevant familial or psychosocial history of intravenous (IV) drug use.

The pacemaker had been initially placed in the right infra-clavicular region. However, due to pacemaker pocket infection and subsequent lead extrusion, the pacemaker required removal on October 7th, 2022, followed by the implantation of a new pacemaker on the left side (Fig. 1). Nevertheless, the leads of the old pacemaker couldn't be removed due to significant fibrosis. She returned to the hospital on May 15th, 2023, 10 months after the previous procedure, due to fever and purulent discharge from her right infra-clavicular region. The right pacemaker leads were again partly popping out of a purulent, erythematous, painful past surgical lesion. Blood and swab cultures were taken. Her creatinine was normal (0.6mg/dL eGFR 110 mL/min/1.73m2). Hence she was started on ciprofloxacin 500mg twice daily, as well as amoxicillin-clavulanic acid 1g twice daily for 6 weeks for presumed skin and soft tissue infection (SSTI). Her cultures returned negative one week later.

2.2. B- clinical management

Upon presentation, physical examination revealed an anxious diaphoretic patient, she had a regular rhythm without any murmurs rubs or gallop, lungs were clear on auscultation. The skin exam showed an erythematous right sub clavicular lesion.

Her labs on presentation figure in Table 1.

Her chest X-ray (CXR) Fig. 2 showed no abnormalities in her lungs or pleural region. However, she didn't show any signs of response to her previous antibiotics regimen treatment. Therefore, bacterial endocarditis caused by a resistant strain was suspected, and a comprehensive set of diagnostic tests consisting of urine analysis, pacemaker swabs (including all leads of old and new pacemaker as well as left pacemaker pocket), and blood culture were obtained. Accordingly, she was started on an antimicrobial regimen consisting of gentamicin 75mg IV q8h, cefepime 2g IV q8h.

2.3. C-cardiac assessment

Consultation with the cardiac team was sought, and a transthoracic echocardiography (TTE) was performed and this initial TTE only significant findings were calcifications were observed along the leads of the old right pacemaker

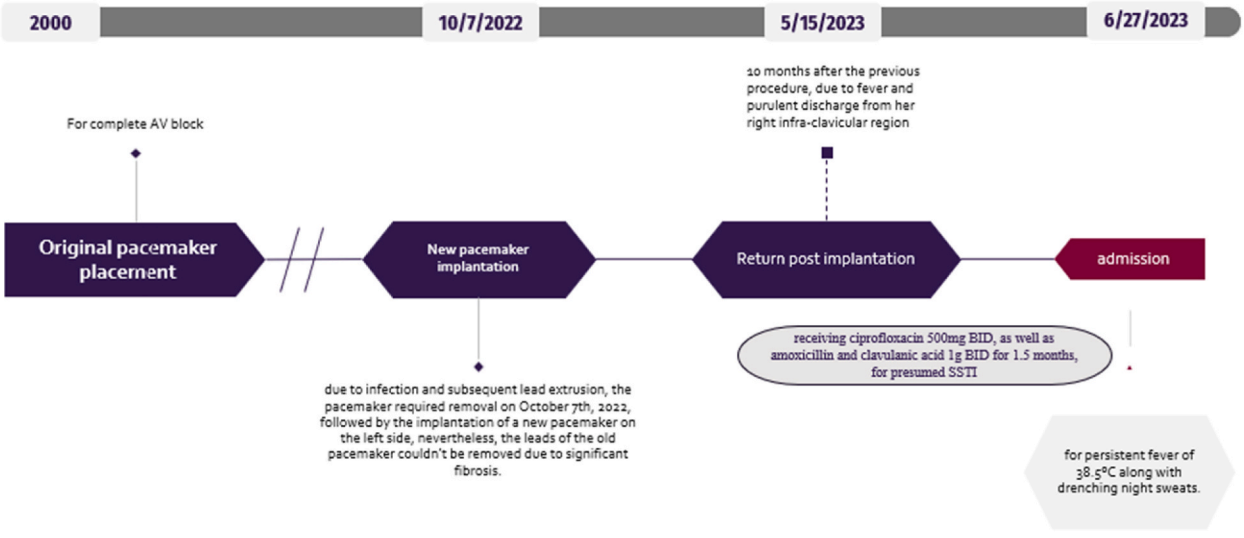

Fig. 1. Timeline of past medical history and interventions.

