

The Heart of the Matter

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ABSTRACT

A 65-year-old Hispanic man receiving peritoneal dialysis presented to the emergency department complaining of the sudden onset of numbness and tingling of the right side of his body and face with associated nausea, vomiting, vertigo, and blurry vision. Further testing revealed a large, mobile mass on his mitral valve, leading to a diagnosis of endocarditis with embolic phenomena. The presentation, diagnosis, and treatment of endocarditis are discussed here.

CASE REPORT

A 65-year-old Hispanic man presented to the emergency department complaining of the sudden onset of numbness and tingling of the right side of his body and face with associated nausea, vomiting, vertigo, and blurry vision. He also complained of a 1-day history of generalized weakness and mild headache but denied fever, dyspnea, anorexia, weight loss, or any flulike symptoms.

His past medical history was significant for diabetes mellitus type 2, hypertension, hyperlipidemia, and end-stage renal disease managed with peritoneal dialysis. Three months prior to admission, the patient underwent a fistulogram and revascularization of his arteriovenous fistula that was reserved for emergent hemodialysis.

Vital signs included a blood pressure of 174/108 mmHg and a heart rate of 104 beats per minute. On physical examination, a right facial droop with ptosis of the right eye was evident along with decreased strength (4/5) and sensation in the right

upper and lower extremities. The cardiovascular examination revealed normal first and second heart sounds; no murmurs were appreciated. Routine laboratory testing yielded a white blood cell count of $13.8 \times 10^3/\mu\text{L}$ with a differential of 86.2% granulocytes, an elevated blood urea nitrogen level of 30 mg/dL, and a serum creatinine level of 11.2 mg/dL. The remainder of his results were unremarkable.

A noncontrast computed tomography of the brain did not reveal any significant abnormalities. In particular, there was no evidence of an acute cerebrovascular infarction or intracranial hemorrhage. Magnetic resonance imaging and angiography and computed tomographic angiography also yielded no abnormalities. However, in light of the patient's signs and symptoms, brainstem infarction was still suspected and a diagnosis of basilar artery stroke was made following consultation with Neurology. Further evaluation with transthoracic echocardiogram was recommended.

Which of the following abnormalities is most likely, given the patient's presentation and transthoracic echocardiogram findings shown here (Figures 1 and 2)?

- (A) Mural thrombus
- (B) Valvular vegetation
- (C) Atrial myxoma
- (D) Valve ring abscess

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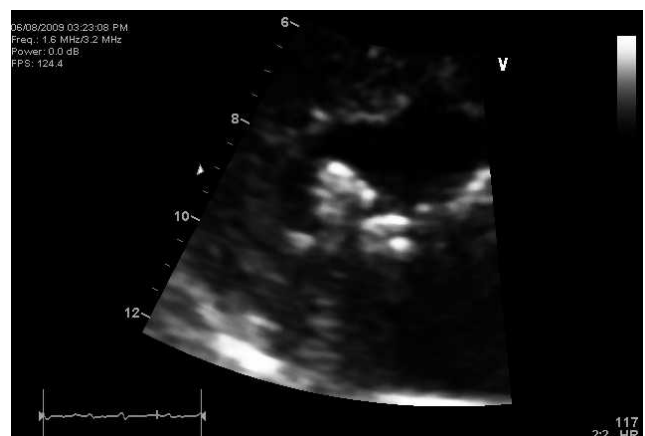


Figure 1. 2-dimensional echocardiogram.

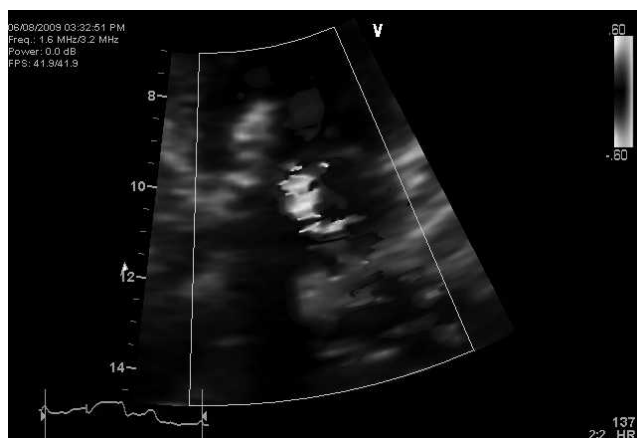


Figure 2. 2-dimensional echocardiogram with Doppler ultrasound.

