SAS Journal of Medicine
Abbreviated Key Title: SAS J Med
ISSN 2454-5112
Journal homepage: https://saspublishers.com

OPEN ACCESS

Cardiology

Cardiac Resynchronization Therapy Pacemaker Pocket Infection Complicated by Lead-Related Infective Endocarditis with Subsequent Vegetation Formation on a Temporary Pacing Lead: A Fatal Case in a Patient with a Prior Bentall Procedure

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DOI: https://doi.org/10.36347/sasjm.2026.v12i11.009 | **Received:** 08.09.2026 | **Accepted:** 03.10.2026 | **Published:** 09.11.2026

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Abstract **Case Report**

Cardiac implantable electronic device infection is a severe complication whose prognosis worsens when it extends to the leads and when patients carry other intracardiac prosthetic material. We report the case of a 62-year-old woman with a mechanical aortic valve and ascending aortic graft (Bentall procedure) for a bicuspid aortic valve, dilated cardiomyopathy with a left ventricular ejection fraction of 25%, and a cardiac resynchronization therapy pacemaker implanted eight months earlier for high degree atrioventricular block. She presented with an afebrile, red, warm and swollen generator pocket that later fistulized to the skin with purulent discharge. The pocket swab grew methicillin-susceptible *Staphylococcus aureus* (MSSA), while blood cultures remained sterile. Transthoracic echocardiography showed an 8 × 9 mm mobile mass at the tip of the right atrial lead, confirmed by transesophageal echocardiography, without valvular, prosthetic or graft involvement. Because she was pacemaker dependent, the entire system was extracted and a temporary pacing lead with an external generator was inserted on the contralateral side. Polymerase chain reaction on the extracted leads also identified MSSA, confirming lead-related infective endocarditis. Under intravenous vancomycin, echocardiography revealed two new vegetations measuring 10 × 8 mm on the temporary lead. As blood cultures remained negative, antibiotic therapy was prolonged, and the vegetations resolved within 15 days. On day 37, she developed altered consciousness, hemodynamic collapse and cardiac arrest, and died despite resuscitation. This case highlights the vulnerability of pacemaker-dependent patients after extraction and the need for close surveillance of temporary leads and early reimplantation planning.

Keywords: Cardiac implantable electronic device infection, lead-related infective endocarditis, cardiac resynchronization therapy, methicillin-susceptible staphylococcus aureus, transvenous lead extraction, temporary cardiac pacing, bentall procedure, mechanical aortic valve prosthesis.

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INTRODUCTION

The use of cardiac implantable electronic devices (CIEDs) has grown steadily, and device infections have increased faster than implantation rates [1,2]. Cardiac resynchronization therapy devices carry a higher infection risk than conventional pacemakers because of longer procedures, more leads and frequent comorbidities such as heart failure [2,3]. CIED infection is associated with substantial in-hospital and long-term mortality, even after appropriate treatment [4].

Infection may remain confined to the generator pocket or extend along the leads to the endocardium, causing lead-related infective endocarditis (LRIE) [5]. *Staphylococcus aureus* is a leading pathogen and carries a high risk of endovascular spread [6]. Current guidelines recommend complete system extraction together with prolonged antibiotic therapy whenever CIED infection is confirmed, including isolated pocket infection [5,7-9]. The 2023 European Society of Cardiology (ESC) endocarditis guidelines include a dedicated diagnostic

algorithm and specific recommendations for CIED-related infective endocarditis [7].

Management becomes particularly difficult in pacemaker-dependent patients who carry other intracardiac prosthetic material. Such patients require bridging pacing after extraction, while the infection threatens the prosthetic valve and aortic graft. We report a fatal case of cardiac resynchronization therapy pacemaker (CRT-P) pocket infection with LRIE due to methicillin-susceptible *Staphylococcus aureus* (MSSA), in a patient with a prior Bentall procedure, complicated by new vegetations on the temporary pacing lead after extraction.

