Cureus
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Open Access Case Report

Poststernotomy Mediastinitis Caused by Staphylococcus simulans: A Case Report Highlighting the Importance of Clinicomicrobiological Interpretation of Coagulase-Negative Staphylococci

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Review began 10/16/2026
Review ended 10/27/2026
Published 10/30/2026

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DOI: 10.7759/cureus.118831

Abstract

Poststernotomy mediastinitis is a serious complication of cardiac surgery. Although coagulase-negative staphylococci can cause deep postoperative infections, their clinical significance may be difficult to establish because of their frequent presence as skin commensals. We report the case of a 71-year-old woman who developed fever, anterior chest pain, and purulent discharge from the sternal wound on the fifth postoperative day after triple coronary artery bypass grafting. Chest computed tomography revealed a retrosternal collection consistent with poststernotomy mediastinitis. Surgical re-exploration with drainage, debridement, and collection of deep microbiological specimens was performed. Direct examination revealed numerous neutrophils and Gram-positive cocci arranged in clusters and tetrads. A pure culture yielded *Staphylococcus simulans*, identified by VITEK® MS PRIME matrix-assisted laser desorption/ionization time-of-flight mass spectrometry (bioMérieux, Marcy-l'Étoile, France). The isolate was resistant to methicillin, fluoroquinolones, aminoglycosides, and rifampicin but remained susceptible to vancomycin. Surgical debridement combined with six weeks of intravenous vancomycin resulted in a favorable clinical and biological outcome, with no recurrence at three months. This case emphasizes that the recovery of a coagulase-negative *Staphylococcus* from a deep specimen should not automatically be interpreted as contamination. Its etiological significance should instead be determined through the concordance of clinical, radiological, surgical, and microbiological findings.

Categories: Pathology, Cardiac/Thoracic/Vascular Surgery, Infectious Disease
Keywords: coagulase-negative staphylococci, maldi-tof, methicillin resistance, poststernotomy mediastinitis, staphylococcus simulans

Introduction

Staphylococcus (S.) simulans is a coagulase-negative staphylococcus primarily recognized as a zoonotic pathogen and frequently isolated from livestock. Although historically considered an uncommon cause of human infection, it is increasingly recognized as an opportunistic pathogen associated with invasive infections, including bacteremia, endocarditis, osteoarticular infections, and device-associated infections. Advances in bacterial identification methods, particularly matrix-assisted laser desorption/ionization time-of-flight (MALDI-TOF) mass spectrometry, have improved the recognition of this species by enabling rapid and reliable species-level identification of coagulase-negative staphylococci in routine clinical microbiology [1-3].

Poststernotomy mediastinitis, a deep postoperative infection involving the mediastinal tissues following median sternotomy, remains a rare but serious complication of cardiac surgery and is associated with substantial morbidity and mortality despite advances in surgical techniques and anti-infective management [4]. *Staphylococcus aureus* and coagulase-negative staphylococci are among its major causative organisms. Although coagulase-negative staphylococci are frequently regarded as contaminants because of their common presence as skin commensals, their recovery from deep specimens should always be interpreted in the context of clinical, radiological, and microbiological findings. Among these species, *S. simulans* has only exceptionally been reported in poststernotomy mediastinitis [3,4].

We report a case of poststernotomy mediastinitis caused by *S. simulans* following coronary artery bypass grafting. Through this case, we illustrate the clinicomicrobiological approach used to establish the pathogenic significance of a coagulase-negative *Staphylococcus* recovered from a deep specimen and emphasize the importance of accurate species-level identification integrated with clinical, radiological, and microbiological findings to distinguish true infection from contamination and guide appropriate management.

How to cite this article
Garrouj D, Benaissa E, Ben Lahlou Y, et al. (October 30, 2026) Poststernotomy Mediastinitis Caused by Staphylococcus simulans: A Case Report Highlighting the Importance of Clinicomicrobiological Interpretation of Coagulase-Negative Staphylococci. Cureus 18(10): e118831. DOI 10.7759/cureus.118831

Case Presentation

A 71-year-old woman with a medical history of hypertension, type 2 diabetes mellitus, dyslipidemia, central obesity, and chronic kidney disease was admitted for surgical management of exertional angina in the setting of triple-vessel coronary artery disease. Preoperative echocardiography showed preserved left ventricular systolic function, with an ejection fraction of 60%. She underwent triple coronary artery bypass grafting under cardiopulmonary bypass, with an initially uncomplicated postoperative course.

