ASM Case Reports

| Mycology | Case Report

When standard blood cultures are negative: *Sarocladium kiliense* endocarditis and the need to consider rare fungal pathogens

Matteo Faltoni,[1] Luca Mezzadri,[1,2] Nicolò Corti,[1,2] Luca Bisi,[1] Ilaria Giuseppina Chiara Caramma,[1] Irene Maria Sciabica,[3] Anna Prigitano,[4] Luisa Romanò,[4] Annalisa Cavallero,[3] Paolo Bonfanti[1,2]

AUTHOR AFFILIATIONS See affiliation list on p. 7.

ABSTRACT

Background Blood culture-negative endocarditis remains a major clinical challenge with potentially fatal consequences due to diagnostic difficulty and inadequacy of empirical antibiotic treatment.

Case Summary In late 2024, a 75-year-old man underwent aortic and mitral valve replacement with bioprostheses due to methicillin-resistant *Staphylococcus epidermidis* endocarditis. Six months after cardiac surgery, the patient was admitted to the hospital for suspected ischemic stroke, confirmed on brain computed tomography (CT), with fever and a slight increase in inflammatory biomarkers. Transesophageal echocardiography revealed degeneration of the prosthetic aortic valve, with leaflet thickening and a hyperechoic nodular lesion. CT imaging showed bilateral renal emboli and pleural effusion. Repeated blood cultures, serologic testing for *Brucella, Bartonella*, *Legionella*, *Mycoplasma pneumoniae*, and *Coxiella burnetii*, as well as screening for autoimmune disease, were negative. Two weeks later, the patient developed acute right iliac artery occlusion requiring urgent revascularization. Finally, repeated extended-incubation blood cultures and culture of the thrombus yielded *Sarocladium kiliense*, a rare opportunistic filamentous mold, supported by persistently positive serum β-D-glucan. Empirical therapy with liposomal amphotericin B was initiated. Following multidisciplinary discussion, the patient was deemed ineligible for surgery due to clinical deterioration and high operative risk. He was transitioned to palliative care and died shortly thereafter.

Conclusion To date, this represents the third case of endocarditis due to *S. kiliense* reported in the literature. When typical causes of endocarditis and differential diagnoses are excluded, fungal endocarditis should be ruled out with proper microbiological testing, even in immunocompetent patients.

KEYWORDS *Sarocladium kiliense*, blood culture-negative endocarditis, fungal endocarditis

Blood culture-negative endocarditis remains a clinical challenge with potentially fatal consequences due to its diagnostic difficulty and inadequacy of empirical antibiotic treatment.

In this scenario, fungal endocarditis carries high mortality (>50%) (1). Diagnosis of fungal endocarditis may be delayed when routine blood cultures remain negative, particularly if uncommon molds are not considered. *Sarocladium kiliense* is an environmental mold rarely implicated in endocarditis, with few reported cases to guide clinical recognition and management (2, 3). In these patients, close collaboration between

Editor Carey-Ann D. Burnham, Pattern Bioscience, Austin, Texas, USA

Address correspondence to Matteo Faltoni, matteo.faltoni@gmail.com.

The authors declare no conflict of interest.

Received 30 March 2026
Accepted 4 October 2026
Published 27 October 2026

Copyright © 2026 Faltoni et al. This is an open-access article distributed under the terms of the Creative Commons Attribution 4.0 International license.

Downloaded from https://journals.asm.org/journal/asmcr on 04 November 2026 by 2a0e:430:9088:0:e08c:84f0:eab8:58f8.

clinicians and the microbiology laboratory is essential to guide targeted investigations and facilitate timely pathogen identification.

Here, we present an atypical case of fungal endocarditis in an immunocompetent patient with recurrent systemic embolization admitted to our ward.

This case illustrates the diagnostic contribution of embolic specimen culture and prolonged incubation blood cultures when routine investigations are inconclusive.

CASE PRESENTATION

A 75-year-old man with a history of stage III chronic kidney disease, microcytic anemia, hypothyroidism, prior radical prostate cancer surgery (2019) on follow-up, chronic obstructive pulmonary disease, and arterial hypertension was hospitalized in 2024 for cardiac surgery consisting of mitral valve replacement with a mechanical prosthesis and aortic valve repair.

In late 2024, he underwent surgical bioprosthetic aortic valve replacement, redo bioprosthetic mitral valve replacement, and De Vega annuloplasty for methicillin-resistant *Staphylococcus epidermidis* endocarditis. The hospitalization was complicated by concomitant SARS-CoV-2 infection with interstitial pneumonia requiring orotracheal intubation. He was later transitioned to cardiac rehabilitation with gradual clinical recovery.