CASE PRESENTATION

A 62-year-old woman was admitted to our cardiology department with a one-week history of a red, warm and painful swelling over the CRT-P generator pocket. Her history included aortic valve and ascending aorta replacement with a mechanical composite graft (Bentall procedure) in 2011 for a bicuspid aortic valve. In 2024, she was diagnosed with hypokinetic dilated cardiomyopathy with severe biventricular dysfunction (left ventricular ejection fraction (LVEF) 15-20%). Coronary angiography had been performed in 2008 and 2020 and was normal on both occasions. In July 2025, eight months before admission, she received a CRT-P for high-degree atrioventricular block. She was also followed for gallstones. She had no diabetes (glycated hemoglobin 5.6%), hypertension, smoking or family history of sudden death. She had a known beta-lactam allergy.

Her treatment comprised sacubitril/valsartan, dapagliflozin 10 mg, spironolactone 25 mg, furosemide, amiodarone 200 mg daily, a proton pump inhibitor and acenocoumarol for the mechanical prosthesis. She reported no fever and her general condition was preserved; she mentioned only a dry cough. On examination, she was alert, with a blood pressure of 100/72 mmHg, a heart rate of 75 beats/min, a respiratory rate of 19 breaths/min, an oxygen saturation of 98% on room air and a temperature of 36.4°C. A crisp mechanical prosthetic click was heard, without murmur or signs of heart failure. There were no Osler nodes, Janeway lesions, purpura or neurological deficit. The generator pocket was red, warm and swollen, without skin breach or discharge.

The 12-lead electrocardiogram showed a paced rhythm at 75 beats/min. Initial laboratory findings showed a mildly elevated C-reactive protein (CRP) of 11 mg/L, a normal white blood cell count and a procalcitonin level below 0.05 ng/mL (Table 1). Bacterial and fungal blood cultures drawn at admission were sterile. Acenocoumarol was replaced by therapeutic low-molecular-weight heparin.

Table 1: Laboratory findings at admission. GFR: glomerular filtration rate

Parameter	Value at admission	Reference range
White blood cells (/mm³)	7,650	4,000-10,000
Hemoglobin (g/dL)	13.1	12-16
Parameter	Value at admission	Reference range
Platelets (/mm³)	256,000	150,000-400,000
C-reactive protein (mg/L)	11	<5
Procalcitonin (ng/mL)	<0.05	<0.05
Creatinine (mg/L)	9.69	5-11
Estimated GFR (mL/min/1.73 m²)	61.6	≥90

Soft-tissue ultrasound, repeated by a senior radiologist, showed extensive infiltration around the generator pocket and along the lead tract, evolving toward a collection, with intact underlying cortical bone. Intravenous vancomycin was then started empirically at 30 mg/kg/day (750 mg twice daily), as the patient had a beta-lactam allergy. The search for a portal of entry and for distant complications found a normal chest radiograph, a sterile urine culture, a simple right renal cyst on abdominal ultrasound and no embolic or immunological manifestations. Complement levels and 24-hour proteinuria were normal, and thoraco-abdominopelvic computed tomography was unremarkable.

Under vancomycin, the swelling fistulized to the skin with purulent discharge. A swab of the discharge grew methicillin-susceptible *Staphylococcus aureus* (MSSA), and vancomycin was continued because of the beta-lactam allergy.

Transthoracic echocardiography (TTE) on admission showed a dilated, globally hypokinetic left ventricle (end-diastolic/end-systolic diameters 70/62 mm, LVEF 25% by biplane Simpson) with spontaneous echo contrast, a normally functioning mechanical aortic prosthesis (mean gradient 6 mmHg), moderate mitral regurgitation and a normal right ventricle; no vegetation was seen. Repeat TTE on day 5 showed an 8 × 9 mm mobile, oscillating mass at the tip of the right atrial lead. CRP peaked at 76 mg/L on day 7. Transesophageal echocardiography (TEE) on day 8 was limited by acoustic shadowing from the prosthesis and graft. It confirmed a thickened right atrial lead bearing this mobile mass at its tip. The left ventricular lead filled the coronary sinus. The aortic prosthesis, the graft and the native mitral, tricuspid and pulmonary valves showed no

vegetation or abscess, and there was no pericardial effusion.