Table 1
The patient's laboratory results on admission, significant for anemia and elevated CRP.

Exam description	values	Normal range
Hemoglobin	11.6	12–16 g/dL
Hematocrit	35	37–47 %
White blood cells	6.67 x10^9/L	4-9 x10^9/L
Neutrophils	85	60–70 %
C reactive protein (CRP)	176	0–10 mg/L
Urine analysis	Negative for RBCs, WBCs and nitrites	

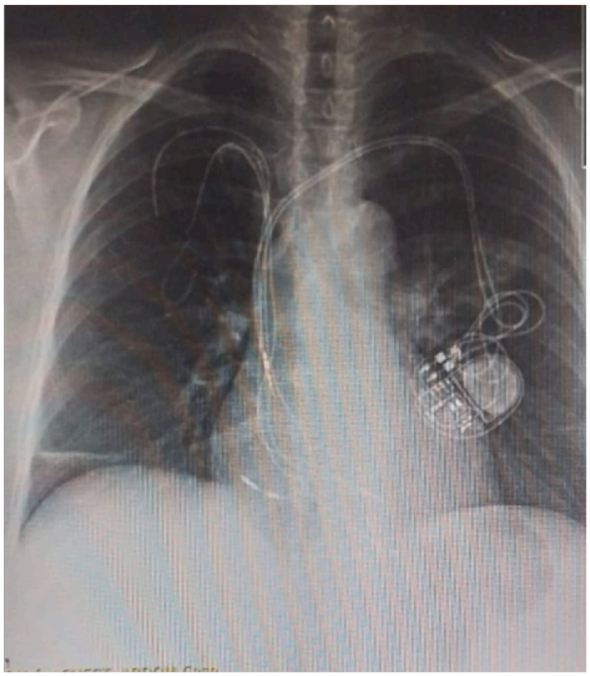

Fig. 2. Chest X-ray showing the new left sided pacemaker and leads as well as the old right side pacemaker leads.

2.4. D-bacterial identification and later findings

On June 30th, blood culture results came back positive for Serratia Marscensens (Table 2) and her pacemaker swabs culture turned out negative. However, the patient continued to experience intermittent fever accompanied by sweating. Gentamicin and cefepime were stopped and the patient was switched to meronem 1g IV every 8 hours. Additionally, a left lower sternal border (LLSB) holosystolic murmur was detected during further examination, although no signs of distal embolization (such as Janeway lesions or subinguinal hemorrhage) were observed.

The cardiology team hence recommended transesophageal echocardiography (TEE) to obtain a comprehensive understanding of the patient's non-resolving state. The TEE results confirmed the presence of several large mobile vegetation of 11 mmm (Fig. 4) present on the pacemaker leads in the right atrium and through the tricuspid valve, responsible for a significant tricuspid regurgitation and a moderate transvalvular gradient of 3mmHG (Table 3).

2.5. E– surgical intervention

After reviewing the TEE results, cardiothoracic surgeon was consulted, and as expected it was decided that open heart surgery was the most suitable and even the sole option for our patient given her persistent fever beyond 7 days of antimicrobial therapy and her valvular damage.

The surgery occurred on the 14th of July at 2 p.m.

During the surgical procedure, the leads of the old and new pacemaker were carefully and completely removed, a tricuspid valvuloplasty was performed (Fig. 3), and an epicardial pacemaker was installed to ensure optimal cardiac rhythm management. Its leads were sutured to the ventricular and right atrial epicardium with both leads connected to a dual chamber pacemaker generator positioned in the abdominal wall. Following the success of the open heart surgery, the patient was transferred to the crisis stabilization unit (CSU) for close monitoring and postoperative care.

