Infective Endocarditis - Adult – Inpatient Clinical Practice Guideline

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Executive Summary
Guideline Overview

This guideline is heavily based on the 2015 AHA Scientific Statement on Infective Endocarditis in Adults: Diagnosis, Antimicrobial Therapy, and Management of Complications and the 2009 Heart and Rhythm Society Expert Consensus on Transvenous Lead Extraction.1,2

Key Practice Recommendations

1. Blood cultures should be drawn prior to antibiotic administration.3 (UW Health Class I; Level of Evidence C)

2. In clinically unstable patients, start empiric antibiotics consistent with the 2015 AHA Scientific Statement on Infective Endocarditis in Adults and consult Infectious Diseases.4 (UW Health Class I; Level of Evidence B)

3. In the absence of sepsis or other defined source of infection (i.e. urinary tract infection, pneumonia) and when infective endocarditis is suspected, antibiotics should be withheld in clinically stable patients until a microorganism is identified.3 (UW Health Class I; Level of Evidence C)

4. Transthoracic echocardiogram (TTE) should be performed in all cases of suspected IE.1 (ACC/AHA Class I; Level of Evidence B)

5. Transesophageal echocardiogram (TEE) should be done if initial TTE images are negative or inadequate in patients for whom there is an ongoing suspicion for IE or when there is concern for intracardiac complications in patients with an initial positive TTE.1 (ACC/AHA Class I; Level of Evidence B)

6. If there is a high suspicion of IE despite an initial negative TEE, then a repeat TEE is recommended in 3 to 5 days or sooner if clinical findings change.1 (ACC/AHA Class I; Level of Evidence B)

7. It is reasonable to complete a TTE at the time of antimicrobial therapy completion (typically 6-8 weeks postdischarge) to establish baseline features.1 (ACC/AHA Class IIa; Level of Evidence C)

8. Use of TEE for surveillance of interval change (e.g., resolution of thrombus after anticoagulation, resolution of vegetation after antibiotic therapy) when no change in therapy is anticipated is NOT recommended.10 (UW Health Class III; Level of Evidence B)

9. Decisions on the indication and timing of surgical intervention should be determined by a multispecialty team with expertise in cardiology, imaging, cardiothoracic surgery, and infectious diseases.1,5 (UW Health Class I; Level of Evidence B)

Companion Documents

1. Patients with Suspected Infective Endocarditis (Adult) Algorithm
2. Guideline for the Pharmacokinetic/Pharmacodynamic Dose Optimization of Antibiotics (β-lactams, aminoglycosides, and ciprofloxacin) for the Treatment of Gram-Negative Infections – Adult – Inpatient Clinical Practice Guideline
3. Clinical Monitoring of Outpatient Parenteral Antimicrobial Therapy (OPAT) and Selected Oral Antimicrobial Agents – Adult – Inpatient/Ambulatory Clinical Practice Guideline
4. Renal Function-Based Dose Adjustments – Adult – Inpatient/Ambulatory Clinical Practice Guideline
5. **Best Practices for Blood Culturing (UWHC)**

External Resources:
1. Revised and Updated Recommendations for the Establishment of Primary Stroke Centers

**Pertinent UW Health Policies & Procedures**
1. UWHC Clinical Laboratories Policy 1507.P014: Blood Culture Collection

**Patient Resources**
- Health Facts For You #5803 Special Precautions after Having a Heart Valve Replaced
- Health Facts For You #7248 Homeward Bound
- Health Facts For You #6154 Congestive Heart Failure for VAD Patients
- Healthwise: Endocarditis
- Healthwise: Endocarditis, Infective – National Organization for Rare Disorders, Inc.
- Healthwise: People Who Need Antibiotics to Prevent Endocarditis
- Healthwise: Procedures That May Require Antibiotics to Prevent Endocarditis
Scope

**Disease/Condition(s):** Suspected and confirmed infective endocarditis.

**Clinical Specialty:** Cardiology, Infectious Diseases, Cardiothoracic Surgery, Hospitalists, Neurosurgery, Internal Medicine, Family Medicine, Pharmacy

**Intended Users:** Physicians, Advanced Practice Providers, Pharmacists, Registered Nurses

**Objective(s):** To provide evidence-based recommendations for the diagnosis and treatment of infective endocarditis (IE).