The diagnosis of CRT-P pocket infection with lead-related endocarditis was established. After a heart team discussion including cardiovascular surgeons, the patient, who was pacemaker-dependent, underwent complete removal of the generator and all three leads on day 8, as soon as TEE confirmed the vegetation. During the same procedure, a temporary pacing lead connected to an external generator was inserted from the contralateral side and secured to the skin. Polymerase chain reaction performed on the histopathological samples of the leads also identified MSSA. CRP fell to 15 mg/L on day 11. A depressive syndrome was diagnosed during the stay, and a selective serotonin reuptake inhibitor was started after psychiatric consultation.

Follow-up echocardiography on day 18 revealed two new mobile vegetations attached to the temporary pacing lead, measuring 10 × 8 mm (Figure 1), and CRP rose again to 32 mg/L. Repeat blood cultures remained sterile, and the native valves, the aortic prosthesis and the graft remained free of vegetations.

The team therefore left the temporary lead in place and prolonged intravenous vancomycin.

Echocardiography 15 days later showed complete disappearance of both vegetations, and CRP fell to 5 mg/L, while procalcitonin remained low.

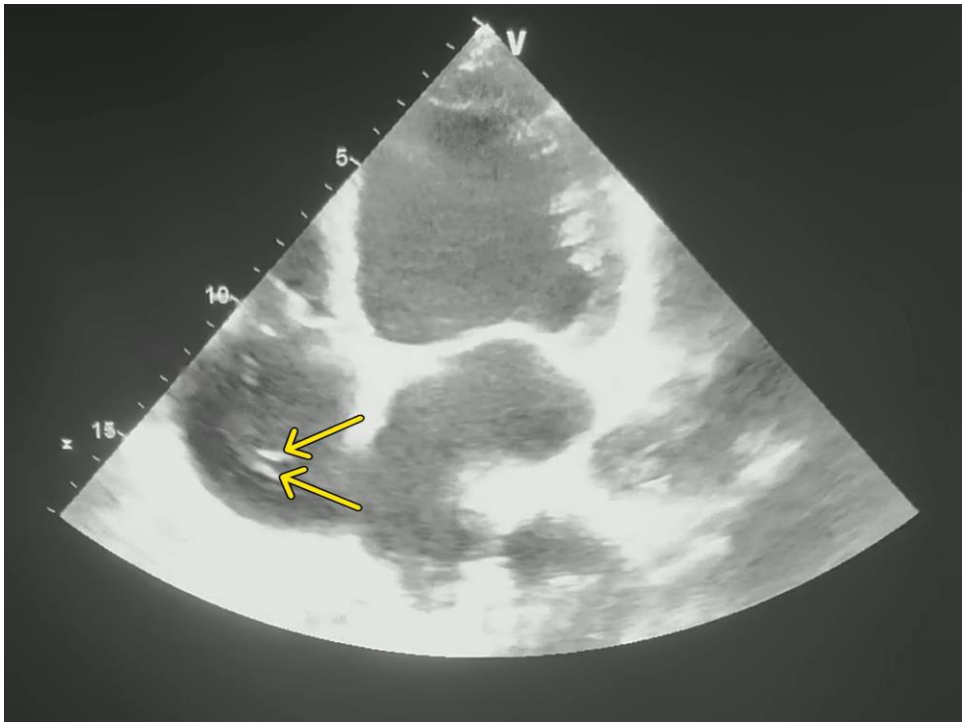


Figure 1: Transthoracic echocardiography showing two vegetations on the temporary pacing lead. Apical four-chamber view; the arrows indicate two mobile vegetations attached to the temporary pacing lead in the right atrium

On day 37, the patient suddenly developed altered consciousness and hemodynamic instability with a blood pressure of 70/40 mmHg, followed by cardiac arrest in asystole. Despite 30 minutes of cardiopulmonary resuscitation with chest compressions and norepinephrine, she died. No autopsy was performed.

