ESC European Society of Cardiology

European Heart Journal - Case Reports (2023) **7**, 1–4
https://doi.org/10.1093/ehjcr/ytad235

CASE REPORT
Cardiovascular imaging

Refractory left atrial mural endocarditis secondary to a mitral valve jet lesion requiring thoracotomy: a case report

Mikiko Nakahara Matsumura [1]*, Kohei Horiuchi[2], Keitaro Domae[3], and Yoshiharu Higuchi[1]

[1]Department of Cardiovascular Medicine, Osaka Police Hospital, 10-31 Kitayamacho, Tennoji-ku, Osaka 543-0035, Japan; [2]Cardiovascular Division, National Hospital Organization Osaka National Hospital, 2-1-14 Hoenzaka, Chuo-ku, Osaka 540-0006, Japan; and [3]Department of Cardiovascular Surgery, Osaka Police Hospital, 10-31 Kitayamacho, Tennoji-ku, Osaka, Osaka 543-0035, Japan

Received 23 September 2022; first decision 2 November 2022; accepted 4 May 2023; online publish-ahead-of-print 9 May 2023

Background Infective endocarditis (IE) lesions rarely exist only in the endocardium, except on the valves. Such lesions are usually treated with the same strategy used to treat valvular IE. Depending on the causative organisms and degree of intracardiac structure destruction, it might be cured with conservative treatment consisting of antibiotics alone.

Case summary A 38-year-old woman had a continuous high fever. Echocardiography revealed a vegetation located on the endocardial side of the posterior wall of the left atrium, from the valve ring on the side of the posteromedial scallop, which was exposed to a mitral regurgitation jet. Mural endocarditis caused by methicillin-sensitive *Staphylococcus aureus* (MSSA) was diagnosed based on blood cultures. Splenic infarction developed despite various types of appropriate antibiotics. The vegetations increased in size over time to >10 mm. The patient underwent surgical resection and had an uneventful post-operative course. There was no evidence of exacerbation or recurrence during the post-operative outpatient follow-up visits.

Discussion Even in cases of isolated mural endocarditis, infections caused by MSSA that are resistant to multiple antibiotics can be challenging to manage with antibiotics alone. Specifically, for cases of MSSA IE that show resistance to various antibiotics, early consideration should be given to surgical intervention as part of the treatment process.

Keywords Infective endocarditis • Methicillin-sensitive *Staphylococcus aureus* • Isolated mural endocarditis • Case report

ESC Curriculum 2.2 Echocardiography • 2.1 Imaging modalities • 4.11 Endocarditis

Learning points

- Mitral regurgitation caused isolated left atrial mural endocarditis.
- Some cases of isolated infective mural endocarditis due to methicillin-sensitive *Staphylococcus aureus* (MSSA) require surgical treatment.
- Infective endocarditis caused by antibiotic-resistant MSSA can result in persistent vegetations and embolic episodes; it requires early surgical intervention.

* Corresponding author. Tel: +81-06-6771-6051, Email: mikkori1025@gmail.com
Handling Editor: Christoph Sinning
Peer-reviewers: Maria Concetta Pastore; Gavin Lewis; Carla Sousa
Compliance Editor: Abdelsalam Bensaaud
Supplementary Material Editor: Abdullah Abdullah
© The Author(s) 2023. Published by Oxford University Press on behalf of the European Society of Cardiology.
This is an Open Access article distributed under the terms of the Creative Commons Attribution-NonCommercial License (https://creativecommons.org/licenses/by-nc/4.0/), which permits non-commercial re-use, distribution, and reproduction in any medium, provided the original work is properly cited. For commercial re-use, please contact journals.permissions@oup.com

Introduction

Infective endocarditis (IE) is a serious condition associated with high mortality rates, with valve lesions being the most common site of infection.[1] Lesions (i.e. vegetations) are rarely located in non-valvular areas of the endocardium.[2] In general, non-valvular infections of the cardiovascular system are secondary; they occur in the previously damaged endocardium or vascular intima and are usually associated with cardiac structural abnormalities or intravascular devices.[3] This case report describes a rare presentation of isolated left atrial wall endocarditis without involving the mitral valve due to eccentric mitral regurgitation (MR). The decision to perform surgery is challenging, as some cases may be cured with conservative treatment while others require surgical intervention.[4,5] In this case, surgical treatment was deemed necessary due to resistance to antibiotics.