Table 2
Antibiograms of blood culture positive for Serratia marscensens.

Identification of	Serratia Marscensens
Antibiogram for	
Aminopenicillin	
Ampicillin	Resistant
Ureidopenicillin	
Piperacillin	Sensitive
Beta lactams + beta lactamase inhibitors	
Amoxicillin + clavulanic acid	Resistant
Piperacillin + tazobactam	Sensitive
Cephalosporins	
Cefuroxime	Resistant
Cefoxitine	Resistant
Cefotaxime	Resistant
Ceftazidime	Resistant
Cefixime	Resistant
Cefepime	Resistant
Monabactam	
Aztreonam	Sensitive
Carbapenems	
Imipenem	Sensitive
Ertapenem	Sensitive
Aminosides	
Gentamycine	Sensitive
Amikacine	Sensitive
Tétracyclines	
Tigecycline	Sensitive
Tetracyclines	Resistant
Quinolones	
Prulifloxacine	Resistant
Ciprofloxacine	Resistant
Others	
Trimethoprime + sulfametoxazole	Sensitive

Table 3
Results of preoperative TEE and postoperative TTE.

Parameters	TEE (preoperative)	TTE (postoperative)
Right and left ventricular function	Preserved	Preserved
Aorta	Normal dimensions	Normal dimensions
Mitral valve	Mild mitral regurgitation MR	Mild mitral regurgitation MR
Aortic valve/pulmonic valve	No significant valvopathies	No significant valvopathies
Tricuspid valve	Many vegetations with the largest being 11mm on the old pacemaker leads, passing through the tricuspid valve causing an important tricuspid regurgitation TR with a transvalvular gradient of 3mmhg	Grade 3 TR
Pericardium	No pericardial effusion	No pericardial effusion
Ejection fraction	–	61 %

The initial recovery period was uneventful, with stable vital signs and well-controlled pain management. She was transferred to a regular room on Tuesday 18 July.

2.6. F- postoperative period

The patient's postoperative recovery journey was characterized by remarkable progress. Four serial blood cultures returned negative.

Therefore, the patient was discharged on July 24, with a broad regimen of antibiotics to prevent any potential complications, including ceftriaxone 1g in 250 cc NSS in 30min for 14 days, cotrimoxazole per os once daily for 10 days. This proactive measure was taken in consultation with the infectious disease team to ensure a swift resolution of the infection and continued progress in the recovery process.

Upon follow up 6 months post discharge our patient was afebrile and reported no concerns.

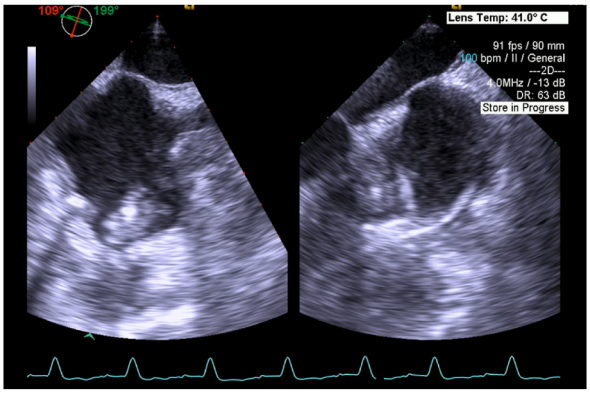

Fig. 3. TEE showing the vegetations on the pacemaker lead and TV.

