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HEART CARE TEAM/MULTIDISCIPLINARY TEAM LIVE

Management of Prosthetic Mitral Valve Infective Endocarditis in a Patient With Congenital Heart Disease

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ABSTRACT

We present the case of an adult patient with Kartagener's syndrome, multiple prior sternotomies, and recurrent prosthetic valve endocarditis, a scenario without clear guidelines to direct management. Ultimately, the team elected for medical management given the high mortality risk associated with surgery; the patient responded to antibiotic therapy. (J Am Coll Cardiol Case Rep 2024;29:102290) © 2024 The Authors. Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

CASE PRESENTATION

A 32-year-old female presented with 4 days of fever and general malaise. Because of persistent symptoms, blood cultures were drawn that had positive results for *Staphylococcus aureus*. She was initiated on meropenem and gentamicin given a possible history of cephalosporin and vancomycin allergies. She was transitioned to oxacillin and gentamicin once methicillin-sensitive *S aureus* was confirmed. She subsequently underwent a transesophageal echocardiogram (TEE), which revealed an 11 × 5 mm vegetation on the prosthetic mitral valve (PMV), prompting transfer to a tertiary care center for consideration of repeat mitral valve replacement and further management.

LEARNING OBJECTIVES

- To understand that monitoring and follow-up for patients with *Staphylococcus aureus* endocarditis can be managed medically.
- To understand assessment and decision-making in the setting of infective endocarditis in patients with high surgical risk

At the time of transfer, the patient was afebrile, with a blood pressure of 96/57 mm Hg, heart rate 90 beats/min, and oxygen saturation 95% on room air. Her cardiovascular exam was notable for dextrocardia with heart sounds auscultated on the right side of the chest as well as a regular rhythm with mechanical S1 and S2. The patient had a crescendo-decrescendo murmur at the right lower sternal border and right apex.

The patient's past medical history was significant for Kartagener's syndrome diagnosed at birth with features including dextrocardia, bronchiectasis, heterotaxy, ventricular septal defect, and anomalous

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ABBREVIATIONS AND ACRONYMS

ECG = electrocardiogram

ESC = European Society of Cardiology

IDSA = Infectious Diseases Society of America

PMV = prosthetic mitral valve

PVE = prosthetic valve endocarditis

TEE = transesophageal echocardiogram

venous connections to a common atrium. She had 6 prior sternotomies, with the first at 18 months of age for ventricular septal defect closure, baffle redirection of anomalous venous connections, and mitral valve repair. The patient underwent repeat sternotomy to repair her mitral valve again at 5 years of age. Subsequent surgeries included placement of a dual-chamber pacemaker for sick sinus syndrome, with subsequent removal due to infection; rerouting of an anomalous right-sided superior vena cava to the left atrium and repeat permanent pacemaker placement for complete heart block; and mitral valve replacement due to infective endocarditis, which was complicated by pseudomonal mediastinitis requiring repeat sternotomy to insert a new mechanical valve and replace the interatrial baffle and epicardial pacing leads. At the end of generator life for her epicardial pacing system, the patient underwent transvenous pacemaker replacement. This was complicated by atrial lead dysfunction, requiring tunneling to connect an existing epicardial atrial lead to the new device.

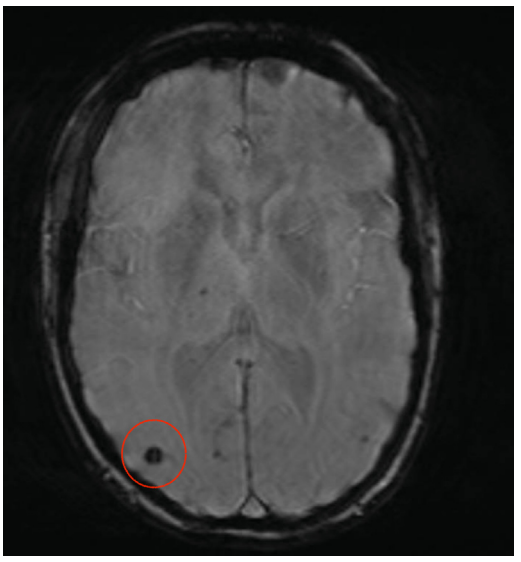
Transthoracic echocardiography was repeated after transfer and showed a small posterior paravalvular leak and a lesion on the mechanical mitral valve leaflet indeterminate for vegetation. Repeat blood cultures had no growth throughout admission.

