Journal of Cardiology Cases 32 (2025) 244–246

Contents lists available at ScienceDirect

Journal of Cardiology Cases

journal homepage: www.elsevier.com/locate/jccase

Case Report

Use of antibiotic loaded absorbable calcium beads in the treatment of infective endocarditis: A case report

Federico Martinelli (MD) *, Silvia Mariani (MD), Enya Di Mascio (MD), Giovanni Marchetto (MD, PhD)

Cardiac Surgery Unit, Cardio-Thoracic and Vascular Department, Fondazione IRCCS San Gerardo dei Tintori, Monza, Italy

ARTICLE INFO

Article history:
Received 5 April 2025
Received in revised form 3 September 2025
Accepted 4 September 2025

Keywords:
Endocarditis
Antibiotic beads
Antibiotic matrix

ABSTRACT

Infective endocarditis in drug-addicted patients is a clinical condition affected by high morbidity and mortality. Valvular lesions are often destructive and can lead to cardiogenic shock for which urgent surgery is necessary before an adequate period of antibiotic therapy. Here we report the case of a 49-year-old man known for drug abuse and referred for urgent surgery due to aortic endocarditis associated with an aortic root abscess. The patient underwent aortic valve replacement. The aortic abscess was excluded using a heterologous pericardial patch after filling with an antimicrobial carrier based on a matrix of calcium sulfate (Stimulan®; Biocomposites Ltd., Keele, UK). The patient had an uneventful postoperative course and recovered well at 6-month follow-up. To our knowledge, this is the first report demonstrating the safety and feasibility of Stimulan® use in the setting of cardiac surgery and infective endocarditis.

Learning objective: Infective endocarditis surgery may benefit from the use of an on-site antibiotic carrier, especially when surgery is urgent, and an extended period of systemic treatment is not feasible. Drawing upon the expertise acquired from orthopedic surgery, the use of a topical antibiotic in a slow-release formulation can be safely deployed at the site of infection, close to a prosthetic aortic valve.

Introduction

The surgical treatment of intravenous drug abuse associated endocarditis requires a concerted clinical effort, as this complex pathology stresses organisms that are already weakened and compromised. The virulence of the involved pathogens often causes destructive lesions to cardiac structures such as abscess and valve perforations, requiring extensive use of prosthetic materials. Critical clinical conditions can require prompt surgical intervention without the time for an adequate antibiotic treatment period. In such cases the risk of reinfection of a recently implanted prosthesis is remarkably high. Stimulan® (Biocomposites Ltd., Keele, UK) is a fully absorbable antimicrobial carrier based on a calcium sulfate matrix and is designed to support the proactive management of dead space and surgical site infections. It can be used as a paste, a bullet, or a bead placed directly into infected and non-infected sites. Its use has been well described in the field of orthopedic surgery [1] based on proven in-vitro efficacy [2]. The use of the Stimulan® is currently approved in 66 nations worldwide, including those of the European Union, United Kingdom, Canada, and Saudi Arabia. Its use in cardiac surgery is novel so that the purpose of this report is to provide a description of our experience and rationale for using this antimicrobial carrier in patients with infective endocarditis.

Case report

A 49-year-old man known for intravenous administration of cocaine and heroin was referred to our emergency department for fever, tachypnea, and mental confusion and was admitted with the diagnosis of septic shock. Antibiotic therapy was promptly started with intravenous piperacillin/tazobactam 4.5 g QID. He was tested positive for human immunodeficiency virus (HIV) and hepatitis C virus (*highly active antiretroviral intake* since 2019), had a previous history of pneumonia due to septic embolization, and history of deep vein thrombosis. His latest blood tests showed a CD4+ lymphocyte count of 464/mm^3 and undetectable HIV-RNA copies. A brain computed tomography (CT) scan showed two recent cerebellar and temporal ischemic lesions. After 48 h from admission, blood cultures tested positive for methicillin-sensitive *Staphylococcus aureus* (MSSA) and antibiotic therapy was modified to oxacillin 12 g/day with daptomycin 700 mg/day. The trans-thoracic echocardiogram showed a severe aortic regurgitation associated with filamentous lesions (from 10 to 15 mm) on the aortic valve. The diagnosis of valvular endocarditis was confirmed by a trans-esophageal echocardiogram. Over the following days, the patient's clinical condition

* Corresponding author at: Cardiac Surgery Unit, Cardio-Thoracic and Vascular Department, IRCCS Fondazione San Gerardo dei Tintori, Via Pergolesi, 33, 20900, Monza, MB, Italy.
E-mail address: federico.martinelli@irccs-sangerardo.it (F. Martinelli).