On postoperative day five, she developed a fever of 39 °C, anterior chest pain, and purulent discharge from the sternal wound. On clinical examination, she was conscious, normotensive, tachycardic, and eupneic. Laboratory investigations revealed a marked inflammatory response, with a C-reactive protein level of 120 mg/L and a procalcitonin level of 2.85 ng/mL, together with a white blood cell count of 18,000/mm³, including 12,000 neutrophils/mm³ (Table *1*). Liver function tests and coagulation parameters showed no significant abnormalities. Renal function was stable. Blood cultures obtained before initiation of antimicrobial therapy remained negative.

Parameters	Patient value	Reference range
Hemoglobin (g/dL)	10.5	12–16
White blood cell count (×10³/mm³)	18	4–10
Neutrophil count (×10³/mm³)	12	1.5–7.5
Platelet count (×10³/mm³)	343	150–450
C-reactive protein (mg/L)	120	<5
Procalcitonin (ng/mL)	2.85	<0.05
Serum creatinine (mg/L)	8	6–13
Estimated glomerular filtration rate (eGFR), MDRD equation (mL/min/1.73 m²)	70.5	≥60
Urea (g/L)	0.25	0.15–0.38
Aspartate aminotransferase (AST) (U/L)	32	<35
Alanine aminotransferase (ALT) (U/L)	38	<40
Total bilirubin (mg/L)	3	3–10
Alkaline phosphatase (ALP) (U/L)	98	40–150
Prothrombin activity (%)	75	70–100
Activated partial thromboplastin time (aPTT) ratio	1.2	≤1.2

TABLE 1: Laboratory findings at the time of diagnosis of poststernotomy mediastinitis

MDRD: modification of diet in renal disease

Contrast-enhanced chest computed tomography revealed an 83 × 22 × 90 mm retrosternal collection with peripheral enhancement, associated with infiltration of the mediastinal fat and communication with the soft tissues of the anterior chest wall, consistent with poststernotomy mediastinitis (Figure *1*).

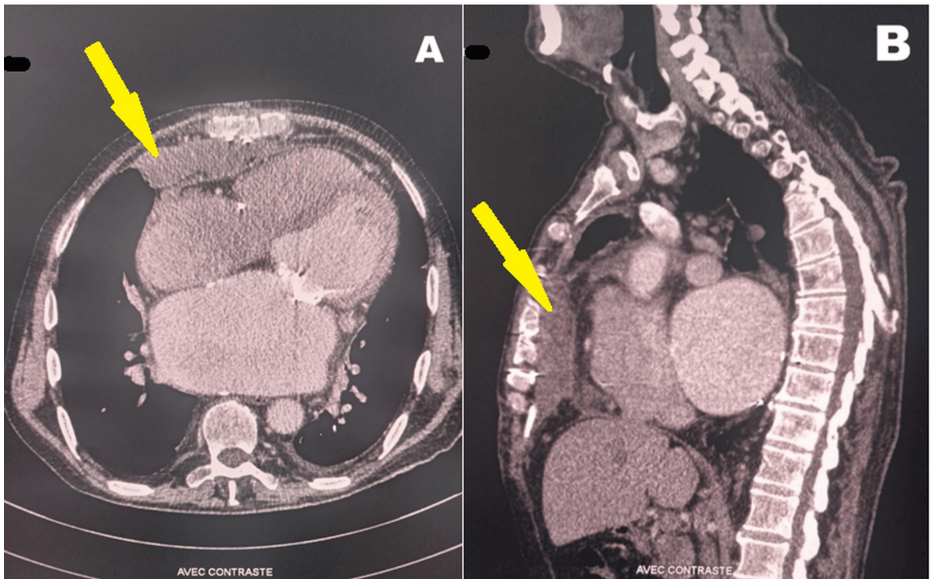


FIGURE 1: Contrast-enhanced chest computed tomography showing a retrosternal collection consistent with poststernotomy mediastinitis

(A) Axial view. (B) Sagittal reconstruction. Arrows indicate the retrosternal collection.

Surgical re-exploration was performed, including evacuation and drainage of the retrosternal collection, debridement of infected tissues, extensive mediastinal lavage, and collection of two deep specimens obtained aseptically from the retrosternal collection for microbiological examination. Sternal stability and viability were assessed intraoperatively to guide the subsequent closure strategy.