Approximately 6 months later, the patient was admitted to our hospital for suspected ischemic stroke and fever. Brain computed tomography (CT) showed cortico-subcortical hypodensities consistent with acute ischemia. Blood tests revealed only a slight increase in C-reactive protein. Due to suspicion of endocarditis, empiric antimicrobial therapy with ceftriaxone 2 g/day and daptomycin (10 mg/kg, 850 milligrams/day) was initiated. Transesophageal echocardiography showed severe degeneration of the prosthetic aortic valve, with diffuse leaflet thickening and a hyperechoic nodular lesion on the right coronary cusp (Fig. 1). Chest and abdominal CT scans showed bilateral renal emboli and early pleural effusion.

Repeated standard blood cultures (BACT/ALERT VIRTUO, BioMérieux, France), serologic testing for *Brucella*, *Bartonella*, *Legionella*, *Coxiella burnetii*, and *Mycoplasma pneumoniae*, as well as screening for autoimmune disease, were negative. Oncologic screening work-up was negative; quantitative immunoglobulin levels were within normal limits.

Two weeks later, he developed acute right lower abdominal and groin pain associated with cold extremities. CT angiography revealed complete thrombotic occlusion of the right common iliac artery. Urgent iliac revascularization was performed.

Finally, extended-incubation blood cultures (maintained for up to 360 h) became positive after 139 h of incubation (Fig. 2). Subsequent culture yielded *S. kiliense*. The same organism was also isolated from a thrombus specimen (identified after 9 days). The culture medium used was Sabouraud Genta chloramphenicol 2 (BioMérieux, France). On macroscopic examination, colonies were white to pale gray, with a slightly powdery or velvety aspect, becoming cottony as incubation progressed, with a pale, unpigmented reverse. Microscopically, the isolate showed narrow, hyaline, septate hyphae, predominantly unbranched conidiophores, and slightly tapered phialides bearing clusters of small cylindrical conidia (Fig. 3 and 4).

Definitive identification was achieved using matrix-assisted laser desorption/ionization–time-of-flight mass spectrometry (MALDI-TOF MS) (VITEK MS PRIME, BioMèrieux, France) using the Spectra Processing Library Software. The identification yielded a confidence score of 99.9%, supporting the assignment of the isolate as *S. kiliense*. Following suspicion of a fungal infection, serum β-D-glucan (FUJIFILM Wako Chemicals Europe GmbH, Neuss, Germany; cut-off value ≤11 pg/mL) was requested and tested positive in two separate samples (respectively, 227.5 and 127.9 pg/mL); serum galactomannan (VirClia MonoTest, Granada, Spain; cut-off value <0.16) was negative. Antibiotic therapy was discontinued, and empiric antifungal therapy with liposomal amphotericin B (approximately 5 mg/kg, 500 mg/day) was initiated. A broth microdilution assay for

Downloaded from https://journals.asm.org/journal/asmcr on 04 November 2026 by 2a0e:430:9088:0:e08c:84f0:eab8:58f8.

Downloaded from https://journals.asm.org/journal/asmcr on 04 November 2026 by 2a0e:430:9088:0:e08c:84f0:eab8:58f8.