https://doi.org/10.1016/j.jccase.2025.09.001

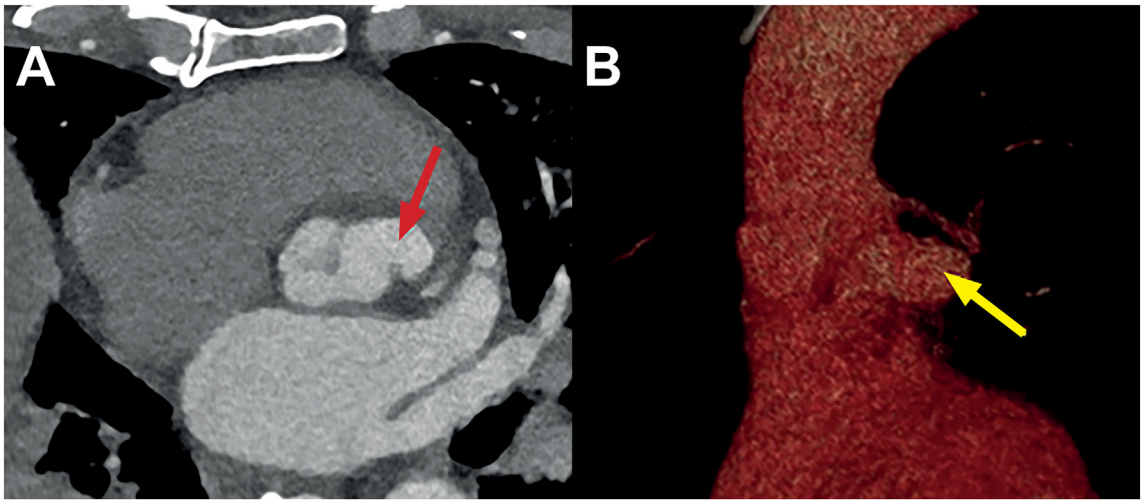

Fig. 1. Pre-operative aortic computed tomography (CT) scan. (A) Red arrow indicates the abscess cavity at the commissure between left and right coronary sinuses. (B) 3D CT scan reconstruction of aortic abscess. Yellow arrow indicates the aortic abscess.

worsened despite targeted antibiotic therapy with disease progression to respiratory failure requiring endotracheal intubation. A further total body CT scan revealed two more brain lesions, renal lesions, and a neocavity close to the left coronary sinus, consistent with an aortic abscess (Fig. 1). The "endocarditis heart-team" discussed the case and decided on an urgent operation after 10 days of antibiotic therapy. Surgery was conducted through a full sternotomy and standard cardiopulmonary bypass. The intraoperative finding confirmed an extensive aortic valve endocarditis with an abscess opened towards the right-left aortic valve commissure. Following a thorough debridement of the infected tissues, a Magna Ease (Edwards Lifesciences, Irvine, CA, USA) aortic biological prosthesis was implanted. The abscess cavity was filled with Stimulan® and excluded using a heterologous pericardial patch.

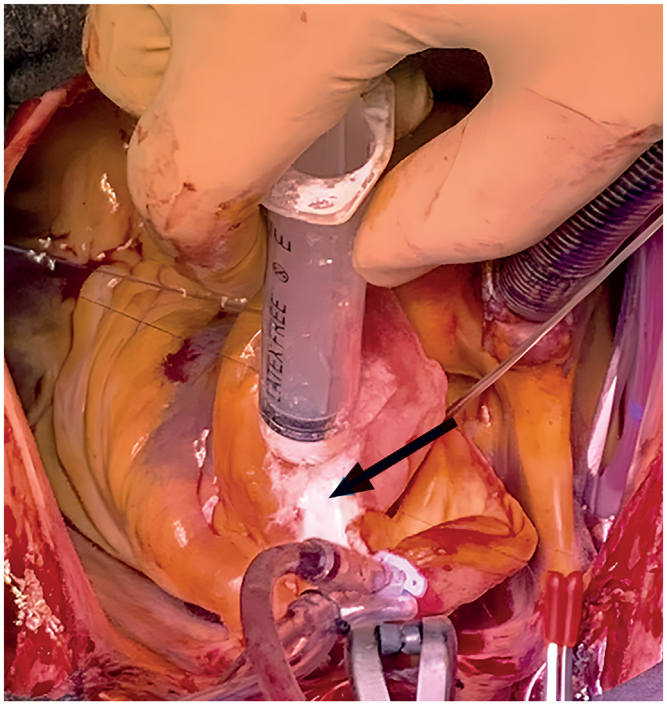

Fig. 2. Intraoperative picture. Black arrow points out the site of injection of antibiotic calcium sulfate matrix into the remnant of abscess cavity.