**Target Population:** Adults with suspected or confirmed endocarditis.

**Interventions and Practices Considered:**
- Surgery
- Anti-microbial therapy

**Major Outcomes Considered:**
- Reduced morbidity and mortality

**Guideline Metrics:**
- Number of cases of endocarditis per quarter (by encounter diagnosis)
- Of the patients with endocarditis
  - % with an ID Consult
  - % with a Cardiology Consult
  - % with a Cardiothoracic Surgery Consult
  - % that had a cardiac surgery
  - % mortality
  - % had thoracic echocardiogram (TTE)
  - % had transesophageal echocardiogram (TEE)
Methodology

Methods Used to Collect/Select the Evidence: Electronic database searches were conducted to collect evidence for review, in addition to review of the 2015 ACC/AHA scientific statement. Expert opinion and clinical experience were also considered during review of the evidence.

Methods Used to Formulate the Recommendations: The workgroup member agreed to adopt recommendations developed by the ACC/AHA and/or arrived at a consensus through discussion of the literature and expert experience. All recommendations endorsed or developed by the guideline workgroup were reviewed and approved by other stakeholders or committees (as appropriate).

Methods Used to Assess the Quality and Strength of the Evidence/Recommendations: Recommendations developed by external organizations (e.g., ACC/AHA) maintained the evidence grade assign within the original source document and were adopted for use at UW Health. Internally developed recommendations were evaluated by the guideline workgroups using the ACC/AHA grading scheme.

Rating Scheme for the Strength of the Evidence/Recommendations: A modified Grading of Recommendations, Assessment, Development, and Evaluation (GRADE) scheme developed by the American Heart Association and American College of Cardiology (see Figure 1) was used to grade each recommendation.

Figure 1. ACC/AHA Grading Scheme
Introduction
Infective endocarditis is a relatively uncommon disease with a high mortality rate. Patients with infective endocarditis are a heterogenous group. A wide variety of pathogens may cause infective endocarditis, and some cases are culture negative. The presentation, clinical course, and approach to treatment can vary widely based on patient characteristics. Therefore, diagnosis and treatment require a collaborative approach between many different disciplines including General Medicine, Infectious Diseases, Microbiology, Cardiology, Cardiothoracic Surgery, Anesthesiology, and Neurosurgery, among others.

Recommendations
Diagnosis

<table>
<thead>
<tr>
<th>Definition of Infective Endocarditis (IE)</th>
<th>According to the Modified Duke Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEFINITIVE INFECTIVE ENDOCARDITIS</td>
<td></td>
</tr>
<tr>
<td>Pathologic criteria</td>
<td>Clinical criteria</td>
</tr>
<tr>
<td>(1) Microorganisms demonstrated by culture or histologic examination of a vegetation, a vegetation that has embolized, or an intracardiac abscess specimen; or (2) Pathologic lesions; vegetation or intracardiac abscess confirmed by histologic examination showing active endocarditis</td>
<td>(1) 2 major criteria; or (2) 1 major and 3 minor criteria; or (3) 5 minor criteria</td>
</tr>
<tr>
<td>POSSIBLE INFECTIVE ENDOCARDITIS</td>
<td></td>
</tr>
<tr>
<td>(1) 1 major criterion and 1 minor criterion; or (2) 3 minor criteria</td>
<td></td>
</tr>
<tr>
<td>REJECTED</td>
<td></td>
</tr>
<tr>
<td>(1) Firm alternate diagnosis explaining evidence of infective endocarditis; or (2) Resolution of infective endocarditis syndrome with antibiotic therapy for &lt;4 days; or (3) No pathologic evidence of infective endocarditis at surgery or autopsy, with antibiotic therapy for &lt;4 days; or (4) Does not meet criteria for possible infective endocarditis, as above</td>
<td></td>
</tr>
</tbody>
</table>
# Modified Duke Criteria for the Diagnosis of Infective Endocarditis (IE)

## MAJOR CRITERIA

### Blood culture positive for IE
- Typical microorganisms consistent with IE from 2 separate blood cultures: Viridans streptococci, *Streptococcus bovis*, HACEK* group, *Staphylococcus aureus*; or Community-acquired enterococci, in the absence of a primary focus; or
- Microorganisms consistent with IE from positive blood cultures greater than 2 days. At least 2 positive cultures of blood samples drawn >12 h apart; or All of 3 or a majority of >4 separate cultures of blood (with first and last sample drawn at least 1 h apart); or
- Single positive blood culture for *Coxiella burnetii* or anti-phase 1 IgG antibody titer ≥1:800