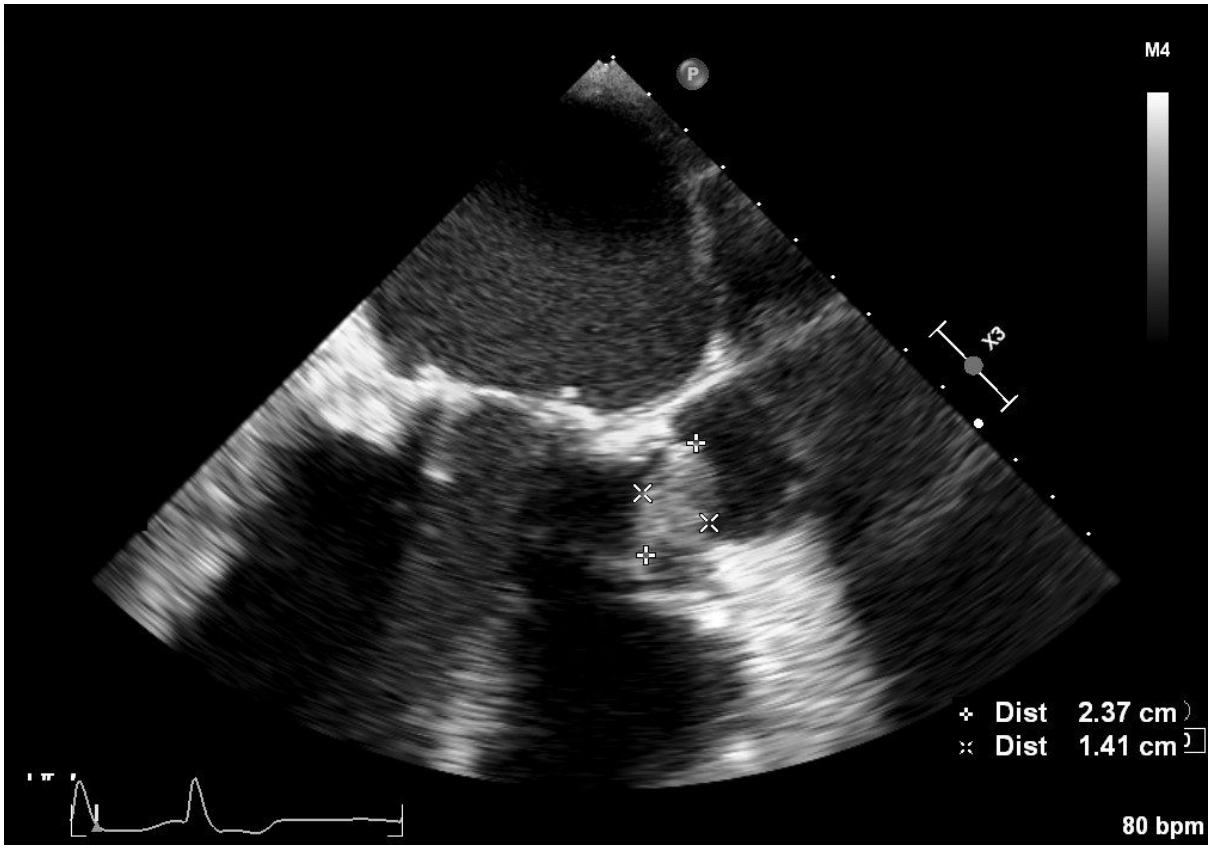


FIG 1 Aortic vegetation on the right coronary cusp.

antifungal susceptibility was performed according to EUCAST methodology (4) (Table 1). After multidisciplinary discussion with the endocarditis surgery team, the patient was deemed ineligible for an elective surgical procedure due to multiple comorbidities, high operative risk, and poor prognosis. Antifungal therapy was discontinued, and the patient was transitioned to palliative care and died shortly thereafter.

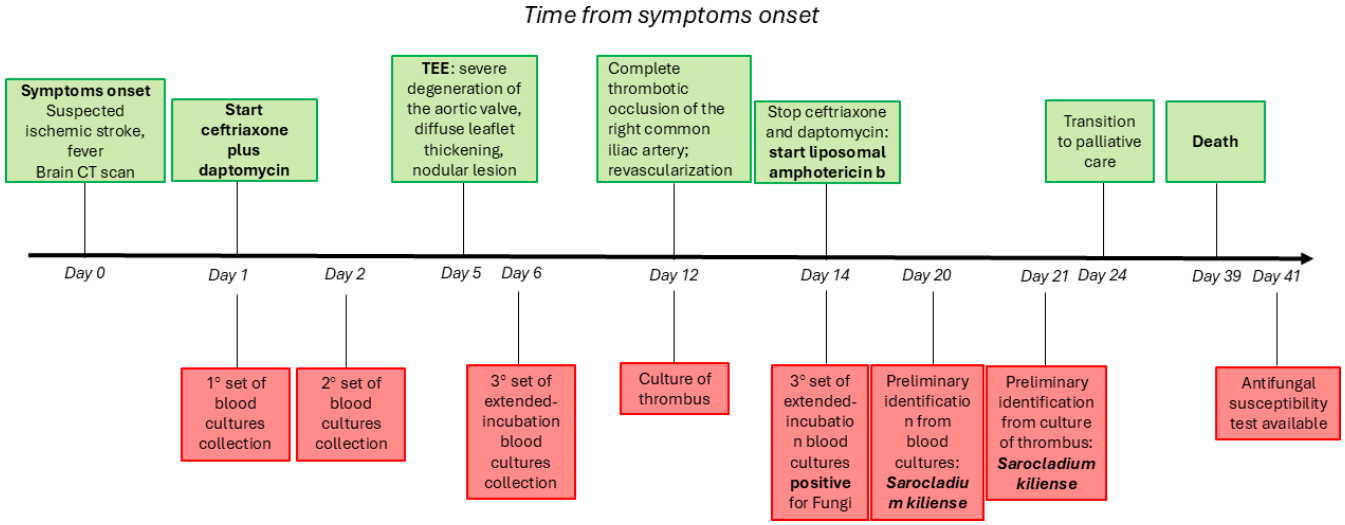


FIG 2 Timeline of clinical course, therapeutics, and diagnostic strategy of the patient.