Briefly, the Stimulan® kit includes the powder and the solution, a mixing bowl of the compounds with a dedicated spatula, and a mat for the beads mold. As per manufacturer's instructions, the calcium matrix can be mixed with three different antibiotics, either in powder or liquid form: vancomycin (powder), tobramycin, or gentamicin (liquid). Based on the antibiogram results, the germ responsible for the infection (MSSA) was sensitive to vancomycin. Thus, 10 cc of Stimulan® paste was mixed to 1000 mg of vancomycin to reach a total volume of roughly 25 cc, forming dozens of beads approximately 5 mm in diameter. The calcium matrix typically takes 3 to 5 min to solidify. We filled the abscess cavity with beads and we used the remnant paste around the pericardial patch (Fig. 2). Some valve samples were sent for microbiological investigations that later resulted to be negative. Total surgery time was 290 min and aortic cross clamp time was 137 min. During the postoperative course, the patient developed hospital-acquired pneumonia so that a

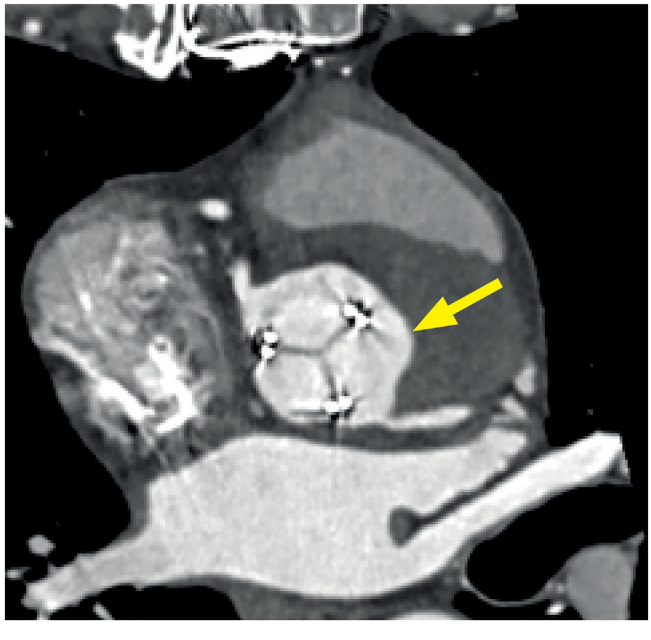

Fig. 3. Follow-up aortic computed tomography scan. Yellow arrow indicates the site of aortic pericardial patch. No residual of calcium matrix next to the patch was detected.

third antibiotic (piperacillin/tazobactam 4.5 g QID) was added to the therapy. There were no further complications during the hospital course and the patient was discharged on postoperative day 34 after 42 days of antibiotic therapy. At six-month follow-up the patient's health conditions were good and there were no signs of infection or heart failure. A thoracic CT scan showed no aortic leakage or any residual aortic root abscess (Fig. 3).

Discussion

The treatment of infective endocarditis in drug-abusers is challenging and requires a unique approach with a multidisciplinary perspective. Specialists have to deal with issues related to both the psychological and behavioral aspects, as well as clinical aspects. From a surgical point of view the greatest concerns relate to the severity of endocarditic lesions due to extremely virulent germs and the high risk of recurrence once patients are discharged. The germs responsible for endocarditic infections in drug-abusers often belong to the staphylococcal strain and therefore exhibit aggressive behavior on cardiac tissues [3]. In addition, the production of a biofilm makes it difficult for systemic antibiotics to reach the target site, especially in case of an abscess [4].

Successful intraoperative use of a topical antibiotic carrier has been reported, especially in orthopedic surgery when dealing with complicated joint or soft-tissue infections [1]. The use of Stimulan® is documented in various studies focused on osteomyelitis [5], joint infections [6], breast prosthetic infections, diabetic foot infections [5], and cranial infections [7]. To date, no reports on Stimulan® use in cardiac surgery are available. In our view, the rationale for using this product in this type of case is based on three considerations. First, due to the history of drug addiction, HIV-positive status, and poor hygiene habits, this patient was highly prone to relapse, especially after discharge. Second, surgery for endocarditis usually involves the use of artificial prostheses or tissues that represent a potentially high-risk site for pathogen growth. Third, in this case, urgent surgery was required due to the patient's extremely critical and worsening condition, making it impossible to provide an adequate period of pre-operative antibiotic therapy [4]. The antimicrobial carrier Stimulan® ensures topical administration of antibiotics for at least 40 days, helping to create a microenvironment that inhibits bacterial replication. According to the manufacturer's specifications, the compound has an intrinsic action against biofilm formation maintaining an antibiotic concentration well above the minimum inhibitory concentration value over time.