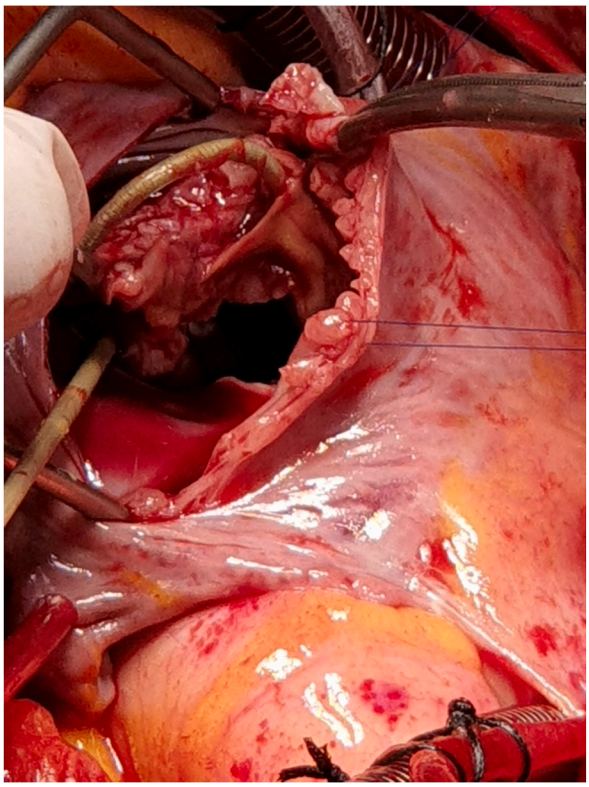

Fig. 4. Image of the vegetations on the tricuspid valve of the patient.

3. Discussion

Infective endocarditis (IE) is a critical medical condition characterized by inflammation of the endocardium, which can lead to severe complications and increased mortality if not managed appropriately. Numerous studies have reported in-hospital mortality rates of 30 % [7,8], yet naturally, these rates can be influenced by various factors such as the causative organism, the patient's comorbidities, the timing of diagnosis, and the timing of treatment. It has been shown that host related factors such as diabetes mellitus, end stage renal disease or renal failure, chronic obstructive lung disease, malignancy, immunosuppression, etc [9,10] all of which are absent in our patient. It is important to note that right-sided endocarditis cases, to which our patient belongs, account for only 5–10 % of all endocarditis cases [11], with Staphylococcus aureus being the most common pathogen [12,13].

Therefore, the presence of other pathogens is uncommon. And what makes our case particular, is the culprit of our patient's pacemaker endocarditis, Serratia marcescens, a gram-negative non-endospore bacillus classified as a member of the Enterobacteriaceae. It is known to cause urinary tract and respiratory tract infections, and rarely endocarditis [14,15] yet with catastrophic

outcomes due to its known high resistance antimicrobial coverage ambiguity [16,17] and poor prognosis [14,18].

It is crucial to diagnose infective endocarditis (IE) early and initiate appropriate treatment promptly to improve outcomes. Diagnosis of IE is based on many criteria, mainly clinical manifestations, blood cultures, and the presence of valvular vegetations detected by echocardiography, which is the main diagnostic tool [19]. The use of TEE has proven to be valuable in diagnosing IE and detecting valvular vegetations with higher sensitivity compared to TTE [20,21].

Lead-dependent IE - involving the leads of cardiac implantable electronic devices, such as pacemakers or implantable cardioverter-defibrillators (ICDs) -is becoming increasingly recognized due to the growing number of patients receiving CIED worldwide [22]. The incidence of CIED-related infections, including lead-dependent IE, ranges from 1 % to 2 % of patients with these devices, with the risk increasing in cases where leads are old and unremoved [23]. Older, unremoved leads serve as a nidus for bacterial colonization, with biofilm forming on the surface of these leads, increasing the risks of treatment failure. S. epidermidis* tends to cause indolent infections due to its strong ability to form biofilms but S. aureus remains the most common pathogen, similar to valve endocarditis [24]. The longer the leads remain in situ, the higher the risk of infection with one study showing that the infection risk increases approximately 2 % with each year that the leads remain implanted [25].