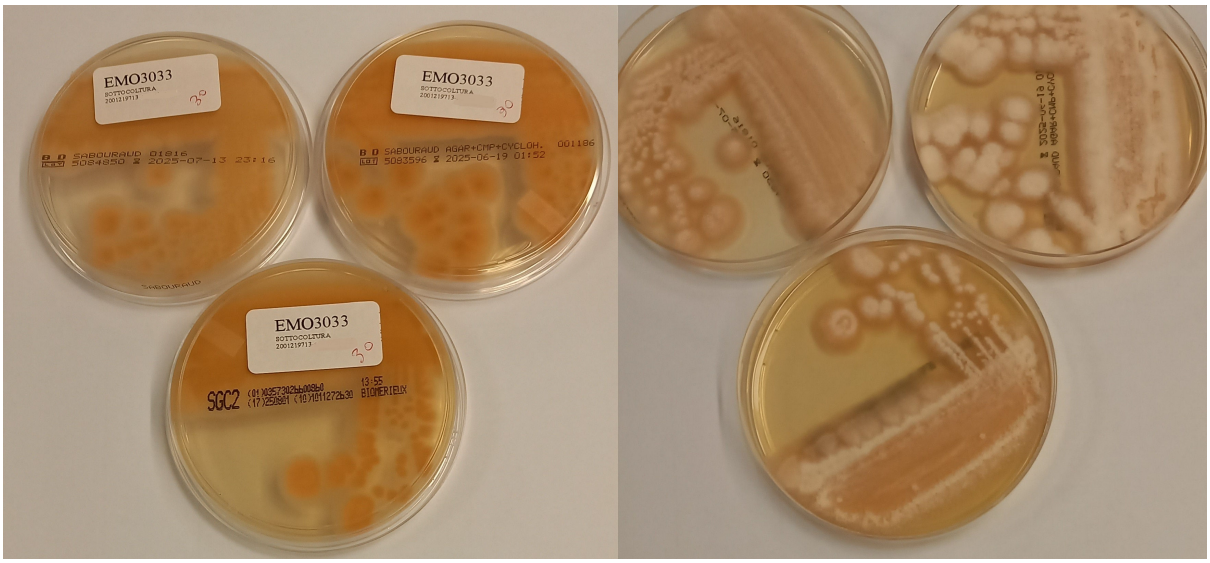


FIG 3 *Sarocladium kiliense* colonies isolated from blood cultures on culture medium (Sabouraud Genta chloramphenicol 2).

DISCUSSION

To our knowledge, this is the third reported case of infective endocarditis (IE) due to *Sarocladium/Acremonium kiliense* in the literature and the second one involving a prosthetic valve (2, 3). Only four additional cases of IE involving other *Acremonium* species have been described (5–9), highlighting the rarity of this pathogen and the related diagnostic challenges.

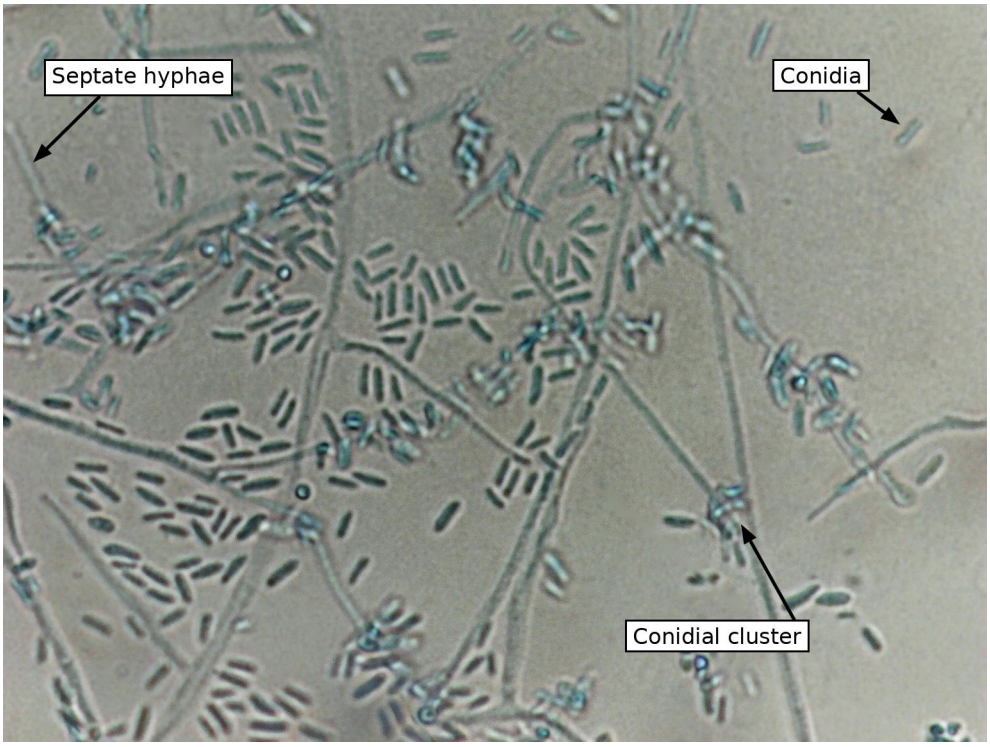


FIG 4 Microscopic features of *S. kiliense* at 40× magnification. Lactophenol blue staining was used for this preparation, highlighting the septate hyphae of the fungus and the conidia, which tend to form clusters with a characteristic arrangement.

Downloaded from https://journals.asm.org/journal/asmcr on 04 November 2026 by 2a0e:430:9088:0:e08c:84f0:eab8:58f8.