While awaiting the microbiological results, empirical antimicrobial therapy with ceftriaxone was initiated.

Direct examination after Gram staining revealed a marked inflammatory reaction, with numerous neutrophils and Gram-positive cocci arranged in clusters and tetrads (Figure *2*).

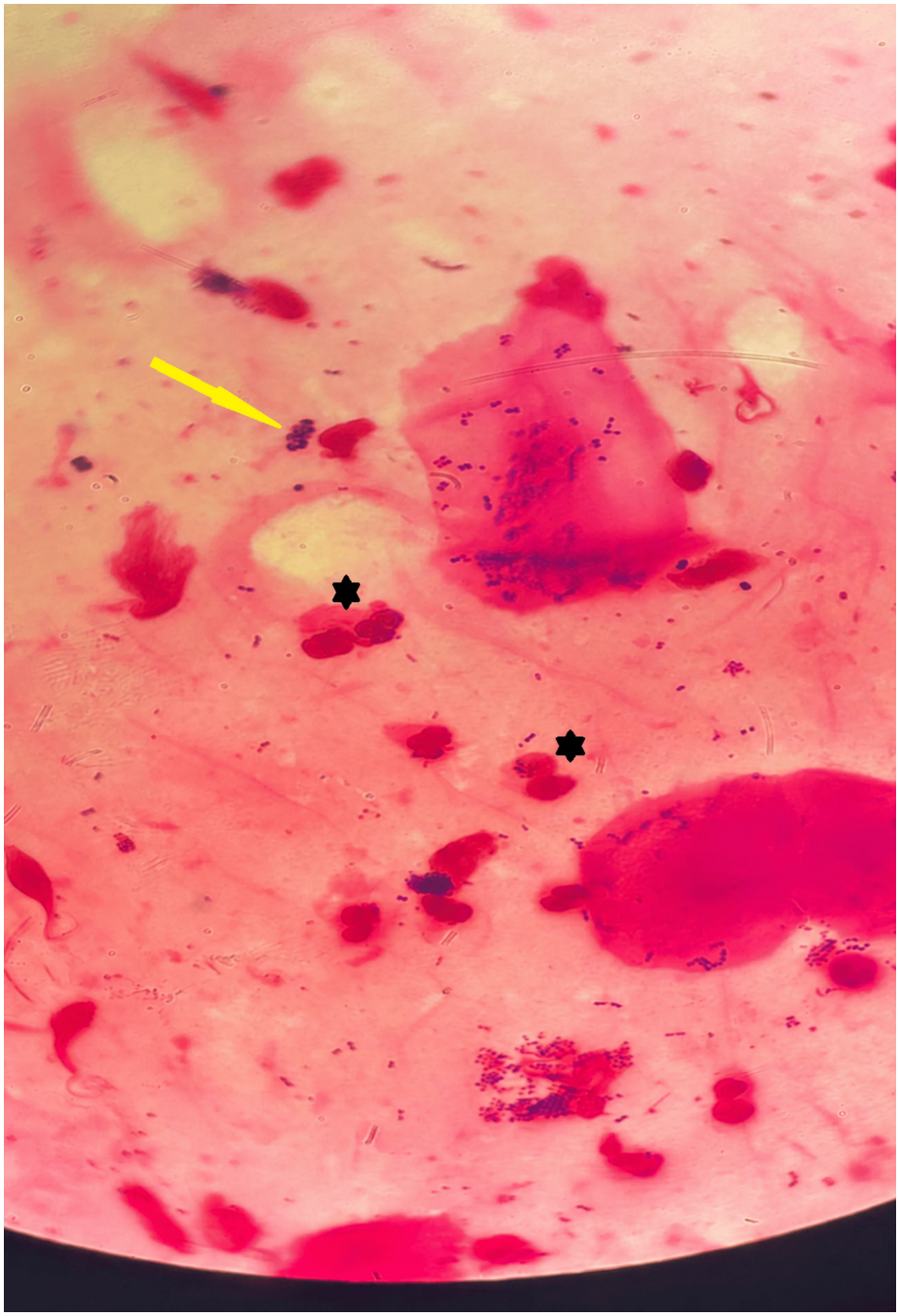


FIGURE 2: Direct Gram-stained examination of the deep intraoperative specimen

Gram staining (×1000, oil immersion) shows numerous neutrophils (asterisks) and Gram-positive cocci arranged in clusters and tetrads (arrow).

