



Infective endocarditis presenting as meningitis: a case report

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Introduction and importance: Infective endocarditis (IE) primarily affects the endocardium of heart valves. Neurologic manifestations include strokes, intracerebral hemorrhages, meningitis, cerebral and spinal abscess, and mycotic aneurysms. Although rare, meningitis is a potentially life-threatening complication of IE, so physicians should be aware of this rare and fatal complication of IE.

Case presentation: Here, the authors present a case of a 53-year-old male who presented with bacterial meningitis secondary to IE. His blood culture was positive for methicillin-sensitive staphylococcal aureus. Echocardiography findings were suggestive of endocarditis. Despite aggressive intensive care management, our patient did not survive.

Clinical discussion: The isolation of *Staphylococcus aureus* in culture should raise a suspicion of foci being elsewhere outside the central nervous system. Treatment of complications like meningitis may require intrathecal antibiotics. The vegetation and neurological complications are often difficult to treat and require the participation of a multidisciplinary team.

Conclusions: The diagnosis of IE in patients presenting with neurologic deficits and fever should be considered. A physician should raise a suspicion of infective foci being elsewhere outside the central nervous system if the organism isolated in culture is *Staphylococcus aureus*.

Keywords: echocardiography, infective endocarditis, meningitis, staphylococcus aureus

Introduction

Infective endocarditis (IE), defined by the presence of a focus of infection within the heart chamber, is a feared disease where more than 50% of the cases occur without any underlying heart disease^[1]. The most common and severe extracardiac complication includes neurological sequela like ischemic stroke, intracranial hemorrhage, intracerebral abscess, and meningitis the symptom of which can range from headache and neck rigidity to life-threatening seizures and coma^[2]. Meningitis as a neurological complication occurs in 1–20% of IE patients^[3]. Although the emergence of the vaccine has reduced the incidence of bacterial meningitis in a patient with IE, its presence is still associated with significant morbidity and mortality^[4]. Bacterial meningitis is often associated

HIGHLIGHTS

- Bacterial meningitis is often associated with foci of infection elsewhere, such as the lungs, sinuses, or ears. Other uncommon and rare foci can be from infective endocarditis.
- Concurrent *Staphylococcus aureus* endocarditis should be considered in cases of *S. aureus* meningitis.
- Medical management primarily involves the administration of antibiotics, sometimes in combination.

with foci of infection elsewhere, such as the lungs, sinuses, or ears. Other uncommon and rare foci can be from IE. Although rare, meningitis is a potentially life-threatening complication of IE^[5]. Although the most common organism for causing bacterial meningitis is *Streptococcus pneumoniae*, the isolation of *Staphylococcus aureus* in culture should raise a suspicion of foci being elsewhere outside the central nervous system^[6].

Here, we present a case of a 53-year-old male who presented with bacterial meningitis secondary to IE. This case has been reported in line with the Surgical CAse REport (SCARE) 2020 criteria^[7].

Case presentation

A 53-year-old male presented to the emergency room with a 3 day history of fever and myalgia, with a maximum temperature of 103°F. This was followed by confusion for one day and a severe frontal headache. There was no history of sick contacts, recent travels, or any recreational use of drug. He has no history of chronic alcoholism, diabetes, chronic kidney disease, or any cardiac disease in the past. He has no history of a recent throat

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infection or skin infection. He became more confused and lethargic in the emergency room and was closely monitored. Upon examination, the patient was lying in bed, exhibiting moderate distress with a Glasgow Coma Scale score of 10, and could not follow commands. Neck examination demonstrated rigidity on flexion, and his motor function revealed rigidity in the left upper extremity, with increased tone on the left side compared to the right.