TABLE 1 Minimum inhibitory concentrations of the antifungal agents tested for *Sarocladium kiliense*

Antifungal tested	MIC (mg/L)
Amphotericin B	8
Itraconazole	>16
Isavuconazole	4
Posaconazole	2
Voriconazole	1

Downloaded from https://journals.asm.org/journal/asmcr on 04 November 2026 by 2a0e:430:9088:0:e08c:84f0:eab8:58f8.

S. kiliense was previously classified as *Acremonium kiliense*. Following phylogenetic and taxonomic revisions based on molecular studies, several species formerly included within the heterogeneous genus *Acremonium* were reassigned to the genus *Sarocladium*, including *A. kiliense* (10, 11).

Within the *Acremonium/Sarocladium* complex, *S. kiliense* is one of the most frequently reported species involved in human disease. It is ubiquitous, commonly isolated from water, soil, plants, and other environmental reservoirs (12). Morphologically, it displays lightly pigmented, septate hyphae and, similarly to other more common species (e.g., *Fusarium*), it may undergo adventitious sporulation *in vivo*, which may account for the higher frequency of recovery in blood cultures compared to other rare fungi (13).

At our center, routine incubation time is set at 5 days for bloodstream infections. All positive blood cultures are routinely plated on chocolate agar solid medium, with adjunctive agar media implemented according to Gram-stain results. Under the same standardized protocol, in cases of suspected endocarditis, incubation might be extended to 15 days, a time span predefined to allow the detection of slowly growing hyphomycetes. Although *S. kiliense* can grow on standard selective media for fungi, its identification remains extremely challenging. Cultivated *S. kiliense* typically forms white and cottony colonies on agar plates, which are characteristic but not exclusive to *S. kiliense* (14). Definitive identification generally relies on MALDI-TOF MS; nonetheless, reference databases may still be incomplete for rare molds, limiting accuracy and accountability. When results are either inconclusive or unavailable, sequencing of the fungal nuclear ribosomal DNA—particularly the internal transcribed spacer region, the primary fungal barcode, and the 18S rRNA gene—provides the most reliable method for identification and taxonomic classification. However, advanced methods such as MALDI-TOF MS and molecular sequencing are not widely available and depend on specialized resources and expertise. In our case, the fungal isolate was not sequenced, as it is not routinely available at our center.

In our case, the patient presented with clinical and radiological findings suggestive of IE; however, repeated standard blood cultures were negative. A definitive diagnosis was established only 14 days after presentation and required extended microbiological investigations.

Positive blood cultures remain a cornerstone of IE diagnosis. However, blood cultures remain negative in up to 30% of cases, most commonly due to prior antibiotic exposure or infection with fastidious or nonculturable organisms (15).

In prosthetic valve endocarditis with negative blood cultures, fungal pathogens are reported more frequently than in other settings, accounting for up to 16% of cases in some series (16). Among fungi, *Candida* and *Aspergillus* species are the most commonly reported pathogens (17), whereas endocarditis due to uncommon molds, including *Sarocladium*, remains exceedingly rare and is largely documented through isolated case reports and small case series (18). Diagnosis of mold endocarditis is particularly challenging, as blood cultures have a very low diagnostic yield, likely owing to transient or absent fungemia (19).

Seven cases of endocarditis due to *Acremonium/Sarocladium*, involving both native and prosthetic valves, were identified in the literature and are summarized in Table 2. These findings are consistent with the broader literature on fungal endocarditis, where major risk factors include prosthetic valves, intracardiac devices, recent cardiac surgery,

TABLE 2 Reported cases of infective endocarditis due to *Acremonium/Sarocladium* species

Reference	Country	Year	Valve type	Species	Predisposing factors	Microbiological source	Antifungal therapy	Surgery	Outcome
Degeorges et al. (8)	France	1971	Not available	Not available	Aortic stenosis	Not available	Amphotericin B	Not available	Died
Lacaz et al. (2)	Brazil	1981	Bioprosthetic valve made of homologous dura mater	*A. kiliense*	Prosthetic valve	Prosthetic valve culture	Amphotericin B + flucytosine	Yes	Died
Heitmann et al. (6)	Switzerland	1997	Pacemaker-related endocarditis	*Acremonium* spp.	Steroid use; pacemaker	Blood culture growth	Amphotericin B → voriconazole	Yes	Alive and no recurrence at 2 years
Guarro et al. (5)	Spain	2008	Prosthetic mitral valve	*Acremonium strictum*	Mitral stenosis	Thrombus culture	Caspofungin → voriconazole	Yes	Died
Panzaru et al. (7)	Romania	2014	Pulmonary valve	*Acremonium* spp.	Pneumonia and chronic heart failure	Blood culture growth	Fluconazole	No	Died
Nasir et al. (9)	Pakistan	2018	Ventricular septal defect patch	*Acremonium* spp.	Tetralogy of Fallot	Blood culture growth	Amphotericin B → voriconazole	Yes	Alive and no recurrence at 1 year
Kitamura et al. (3)	Japan	2022	Basal interventricular septum	*Sarocladium kiliense*	Aplastic anemia	Autopsy finding with molecular assay	Voriconazole	No	Died

prolonged intravascular catheterization, intravenous drug use, and immunosuppression (https://www.zotero.org/google-docs/?9FS3rp) (18–20).

