

## The EM Educator Series

The EM Educator Series: Endocarditis - How to put all of the findings together

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**Case 1:** A 42-year-old male with a history of IV drug use presents with fevers, chills, and myalgias. He was seen 2 days ago and diagnosed with an upper respiratory infection. He is febrile in the ED, and he states his symptoms have worsened with increased generalized weakness. You detect a 2/6 murmur on your exam, but his lungs and skin are otherwise normal.

### Questions for Learners:

1. When should endocarditis be considered? How can it present?
2. What are the risk factors on history, and what might you find on examination?
3. What is the ED work-up of suspected endocarditis?
4. When should these patients be given antibiotics, and when they are administered, what antibiotics are recommended?
5. What are potential complications of endocarditis?
6. When should you consult cardiothoracic surgery for endocarditis?

### Suggested Resources:

- Articles:
  - MDCalc – [Duke Criteria](#)
  - emDocs – [Flu mimics](#)
  - REBEL EM – [Endocarditis](#)
  - emDocs – [Endocarditis – a complicated case](#)
  - EMPharmMD - [Antibiotics](#)
- Podcasts:
  - [Emergency Medicine Best Case Ever](#)
  - EMCrit – [Endocarditis](#)
- PMID:
  - [American Journal of Emergency Medicine](#)
  - [Journal of Emergency Medicine – Flu Mimics](#)

## Answers for Learners:

### 1. When should endocarditis be considered? How can it present?

Endocarditis should be on your radar for any patient with valvular heart disease who presents to the ED whether they are febrile or not. Keep Endocarditis on the radar for all febrile patients without a source

Presenting signs and symptoms: fever, loss of appetite, unexplained weight loss, new skin lesions (Osler nodes and Janeway lesions), splinter hemorrhages, headache, joint pain, confusion, shortness of breath, heart murmur, fatigue, or sudden weakness in the face or limbs.

- Signs and symptoms can be very non-specific. Suspect the diagnosis in anyone with a new murmur, bacteremia without a clear focus, peripheral embolic phenomena or IVDU

### 2. What are the risk factors on history, and what might you find on examination?

#### Risk factors:

- Diseased/damaged heart (highest risk)
- IV drug use (IVDU)
- Low immune function –
- Poor oral hygiene. (Faza 2013)
- Nosocomial

Even though we were taught about Janeway lesions and Osler's nodes in medical school, the reality is that these peripheral manifestations of endocarditis occur in only about 10% of patients. Listening for heart murmurs which are present in about 90% of patients with endocarditis is one of the most important physical exam maneuvers in patients who present with fever NYD.

### 3. What is the ED work-up of suspected endocarditis?

- Labs:
  - CBC, UA, ESR, CRP,
  - BCx x3 sets
  - Serologies – ELISA, PCR
  - Imaging: CXR, CT scan, TTE

**Table 34.3.** The Modified Duke Criteria for the Diagnosis of Endocarditis

<b>Major Criteria</b>
<ul style="list-style-type: none"><li>• Blood culture positive for IE<ul style="list-style-type: none"><li>• Typical microorganisms consistent with IE from two separate blood cultures<ul style="list-style-type: none"><li>• Viridans streptococci, <i>Streptococcus bovis</i>, HACEK group, <i>Staphylococcus aureus</i>; or</li><li>• Community-acquired enterococci, in the absence of a primary focus</li></ul></li><li>• Microorganisms consistent with IE from persistently positive blood cultures, defined as follows:<ul style="list-style-type: none"><li>• At least two positive blood cultures of blood samples drawn &gt;12 h apart; or</li><li>• All of three or a majority of ≥4 separate cultures of blood (with first and last sample drawn at least 1 h apart)</li></ul></li><li>• Single positive blood culture for <i>Coxiella burnetii</i> or antiphase I IgG antibody titer &gt;1:800</li></ul></li><li>• Evidence of endocardial involvement<ul style="list-style-type: none"><li>• Echocardiogram positive for IE (TEE recommended in patients with prosthetic valves, rated at least "possible IE" by clinical criteria, or complicated IE [paravalvular abscess]; TTE as first test in other patients), defined as follows:<ul style="list-style-type: none"><li>• Oscillating intracardiac mass on valve or supporting structures, in the path of regurgitant jets, or on implanted material in the absence of an alternative anatomic explanation; or</li><li>• Abscess; or</li><li>• New partial dehiscence of prosthetic valve</li></ul></li><li>• New valvular regurgitation (worsening or changing or preexisting murmur not sufficient)</li></ul></li></ul>
<b>Minor Criteria</b>
<ul style="list-style-type: none"><li>• Predisposition, predisposing heart condition or injection drug use</li><li>• Fever, temperature &gt;38°C</li><li>• Vascular phenomena, major arterial emboli, septic pulmonary infarcts, mycotic aneurysm, intracranial hemorrhage, conjunctival hemorrhages, and Janeway lesions</li><li>• Immunologic phenomena: Glomerulonephritis, Osler nodes, Roth's spots, and rheumatoid factor</li><li>• Microbiological evidence: Positive blood culture but does not meet a major criterion as noted previously (excluding single positive cultures for coagulase-negative staphylococci and organisms that do not cause endocarditis) or serologic evidence of active infection with organisms consistent with IE</li><li>• Echocardiographic minor criteria eliminated</li></ul>