DISCUSSION

This case combines several features that independently worsen the prognosis of CIED infection: a cardiac resynchronization therapy device, advanced heart failure, pacemaker dependency, a mechanical aortic prosthesis with an aortic graft, and *Staphylococcus aureus* as the causative organism. It also illustrates a rarely reported complication, the formation of new vegetations on the temporary pacing lead used to bridge the patient after extraction.

The 2023 ESC guidelines dedicate a specific section and diagnostic algorithm to CIED-related infective endocarditis [7]. In line with their class I recommendations, our patient underwent repeated transthoracic and transesophageal echocardiography, blood cultures before antibiotic therapy and complete system extraction without delay [7]. Because of her mechanical prosthesis, the guidelines also support extending antibiotic therapy to four to six weeks after extraction, and the lead vegetation called for a delay of at least two weeks before any reimplantation at a site distant from the previous generator [7].

The patient presented with an apparently localized pocket infection, without fever and with sterile blood cultures and a normal procalcitonin. Such a presentation can mislead clinicians into considering the infection superficial. Yet the leads are in continuity with the pocket, and endovascular extension may occur without detectable bacteremia [5]. In our patient, TEE identified a mobile mass on the atrial lead, and polymerase chain reaction on the extracted leads identified MSSA. The 2023 DukeInternational Society for Cardiovascular Infectious Diseases criteria include the identification of a microorganism on an explanted intracardiac device associated with a vegetation as a pathological criterion, and the 2023 ESC guidelines consider this combination diagnostic of CIED-related endocarditis [7,10]. The admission TTE was normal, and the vegetation only appeared on repeat TTE on day 5, which supports repeated imaging and systematic TEE in every patient with CIED infection, including isolated pocket infection [5,7].

Several risk factors were present. Device upgrade or CRT implantation, heart failure and prosthetic heart valves are recognized predictors of CIED infection [3]. Oral anticoagulation, required here for the mechanical prosthesis, increases the risk of pocket hematoma, one of the strongest predictors of infection [3]. At reimplantation, an antibacterial envelope reduces major CIED infection in high-risk patients and would have been a reasonable option [11].

Complete removal of the generator and all leads is the cornerstone of treatment and is recommended for any confirmed CIED infection, including pocket infection without bacteremia [5,7-9]. Conservative management or partial removal is associated with relapse and higher mortality, and delayed extraction is independently associated with increased mortality [12,13]. In large registries, transvenous lead extraction has a high clinical success rate, but patients extracted for infection, especially for systemic infection, have higher procedural and in-hospital mortality [14]. Moreover, residual fibrous or infected remnants ("ghosts") seen on echocardiography after extraction are associated with higher mortality [15]. In our patient, extraction was performed on day 8, the same day TEE confirmed the lead vegetation, in line with recommendations for early device removal. Whether a remnant persisted in the right atrium and served as a nidus for the new vegetations remains unknown.

The main challenge after extraction was pacemaker dependency. Conventional passive-fixation temporary leads carry risks of dislodgement, loss of capture, thrombosis and infection, and they confine the patient to bed [5,16,17]. An active-fixation lead connected to an externalized generator offers more stable pacing and allows mobilization over several days or weeks [16,17]. Our patient received a temporary lead with an external generator through a contralateral venous access, away from the infected pocket, and secured to the skin. Shortening the bridging period is the other key measure. Expert consensus recommends reimplantation on the contralateral side once blood cultures have been negative for at least 72 hours, with a longer delay when valvular vegetations are present [5]. Leadless or epicardial systems are alternatives in patients at high risk of reinfection [5,8]. In a patient with an LVEF of 25% and a prior resynchronization indication, an epicardial resynchronization system could have been discussed at the time of extraction.