Biofilm formation is a key fungal virulence mechanism on prosthetic material (21). Although the source of acquisition cannot be definitively established, perioperative contamination cannot be excluded. Similar mechanisms have been described for other healthcare-associated pathogens such as *Mycobacterium chimaera* or *Candida parapsilosis*, where surgical device or operating room contamination has caused delayed-onset prosthetic infection after cardiac surgery (22, 23). An analogous, unproven pathway may be hypothesized in our case.

In this patient, persistent negative blood cultures in the presence of predisposing factors raised concern for an uncommon pathogen.

Following an initial workup according to guidelines for blood culture-negative endocarditis (1, 15), prolonged incubation of blood culture and use of fungal-specific media were requested, leading to pathogen identification.

Notably, evidence for this practice is nuanced: modern continuous-monitoring systems generally detect *Candida spp*. within 5 days, and one retrospective cohort study found no additional yield from extending incubation to 15 days for *Candida spp.* (24). Nonetheless, our case suggests that slow-growing, low-inoculum isolates may benefit from individualized, clinically driven extension and close microbiology laboratory communication.

Persistently positive β-D-glucan in our patient supported the suspicion of fungal infection. Experimental models evaluating *Acremonium* species have assessed β-D-glucan as a marker of invasive infection, demonstrating detectable serum levels even with low inocula and higher values for *S. kiliense* compared with other species (25). In some reports, negative fungal markers led to discontinuation of empirical antifungal therapy, with *Sarocladium* diagnosis established only post-mortem (4). β-D-glucan is a non-specific fungal biomarker for invasive fungal infections; however, its diagnostic performance is limited by suboptimal specificity, which varies considerably across patient populations, clinical settings, and assay platforms. False-positive results have occurred in patients receiving certain blood products, undergoing hemodialysis with cellulose-containing membranes, or exposed to specific antibiotics and surgical materials (26). Therefore,

Downloaded from https://journals.asm.org/journal/asmcr on 04 November 2026 by 2a0e:430:9088:0:e08c:84f0:eab8:58f8.

fungal biomarkers should be considered adjunctive tools and must not replace culture-based investigations when fungal endocarditis is suspected.

Importantly, the culture of the retrieved thrombus increased the diagnostic yield and was instrumental in establishing a definitive diagnosis. According to the 2023 Duke Criteria (27), identification of a microorganism in the setting of active endocarditis from an arterial embolus constitutes a pathological criterion for definitive endocarditis. In our case, definitive microbiological confirmation relied on culture-based methods, highlighting the diagnostic value of traditional fungal culture even in the era of advanced techniques.

In terms of treatment, *in vitro* susceptibility data are limited and heterogeneous. There are currently no breakpoints for *S. kiliense*. Fluconazole, itraconazole, echinocandins, and often amphotericin B show poor activity, whereas voriconazole appears to have the most consistent *in vitro* efficacy (11). In our case, the susceptibility profile was consistent with previously reported data. Unfortunately, definitive source control through repeat valve surgery was not feasible. As surgical intervention is often crucial in fungal endocarditis due to its high mortality (18), the absence of source control likely contributed to the fatal outcome. In conclusion, when typical causes of endocarditis and differential diagnoses are excluded, fungal endocarditis should be ruled out with proper microbiological testing, even in immunocompetent patients.

ACKNOWLEDGMENTS

This research received no external funding.

Matteo Faltoni: conceptualization, writing original draft, review, and editing. Luca Mezzadri: literature review, writing, review, and editing. Nicolò Corti: writing, review, and editing. Luca Bisi and Ilaria Giuseppina Chiara Caramma: patient care. Irene Maria Sciabica, Annalisa Cavallero, Anna Prigitano, and Luisa Romano: laboratory analysis and review. Paolo Bonfanti: supervision and review.