The specimens were inoculated onto Columbia blood agar, chocolate PolyViteX agar, and Columbia colistin-nalidixic acid (CNA) agar and incubated at 35-37 °C for 24 hours. Both specimens yielded pure, monomorphic growth of medium-sized, circular, smooth, opaque colonies. The isolates were identified as *Staphylococcus simulans* by VITEK® MS PRIME matrix-assisted laser desorption/ionization time-of-flight mass spectrometry (bioMérieux, Marcy-l'Étoile, France) (Figure 3). Given the concordant recovery of *S. simulans* in pure culture from both deep intraoperative specimens, together with the direct microscopic findings and the clinical and radiological features of postoperative mediastinitis, the organism was considered clinically significant.

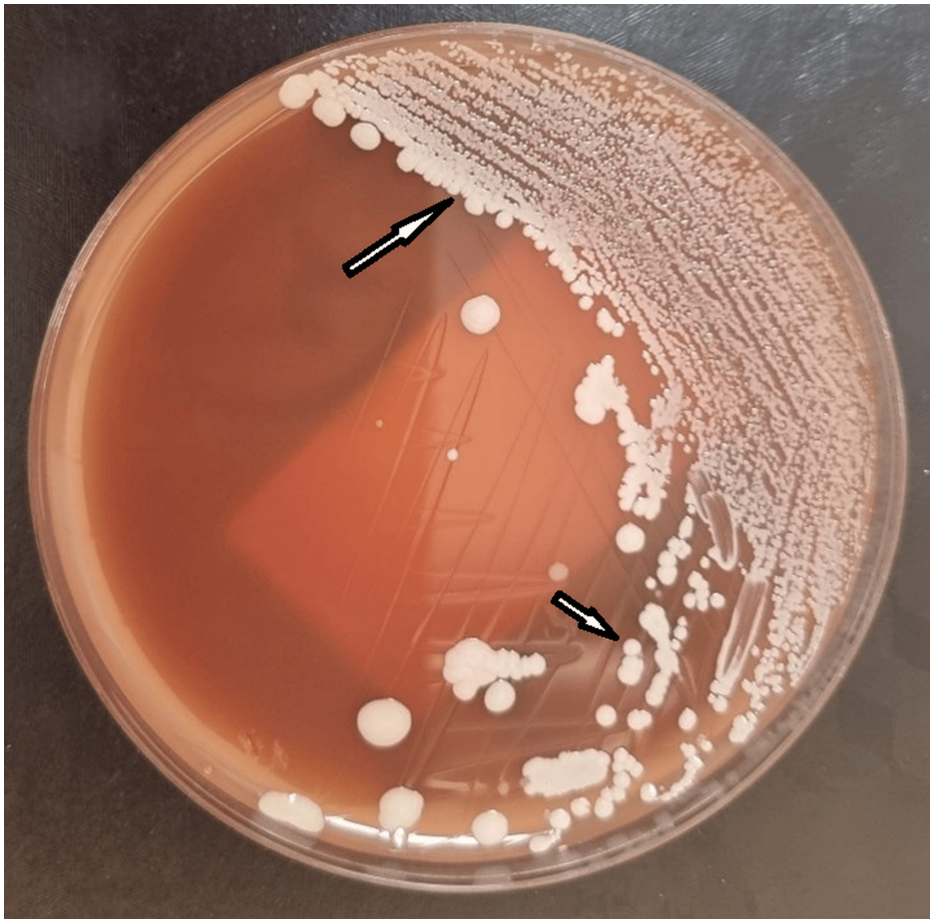


FIGURE 3: Staphylococcus simulans colonies on chocolate PolyViteX agar

The arrows show medium-sized, circular, smooth, opaque colonies of *Staphylococcus simulans* after 24 hours of incubation.

Antimicrobial susceptibility testing was performed and interpreted according to the 2025 CA-SFM/EUCAST guidelines [5]. Disk diffusion was used for the tested antimicrobial agents, whereas the vancomycin minimum inhibitory concentration (MIC) was determined by broth microdilution. The isolate was penicillinase-producing and methicillin-resistant and showed resistance to fluoroquinolones, aminoglycosides, and rifampicin, while remaining susceptible to glycopeptides. The vancomycin MIC was 1.25 mg/L (Table *2*). The D-test was negative, indicating the absence of inducible clindamycin resistance.