### Evidence of endocardial involvement
- Echocardiogram positive for IE: 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 abscess; or new partial dehiscence of prosthetic valve
- New valvular regurgitation

## MINOR CRITERIA

- **Predisposition**: predisposing heart condition or injection drug use
- **Fever**: temperature >38°C
- **Vascular phenomena**: major arterial emboli, septic pulmonary infarcts, mycotic aneurysm, intracranial hemorrhage, conjunctival hemorrhages, and Janeway’s lesions
- **Immunologic phenomena**: glomerulonephritis, Osler’s nodes, Roth’s spots, and rheumatoid factor
- **Microbiological evidence**: positive blood culture but does not meet a major criterion as noted above or serological evidence of active infection with organism consistent with IE.

**NOTE.** Excludes single positive cultures for organisms less likely to cause infective endocarditis such as coagulase-negative staphylococci.

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Blood Cultures, Antimicrobial Therapy, and Vascular Access

1. Blood cultures should be drawn prior to antibiotic administration.³ (UW Health Class I; Level of Evidence C) Patients with suspected endocarditis should have two sets of blood cultures drawn from different venipuncture sites per UW Clinical Laboratories policy 1507.P014, “Blood Culture Collection.” Collection of a full 10 mL of blood in each vial is preferred for suspected infective endocarditis (IE).⁸ (UW Health Class I; Level of Evidence C)

2. In clinically unstable patients, start empiric antibiotics consistent with the 2015 AHA Scientific Statement on Infective Endocarditis in Adults and consult Infectious Diseases.⁴ (UW Health Class I; Level of Evidence B)

3. In the absence of sepsis or other defined source of infection (i.e. urinary tract infection, pneumonia) and when infective endocarditis is suspected, antibiotics should be withheld in clinically stable patients until a microorganism is identified.³ (UW Health Class I; Level of Evidence C)

4. Once an organism is identified, consult Infectious Diseases (if not already done) to begin an antimicrobial regimen consistent with the 2015 AHA Scientific Statement on Infective Endocarditis in Adults.¹

5. Pharmacokinetic/pharmacodynamics (PK/PD) principles should be used to optimize (improve efficacy and minimize toxicity) antimicrobial utilization when possible per Guidelines for the Pharmacokinetic/Pharmacodynamic Dose Optimization of Antibiotics (β-lactams, aminoglycosides, and ciprofloxacin) for the Treatment of Gram-Negative Infections – Adult – Inpatient Clinical Practice Guideline and Intravenous Vancomycin Use – Adult – Inpatient. For patients with renal impairment, make antimicrobial therapy dose adjustments per Renal Function-Based Dose Adjustments – Adult – Inpatient/Ambulatory Clinical Practice Guideline.

6. It is reasonable to obtain at least 2 sets of blood cultures every 24 to 48 hours until bloodstream infection has cleared.¹ (ACC/AHA Class IIa, Level of Evidence C)

7. If a patient has a glomerular filtration rate (GFR) less than 30 mL/minute, it is recommended to avoid placement of a peripherally inserted central catheter (PICC) and instead to place a tunneled internal or external jugular PICC which preserves the patient’s basilic and cephalic veins for future arteriovenous access.⁹ (UW Health Class I; Level of Evidence C)

Echocardiography

1. Echocardiography should be performed expeditiously in patients suspected of having IE.¹ (ACC/AHA Class I; Level of Evidence A)

2. Transthoracic echocardiogram (TTE) should be performed in all cases of suspected IE.¹ (ACC/AHA Class I; Level of Evidence B)

3. Transesophageal echocardiogram (TEE) should be done if initial TTE images are negative or inadequate in patients for whom there is an ongoing suspicion for IE or when there is concern for intracardiac complications in patients with an initial positive TTE.¹ (ACC/AHA Class I; Level of Evidence B)

4. If there is a high suspicion of IE despite an initial negative TEE, then a repeat TEE is recommended in 3 to 5 days or sooner if clinical findings change.¹ (ACC/AHA Class I; Level of Evidence B)

5. Repeat TEE should be done after an initially positive TEE if clinical features suggest a new development of intracardiac complications.¹ (ACC/AHA Class I; Level of Evidence B)
6. It is reasonable to complete a TTE at the time of antimicrobial therapy completion (typically 6-8 weeks postdischarge) to establish baseline features.\(^1\) (ACC/AHA Class IIa; Level of Evidence C)