AUTHOR AFFILIATIONS

[1]Fondazione IRCCS San Gerardo dei Tintori, Infectious Diseases, Monza, Italy
[2]School of Medicine and Surgery, University of Milano-Bicocca, Milan, Italy
[3]Fondazione IRCCS San Gerardo dei Tintori, Microbiology Unit - Monza, Monza, Italy
[4]Department of Biomedical Sciences for Health, Università degli Studi di Milano, Milano, Italy

AUTHOR ORCIDs

Matteo Faltoni http://orcid.org/0009-0007-8794-984X

AUTHOR CONTRIBUTIONS

Matteo Faltoni, Conceptualization, Data curation, Investigation, Resources, Validation, Writing – original draft, Writing – review and editing | Luca Mezzadri, Data curation, Resources, Validation, Writing – original draft, Writing – review and editing | Nicolò Corti, Validation, Writing – original draft, Writing – review and editing | Luca Bisi, Investigation, Validation | Ilaria Giuseppina Chiara Caramma, Investigation, Validation | Irene Maria Sciabica, Methodology, Resources, Validation | Anna Prigitano, Methodology, Validation | Luisa Romanò, Methodology, Validation | Annalisa Cavallero, Methodology, Validation | Paolo Bonfanti, Supervision, Validation, Writing – review and editing

DATA AVAILABILITY

All relevant data supporting these findings are included in the article. Additional details can be provided by the corresponding author upon reasonable request.

Downloaded from https://journals.asm.org/journal/asmcr on 04 November 2026 by 2a0e:430:9088:0:e08c:84f0:eab8:58f8.

ETHICS APPROVAL

This study was conducted in accordance with institutional and ethical guidelines. As a publicly recognized research hospital (Istituto di Ricovero e Cura a Carattere Scientifico, IRCCS), Fondazione IRCCS San Gerardo obtains general research consent from all patients upon admission.

