ENOCARDITIS

I. General
   A. infective endocarditis (IE)
      1. definition: infection of the endocardial surface of the heart; implies
         the physical presence of microorganisms in the lesion
      2. infecting organisms can be on valves (most common), septal defects,
         endocardial surface, or abnormal vessels
      3. Classification
         a. old
            acute: fulminant course, high fever, systemic toxicity
            (Staphylococcus aureus, Streptococcus pyogenes for
            examples).
            Subacute/chronic: commonly occur in the setting of prior
            valve disease; slow, indolent course with low grade fevers,
            night sweats, weight loss; (example: viridans streptococci)
         b. new
            based on etiologic agent better as helps to determine:
            course/prognosis: choice of antimicrobial, likelihood of pre-
            existing heart disease

II. Epidemiology
   A. approximately 1/3 are “acute”
   B. more than 50% of cases are older than 50 years
   C. more common in males
   D. Mitral valve most commonly involved, except injection drug users (tricuspid
      valve)
   E. associated with underlying valvular disease
      1. rheumatic heart disease (25% of cases)
         a. mitral most common
      2. congenital heart disease (6-24% of cases)
         a. congenitally bicuspid aortic valve
            (20% of cases > age 60) poor prognosis
         b. IE essentially does not occur with secundum atrial defects
            (low-pressure shunt; little turbulence)
      3. “degenerative” cardiac lesions (30-40% of cases without underlying
         valve disease)
      4. other conditions that my predispose
         ex: syphilitic heart disease, hemodialysis, shunts/fistulas, pacemaker
         wires or prosthetic valves, injection drug use, mitral valve prolapse
         with regurgitation (midsystolic click with murmur)

III. Pathogenesis/Pathophysiology
   A. turbulent flow results in deposition of platelets and fibrin (nonbacterial
      thrombotic endocarditis).
   B. Nonbacterial thrombotic endocarditis (NBTE)
1. alteration of valve surface is prerequisite for bacterial colonization
2. found in many conditions causing acute/chronic illness (malignancy, uremia, connective tissue diseases)
3. hypercoagulability and/or endothelial damage are pathogenic mechanisms
4. found most frequently on low-pressure side of cardiac valves along the ling of closure (same site as IE)

C. Hemodynamic factors
1. lesions with high degrees of turbulence readily create conditions that lead to bacterial colonization
2. low flow states (secundum atrial defects) rarely associated with IE

D. Transient bacteremia
1. occurs when mucosal surface heavily colonized with bacteria is traumatized
2. blood stream is usually clear 15-30 minutes after the procedure
3. bacteria in bloodstream can then colonized NBTE lesions

E. Microorganism – NBTE Interaction
1. organisms differ in their propensity to case IE (ex: Staph. aureus)
2. once bacteria bind they proliferate, causing further platelet – fibrin deposition.
3. vegetation creates an environment of impaired host resistance (bacteria covered by platelets/fibrin)

F. Immunopathologic Factors
1. stimulation of humoral and cellular immunity
2. Rheumatoid factor (RF) can be positive
3. antinuclear antibodies (ANA) can be present
4. circulating immune complexes

IV. Pathologic changes
A. Heart
1. vegetation located along line of closure of valve leaflet
2. complications
   perforation of valve leaflet, valve ring abscess, myocardial abscesses (20%), rupture of chordae tendineae/interventricular septum/papillary muscle, valvular stenosis (large lesions), myocarditis, pericarditis, myocardial infarction (40-60% of autopsied cases)

B. Kidney
1. abscess
2. infarction
3. glomerulonephritis (focal or diffuse) secondary to immune complex deposition

C. Mycotic aneurysms
1. usually develop during active disease, but can occur months to years later
2. tend to occur at bifurcation points
3. mechanisms leading to aneurysm
   a. direct bacterial invasion of arterial wall with abscess formation
b. embolic occlusion of vasovasorum

c. immune complex deposition with injury to vessel wall

4. clinically silent until rupture occurs

D. lung (tricuspid valve endocarditis)

5. embolic

6. pleural effusion/empyema

E. Virtually any organ system can be involved (liver, skin, eye)

V. Clinical manifestations

A. “incubation period” 2 weeks
   (ex: from dental procedure to symptom onset) but time from symptom onset to diagnosis averages 5 weeks

B. processes contributing to the clinical picture
   1. infectious process on the valve
   2. bland/septic emboli to any organ system
   3. constant bacteremia (with metastatic foci)
   4. circulating immune complexes

C. fever (95%)
   1. usually remittent
   2. absent in: CHF, renal failure, older age, terminal illness, prior antibiotic therapy