7. Use of TEE for surveillance of interval change (e.g., resolution of thrombus after anticoagulation, resolution of vegetation after antibiotic therapy) when no change in therapy is anticipated is NOT recommended.\(^{10}\) (UW Health Class III; Level of Evidence B)

Figure 2. An Approach to the Diagnostic Use of Echocardiography in Suspected Infective Endocarditis

Additional Evaluation and Management

1. Decisions on the indication and timing of surgical intervention should be determined by a multispecialty team with expertise in cardiology, imaging, cardiothoracic surgery, and infectious diseases.\(^{1,5}\) (UW Health Class I; Level of Evidence B)

2. Metastatic foci of infection are common. In symptomatic patients, diagnostic evaluation is vital, especially in patients who require valve surgery. The choice of diagnostic procedure (e.g. CT, MRI, ultrasonography) varies and the selection should be individualized for each patient.\(^1\) (ACC/AHA Class I, Level of Evidence C).

3. A thorough dental evaluation is reasonable, especially in patients deemed likely to require valve replacement, with all active sources of oral infection eradicated.\(^1\) (ACC/AHA Class IIa; Level of Evidence C) Inpatient dental evaluation may be achieved by
placing a consult to Dental (Inpatient) and completing Panorex x-rays. If deemed necessary, tooth extraction can be done on either an inpatient or outpatient basis with physician referral.

**Mycotic Aneurysms**

1. Cerebrospinal imaging should be performed to detect intracranial mycotic aneurysms (ICMA) or central nervous system (CNS) bleeding in all patients with IE or contiguous spread of infection who develop severe, localized headache, neurological deficits, or meningeal signs. \(^1\) (ACC/AHA Class I; Level of Evidence B)

2. Cerebrovascular imaging (CT angiography, magnetic resonance angiography, or digital subtraction angiography) may be considered in all patients with left-sided IE who have no CNS signs or symptoms. \(^1\) (ACC/AHA Class IIb; Level of Evidence C) At UW Health cerebrovascular imaging is recommended for all patients with left-sided infective endocarditis as the results may impact the choice and duration of antimicrobial therapy. \(^1\) (UW Health Class I; Level of Evidence C)

**Anticoagulation**

1. Discontinuation of all forms of anticoagulation in patients with mechanical valve IE who have experienced a CNS embolic event for at least 2 weeks is reasonable. \(^1\) (ACC/AHA Class IIa; Level of Evidence C)

2. Initiation of aspirin or other antiplatelet agents as adjunctive therapy in IE is not recommended. \(^1\) (ACC/AHA Class III; Level of Evidence B)

3. The continuation of long-term antiplatelet therapy at the time of development of IE with no bleeding complications may be considered. \(^1\) (ACC/AHA Class IIb; Level of Evidence B)

**Early Valve Surgery in Left-Sided Native Valve Endocarditis (NVE)**

1. Early surgery (during initial hospitalization and before completion of a full course of antibiotics) is indicated in patients with IE who present with valve dysfunction resulting in symptoms or signs of heart failure. \(^1\) (ACC/AHA Class I; Level of Evidence B)

2. Early surgery should be considered particularly in patients with IE caused by fungi or highly resistant organisms (eg, vancomycin-resistant *Enterococcus*, multidrug-resistant Gram-negative bacilli). \(^1\) (ACC/AHA Class I; Level of Evidence B)

3. Early surgery is indicated in patients with IE complicated by heart block, annular or aortic abscess, or destructive penetrating lesions. \(^1\) (ACC/AHA Class I; Level of Evidence B)

4. Early surgery is indicated for evidence of persistent infection (manifested by persistent bacteremia or fever lasting >5–7 days and provided that other sites of infection and fever have been excluded) after the start of appropriate antimicrobial therapy. \(^1\) (ACC/AHA Class I; Level of Evidence B)

5. Early surgery is reasonable in patients who present with recurrent emboli and persistent or enlarging vegetations despite appropriate antibiotic therapy. \(^1\) (ACC/AHA Class IIa; Level of Evidence B)

6. Early surgery is reasonable in patients with severe valve regurgitation and mobile vegetations >10 mm. \(^1\) (ACC/AHA Class IIa, Level of Evidence B)
7. Early surgery may be considered in patients with mobile vegetations >10 mm, particularly when involving the anterior leaflet of the mitral valve and associated with other relative indications for surgery. \(^1\) (ACC/AHA Class Iib; Level of Evidence C)

8. Further recommendations on the surgical management of conditions not specifically addressed in this guideline (i.e., right-sided endocarditis) are available in the 2015 ACC/AHA Scientific Statement on Infective Endocarditis in Adults.