REFERENCES

1. Delgado V, Ajmone Marsan N, de Waha S, Bonaros N, Brida M, Burri H, Caselli S, Doenst T, Ederhy S, Erba PA, et al. 2023. 2023 ESC guidelines for the management of endocarditis. Eur Heart J 44:3948–4042. https://doi.org/10.1093/eurheartj/ehad193
2. Lacaz C da S, Porto E, Carneiro JJ, Pazianni IO, Pimenta WP. 1981. Endocarditis in dura mater prosthesis caused by *Acremonium kiliense*. Rev Inst Med Trop Sao Paulo 23:274–279.
3. Kitamura H, Kubota Y, Tomimasu R, Akashi M, Mori T, Mine Y, Ando J, Yamagata Murayama S, Kimura S, Miyahara M. 2022. Non-valvular infective endocarditis caused by *Sarocladium kiliense* in an immunocompromised patient with aplastic anemia. Intern Med 61:1279–1283. https://doi.org/10.2169/internalmedicine.7536-21
4. Arendrup MC, Guinea J, Cuenca-Estrella M, Meletiadis J, Mouton JW, Lagrou K, Howard SJ. 2015. EUCAST definitive document E.DEF 9.3: method for the determination of broth dilution minimum inhibitory concentrations of antifungal agents for conidia forming moulds. EUCAST
5. Guarro J, del Palacio A, Gené J, Cano J, González CG. 2009. A case of colonization of a prosthetic mitral valve by *Acremonium strictum*. Revista Iberoamericana de Micología 26:146–148. https://doi.org/10.1016/S1130-1406(09)70025-7
6. Heitmann L, Cometta A, Hurni M, Aebischer N, Tschan-Schild I, Bille J. 1997. Right-sided pacemaker-related endocarditis due to *Acremonium* species. Clin Infect Dis 25:158–160. https://doi.org/10.1086/516892
7. Pânzaru C, Dan M, Balasanian MO, Coadă G, Tinică G, Dabija ER. 2014. Subacute fungal endocarditis due to *Acremonium* spp: a case study and review of the literature. Rev Med Chir Soc Med Nat Iasi 118:182–185.
8. Degeorges M, Heintz C, Valty J, Drouhet E, Acar JF, Leduc G. 1971. Infectious endocarditis due to *Listeria monocytogenes* and *Cephalosporium*. Presse Med 79:1377–1380.
9. Nasir N, Jabeen K, Farooqi J, Sultan BA, Zafar A, Khan AH, Amanullah M, Ali F. 2018. Infection of a ventricular septal defect patch with *Acremonium* species. Case Rep Infect Dis 2018:3057463. https://doi.org/10.1155/2018/3057463
10. Summerbell RC, Gueidan C, Schroers H-J, de Hoog GS, Starink M, Rosete YA, Guarro J, Scott JA. 2011. *Acremonium* phylogenetic overview and revision of gliomastix, sarocladium, and trichothecium. Stud Mycol 68:139–162. https://doi.org/10.3114/sim.2011.68.06
11. Pérez-Cantero A, Guarro J. 2020. Sarocladium and *Acremonium* infections: New faces of an old opportunistic fungus. Mycoses 63:1203–1214. https://doi.org/10.1111/myc.13169
12. Das S, Saha R, Dar SA, Ramachandran VG. 2010. *Acremonium* species: a review of the etiological agents of emerging hyalohyphomycosis. Mycopathologia 170:361–375. https://doi.org/10.1007/s11046-010-9334-1
13. Liu K, Howell DN, Perfect JR, Schell WA. 1998. Morphologic criteria for the preliminary identification of *Fusarium, Paecilomyces*, and *Acremonium* species by histopathology. Am J Clin Pathol 109:45–54. https://doi.org/10.1093/ajcp/109.1.45
14. Júnior MC, de Moraes Arantes A, Silva HM, Costa CR, Silva M do RR. 2013. *Acremonium kiliense*: case report and review of published studies. Mycopathologia 176:417–421. https://doi.org/10.1007/s11046-013-9700-x
15. DeSimone DC, Garrigos ZE, Marx GE, Tattevin P, Hasse B, McCormick DW, Hannan MM, Zuhlke LJ, Radke CS, Baddour LM. 2025. Blood culture–negative endocarditis: a scientific statement from the American heart association. JAHA 14:e040218. https://doi.org/10.1161/JAHA.124.040218
16. Thuny F, Fournier P-E, Casalta J-P, Gouriet F, Lepidi H, Riberi A, Collart F, Habib G, Raoult D. 2010. Investigation of blood culture-negative early prosthetic valve endocarditis reveals high prevalence of fungi. Heart 96:743–747. https://doi.org/10.1136/hrt.2009.181594
17. Mezzadri L, Caramma IGC, Sciabica IM, Migliorino GM, Cavallero A, Marchetto G, Lapadula G, Bonfanti P. 2025. *Aspergillus* endocarditis: a rare but serious complication during treatment with ibrutinib. Case Rep Infect Dis 2025:6863015. https://doi.org/10.1155/crdi/6863015
18. Thompson GR 3rd, Jenks JD, Baddley JW, Lewis JS 2nd, Egger M, Schwartz IS, Boyer J, Patterson TF, Chen SC-A, Pappas PG, Hoenigl M. 2023. Fungal endocarditis: pathophysiology, epidemiology, clinical presentation, diagnosis, and management. Clin Microbiol Rev 36:e0001923. https://doi.org/10.1128/cmr.00019-23
19. Akritidou O, Peristeri A-M, Lymperatou D, Prokopidou A, Christaki E, Nikopoulou A. 2025. A review of current insights in fungal endocarditis. J Clin Med 14:6149. https://doi.org/10.3390/jcm14176149
20. Fidanzati A, Scheggi V, Papi M, Stefàno PL. 2025. Fungal endocarditis. A retrospective analysis from a high-volume surgical centre and review of the literature. BMC Infect Dis 25:1479. https://doi.org/10.1186/s12879-025-11801-w
21. Ramage G, Kean R, Rautemaa-Richardson R, Williams C, Lopez-Ribot JL. 2025. Fungal biofilms in human health and disease. Nat Rev Microbiol 23:355–370. https://doi.org/10.1038/s41579-025-01147-0
22. van Ingen J, Kohl TA, Kranzer K, Hasse B, Keller PM, Katarzyna Szafrańska A, Hillemann D, Chand M, Schreiber PW, Sommerstein R, et al. 2017. Global outbreak of severe *Mycobacterium chimaera* disease after cardiac surgery: a molecular epidemiological study. Lancet Infect Dis 17:1033–1041. https://doi.org/10.1016/S1473-3099(17)30324-9
23. Diekema DJ, Messer SA, Hollis RJ, Wenzel RP, Pfaller MA. 1997. An outbreak of *Candida parapsilosis* prosthetic valve endocarditis. Diagn Microbiol Infect Dis 29:147–153. https://doi.org/10.1016/s0732-8893(97)81804-4
24. Fihman V, Faury H, Moussafeur A, Huguet R, Galy A, Gallien S, Lim P, Lepeule R, Woerther P-L. 2021. Blood cultures for the diagnosis of infective endocarditis: what is the benefit of prolonged incubation? J Clin Med 10:5824. https://doi.org/10.3390/jcm10245824
25. Fernández-Silva F, Capilla J, Mayayo E, Sutton D, Guarro J. 2014. Experimental murine acremoniosis: an emerging opportunistic human infection. Med Mycol 52:29–35. https://doi.org/10.3109/13693786.2013.797610
26. Theel ES, Doern CD. 2013. β-D-glucan testing is important for diagnosis of invasive fungal infections. J Clin Microbiol 51:3478–3483. https://doi.org/10.1128/JCM.01737-13
27. Fowler VG, Durack DT, Selton-Suty C, Athan E, Bayer AS, Chamis AL, Dahl A, DiBernardo L, Durante-Mangoni E, Duval X, Fortes CQ, Fosbøl E, Hannan MM, Hasse B, Hoen B, Karchmer AW, Mestres CA, Petti CA, Pizzi MN, Preston SD, Roque A, Vandenesch F, van der Meer JTM, van der Vaart TW, Miro JM. 2023. The 2023 Duke-International Society for Cardiovascular Infectious Diseases criteria for infective endocarditis: updating the Modified Duke Criteria. Clin Infect Dis 77:518–526. https://doi.org/10.1093/cid/ciad271

Downloaded from https://journals.asm.org/journal/asmcr on 04 November 2026 by 2a0e:430:9088:0:e08c:84f0:eab8:58f8.