The patient's white blood cell count was $10 \times 10^9/L$ with a hemoglobin level of 13.4 g/dl with thrombocytopenia with a platelet count of $54 \times 10^9/L$. The patient's laboratory findings showed a sodium level of 134 mEq/l, a calcium level of 8.4 mg/dl, a magnesium level of 1.7 mg/dl, and a phosphorus level of 3.2 mg/dl. The patient's bicarbonate level was 24 mEq/l, and the blood glucose level was 142 mg/dl. The patient's troponin level increased from 0.16 ng/ml–0.38 ng/ml, but the electrocardiogram showed normal sinus rhythm. The patient's ammonia level was 47 $\mu\text{mol/L}$. The thyroid-stimulating hormone level and liver function tests were within normal limits. The patient tested negative for flu, respiratory syncytial virus, and coronavirus disease 2019. The results of the patient's urine analysis, urine toxicology screen, and salicylate and alcohol levels were negative.

A lumbar puncture was performed, which showed an elevated white blood cell count of $682 \times 10^9/l$ (neutrophil 81%), red blood cell count of $10 \times 10^9/l$, a protein level of 117 mg/dl, and a glucose level of 58 mg/dl suggestive for possible bacterial meningitis.

The patient was admitted to the MICU and received an empirical therapy for meningitis, consisting of vancomycin, cefepime 2 g every 8 h, and ampicillin 2 g every 4 h, as per the recommendation of the Infectious Diseases team. While in the ICU, he developed new-onset left-sided weakness. The stroke team was called. Computed tomography scan showed no evidence of intracranial hemorrhage but an incidental finding of a 778 mm mass concerning an aneurysm. Neurosurgery recommended a neuro interventional radiology consultation for the aneurysm. His blood grew Methicillin-sensitive staphylococcal aureus in the blood. The antibiotics were deescalated to Oxacillin 2 g to cover Methicillin-sensitive Staphylococcal Aureus bacteremia and bacterial meningitis (which crosses the blood-brain barrier). The steroid was stopped as there was no evidence of streptococcal infection. A transesophageal echo showed vegetation in the aortic valve suggestive of IE, as shown in Figure 1.

The patient was intubated for respiratory distress while in the ICU. He remained persistently bacteremic and febrile, and cefazoline was added as the infectious diseases team recommended. The MRI showed a large posterior cerebral artery infarct, as shown in Figure 2.

The cardiothoracic surgery team was consulted for aortic valve replacement due to IE with an embolic stroke. However, surgery was not deemed appropriate due to the patient's recent large posterior cerebral artery infarct and the high risk of intracerebral hemorrhage during open heart surgery with cardiopulmonary bypass. A repeat computed tomography head scan showed an intraparenchymal bleed in the right frontal area. The results were discussed with the stroke team, and the patient was deemed not cleared for open heart surgery due to the intraparenchymal bleed. The patient's lactic acid level started rising with worsening kidney function. Bicarbonate was administered.

Unfortunately, the patient's oxygen saturation levels decreased to 40%, and he had a cardiac arrest. Cardiopulmonary

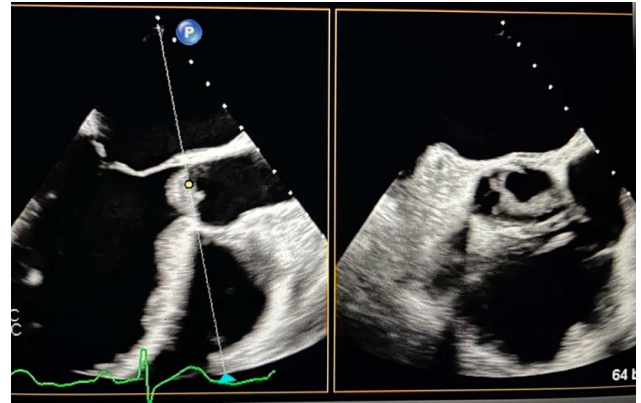


Figure 1. A transesophageal echo (TEE) showing vegetation in the Aortic valve.

resuscitation was immediately initiated, and advanced life support measures were employed. Despite these efforts, the patient could not be revived and was pronounced dead.