To evaluate for potential septic emboli, as a part of multimodal imaging, the patient underwent computed tomography angiography of the chest, abdomen, and pelvis notable for wedge-shaped hypoattenuation in the right kidney concerning for a renal infarct and a potential mycotic infrarenal aneurysm.[1]

No intervention was recommended by either the vascular surgery or infectious disease services. A computed tomography (CT) of the head with contrast was concerning for trace subarachnoid hemorrhage (SAH), prompting magnetic resonance imaging (MRI) that did not show SAH or mycotic aneurysm but did show multifocal regions concerning for micro-hemorrhages and foci of enhancement compatible with septic emboli to the brain (**Figures 1 and 2**).[1] As a result, the patient's warfarin was transitioned to heparin under neurology's guidance.

Given the concerns and complications as described above, PMV replacement was strongly considered. After discussion of risks and benefits, the patient underwent repeat TEE to evaluate the status of the initially reported vegetation (Videos 1 and 2) which showed that the vegetation had either largely resolved or embolized with only a small remaining echodensity on the valve.

FIGURE 1 Brain Magnetic Resonance Imaging



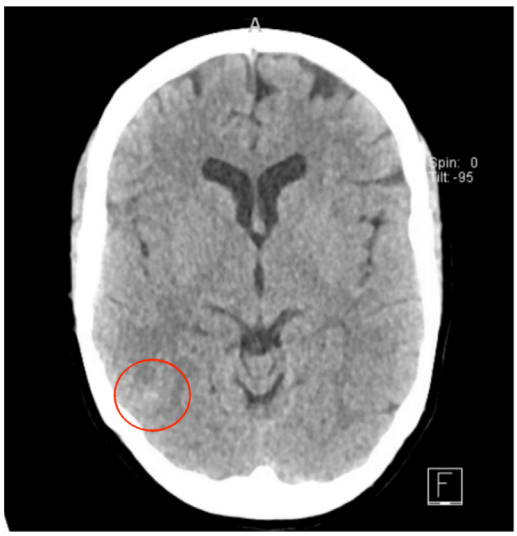
A punctate hemorrhagic focus in the right parietal lobe (red circle).

After evaluation by a multidisciplinary team (including pediatric and adult cardiology, cardiothoracic surgery, neurology, infectious disease, and radiology), it was decided to pursue medical therapy with close follow-up due to the high risk of repeat sternotomy. The patient successfully completed 8 weeks of oxacillin and rifampin from the date of last positive blood cultures, with 2 weeks of gentamicin during her initial course of treatment.

With respect to the patient's anticoagulation, repeat imaging while on therapeutic anticoagulation showed microhemorrhage stability. After the decision was made to pursue medical management of her prosthetic valve endocarditis (PVE), she was bridged to warfarin with a goal international normalized range of 2.5-3.5 as recommended by the European Society of Cardiology (ESC) and American Heart Association guidelines for mechanical PMV.[2,3] Because of the rifampin-induced increase in hepatic CYP2C9 synthesis, she was unable to discontinue heparin until completion of antibiotics.[4]

Determining the most effective treatment for PVE requires an individualized approach with factors including age, culprit organism, comorbidities, and clinical features considered in the decision-making process.[1,2,5] In contrast to the mortality rate for all-comers with infective endocarditis (16.6%), *S aureus* PVE has an exceptionally high in-hospital mortality

FIGURE 2 Brain Computed Tomography Scan



An equivalent lesion reported in the brain magnetic resonance image (red circle).

rate (47.5%).[6] According to recommendations from the ESC, noncomplicated and non-staphylococcal PVE can be managed medically; however, the outcomes of surgery generally outperform management with antibiotics alone in the setting of *S aureus* PVE.[1,7]

The American College of Cardiology/American Heart Association 2020 valve guidelines are very clear in their recommendations for surgical management of endocarditis, with this patient meeting criteria for valve surgery generally. However, these guidelines do not consider management nuances inherent to the care of patients such as ours.

The Society for Thoracic Surgeons Adult Cardiac Risk Score and EuroSCORE II (the European System for Cardiac Operative Risk Evaluation)[8-10] have been shown to predict long-term outcomes in high-risk patients undergoing repeat mitral valve replacement in cohort studies. EuroSCORE II predicted 38.09% in-hospital mortality for our patient.[8] Our patient's only indication for surgery by the time of admission to our hospital was infection with methicillin-sensitive *S aureus*, as repeat TEE on admission to our hospital did not redemonstrate the >10 mm vegetation that had been found previously. Thus, surgery risks were deemed to outweigh the advantages of repeat operation.[1]

The patient completed antibiotics and reinitiation of coumadin under careful surveillance by cardiology and infectious disease services after discharge. Inflammatory markers including erythrocyte sedimentation rate and C-reactive protein were within normal limits 3 weeks after antibiotic completion, and the patient was asymptomatic on follow-up. Given her history of recurrent endocarditis, she will continue lifelong antibiotic suppressive therapy with twice-daily Cefadoxil 500 mg with repeat assessment at 3-month intervals.

