A 30 yo man is admitted with a three week history of low grade fever, malaise, sweats and 10 pound weight loss. He was told he had a heart murmur as a child, but is otherwise healthy. On exam he has a temperature of 38.2, pulse of 92, and BP of 130/45. He has dark red, painful nodules on the tips of the second finger of left hand, right thumb and right second toe. There are two petechiae on the palpebral conjunctiva of the right eye but no oral lesions. Lungs are clear. PMI is 1 cm outside MCL and dynamic. There is a 2/4 diastolic blowing murmur loudest at the lower left sternal border. The spleen tip is palpable.

Hemoglobin is 11 and normocytic, WBC is 5.6 and platelets are 160. Electrolytes are normal as is creatinine. Urinalysis discloses trace protein and 5 RBCs. CXR – clear lung fields and a slightly enlarged cardiac silhouette.

You suspect endocarditis. What test is most likely to provide the etiologic diagnosis?

1. Echocardiogram
2. Throat Culture
3. Urine Culture
4. Blood Culture
5. CT scan of the abdomen and pelvis
6. Sedimentation rate
7. CRP
Describe the pathogenesis of endocarditis, i.e., how does it happen?

Valvular Endothelium → Mucous membranes or other colonized tissue

Platelet-fibrin deposition → Bacteremia

Nonbacterial thrombotic endocarditis → Adherence

Trauma

Turbulence

Metabolic changes

PATHOPHYSIOLOGY (cont)

ADHERENCE

COLONIZATION

Bacterial division to $10^9-10^{10}$

Fibrin deposition

Platelet aggregation

Sessile (inactive) population

Protection from neutrophils

MATURE VEGETATION

Host Response

Antibiotic Delivery

What were the nodules and petechiae described in the case?
What other findings in the case support the diagnosis of endocarditis?

- Splenomegaly – 10 - 25%
- Anemia – 50%
- Hematuria – 25%

What valve is likely involved in this patient?

1. Mitral
2. Aortic
3. Tricuspid
4. Pulmonic
5. No valve, he has a congenital ventricular septal defect
What organisms are more likely causes of native valve endocarditis (choose 4 from below)?

1. Group A beta hemolytic streptococci
2. Viridans streptococci
3. Hemophilus influenzae
4. Neisseria gonorrhoeae
5. Enterococcus species
6. Staphylococcus aureus
7. Coagulase negative staphylococci
8. HACEK group
   1. Hemophilus parainfluenzae
   2. Actinobacillus, Aggregatibacter
   3. Cardiobacterium
   4. Eikenella
   5. Kingella

Other Causes of Endocarditis
Prosthetic valve
Culture Negative

### Prosthetic Valve Endocarditis

<table>
<thead>
<tr>
<th>Etiologic Agent</th>
<th>“Early”</th>
<th>“Late”</th>
<th>Total</th>
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<tbody>
<tr>
<td>Staphylococci</td>
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<td>S. aureus</td>
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<td>12</td>
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<td>Group D Strep/Enterococcus</td>
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<tr>
<td>Diphtheroids</td>
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<tr>
<td>Culture negative</td>
<td>1</td>
<td>4</td>
<td>3</td>
</tr>
</tbody>
</table>

**Early (surgically related) days 0-60, Late > 60 days**
Risk: 1-4% year 1, then 1%/year thereafter
Culture Negative Endocarditis

Reasons for Negative Cultures

- Fastidious organisms (ie. Anaerobes, HACEK)
- More common in countries with zoonoses
- Prior administration of antibiotics
- Fungal IE
- Non-infective endocarditis

What organism commonly causes endocarditis in intravenous drug users?

What valve is more commonly involved in intravenous drug users with endocarditis?

Are there objective criteria for diagnosing endocarditis?

Modified Duke Criteria

- DEFINITIVE IE - Pathologic Criteria
  - Microorganisms: shown by culture or histology in a vegetation, or in a vegetation that has embolized, or in an intracardiac abscess
  - Pathologic lesions: vegetation or intracardiac abscess present, confirmed by histology showing active endocarditis
- Clinical Criteria - Major (in absence of definitive)
  - Persistently positive blood cultures for typical organism (vs. strep, S. bovis (gallolyticus), Granulicatella, Abiotrophia, HACEK, S. aureus, Enterococcus)
  - Typical findings on ECHO (i.e. mobile vegetation) or endocardial damage (new regurgitant murmur)
  - Serological or cultural evidence of Coxiella burnetti

Are there objective criteria for diagnosing endocarditis?