D. nonspecific symptoms
   1. anorexia, weight loss, fatigue, chills, weakness, nausea, vomiting, nightsweats
   2. often results in incorrect initial diagnosis

E. heart murmur (85%) classically a new or changing murmur

F. peripheral manifestations (50%)
   1. clubbing 10 – 20%
   2. splinter hemorrhages (linear red/brown streaks in the nail bed).
   3. petichiae on conjunctiva, buccal mucosa, palate an extremities 20 – 40%
   4. Osler nodes: small painful nodular lesions on the pads of fingers/toes or thenar eminence 10 – 25% (immune complex deposition)
   5. Janeway lesions: hemorrhagic, macular, painless plaques with predilection for the palms/soles (emboli)
   6. Roth spots: oval, pale, retinal lesions surrounded by hemorrhage, usually near the optic disk (funduscopic exam)

G. Splenomegaly 25 – 60%

H. musculoskeletal complaints (aches, arthralgias)

I. Major embolic episode to any organ system

J. central nervous system 20 – 40%
   major cerebral emboli 10 – 30%
   subarachnoid hemorrhage due to mycotic aneurysm
   seizures
   cranial nerve palsies
   toxic encephalopathy
K. renal failure 25- 35%
L. injection drug users
   1. tricuspid valve most common
   2. often present with prominent pulmonary findings
      (septic emboli to lungs)
   3. often occurs on otherwise normal heart valves

VI. Laboratory
    A. anemia common 70 – 90% (low hemoglobin)
    B. thrombocytopenia 5 – 15% (low platelet count)
    C. leukocytosis 20 – 30% (elevated white blood count)
    D. sedimentation rate (ESR) nearly always elevated 90-100%
    E. urinalysis
       proteinura (50-65%), microscopic hematuria (30-60%),
       red cell casts (12%), gross hematuria, pyuria, white cell
       casts, bactiuria
    F. blood culture
       1. most important lab test
       2. bacteremia usually continuous
       3. in >90% of cases the first 2 sets of blood cultures drawn will yield
          the organism responsible
       4. less likely to be positive if patient has received antibiotics in the
          prior 2 weeks
       5. procedure for collecting blood culture
          • 3 sets within 24 hours (3 separate venapunctures)
          • at least 10 ml of blood per bottle

VII. Special diagnosis tests
    A. 2D Echocardiogram
       1. can visualize vegetations greater than 2 mm in size
    B. Transesophageal echocardiogram (TEE)
       1. negative study does not exclude IE
       2. false-positive results are rare
       3. dependent upon experience of technician/reader
       4. valuable to assess local complications of IE (valve ring abscess)
       5. better for visualizing aortic valve than 2D Echo
       6. patients with vegetations are at increased risk for embolization.
    C. Combination of Clinical and Diagnostic criteria used to classify as definite,
       possible, or not IE.

VIII. Specific Etiological Agents
    A. Streptococcus viridans (gram-positive cocci)
       1. typically subacute
       2. 80% have underlying valve disease
       3. most common cause of IE (dental procedures)
4. many species comprise the viridans group of Streptococci
5. good prognosis
6. most common cause of endocarditis in patients with mitral valve prolapse

B. Enterococci (gram-positive cocci)
1. becoming increasingly common cause of endocarditis
2. very difficult to treat
3. usually subacute
4. peripheral manifestations uncommon
5. seen in older men after genitourinary procedures and young women after obstetrical procedures

C. Streptococcus pneumoniae (gram-positive cocci)
1. unusual cause
2. usually fulminant
3. predilection for aortic valve (70%)
4. often alcoholics
5. many have meningitis (70%)
6. poor outcome (50% mortality)

D. Staphylococcus aureus (gram-positive cocci in clusters)
1. coagulase-positive staph
2. causes 80 – 90% of cases of Staphylococcal endocarditis
3. commonly attacks normal heart valve (1/3 of cases)
4. prognosis poor (40% mortality)
5. more commonly causes myocardial abscesses, purulent pericarditis, and valve ring abscesses than other causes of IE
6. metastatic infection to lung, brain, spleen, kidney common
7. common cause of IE in injection drug users but in IDU has less fulminant course with less mortality

E. Staphylococcus epidermidis (gram-positive cocci in clusters)
1. coagulase-negative
2. common cause of prosthetic valve endocarditis
3. can cause endocarditis in neonates
4. medical and/or surgical therapy usually successful

F. Gram-negative bacilli
1. uncommon but increasing
2. risks: injection drug users, prosthetic valve recipients, cirrhotics
3. CHF common
4. prognosis poor (70-80% mortality)
5. commonly require early valve replacement, especially left-sided disease due to Pseudomonas species