Antimicrobial agent	Method	Disk content	Inhibition zone diameter (mm)	MIC (mg/L)	Interpretation
Cefoxitin	Disk diffusion	30 µg	12	—	Resistant
Penicillin G	Disk diffusion	1 unit	6	—	Resistant
Norfloxacin	Disk diffusion	10 µg	8	—	Resistant
Ciprofloxacin	Disk diffusion	5 µg	8	—	Resistant
Erythromycin	Disk diffusion	15 µg	6	—	Resistant
Clindamycin	Disk diffusion	2 µg	32	—	Susceptible
Gentamicin	Disk diffusion	10 µg	7	—	Resistant
Tobramycin	Disk diffusion	10 µg	8	—	Resistant
Tetracycline	Disk diffusion	30 µg	28	—	Susceptible
Tigecycline	Disk diffusion	15 µg	30	—	Susceptible
Rifampicin	Disk diffusion	5 µg	6	—	Resistant
Chloramphenicol	Disk diffusion	30 µg	28	—	Susceptible
Fusidic acid	Disk diffusion	10 µg	32	—	Susceptible
Trimethoprim-sulfamethoxazole	Disk diffusion	1.25/23.75 µg	26	—	Susceptible
Linezolid	Disk diffusion	10 µg	29	—	Susceptible
Vancomycin	Broth microdilution	—	—	1.25	Susceptible

TABLE 2: Antimicrobial susceptibility profile of Staphylococcus simulans according to the 2025 CA-SFM/EUCAST guidelines

MIC: minimum inhibitory concentration

Based on the antimicrobial susceptibility results, intravenous vancomycin was initiated and continued for six weeks following surgical debridement. Renal function was monitored serially throughout vancomycin therapy and remained stable. The clinical course was favorable, with resolution of fever and progressive healing of the sternal wound. A marked improvement in inflammatory and hematological parameters was observed during follow-up, with substantial decreases in C-reactive protein and procalcitonin levels, although both remained above the reference range at six weeks, together with normalization of the white blood cell count (Table *3*). No clinical or biological evidence of recurrence was observed at the three-month follow-up.

Parameters	At diagnosis	At the six-week follow-up	Reference range
C-reactive protein (mg/L)	120	15	<5
Procalcitonin (ng/mL)	2.85	0.14	<0.05
White blood cells (×10³/mm³)	18	9	4–10
Neutrophils (×10³/mm³)	12	7	1.5–7.5

TABLE 3: Evolution of laboratory parameters after six weeks of treatment

Discussion

Staphylococcus simulans is a coagulase-negative staphylococcus primarily recognized as a zoonotic organism and is frequently associated with livestock [1]. Historically considered an uncommon cause of human infection, *S. simulans* is increasingly recognized as an opportunistic pathogen, partly because of advances in bacterial identification methods, particularly matrix-assisted laser desorption/ionization time-of-flight

(MALDI-TOF) mass spectrometry [1-3]. Human infections attributed to this species include bacteremia, endocarditis, osteoarticular infections, and device-associated infections [1-3]. The present case describes poststernotomy mediastinitis caused by *S. simulans*, an exceptionally reported clinical presentation, and further expands the spectrum of invasive human infections associated with this species.

The microbiological interpretation of coagulase-negative staphylococci remains challenging because these organisms are common members of the skin microbiota and are therefore frequently regarded as contaminants [3]. In the present case, several findings supported true infection rather than contamination: concordant recovery of *S. simulans* in pure culture from both deep intraoperative specimens, direct microscopic examination showing numerous neutrophils and Gram-positive cocci, and consistency with the clinical and radiological findings of poststernotomy mediastinitis. The favorable outcome following surgical debridement combined with targeted antimicrobial therapy further supported the clinical significance of the isolate. This observation highlights that the recovery of a coagulase-negative staphylococcus from a deep specimen should not be dismissed solely on the basis of its classification as a skin commensal; instead, its significance should be assessed by integrating clinical, radiological, sampling, and microbiological findings [3].