**Early Valve Surgery in Prosthetic Valve Endocarditis (PVE)**

1. Early surgery is indicated in patients with symptoms or signs of heart failure resulting from valve dehiscence, intracardiac fistula, or severe prosthetic valve dysfunction. \(^1\) (ACC/AHA Class I; Level of Evidence B)

2. Early surgery should be done in patients who have persistent bacteremia despite appropriate antibiotic therapy for 5 to 7 days in whom other sites of infection have been excluded. \(^1\) (ACC/AHA Class I; Level of Evidence B)

3. Early surgery is indicated when IE is complicated by heart block, annular or aortic abscess, or destructive penetrating lesions. \(^1\) (ACC/AHA Class I; Level of Evidence B)

4. Early surgery is indicated in patients with PVE caused by fungi or highly resistant organisms. \(^1\) (ACC/AHA Class I; Level of Evidence B) Antibiotics may be considered as first line therapy for patients with prosthetic valve endocarditis associated with small vegetations and without significant valve destruction. \(^12\) (UW Health Class Iib; Level of Evidence C)

5. Early surgery is reasonable for patients with PVE who have recurrent emboli despite appropriate antibiotic treatment. \(^1\) (ACC/AHA Class Iib; Level of Evidence B)

6. Early surgery is reasonable for patients with relapsing PVE. \(^1\) (ACC/AHA Class Iib; Level of Evidence B)

7. Early surgery may be considered in patients with mobile vegetations >10 mm. \(^1\) (ACC/AHA Class I; Level of Evidence B)

8. Further recommendations on the surgical management of conditions not specifically addressed in this guideline (i.e., right-sided endocarditis) are available in the 2015 ACC/AHA Scientific Statement on Infective Endocarditis in Adults.

**Valve Surgery in Patients with Prior Emboli/Hemorrhage/Stroke**

1. Valve surgery may be considered in IE patients with stroke or subclinical cerebral emboli and residual cerebral emboli without delay if intracranial hemorrhage has been excluded by imaging studies and neurological damage is not severe (i.e., coma). \(^1\) (ACC/AHA Class Iib; Level of Evidence B)

2. In patients with major ischemic stroke or intracranial hemorrhage, it is reasonable to delay valve surgery for at least 4 weeks. \(^1\) (ACC/AHA Class Iia; Level of Evidence B) A small ischemic stroke is not a contraindication for surgery for the appropriately selected patient.

**Cardiovascular Implanted Electronic Device (CIED) Lead Extraction**

1. Complete device and lead removal is recommended in all patients with definite CIED system infection, as evidenced by valvular endocarditis, lead endocarditis or sepsis. \(^2\) (ACC/AHA Class I; Level of Evidence B)

2. Complete device and lead removal is recommended in all patients with valvular endocarditis without definite involvement of the lead(s) and/or device. \(^2\) (ACC/AHA Class I; Level of Evidence B)
3. Complete device and lead removal is recommended in patients with occult gram-positive bacteremia (not contaminant).² (ACC/AHA Class I; Level of Evidence B)

4. Complete device and lead removal is reasonable in patients with persistent occult gram-negative bacteremia.² (ACC/AHA Class IIa; Level of Evidence B)

5. For every patient with bacteremia and a suspicion of infective endocarditis who also has a CIED, early consultation with the Electrophysiology Service is recommended. (UW Health Class I; Level of Evidence C)

6. Further recommendations on device and lead removal, as well as replacement after infected removal, are available in the 2009 Heart and Rhythm Society Expert Consensus on Transvenous Lead Extraction.²

Discharge and Follow-up Care

1. Prior to discharge from the hospital, a follow-up provider should be identified and initial follow up visit arranged for 5 days to 2 weeks post-discharge, depending on the prescribed anti-microbial agent. This provider is responsible for ensuring monitoring and continued follow up per Clinical Monitoring of Outpatient Parenteral Antimicrobial Therapy (OPAT) – Adult – Inpatient/Ambulatory. (UW Health Class I; Level of Evidence C)