The formation of two vegetations on the temporary lead despite complete extraction and antibiotic therapy is the most unusual feature of this case. It suggests that the new lead was seeded from a persistent intravascular focus, such as residual infected tissue in the right atrium or along the venous tract, consistent with the association between post-extraction remnants and mortality [15]. A bland thrombus was also possible, given the low cardiac output and the presence of an intravascular foreign body, although the patient was receiving therapeutic low-molecular-weight heparin. Because blood cultures remained negative and no valvular or prosthetic involvement was detected, the team kept the temporary lead and prolonged intravenous vancomycin. The complete resolution of both vegetations within 15 days supports this conservative strategy, which spared a pacemaker-dependent patient a further lead manipulation. Although an antistaphylococcal penicillin or cefazolin is preferred for MSSA, the 2023 ESC guidelines retain vancomycin for patients with beta-lactam allergy, as in our patient [7].

The prosthetic aortic valve and the Bentall graft remained free of visible vegetation, but TEE was limited by acoustic shadowing. In this setting, the ESC guidelines recommend 18F-fluorodeoxyglucose positron emission tomography/computed tomography and cardiac computed tomography to detect prosthetic valve, graft or lead infection [7], but neither was performed in our patient. *S. aureus* infection in patients with intracardiac devices carries a high risk of device and prosthetic involvement [6].

The exact cause of death remains uncertain because no autopsy was performed. The resolution of the vegetations, the sterile blood cultures and the fall in CRP to 5 mg/L suggest that the infection was controlled, although occult infection of the prosthetic aortic material cannot be excluded without nuclear imaging or autopsy. The sudden altered consciousness could reflect a cerebral embolism from the mechanical valve or a left-sided source; paradoxical embolism of a right-sided vegetation appeared unlikely given the intact interatrial septum. Embolization of the temporary lead vegetations to the pulmonary circulation, loss of capture or dislodgement of the temporary lead in a pacemaker-dependent patient, and a ventricular arrhythmia in the setting of severe left ventricular dysfunction are other plausible mechanisms.

Mortality after CIED infection remains substantial during the first year, particularly in patients with endocarditis or heart failure [4,12].

This report has limitations. The absence of autopsy prevents firm conclusions about the cause of death and the nature of the temporary lead masses. Nuclear imaging was not performed, and the limited TEE windows may have missed prosthetic involvement. Finally, a single case cannot establish causal links between the management choices discussed and the outcome.

CONCLUSIONS

A fistulized CIED pocket infection should be regarded as a systemic device infection until proven otherwise, even without fever or bacteremia. TEE should be performed early, and complete extraction should not be delayed. In pacemaker-dependent patients, the temporary lead can itself become infected and requires close echocardiographic surveillance. In our case, prolonged antibiotic therapy led to the resolution of these vegetations without lead replacement, yet the patient died, underlining the fragility of patients with prosthetic heart material and advanced heart failure. Early planning of reimplantation, including epicardial or leadless options, may improve outcomes in this population.

Disclosures (entered in the Cureus submission form)

Human subjects:

Consent for treatment and open access publication was obtained or waived by all participants in this study. As the patient is deceased, verbal informed consent for publication was obtained from her family.

Conflicts of interest:

In compliance with the ICMJE uniform disclosure form, all authors declare the following. Payment/services info: All authors have declared that no financial support was received from any organization for the submitted work. Financial relationships: All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. Other relationships: All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

Author contributions:

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work. Concept and design: Asma Ouaziz, Leila Ait Benali, Youssef Kourima, Joumana Elmasrioui, Mustapha El Hattaoui. Acquisition, analysis, or interpretation of data: Asma Ouaziz, Leila Ait Benali, Youssef Kourima, Joumana Elmasrioui, Mustapha El Hattaoui. Drafting of the manuscript: Asma Ouaziz, Leila Ait Benali, Youssef Kourima, Joumana Elmasrioui, Mustapha El Hattaoui. Critical review of the manuscript for important intellectual content: Asma Ouaziz, Leila Ait Benali, Youssef Kourima, Joumana Elmasrioui, Mustapha El Hattaoui. Supervision: Asma Ouaziz, Leila Ait Benali, Youssef Kourima, Joumana Elmasrioui, Mustapha El Hattaoui.

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