Timeline

Time	Event
Day 1	The patient presented with continuous high fever, fatigue upon minimal exertion, thrombocytopaenia, and a high C-reactive protein level.
Day 6	Intravenous ceftriaxone (2 g/day) was started.
Day 7	*Staphylococcus aureus* was detected in serial blood cultures (two sets). The patient underwent contrast-enhanced computed tomography and magnetic resonance imaging of the head. These examinations showed multiple areas of low density in the spleen and hyperintense signals in the parietal lobe on diffusion-weighted imaging.
Day 10	Transthoracic echocardiography (TTE) detected a vegetation on the endocardial side of the posterior wall of the left atrium (LA), sticking like a broad stem from the valve ring on the side of the medial scallop of the posterior leaflet of the mitral valve. Changed to ampicillin/sulbactam (12 g/day). In addition, anticoagulant therapy with heparin was started.
Day 13	Transoesophageal echocardiography revealed the vegetation was attached to the posterior wall of the LA where the mitral regurgitation jet was directly blowing.
Day 14	Added rifampicin (600 mg/day), trimethoprim/sulfamethoxazole (4 cups/day), daptomycin (350 mg/day), and clindamycin (1800 mg/day).
Day 26	TTE showed that the vegetation had expanded to >10 mm and was more mobile.
Day 31	Open-heart surgery consisting of surgical excision of an abscess and mitral annuloplasty was performed.
Day 46	The patient was discharged ambulatory without any medication.

Case presentation

A 38-year-old Japanese woman complained of continuous high fever, chills, and muscular pain on minimal exertion for 5 days. Blood tests revealed a platelet count of 27 000/μL (normal range: 150 000–450 000/μL) and a C-reactive protein level of 159.1 mg/L (0–5 mg/L). She had a history of dental infection treated with antibiotics 3 months prior, but no teeth were extracted. She denied tobacco, alcohol, or intravenous (i.v.) drug abuse. Her vital signs were within the normal range except for the high fever, and she showed no vascular or immunological phenomena. Her heart exam on admission revealed normal S1 and S2, with an apical systolic regurgitant murmur. On admission, ceftriaxone was initiated at a dosage of 2 g/day for 4 days, and two sets of blood cultures showed *Staphylococcus aureus* growth after 2 days. Contrast-enhanced computed tomography (CT) and magnetic resonance imaging (MRI) of the head showed multiple low-density areas in the spleen and a hyperintense signal in the parietal lobe on diffusion-weighted imaging. Transthoracic echocardiography (TTE) revealed an abnormal structure located posterior to the medial side of the left atrium (LA) (*Figure 1*). Furthermore, we confirmed moderate MR and abnormal structures in the posterior wall of the medial LA with transoesophageal echocardiography (TEE) (*Figure 2*). The anterior mitral leaflet (AML) was large, with thickening of the A2 extremity and pseudoprolapse. Transoesophageal echocardiography showed that the vegetation was attached to the posterior wall of the LA where the MR jet was directly blowing, sticking out like a broad stem from the mitral annulus on the side of the medial scallop of the posterior leaflet. Thus, we made a definitive diagnosis of IE using the Duke criteria. Since there was a slight possibility that the abnormal structure in the LA was a thrombus, we administered unfractionated heparin as antithrombotic therapy simultaneously with i.v. ampicillin/sulbactam (12 g/day for 5 days). However, her fever persisted and the inflammatory response tended to get worse. Consequently, the patient was prescribed oral rifampicin (600 mg/day) and trimethoprim/sulfamethoxazole (four tablets/day) and i.v. daptomycin (350 mg/day) and clindamycin (1800 mg/day). Transthoracic echocardiography during follow-up after 17 days of treatment showed a tendency for the vegetation to expand and become more mobile as the inflammatory response worsened. Thrombus was ruled out because it did not shrink despite appropriate anticoagulant therapy. The patient had already experienced embolic episodes when the vegetation had expanded to >10 mm. Although she had no symptoms of heart failure and MR was not too severe, we decided to surgically remove the infected tissues and repair the mitral valve on the 26th day of hospitalization. No vegetations were attached to the mitral valve leaflets themselves (*Figure 3*). Since A3 deviation and a cleft were observed, regurgitation was caused by improper coaptation of the leaflets. After debridement of the vegetation on the posterior wall of the LA, valve repair was performed. An annuloplasty ring (Physio II, 30 mm) was sewn to the mitral valve ring, resulting in a marked reduction in regurgitation. The removed vegetation was not referred to pathology or microbiology examination due to insufficient amount collected. Fever or clinical worsening was not observed after the operation. Follow-up TTE showed a well-functioning mitral valve, mild MR, and good systolic dysfunction. The patient was discharged in an ambulatory condition without the need for any medication on the 41st day of hospitalization. During a 1-year follow-up period after discharge, she did not have any relapses.