2. It is reasonable to complete a TTE at the time of antimicrobial therapy completion (typically 6-8 weeks postdischarge) to establish baseline features.¹ (ACC/AHA Class IIa; Level of Evidence C)

3. Use of TEE for surveillance of interval change (e.g., resolution of thrombus after anticoagulation, resolution of vegetation after antibiotic therapy) when no change in therapy anticipated is NOT recommended.¹⁰ (UW Health Class III; Level of Evidence B)

4. Patients with significant valve lesion (i.e. moderate or greater valve regurgitation) should have cardiology follow up 6-8 weeks after discharge, following or in conjunction with the TTE at end of antimicrobial therapy. (UW Health Class I; Level of Evidence C)

5. Prior to discharge, inpatients with IE should be thoroughly evaluated by a dentist to identify and eliminate oral diseases that predispose to bacteremia and may therefore contribute to the risk for recurrent IE.¹ (ACC/AHA Class I; Level of Evidence C) At UW Health, inpatient dental evaluation may be achieved by completing Panorex x-rays and placing a Health Link consult to Dental (Inpatient). A dentist is on call 24/7. The evaluation would typically be performed during regular dental clinic hours if possible. If deemed necessary, tooth extraction can be done on either an inpatient or outpatient basis. The dental clinic at University Hospital does not provide general dentistry services, for example, cleaning, fillings, crowns, or root canals. The dental clinic phone number is available via paging.

6. Daily dental hygiene should be stressed, with serial evaluations by a dentist or dental hygienist (e.g., biannual cleanings) who is familiar with this patient population.¹ (ACC/AHA Class I; Level of Evidence C). Access to dental care for uninsured and Medicaid patients is a challenge. A phone call from a physician or nurse may expedite follow up care. Dane County dental resources. Dental resources in surrounding counties.
7. Prophylaxis against endocarditis is recommended for patients with a previous endocarditis, including those with and without prosthetic valve replacement or repair, only prior to specific dental and invasive procedures as outlined in the 2008 ACC/AHA Guideline Update on Valvular Heart Disease: Focused Update on IE.\(^\text{13}\) (UW Health Class I; Level of Evidence B)
UW Health Implementation

Potential Benefits:
- Reduced morbidity and mortality

Potential Harms:
- Harms associated with valve replacement surgery
- Toxic effects of some antimicrobial agents

Implementation Plan/Tools
1. Guideline will be housed on U-Connect in a dedicated folder for CPGs.
2. Release of the guideline will be advertised in the Physician/APP Briefing.
3. Development of appropriate Health Link tools such as an order set.
4. Development of tools for early identification of patients at high risk for infective endocarditis.

Disclaimer
CPGs are described to assist clinicians by providing a framework for the evaluation and treatment of patients. This Clinical Practice Guideline outlines the preferred approach for most patients. It is not intended to replace a clinician’s judgment or to establish a protocol for all patients. It is understood that some patients will not fit the clinical condition contemplated by a guideline and that a guideline will rarely establish the only appropriate approach to a problem.

References


Suspected Infective Endocarditis

- Draw Blood Cultures
- Consult ID

In clinically unstable patients, start **empiric antimicrobial therapy**. In clinically stable patients, **HOLD** antimicrobial therapy until organism identified. 

- Transthoracic echo (TTE)
- Transesophageal echo (TEE) if any of the following:
  1. High risk clinical features.
  2. Suboptimal TTE images.
  3. High risk TTE findings.

Positive Echo?

- YES
  - ECHO ATTENDING (OR FELLOW) reports critical findings to primary team

- NO
  - Look for alternate sources of infection
  - Repeat TEE in 3-5 days if suspicion remains high

Additional Evaluation & Management

- Repeat blood cultures every 24-48 hours until negative.
- Continue antimicrobial therapy as per Infectious Disease.
- Repeat TTE/TEE if clinical features suggest development of new cardiac complications.
- Cerebrovascular imaging to detect ICMA or CNS bleed in symptomatic patients.
- Evaluation for metastatic foci of infection in symptomatic patients.
- Dental evaluation for pre-valve surgical patients, and upon discharge of all confirmed IE cases.

Notes regarding IE Consult Panel:
- The echo staff will communicate the critical echo findings to the **primary team**.
- The echo attending will prompt the primary team to use the IE Consult order.
- The consult orders will be placed by the primary team.
- On a case by case basis, the echo staff/fellow will directly communicate the critical echo findings to the consulting service(s).