**Table 34.2.** The Modified Duke Criteria Definitions of Definite, Possible, and Rejected Endocarditis

<b>Definite IE</b>
<ul style="list-style-type: none"><li>• Pathologic criteria<ul style="list-style-type: none"><li>1. Microorganisms demonstrated by culture or histologic examination of a vegetation, a vegetation that has embolized, or an intracardiac abscess specimen; or</li><li>2. Pathologic lesions; vegetation or intracardiac abscess confirmed by histologic examination showing active endocarditis</li></ul></li><li>• Clinical criteria (see Table 34.3)<ul style="list-style-type: none"><li>1. Two major criteria</li><li>2. One major criterion and three minor criteria</li><li>3. Five minor criteria</li></ul></li></ul>
<b>Possible IE (see Table 34.3)</b>
<ul style="list-style-type: none"><li>1. One major criterion and one minor criterion</li><li>2. Three minor criteria</li></ul>
<b>Rejected</b>
<ul style="list-style-type: none"><li>1. Firm alternate diagnosis explaining evidence of IE</li><li>2. Resolution of infection endocarditis syndrome with antibiotic therapy for ≤4 days</li><li>3. No pathologic evidence of IE at surgery or autopsy, with antibiotic therapy for ≤4 days</li><li>4. Does not meet criteria for possible IE, as described previously</li></ul>

IE, Infective endocarditis.  
Modified from Li, J. S., Sexton, D. J., Mick, N., Nettles, R., Fowler, V. G., Ryan, T., et al. (2000). Proposed modifications to the Duke criteria for the diagnosis of infective endocarditis. *Clinical Infectious Diseases*, 30(4), 633–638.

IE, Infective endocarditis; TEE, transesophageal echocardiography; TTE, transthoracic echocardiography.  
Modified from Li, J. S., Sexton, D. J., Mick, N., Nettles, R., Fowler, V. G., Ryan, T., et al. (2000). Proposed modifications to the Duke criteria for the diagnosis of infective endocarditis. *Clinical Infectious Diseases*, 30(4), 633–638.

**4. When should these patients be given antibiotics, and when they are administered, what antibiotics are recommended?**

- Empiric endocarditis therapy using vancomycin should target a trough of 15-20 mg/L
- Ensure blood cultures are obtained prior to initiation of antibiotics
  - Always do 2 or 3 sets of blood cultures from 2 or 3 sites on patients in whom you suspect endocarditis. Drawing a single blood culture is much more likely to lead to a missed diagnosis.
  - Empiric treatment with antibiotics for patients suspected of endocarditis can usually wait until consultation with an infectious disease specialist as the majority of patients with endocarditis will not present in severe sepsis or septic shock.
  - Antibiotic coverage-your empiric sepsis antibiotics + sepsis-dose Vanco will cover everything you need to worry about. Vanco alone will get the job done in almost every case.

Valve Status	Empiric Regimen	Empiric Regimen if Severe PCN Allergy, <b>Challenge Not Feasible</b>
Native valve	Cefepime 2 g IV Vancomycin 25 mg/kg IV*	Aztreonam 2 g IV Vancomycin 25 mg/kg IV*
Prosthetic valve	Cefepime 2 g IV Vancomycin 25 mg/kg IV* Gentamicin 1 mg/kg IV Rifampin 300 mg IV/PO	Aztreonam 2 g IV Vancomycin 25 mg/kg IV* Gentamicin 1 mg/kg IV Rifampin 300 mg IV/PO

**5. What are potential complications of endocarditis?**

Complications: destruction of heart valves, congestive heart failure, and/or embolic complications that can lead to organ damage, brain abscesses and infarcts.

**6. When should you consult cardiothoracic surgery for endocarditis?**

There appears to be a trend towards better outcomes when surgery is done instead of medical management

- Particularly true in left sided endocarditis and s. aureus endocarditis (Fraitow 2013)
- No randomized controlled trials on medical vs. surgical management (Fraitow 2013)
- In IVDU associated IE, medical management usually is effective (Tan 2014)

A recent meta-analysis of 32 studies that included 2,636 pts found that valve reoperation for PVE had a lower mortality and similar rate of PVE endocarditis compared to medical management Mihos 2017

Broad indications for surgery

- Refractory CHF
- Cardiogenic shock due to valvular insufficiency
- Persistent infection despite optimal antimicrobial therapy
- Fungal or other difficult-to-treat organisms

- One or more emboli during the first weeks of antimicrobial therapy
- Balvular complications of dehiscence, perforation, fistula, and large perivalvular abscesses (Baddour 2005, Osman 2013)
- Other potential indications for surgery in patients with IE are failure of antibiotic therapy, vegetations larger than 10 mm on echocardiography, fungal endocarditis, early prosthetic valve endocarditis (within the first 2 months after surgery), and recurrent embolization despite medical therapy. (Osman 2013)

R sided endocarditis generally doesn't get surgery. In part because there is a high recurrence rate of IE in IVDU

- ESC 2015 guidelines when to do surgery on RH endocarditis: Right HF due to severe tricuspid regurgitation (TR) not responding to diuretics, Tricuspid valve vegetations greater than 20 mm that persist after recurrent pulmonary emboli with or without concomitant right HF, IE caused by organisms that are difficult to eradicate or bacteremia for at least 7 days despite adequate antimicrobial therapy