Human infections caused by *Staphylococcus simulans* remain uncommon and are predominantly documented through isolated case reports. Published cases encompass a broad range of clinical presentations, including bloodstream infections, endocarditis, osteoarticular infections, urinary tract infections, and infections involving implanted medical devices [1,2,6]. This diversity of infection sites illustrates the ability of *S. simulans* to behave as an opportunistic pathogen and cause invasive disease in humans. In contrast, poststernotomy mediastinitis attributable to S. *simulans* appears to be exceptionally documented in the literature. The present case therefore adds an unusual postoperative deep infection to the reported clinical spectrum of this species.

The development of poststernotomy mediastinitis in this patient was likely multifactorial, involving host-, procedure-, and microorganism-related factors. Diabetes mellitus, chronic kidney disease, and obesity are recognized risk factors for deep sternal wound infection and poststernotomy mediastinitis, as they may adversely affect wound healing and increase susceptibility to postoperative infection [7]. In addition, cardiac surgery involving median sternotomy and the presence of sternal closure material provide conditions that may facilitate bacterial adherence and persistence. Coagulase-negative staphylococci possess several virulence mechanisms relevant to foreign-material-associated infections, particularly adhesion to biomaterials and biofilm formation [8]. These mechanisms may contribute to the persistence of deep postoperative infections. In the present case, the combination of patient-related risk factors, major cardiac surgery, and the ability of CoNS to cause deep postoperative infections likely contributed to the development of mediastinitis.

In the present case, MALDI-TOF mass spectrometry provided rapid species-level identification of the isolate as *Staphylococcus simulans*. This level of identification was particularly relevant because coagulase-negative staphylococci comprise numerous species with differing clinical significance and are often initially regarded as contaminants. MALDI-TOF mass spectrometry has substantially improved the routine identification of bacterial isolates, including accurate discrimination of a wide range of species that may be difficult to identify using conventional phenotypic methods [9]. Nevertheless, species-level identification alone does not establish causality. In our patient, the identification of *S. simulans* became clinically meaningful only when interpreted together with the deep intraoperative origin of the specimens, the inflammatory direct examination, and the concordant clinical and radiological findings. Thus, MALDI-TOF contributed not only to precise taxonomic identification but, when integrated with the overall clinicomicrobiological context, also strengthened the etiological interpretation of the isolate.

Antimicrobial susceptibility testing is essential for guiding the treatment of infections caused by *Staphylococcus simulans*, as resistance patterns among coagulase-negative staphylococci may vary considerably. In the present case, the isolate was methicillin-resistant and also resistant to fluoroquinolones, aminoglycosides, and rifampicin, while remaining susceptible to vancomycin. Current recommendations for post-surgical mediastinitis support the use of vancomycin or daptomycin for infections caused by methicillin-resistant staphylococci, with antimicrobial therapy generally administered for four to six weeks [10]. Accordingly, our patient underwent early surgical debridement followed by six weeks of intravenous vancomycin, resulting in a favorable clinical and biological outcome with no evidence of recurrence at three months. This case underscores the importance of combining adequate surgical source control with susceptibility-guided antimicrobial therapy in the management of deep postoperative infections caused by coagulase-negative staphylococci.

Conclusions

Staphylococcus simulans should be recognized as a potential cause of deep postoperative infection, including poststernotomy mediastinitis. This case emphasizes that the isolation of a coagulase-negative staphylococcus from a deep specimen should not automatically be dismissed as contamination; its clinical significance should be assessed by integrating the sampling context with clinical, radiological, and microbiological findings. Accurate species-level identification and antimicrobial susceptibility testing can

support etiological interpretation and guide targeted antimicrobial therapy, while favorable management of poststernotomy mediastinitis relies on appropriate surgical source control combined with antimicrobial treatment. This case also underscores the importance of antimicrobial stewardship and careful microbiological interpretation of unusual coagulase-negative staphylococci in the postoperative setting.

Additional Information

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: Doha Garrouj

Acquisition, analysis, or interpretation of data: Doha Garrouj, Elmostafa Benaissa, Yassine Ben Lahlou, Mariama Chadli

Drafting of the manuscript: Doha Garrouj

Critical review of the manuscript for important intellectual content: Elmostafa Benaissa, Yassine Ben Lahlou, Mariama Chadli

Supervision: Elmostafa Benaissa

Disclosures

Human subjects: Informed consent for treatment and open access publication was obtained or waived by all participants in this study. **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.

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