• Clinical Criteria - Minor
  1) FEVER: ≥ 38°C (≥ 100.4°F)
  2) PREDISPOSITION: predisposing heart condition (valve with regurgitation or turbulent blood flow, prosthetic valve) or IV drug use
  3) VASCULAR PHENOMENA: arterial embolism, septic pulmonary infarcts, Janeway lesions, conjunctival hemorrhages
  4) IMMUNOLOGIC PHENOMENA: glomerulonephritis, Osler nodes, Roth spots, rheumatoid factor
  5) MICROBIOLOGIC: positive blood culture but not meeting major criteria OR serologic evidence of active IE with organism consistent with IE.

• DEFINITE IE: Clinical Criteria
  • 2 Major criteria, OR
  • 1 Major and 3 Minor criteria, OR
  • 5 Minor

After obtaining two (three) blood cultures, what antibiotics would you start?

1. Penicillin G
2. Penicillin G + gentamicin
3. Nafcillin
4. Nafcillin + gentamicin
5. Vancomycin
6. Clindamycin
7. Levofloxacin
8. Doxycycline
9. I would not start antibiotics

In addition to the blood cultures, what other test would you order to support your working diagnosis?

1. Chest x-ray
2. Electrocardiogram
3. CT of Chest
4. Urinalysis
5. CBC and diff
6. Trans thoracic echocardiogram
7. Trans esophageal echocardiogram
Sensitivity of Echocardiogram

• What is the likelihood of detecting endocarditis with a transthoracic echocardiogram (TTE)?

• What is the likelihood of detecting endocarditis with a transesophageal echocardiogram (TEE)?

On the second hospital day, the nurse reports that the patient is not moving his left side. On evaluation he has facial weakness and can barely lift his left arm or leg.

What is the cause of the sudden paralysis?
1. Hemorrhage into a brain tumor
2. Thrombosis of the left middle cerebral artery
3. Embolus to the right middle cerebral artery
4. Herpes encephalitis

Echocardiogram discloses a 1.3 cm vegetation on the noncoronary cusp of the aortic valve and moderate aortic insufficiency. All three blood cultures return positive for gram positive cocci in chains. What antibiotic would you choose?

1. Penicillin G
2. Ampicillin
3. Cefazolin
4. Penicillin G + gentamicin
5. Vancomycin + penicillin G + gentamicin
The following day there are non hemolytic colonies on the blood culture plate.

What is the most likely organism?
1. Group A Streptococcus
2. Viridans streptococcus
3. One of the HACEK’s
4. Staphylococcus aureus
5. Enterococcus
6. Group B streptococcus

The organism is pan-susceptible and penicillin and gentamicin are started. After 2 hours, the patient develops a rash on his face, arms and legs consisting of annular lesions 1-2.5 cm in diameter along with associated swelling (hives). The rash is pruritic. What is the rash?
1. A drug-induced type 1 hypersensitivity reaction
2. A drug-induced type 2 hypersensitivity reaction
3. A drug-induced delayed hypersensitivity reaction
4. Emboli to the skin from the vegetation on the valve
5. Chickenpox
6. A serum sickness like vasculitis

What would you do next?
1. Stop the penicillin and treat with gentamicin alone
2. Stop the gentamicin
3. Stop the penicillin, continue the gentamicin and substitute vancomycin
4. Stop the penicillin, continue the gentamicin and substitute clindamycin
5. Stop both antibiotics and start imipenem
Therapy is continued with vancomycin and gentamicin and the patient is sent home. On the 18th day of therapy you are called by the home care nurse and informed that the patient’s creatinine has risen from normal to 2.6. What is the likely cause?

1. Infarct of the kidney secondary to emboli from the vegetation
2. Immune complex nephritis
3. Vancomycin induced nephrotoxicity
4. Gentamicin induced nephrotoxicity
5. Dehydration secondary to poor oral intake
6. Secondary infection of the PICC line

How long do we treat endocarditis?

• Prolonged therapy indicated ranging from two weeks (exquisitely sensitive viridans streptococci) to six weeks.
• Four weeks is typical for streptococcal species
• Nearly always intravenous antibiotic therapy

How do we manage a patient who has acute aortic insufficiency and develops heart failure due to the damaged valve?

• Valve replacement surgery

There are other types of intravascular infections which are clinically important and which you will need to learn about. They are:

• Infected aortic aneurysm
• Mycotic aneurysm
• Septic phlebitis
  • Accompanying extensive localized infection
  • Nosocomial due to intravascular catheters
• Infected intravascular device
  • Cardiac pacemaker
  • Implantable defibrillator
  • Infected vascular grafts
Thank You