ANSWER

The correct answer is (B), valvular vegetation.

The transthoracic echocardiogram showed a pedunculated echogenic mass, 1.5×0.7 cm in size, affixed to the anterior mitral valve leaflet. The mass was mobile within the left ventricle and likely represented valvular vegetation. There was also associated mild to moderate mitral regurgitation. A presumptive diagnosis of subacute bacterial endocarditis was made on the basis of the echocardiogram. Vegetations that are >10 mm in diameter and those located on the mitral valve are more likely to embolize than vegetations that are smaller or non-mitral.¹⁻³ Arterial emboli are clinically apparent in up to 50% of patients with endocarditis.

A mural thrombus most commonly occurs in the left ventricle and appears as an echodense structure, usually in the apical region associated with regional wall motion abnormalities.⁴ An atrial myxoma can be diagnosed by the appearance of a well-circumscribed mobile mass with attachments to the atrial septum.⁵ The mass described here is attached to a mitral valve leaflet. A valve ring abscess is diagnosed as an echo-free area within the echodense valvular ring region and occurs more commonly in the aortic root or aortic valve area.⁶

CLINICAL COURSE OF CASE PATIENT

After the echocardiogram was interpreted, blood cultures were collected and the infectious disease team was consulted for further management recommendations. The large size of the vegetation (>10 mm) along with its hypermobile nature and increased risk of embolization were indications for cardiac surgical intervention. However, the patient's recent history of stroke, combined with his comorbidities, made him an unfavorable surgical candidate.

It was suspected that inoculation could have occurred during the arteriovenous fistula declotting procedure 3 months earlier. The patient is currently receiving vancomycin and gentamicin at doses adjusted for his renal function.

INFECTIVE ENDOCARDITIS

Infective endocarditis (IE), previously referred to as *bacterial endocarditis*, is defined as an infection of the endocardial surface of the heart that may include 1 or more heart valves, the mural endocardium, or a septal defect. It generally occurs as a consequence of turbulence or trauma to the endothelial surface of the heart. Transient bacteremia then leads to seeding of lesions with adherent bacteria, which causes IE to develop.

Microbiology and Risk Factors

Although the pathogens vary with the clinical types of endocarditis, staphylococci and streptococci account for the majority of cases (42% and 40%, respectively).⁷ Other less common pathogens include *Enterococcus*, HACEK organisms (*Haemophilus*, *Actinobacillus*, *Cardiobacterium*, *Eikenella*, and *Kingella*), non-HACEK gram-negative bacteria, and fungi. The Duke criteria (Table), a highly sensitive and specific diagnostic scheme based on clinical, laboratory, and echocardiographic findings, define the following organisms as "typical causes" of IE: *Staphylococcus aureus*, viridans streptococci, *Streptococcus bovis*, *Enterococcus*, and HACEK organisms.^{8,9}

A number of factors predispose a patient to the development of IE, with the most common being injection drug use, prosthetic heart valves, and structural heart disease. Classically, injection drug use is associated with right-sided IE, with the most common pathogen being *S aureus*, many of which are methicillin resistant.¹⁰ Prosthetic valve endocarditis has the greatest risk of occurring during the initial 3 months after surgery. The type of prosthetic valve does not have an impact on the development of IE.¹¹ The majority of patients with IE have a pre-existing structural heart defect, the most common of which is mitral valve prolapse.¹² Other risk factors associated with IE include a history of IE, hemodialysis, and human immunodeficiency virus infection.