Discussion

Mural endocarditis secondary to jet lesions is very rare and can easily be missed.[2] High-velocity intracardiac jets can lead to endothelial injury and mural endocarditis via multiple mechanisms.[3] Prompt diagnosis and treatment with proper intervention might reduce endocardial damage and maintain the structural integrity of the valve. In our patient, a vegetation was found on the posterior wall of the LA, the area where the regurgitant jet made contact. The differential diagnosis for an anomalous structure on the wall of the LA includes IE, thrombus, primary cardiac tumour such as myxoma, and secondary cardiac tumour. A left atrial myxoma was ruled out due to the acute onset and positive

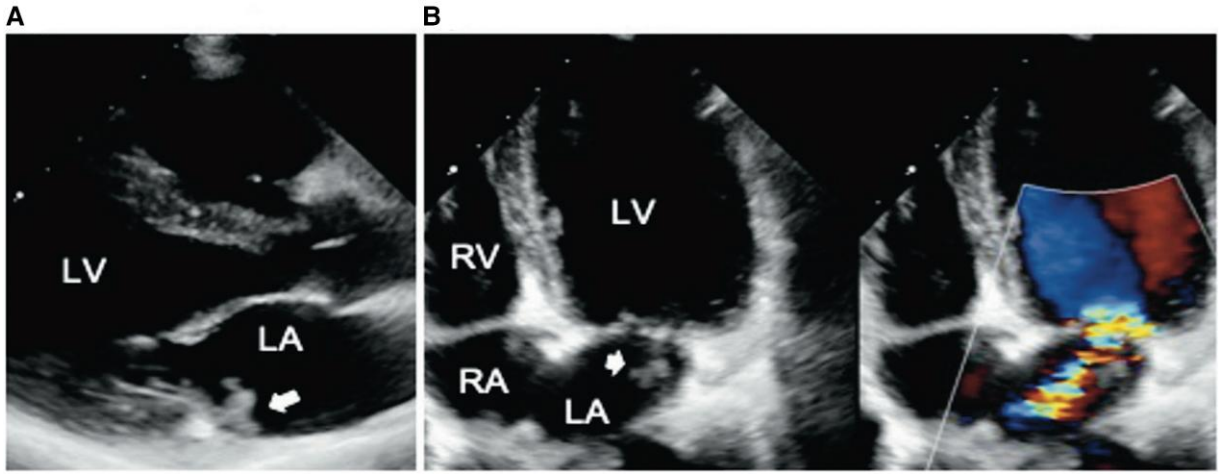

Figure 1 (*A*) Transthoracic echocardiogram showing a 1.5 × 0.9 cm mobile mass attached to the posterior wall of the LA. The white arrow indicates a vegetation in the left atrium. (*B*) Transthoracic echocardiography with Doppler revealed that the vegetation was directly exposed to the mitral regurgitation jet. LA, left atrium; LV, left ventricle; RA, right atrium; RV, right ventricle.