Remembering that medicine is an art is important for an individualized decision-making approach. In the case of this complex patient with multiple prior operations and complex anatomy, surgical risk was deemed to outweigh the potential benefits of surgery, and a medical management strategy with close follow-up to monitor for recurrence was preferable to control infection.

Question 1: What were the differential diagnoses for the presented patient?

The clinical history, previous surgeries, and physical examination findings all pointed to PMV infective endocarditis (IE). Pulmonary embolism, viral upper respiratory tract infection, severe community-acquired pneumonia, and other indwelling hardware infections were additionally considered on the differential diagnosis. The patient was incidentally found to also have rhinovirus during her hospitalization.

Question 2: Which diagnostic criteria were considered to establish the diagnosis of IE?

The patient met the Modified Duke criteria for the diagnosis of IE. The evaluation conducted at the outside hospital revealed positive blood cultures and positive TEE findings, which constitute 2 major criteria (**Table 1**), confirming a diagnosis of definite IE. In addition, the patient's predisposing heart condition and high fever also represent minor diagnostic criteria.[1] Following the diagnosis of IE at the outside hospital, the patient was transferred to our medical facility for further investigation.

Question 3: What was the reason to perform a whole-body CT/ brain MRI instead of a cardiac CT and positron emission tomography-CT to identify paravalvular complications and septic emboli, respectively?

The latest guidelines for PVE recommend cardiac computed tomography angiography to evaluate paravalvular complications and brain and whole-body imaging (CT, fluorodeoxyglucose F18-positron emission tomography (PET)/CT, and/or MRI) for detecting extracardiac complications when symptoms are present.[1]

Recommendations from the 2023 ESC guidelines, supported by evidence level I B, were included in the

TABLE 1 2023 European Society of Cardiology Modified Diagnostic Criteria of IE

Major criteria
Blood cultures positive for IE
Typical micro-organisms consistent with IE from 2 separate blood cultures:
Oral streptococci, *Streptococcus gallolyticus* (formerly *S bovis*), HACEK group, *S aureus*, *E faecalis*
Microorganisms consistent with IE from continuously positive blood cultures:
≥2 positive blood cultures of blood samples drawn >12 hours apart
All of 3 or a majority of ≥4 separate cultures of blood (with first and last samples drawn ≥1 hour apart)
Single positive blood culture for *C burnetii* or phase I IgG antibody titer >1:800
Imaging positive for IE
Valvular, perivalvular/periprosthetic and foreign material anatomic and metabolic lesions characteristic of IE detected by any of the following imaging techniques:
Echocardiography (TTE and TOE)
Cardiac CT
^{18F}FGD-PET/CT(A)
WBC SPECT/CT
Minor criteria
Predisposing conditions (ie, predisposing heart condition at high or intermediate risk of IE or PWIDs)
Fever defined as temperature >38°C
Embolic vascular dissemination (including those asymptomatic detected by imaging only):
Major systemic and pulmonary emboli/infarcts and abscesses
Hematogenous osteoarticular septic complications (ie, spondylodiscitis)
Mycotic aneurysms
Intracranial ischemic/hemorrhagic lesions
Conjunctival hemorrhages
Janeway's lesions
Immunologic phenomena
Glomerulonephritis
Osler nodes and Roth spots
Rheumatoid factor
Microbiological evidence
Positive blood culture but does not meet a major criterion as noted above
Serologic evidence of active infection with organism consistent with IE
IE classification (at admission and during follow-up)
Definite
2 major criteria
1 major criterion and at least 3 minor criteria
5 minor criteria
Possible
1 major criterion and 1 or 2 minor criteria
3 to 4 minor criteria
Rejected
Does not meet criteria for definite or possible at admission with or without a firm alternative diagnosis

^{18F}FDG = 18F-fludeoxyglucose; CT = computed tomography; CTA = computed tomography angiography; IE = infective endocarditis; IgG = immunoglobulin G; PET = positron emission tomography; PWID = people who inject drugs; SPECT = single-photon emission computed tomography; TOE = transesophageal echocardiography; TTE = transthoracic echocardiography; WBC = white blood cells.

reference section for the use of brain and whole-body CT scans to identify peripheral lesions.

PET/CT is a potentially important diagnostic tool in the setting of IE when other imaging modalities may be unclear or inadequate. In this case, the patient was already deemed to have definite IE with a class I recommendation for valve removal. Therefore, PET/CT was not pursued due to the perceived limited additional diagnostic benefit.

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KEY WORDS **infective endocarditis, medical management, methicillin-sensitive *Staphylococcus aureus*, prosthetic valve endocarditis**

APPENDIX **For supplemental videos, please see the online version of this paper.**