Clinical Manifestations

The clinical syndrome of IE is highly variable and can range between acute and subacute presentations. The most common clinical and laboratory features of IE include fever, heart murmur, anemia, elevated erythrocyte sedimentation rate, and elevated C-reactive protein.¹³ Physical examination should include a careful cardiac examination for signs of

Modified Duke Criteria for Diagnosis of Infective Endocarditis

Major Criteria

1. Blood Culture
 - Positive blood cultures (>2/2) with typical IE micro-organisms (*viridans* streptococci, *Streptococcus bovis*, HACEK group or community-acquired *Staphylococcus aureus* or enterococci in the absence of primary focus)
 - Persistently positive blood cultures defined as two culture sets drawn >12 hours apart, or three or the majority of four culture sets with the first and last separated at least by 1h hour
 - Single positive culture for *Coxiella burnetii* or anti-phase I antibody titer >1:800
2. Endocardial Involvement
 - New valve regurgitation
 - Positive echocardiogram for IE (transesophageal echo recommended in patients who have prosthetic valves and patients rated as 'possible' IE by clinical criteria) defined as:
 - (i) oscillating intracardiac mass in the valve or supporting structure, *or* in the path of regurgitant jets, *or* on implanted material, in the absence of an alternative anatomic explanation, *or*
 - (ii) abscess, *or*
 - (iii) new partial dehiscence of prosthetic valve

Minor Criteria

1. Predisposing cardiac condition or intravenous drug use
2. Fever: >100.4°F (>38°C)
3. Vascular phenomena: arterial emboli, mycotic aneurysms, petechiae, Janeway lesions
4. Immunologic phenomena: glomerulonephritis, Osler nodes, Roth spots, rheumatoid factor
5. Microbiology: positive blood cultures, but not meeting major criteria, serologic evidence of active infection with plausible micro-organisms

Diagnosis:

- Pathology or bacteriology of vegetations, *or*
- 2 major criteria, *or*
- 1 major and 3 minor criteria, *or*
- 5 minor criteria

Durack DT, Lukes AS, Bright DK. New criteria for diagnosis of infective endocarditis: utilization of specific echocardiographic findings Duke endocarditis service. *Am J Med.* 1994; 96:200-209

new, regurgitant murmurs or heart failure. Attention should also be paid to noncardiac manifestations such as petechiae, Osler nodes (painful palpable nodules on the tips of the fingers), Roth spots (round retinal hemorrhages with white centers), Janeway lesions (nontender, erythematous lesions on the palms and soles), and splinter hemorrhages (small, asymptomatic linear hemorrhages under the nails). Patients with IE may also present with signs and symptoms secondary to embolic phenomena (e.g., stroke, as in our patient), systemic immune reactions (glomerulonephritis and arthritis), and shortness of breath (septic pulmonary infarcts).

Diagnosis

The diagnosis of IE is established with certainty only by a positive culture for vegetation or embolus or by histologic confirmation of a vegetation or embolus. In most cases, this is obtained only at cardiac surgery or autopsy. Transthoracic echocardiography (TTE)

may confirm the diagnosis of IE if vegetation is detected. However, TTE has a relatively low sensitivity for vegetations in IE. If TTE has negative findings and IE is still suspected, transesophageal echocardiography is usually warranted. It is also reasonable to begin diagnosis with transesophageal echocardiography in high-risk patients (e.g., those with prosthetic heart valves or prior endocarditis) or if there is high clinical suspicion of IE.⁸

Treatment

Eradication of bacteria in IE is difficult because of the avascular nature of vegetations and the deficiency of host defenses in those areas. Therefore, therapy is bactericidal and prolonged. Antibiotics are usually given parenterally and are tailored based on the susceptibility of the causative organisms.^{14,15} In some cases, surgical intervention is required for effective treatment of the complications of IE. Indications for surgery include moderate to severe congestive heart

failure due to valve dysfunction, persistent bacteremia despite optimal antibiotic therapy, partially dehisced unstable prosthetic valve, lack of effective microbicidal therapy (e.g., fungal or *Brucella* endocarditis), *S aureus* prosthetic valve endocarditis with an intracardiac complication, or relapse of prosthetic valve endocarditis after optimal antimicrobial therapy. Other situations in which surgery is to be strongly considered include perivalvular extension of infection, large (>10 mm diameter) hypermobile vegetations with increased risk of embolism, and persistent fever.^{16,17}

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