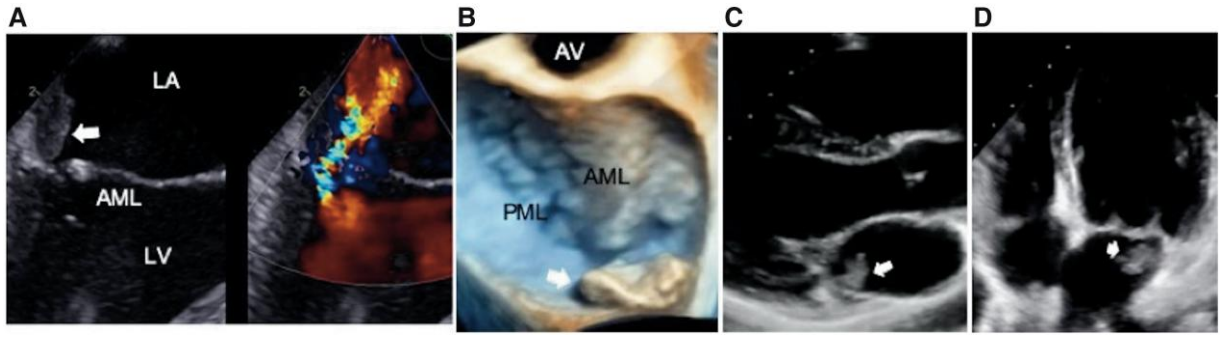

Figure 2 (*A*) Transoesophageal echocardiography revealed that the vegetation was located at the posterior wall, which was exposed to an eccentric mitral regurgitation jet. (*B*) Three-dimensional images showed the morphology of the vegetation and its attachment to the posterior wall. (*C*) Transthoracic echocardiography during follow-up (arrows) in the parasternal long-axis view. (*D*) Transthoracic echocardiography during follow-up (arrows) in the apical four-chamber view. LA, left atrium; LV, left ventricle; AV, aortic valve; AML, anterior mitral leaflet; PML, posterior mitral leaflet.

blood culture findings. Blood tests at admission showed negative major tumour markers, and systemic imaging ruled out a secondary cardiac tumour. Thrombus was unlikely due to the mass increasing in size despite optimal anticoagulant therapy. Thus, the diagnosis of IE was made based on fulfilling two major and one minor criteria of the Duke criteria.[6] We immediately switched from ceftriaxone to ampicillin/sulbactam after finding out that the causative agent was methicillin-sensitive *S. aureus* (MSSA), following European Society of Cardiology guidelines.[2] However, fever and inflammatory responses often do not resolve when *S. aureus* is the causative agent.[7] There are several hypotheses about why proper antibiotic treatment does not lead to improvement. One possibility is the virulence of the bacterial species involved. Our patient's MSSA was sensitive to vancomycin but resistant to penicillin, ampicillin, levofloxacin, clindamycin, erythromycin, and gentamicin. Although it was sensitive to ampicillin/sulbactam and ceftriaxone, the minimum inhibition concentration (MIC) was 8 and 16 μg/mL, respectively, corresponding to intermediate sensitivity (*Table 1*). This is one reason why cefazolin or anti-staphylococcal penicillin might not be sufficient for sterilization. The MIC could be used to identify a subgroup of patients with MSSA IE at risk of higher mortality. Fewer than 50% of patients with MSSA IE require surgical repair and abscess removal along with long-term antibiotic therapy.[8] Higher vancomycin MIC (>1.5 μg/mL) is associated with increased in-hospital mortality,[9] but the vancomycin MIC of our patient was unknown due to limitations at our institution. Effective antibiotics were chosen based on susceptibility testing, but the response was unsatisfactory, likely due to MSSA resistance to multiple antibiotics. During follow-up, TTE showed the vegetation expanding >10 mm despite appropriate antibiotic therapy. The patient developed splenic and cerebral embolisms, and we were concerned about the possibility of further emboli and complications. Surgical treatment allowed the patient to be discharged without serious complications. In cases of MSSA IE resistant to various antibiotics, surgical treatment should be considered as soon as possible, even in the case of isolated mural endocarditis.

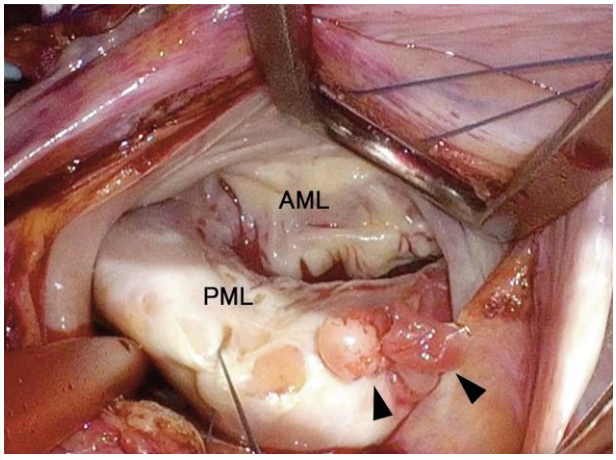

Figure 3 Macroscopic view of the left ventricular cavity via an incision in the left atrium showing extraction of the mural vegetation (black arrowheads) during surgery. AML, anterior mitral leaflet; PML, posterior mitral leaflet.