G. “HACEK” group (“culture-negative endocarditis)
1. fastidious; require 2-3 weeks to grow

H  Hemophilus species
A  Actinobacillus actinomycescomitans
C  Cardiobacterium hominis
E  Eikenella corrodens
K  Kingella kingae (and other species)
2. causes subacute course
3. need to alert microbiology lab to supplement media and hold cultures longer

H. Fungi
1. risks: injection drug users, patients after reconstructive cardiovascular surgery, patients after prolonged IV/antibiotic therapy
2. cure virtually impossible without surgery

I. Other causes of “culture-negative” endocarditis
   - Brucella species
   - fungi
   - rickettsia
   - chlamydia
   - mycobacteria

IX. Therapy
A. prolonged course of antibiotics (4-6 weeks) with bactericidal agents directed against the specific pathogen
B. surgical intervention indicated if:
   1. congestive heart failure unresponsive to medical therapy
   2. greater than 1 major systemic embolic complication
   3. inability to clear organism from blood stream (time varies with organism and antimicrobial used)
   4. local complications (perivalvular abscess)
   5. prosthetic valve endocarditis (usually)
   6. certain hard to cure organisms such as fungi, Pseudomonas species

SUPPERATIVE THROMBOPHLEBITIS

1. Definition: inflammation of the vein wall due to the presence of microorganisms

II. Classification
A. superficial – associated with the use of peripheral IV catheters
B. central (ex: pelvic veins) – associated with the use of central IV catheters; pelvic vein associated with gyn surgery, childbirth, septic abortion, pelvic abscesses
C. cavernous sinus
D. portal (pyophlebitis)

III. Pathogenesis
   probably similar to IE with turbulent flow \(\rightarrow\)thrombus\(\rightarrow\)infection

IV. Pathologic
   vein lumen contains both thrombus and pus and vein is enlarged, thickened, tortuous

V. Clinical Manifestations
   fever
   local pain, redness, tenderness over vein
   septic pulmonary emboli common
VI. Lab
   bacteremia (can be continuous like IE)
   CT scan for pelvic vein

VII. Etiology
   *Staphylococcus aureus*, aerobic gram-negative bacilli, Candida species

VIII. Therapy
   antibiotic plus surgery

**PROPHYLAXIS OF INFECTIVE ENDOCARDITIS**

I. Underlying cardiac conditions predisposing to IE
   A. High risk
      prosthetic valves
      previous IE
      tetralogy of Fallot
      cyanotic congenital heart disease
      ventricular septal defect
      coarctation of the aorta
      aortic valve disease
      mitral regurgitation
      Marfan syndrome
      arteriovenous fistulas
   B. Intermediate risk
      mitral valve prolapse with regurgitation
      tricuspid valve disease
      asymmetric septal hypertrophy
      mitral stenosis
      degenerative valve disease (elderly)

II. Procedures with high risk of transient bacteremia
   dental procedures likely to cause bleeding (Not simple filling above
   the gum line)
   oral surgery involving teeth and gums
   delivery, abortion, Dilation and curettage in presence of pelvic
   infection, insertion/removal of IUD
   tonsillectomy, adenoidectomy
   urinary catheterization, urethral dilatation, cystoscopy, prostatectomy
   drainage of abscesses, operations involving infected skin
   injection of esophageal varices, esophageal dilatation
   
   C. Agent used depends upon type of procedure

**MYOCARDITIS**

I. Definition: Inflammation of the myocardium

II. Etiology
mostly viral (esp Coxsackie), but also fungal, parasitic, rickettsial

III. Clinical Manifestations
   A. nonspecific: fever, malaise, arthralgias
   B. Cardiac: CHF, arrhythmias

IV. Diagnosis
   A. high index of suspicion
   B. usually CK-MB fraction elevated
   C. usually presents as part of overall systemic illness
   D. Endomyocardial biopsy for diagnosis attempt

V. Treatment
   A. supportive
   B. STEROIDS CONTRAINDICATED IN EARLY VIRAL DISEASE
   C. aim specific therapy towards etiologic agent

PERICARDITIS

I. Definition: Inflammation of the pericardium

II. Etiology:
   broad; same as for myocarditis
   if bacterial, patients appear toxic
   commonly caused by mycobacteria

III. Clinical manifestations
   chest pain: retrosternal, radiates to shoulder/neck, aggravated by breathing
   and lying flat
   three component pericardial friction rub on exam

IV. Treatment
   supportive
   aimed at specific agent