Treatment of CIED infections requires a comprehensive approach. Antimicrobial therapy alone is unlikely to be curative, and removal of the infected device is recommended in all cases of confirmed pacemaker endocarditis. Studies have shown that the complete removal of infected pacemaker components, including leads and the generator, is necessary for the successful management of CIED infection [26–28]. Additionally, expert consensus universally recommends delayed replacement on the opposite side [29]. Moreover, multiple studies highlight the risks associated with leaving leads in place when treating pocket infections in cardiac devices. The AHA 2023 update on CEID infections [30] supports full lead extraction as the safer standard, noting that lead retention often leads to recurrent infections, though conservative management can be considered. Research by Sekiguchi [31] also points out that conservative management— administration of intravenous antibiotics and leaving the leads intact— may allow bacteria to linger on the leads with biofilms, making complete removal essential to resolve the infection. Similarly, findings by Caldonazo et al. [32] show that patients with immune compromise or prior infections face higher risks of reinfection when leads are left in place.

Nonetheless, the leads can be removed through two different methods: open heart surgery or percutaneous extraction. The patient is a candidate for the latter, only when the vegetation size is smaller than 10 mm, the tricuspid valve is unaffected, the implantation time is less than 1 year, and the patient does not rely on the pacemaker for cardiac function. However, in cases where these criteria are not respected, surgical extraction should be seriously considered as the preferred approach [33].

In rare cases of intractable endocarditis, even after pacemaker replacement on the opposite side, epicardial, pacing becomes the best and sole option left [34,35].

The incidence of Serratia endocarditis is low, with less than 1 % of all reported endocarditis cases. The presence of old, unremoved leads in patients with CIEDs, in conjunction with healthcare exposure (e.g., prolonged hospital stays, prior antibiotic therapy, or invasive procedures), are risk factors. Biofilm formation on the device leads plays a important role in the pathogen's persistence and resistance to treatment [36]. Several articles have reported patients with *Serratia* lead-associated endocarditis needing transvenous lead extraction (TLE), followed by prolonged antibiotic courses, ranging from 4 to 6 weeks. A 2016 case report [37] described a 65-year-old patient with a 7-year-old pacemaker lead who presented with recurrent fevers and was found to have *Serratia marcescens* endocarditis. Despite initial treatment with intravenous antibiotics, the infection persisted, and TLE was required. Good response was achieved after lead removal and antimicrobial therapy. Another case [38] was reported in a 72-year-old man with a history of recurrent prostatitis who later on developed lead-associated IE caused by *Serratia marcescens.* This patient also had to go undergo TLE and valve replacement, followed by a 6-week course of ceftazidime with full recovery.

4. Conclusion

This case exemplifies a complex and rare clinical scenario involving a pacemaker infected by *Serratia marcescens*, tricuspid valve involvement, and subsequent surgical intervention. The interdisciplinary approach, consisting of cardiology, cardiothoracic surgery, and infectious disease management plays a crucial role in ensuring optimal patient outcomes. The successful removal of the old pacemaker lead, repair of the tricuspid valve, and installation of an epicardial pacemaker addressed the underlying cardiac pathology. With proper medical management and vigilant postoperative care, the patient will achieve a favorable recovery, allowing for a return to an improved quality of life.

CRediT authorship contribution statement

Gaelle Ghazal: Writing – original draft, Visualization, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Michel Boueiz:** Writing – original draft, Visualization, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Georgio El Koubayati:** Writing – original draft, Visualization, Methodology, Investigation, Formal analysis, Data curation. **Majd Khalil:** Writing – review & editing, Visualization, Validation, Supervision, Conceptualization. **Ziad Mansour:** Writing – review & editing, Validation, Supervision. **Nabil Khoury:** Writing – review & editing, Validation, Supervision.

Ethical statement

Written and signed consent was obtained from the patient to publish her history, of all images, her clinical data, and other data included in the manuscript.

Data and Code availability

Data will be made available on request.

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Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:Georgio EL KOUBAYATI reports was provided by Lebanese University. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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