Table 1 Antibiogram of the MSSA isolate based on MIC

Antibiotics tested	MIC values(μg/mL)
Penicillin G	*R* > 8
Ampicillin	*R* > 8
Sulbactam/ampicillin	*S* ≤ 8
Cefazolin	*S* ≤ 8
Cefmetazole	*S* ≤ 16
Imipenem	*S* ≤ 1
Gentamicin	*R* > 8
Arbekacin	*S* 2
Erythromycin	*R* > 4
Clindamycin	*R* ≤ 0.5
Levofloxacin	*R* > 4
Minocycline	*S* ≤ 2
Fosfomycin	*S* ≤ 4
Sulfamethoxazole/trimethoprim	*S* ≤ 1
Vancomycin	*S* 1
Teicoplanin	*S* ≤ 2
Daptomycin	*S* 0.5

MIC, minimum inhibition concentration; *S*, susceptible; *R*, resistant.

Conclusion

The specific properties of the native valve can lead to IE even in the absence of valve destruction. In cases of isolated mural endocarditis, infections caused by *S. aureus* can be difficult to manage with antibiotics alone, and effective antibiotic therapy remains elusive. Especially in cases of MSSA IE that are resistant to various antibiotics, such as this case, early consideration should be given to surgical intervention as part of the treatment process.

Lead author biography

My name is Mikiko Nakahara Matsumura, MD. After attending Osaka University in Japan, I became a specialist in cardiology at Osaka Police Hospital in October 2022. I have developed a strong interest in cardiac imaging, physiology, and cardiac electrophysiology. I currently work at Osaka Police Hospital in Osaka, Japan.

Supplementary material

Supplementary material is available at *European Heart Journal – Case Reports*.

Acknowledgements

We thank Takaharu Hayashi MD, PhD, and Yukitoshi Shirakawa MD, PhD, for their contributions to the imaging diagnosis and surgical treatment.

Slide sets: A fully edited slide set detailing this case and suitable for local presentation is available online as Supplementary data.

Consent: The authors confirm that written consent for submission and publication of this case report, including images and associated text, has been obtained from the patient in line with COPE guidance.

Conflict of interest: None declared.

Funding: None declared.

Data availability

The data underlying this article are available in the article and in its online supplementary material.

References

1. Murdoch DR, Corey GR, Hoen B, Miró JM, Fowler VG, Jr, *et al.* Clinical presentation, etiology, and outcome of infective endocarditis in the 21st century: the International Collaboration on Endocarditis-Prospective Cohort Study. *Arch Intern Med* 2009;**169**:463–473.
2. Habib G, Lancellotti P, Antunes MJ, Bongiorni MG, Casalta JP, Del Zotti F, *et al.* 2015 ESC guidelines for the management of infective endocarditis: the Task Force for the Management of Infective Endocarditis of the European Society of Cardiology (ESC) endorsed by: European Association for Cardio-Thoracic Surgery (EACTS), the European Association of Nuclear Medicine (EANM). *Eur Heart J* 2015;**36**:3075–3128.
3. Reddy G, Chatterjee A, Leon K. Left atrial mural endocarditis secondary to mitral valve jet lesion. *Circulation* 2015;**131**:1529–1530.
4. Tahara M, Nagai T, Takase Y, Takiguchi S, Tanaka Y, Kunihara T, *et al.* Primary mural endocarditis without valvular involvement. *J Ultrasound Med* 2017;**36**:659–664.
5. Hosokawa S, Okayama H, Hiasa G, Kawamura G, Shigematsu T, Takahashi T, *et al.* Isolated left atrial infective mural endocarditis. *Intern Med* 2018;**57**:957–960.
6. Li JS, Sexton DJ, Mick N, Nettles R, Fowler VG Jr, Ryan T, *et al.* Proposed modifications to the Duke criteria for the diagnosis of infective endocarditis. *Clin Infect Dis* 2000;**30**:633–638.
7. Fridkin SK, Hageman J, McDougal LK, Mohammed J, Jarvis WR, Perlet TM, *et al.* Vancomycin-Intermediate *Staphylococcus aureus* Epidemiology Study Group. Epidemiological and microbiological characterization of infections caused by *Staphylococcus aureus* with reduced susceptibility to vancomycin, United States, 1997-2001. *Clin Infect Dis* 2003;**36**:429–439.
8. Baddour LM, Wilson WR, Bayer AS, Fowler Jr VG, Tleyjeh IM, Rybak MJ, *et al.* Infective endocarditis in adults: diagnosis, antimicrobial therapy, and management of complications. *Circulation* 2015;**132**:1435–1486.
9. Cervera C, Castañeda X, Garcia de la Maria C, del Rio A, Moreno A, Soy D, *et al.* Effect of vancomycin minimal inhibitory concentration on the outcome of methicillin-susceptible *Staphylococcus aureus* endocarditis. *Clin Infect Dis* 2014;**58**:1668–1675.