Discussion

IE remains a significant concern in the medical field, despite its relatively low prevalence^[8]. It ranks as the third or fourth most prevalent life-threatening infection syndrome, following sepsis, pneumonia, and intraabdominal abscess^[9]. Concurrent staphylococcus aureus endocarditis should be considered in cases of S. aureus meningitis. In a study of 33 patients with S. aureus meningitis, IE was diagnosed in 21% of cases^[10]. Endocarditis results from the adhesion of microorganisms, including bacteria and fungi, to the endocardium and valves, leading to infection, inflammation, and progressive valve damage^[11]. The significant risk factors for IE can be divided into host and procedure-related risk factors. Host-related risk factors are chronic alcoholism, meningitis, and diseases associated with immunity defects, such as systemic lupus erythematosus, inflammatory bowel disease,



Figure 2. MRI brain showing hyperintensities in the zone of right posterior cerebral artery.

and diabetes. Risk factors related to the procedure cause IE through the induction of bacteremia and the seeding of heart valves^[12].

Symptoms may present nonspecifically as fever, fatigue, weight loss, joint and muscle pain, and chest pain^[13]. Diagnosis requires a comprehensive evaluation that includes clinical findings, echocardiography, and microbiological testing. Echocardiography is crucial in detecting aortic valve changes and monitoring disease progression^[14]. Although the Duke criteria of 1994 remain the gold standard for diagnosing IE, they must be interpreted alongside other clinical findings to ensure an accurate diagnosis^[9]. Modified Duke's criteria were proposed for better diagnostic accuracy^[15]. In addition to embolization, heart failure, and other cardiovascular complications, endocarditis can cause neurological problems such as stroke and meningitis.

Neurological complications in 20–40% of IE cases may arise from direct microorganism invasion, embolic events, or immune-mediated processes^[16]. Meningitis, a severe neurological complication, is characterized by meningeal inflammation. Symptoms may range from headache, fever, and stiff neck to confusion, progressing to life-threatening complications such as seizures and coma. Diagnosing meningitis in IE requires a thorough clinical assessment, laboratory tests, imaging studies, and possibly a lumbar puncture for cerebrospinal fluid analysis. Treatment involves antimicrobial therapy and supportive care, with the potential incorporation of specialized therapies, such as intrathecal antimicrobial therapy or corticosteroids, depending on the severity and course of the infection^[17]. Neurological complications significantly impact morbidity and mortality in IE patients, emphasizing the importance of prompt diagnosis and management. Optimal care often requires a multidisciplinary approach that involves neurologists, infectious disease specialists, and critical care physicians^[18].

Medical management primarily involves the administration of intravenous antibiotics. Rarely, in a case of meningitis caused by multidrug-resistant pathogens, intraventricular combined with systemic antimicrobial therapy with drugs like aminoglycosides, colistin, daptomycin, tigecycline, and vancomycin can be used^[17]. Surgical intervention may be required along with other multidisciplinary approach for severe valve damage, heart failure, or embolic events. Surgery indications for IE include large or mobile vegetations, heart failure or valvular dysfunction, unresponsive to medical therapy, perivalvular abscess or fistula, recurrent emboli despite appropriate antimicrobial therapy, and persistent bacteremia after 7–10 days of appropriate therapy^[1]. Surgical options include valve repair, valve replacement, and surgical debridement of infected tissue^[19]. A multidisciplinary approach is essential to determine the need for surgery and to select the most suitable surgical approach.

Conclusion

Neurologic complications are frequent and essential to recognize in managing patients with IE. It may present with neurological complications like meningitis. The diagnosis of IE in patients presenting with neurologic deficits and fever should be considered. In addition to urgently obtaining blood cultures and initiating antibiotics, specific neurologic manifestations should be managed as they would be otherwise managed without a septic source. A physician should raise a suspicion of infective foci being

elsewhere outside the central nervous system if the organism isolated in culture is *Staphylococcus aureus*.

Ethical approval

Not required.

Patient Consent

Written informed consent was obtained from the patient's family. A copy of written consent is available for review by the Editor-in-Chief of this journal on request.

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Author contribution

S.G., N.R.S., S.L., M.P., A.B., and S.K. were involved in conceptualization, design, and preparation of manuscript. S.L. and N.R.S. were involved in finalization of manuscript.

Conflicts of interest disclosure

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