Additional Details

A. In the absence of sepsis or other defined source of infection (i.e., UTI, pneumonia) and high suspicion of IE.

B. High risk clinical features: Prosthetic heart valves, most congenital heart diseases, previous IE, heart failure, or other stigmata of endocarditis.

C. High risk echo findings: Large or mobile vegetations, valvular insufficiency, suggestion of perivalvular extension, or secondary ventricular dysfunction.

D. Cardiology consult service will assess patient for appropriateness of transfer to inpatient cardiology service.

E. Potential surgical indications: Left sided vegetation > 1 cm, recurrent embolic events, heart failure, perivalvular extension or abscess, prosthetic heart valve, persistently positive cultures.

IE CONSULT PANEL INITIATED

□ ID (if not already consulted)
□ Cardiology (if potential surgical indication)
□ CT Surgery (if potential surgical indication)
□ EP if patient has cardiac implanted device

Reference: Infective Endocarditis – Adult – Inpatient Clinical Practice Guideline
Empiric Antimicrobial Therapy for Infective Endocarditis

For use in the absence of sepsis or other defined source of infection (i.e. UTI, pneumonia) and high suspicion of IE:
- In clinically unstable patients, start empiric antimicrobial therapy as outlined below. *(UW Health Class I; Level of Evidence B)*
- In clinically stable patients, withhold antibiotics until an organism is identified. *(UW Health Class I; Level of Evidence C)*
- Dose adjustments may be warranted per collateral guidelines: Vancomycin Use, Renal Dosing, and Pharmacokinetic/Pharmacodynamic Dose Optimization.

### Native Valve Endocarditis (acute clinical presentation)
Comment: Most common organisms include *Staphylococcus aureus*, β-hemolytic Streptococci, and aerobic Gram–negative bacilli
*(ACC/AHA Class IIa, Level of Evidence C)*

- Vancomycin 20mg/kg IV x1, then 15mg/kg IV every 12 hours
- Cefepime 2g IV every 8 hours prolonged infusion

### Native Valve Endocarditis (subacute presentation)
Comment: Most common organisms include *Staphylococcus aureus*, nutritionally variant Streptococci, HACEK organisms, and *Enterococci* sp.
*(ACC/AHA Class IIa, Level of Evidence C)*

- Vancomycin 20mg/kg IV x1, then 15mg/kg IV every 12 hours
- Ampicillin/sublactam 3g IV every 6 hours

### Prosthetic Valve Endocarditis (< 1 year from valve replacement surgery)
Comment: Most common organisms include *Staphylococcus aureus*, nutritionally variant Streptococci, HACEK organisms, *Enterococci* sp., and pseudomonas
*(ACC/AHA Class IIa, Level of Evidence C)*

- Vancomycin 20mg/kg IV x1, then 15mg/kg IV every 12 hours
- Cefepime 2g IV every 8 hours prolonged infusion
- Tobramycin 5mg/kg IV x1 OR Ciprofloxacin 400mg IV every 8 hours

### Prosthetic Valve Endocarditis (> 1 year from valve replacement surgery)
Comment: Most common organisms include *Staphylococcus* (MRSE, MRSA, and MSSA), nutritionally variant Streptococci, and *Enterococci* sp.
*(ACC/AHA Class IIa, Level of Evidence C)*

- Vancomycin 20mg/kg IV x1, then 15mg/kg IV every 12 hours
- Ceftriaxone 2g IV every 24 hours

### Discharge & Follow-Up

- Identify and schedule initial visit with the healthcare team responsible for administration and monitoring OPAT per Clinical Monitoring of Outpatient Parenteral Antimicrobial Therapy (OPAT) – Adult. Initial visit is typically 5 days to 2 weeks post-discharge, depending on antimicrobial agents used.
- Schedule TTE at the time of completion of antimicrobial therapy, usually 6-8 weeks post-discharge (TEE usually not warranted)
- Schedule Cardiology follow up for patients with significant valve lesion (schedule after or in conjunction with TTE)
- Arrange for dental evaluation if not completed while IP. Dane County dental resources

Dental resources in surrounding counties

- Patient education: Signs & symptoms of IE, daily dental hygiene, dental visits every 6 months, and antibiotic prophylaxis prior to specific dental and invasive procedures as outlined in the 2008 AHA ACC Guideline Update on Valvular Heart Disease: Focused Update on IE.


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