The main concern with the use of this product in cardiac surgery may be the potential risk of calcification of the vessel wall as a result of intense tissue reaction. In the event of re-do surgery, parietal calcifications represent an area of fragility to be dealt with. Nevertheless, according to available information, the Stimulan® carrier does not cause third body damage due to its controlled reabsorption formula [8]. Furthermore, the carrier's delivery method, whether in bead or paste form, ensures a precise and circumscribed dosage of the calcium matrix. Although the use of Stimulan® in cardiac surgery has not been previously described, its use in treating soft-tissue infections, especially in patients at high risk of recurrence, is approved. Thus, the use in an extra-vascular cavity as in the current case is not considered as off-label as it would be in the case of endovascular or endocardiac use, and the need for a dedicated ethics committee approval was waived.

During the follow-up examination, the patient showed no signs of heart failure. Additionally, the patient did not report any issues with the chest wound itself, suggesting that the surgical site was healing properly without any apparent complications. The full reabsorption of the calcium matrix was documented by CT scan performed 6 months after surgery.

Our experience comprises a single case and cannot yield definitive conclusions, however, it can be speculated that the use of Stimulan® may be useful in the treatment of extra-vascular abscesses and, more widely, in the treatment of infective endocarditis when a patch repair is indicated, also if the patient is not a drug abuser. Larger case series are required to provide more robust evidence on this application of Stimulan®.

To the best of our knowledge, this case represents the first use of Stimulan® as a topical antimicrobial carrier in cardiac surgery. We found the use of Stimulan® to be easy to manage, the surgical time was not significantly prolonged, and the administration went smoothly. Six months after surgery, the patient experienced no complications at the surgical site and no relapse of the infectious disease.

The use of the antibiotic calcium matrix in endocarditis surgery seems promising as it represents an additional therapeutic tool in the treatment of this challenging clinical condition. However, a thorough evaluation with larger clinical studies and longer follow-up time is needed.

Declaration of competing interest

The authors declare that there is no conflict of interest.

Acknowledgments

None.

Consent statement

Written informed consent was obtained from the patient for publication of this case report, including accompanying images.

References

[1] Mereddy P, Nallamilli SR, Gowda VP, Kasha S, Godey SK, Nallamilli RR, Gprk R, Meda VGR. The use of Stimulan in bone and joint infections. Bone Jt Open 2023;4:516–22. https://doi.org/10.1302/2633-1462.47.BJO-2023-0036.R1.
[2] Fletcher J, Porter R, Boulton Z, Brown L, Knight B, Romanczuk L, Aiken S, Delury C, Michell S. In vitro efficacy of antibiotic loaded calcium sulfate beads (Stimulan rapid cure) against polymicrobial communities and individual bacterial strains derived from diabetic foot infections. J Med Microbiol 2022;71. https://doi.org/10.1099/jmm.0.001517.
[3] Lorson WC, Heidel RE, Shorman MA. Microbial epidemiology of infectious endocarditis in the intravenous drug abuse population: a retrospective study. Infect Dis Ther 2019;8:113–8. https://doi.org/10.1007/s40121-019-0232-7.
[4] Holland TL, Baddour LM, Bayer AS, Hoen B, Miro JM, Fowler VG. Infective endocarditis. Nat Rev Dis Primers 2016;2:16059. https://doi.org/10.1038/nrdp.2016.59.
[5] Qin CH, Zhou CH, Song HJ, Cheng GY, Zhang HA, Fang J, Tao R. Infected bone resection plus adjuvant antibiotic-impregnated calcium sulfate versus infected bone resection alone in the treatment of diabetic forefoot osteomyelitis. BMC Musculoskelet Disord 2019;20:246. https://doi.org/10.1186/s12891-019-2635-8.
[6] Abosala A, Ali M. The use of calcium sulphate beads in periprosthetic joint infection, a systematic review. J Bone Jt Infect 2020;5:43–9. https://doi.org/10.7150/jbji.41743.
[7] Evans AR, Kimmel ME, Kharbat AF, Shakir HJ. Safety and efficacy of antibiotic-impregnated absorbable calcium sulfate beads (Stimulan) in cranioplasty. J Surg Case Rep 2024;2024:rjae468. https://doi.org/10.1093/jscr/rjae468.
[8] Tarar MY, Toe KKZ, Javed K, Shah N, Khalid A. The risk of iatrogenic hypercalcemia in patients undergoing calcium sulphate beads implantation in prosthetic joint surgery: a systematic review. Cureus 2021;13:e18777. https://doi.org/10.7759/cureus.18777.