Infective Endocarditis

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- **Infective endocarditis** is a microbial infection of the endocardial (endothelial) surface of the heart. Native or prosthetic heart valves are the most frequently involved sites. Endocarditis also can involve septal defects, the mural endocardium, or intravascular foreign devices such as intracardiac patches, surgically constructed shunts, and intravenous catheters. Infective endarteritis is a similarclinical illness involving arteries, including the ductus arteriosus, the great vessels, aneurysms, or arteriovenous shunts.

Pathogenesis

- Two factors are important in the pathogenesis of IE: (1) a damaged area of endothelium and (2) bacteremia, even transient. The presence of structural abnormalities of the heart or great arteries, with a significant pressure gradient or turbulence, produces endothelial damage. Such endothelial damage induces thrombus formation with deposition of sterile clumps of platelet and fibrin (nonbacterial thrombus). Prosthetic valves or prosthetic materials used in surgery also promote deposition of sterile thrombus,occurrence of a transient bacteremia, adherence of these bacteria and subsequent proliferation of the bacteria within a vegetation.

- All congenital heart defects (CHDs), with the exception of secundum-type atrial septal defect (ASD), predispose to endocarditis. More frequently encountered defects are tetralogy of Fallot (TOF), ventricular septal defect(VSD), aortic valve disease, transposition of the great arteries (TGA), and systemic-to-PA shunt
- Bacteremia resulting from dental procedures can cause IE..
- Bacteremia also occurs with activities such as chewing or brushingthe teeth. Chewing with diseased teeth or gums may be the most frequent cause of bacteremia
- Therefore, good dental hygiene is very important in the prevention of IE

Microbiology

- In the past, Streptococcus viridans, enterococci, and Staphylococcus. aureus were responsible for more than 90% of the cases. In recent years, this frequency has decreased to 50% to 60%, with a concomitant increase in cases caused by fungi and HACEK organisms (Haemophilus, Actinobacillus Cardiobacterium, Eikenella, and Kingella spp.). HACEK organisms are particularly common in neonates and immunocompromised children accounting for 17% to 30% of cases
- α-Hemolytic streptococci (S. viridans) are the most common cause of endocarditis in patients who have had dental procedures or in those with carious teeth or periodontal disease
- Enterococci are the organisms most often found after genitourinary or gastrointestinal (GI) surgery or instrumentation
- The organisms most commonly found in postoperative endocarditis are staphylococci
- Intravenous (IV) drug abusers are at risk for IE caused by infection with S. aureus
- Fungal endocarditis (which has a poor prognosis) may occur in sick neonates, in patients who are on long-term antibiotic or steroid therapy, or after open heart surgery.

Clinical Manifestations

History

- Most patients have a history of an underlying heart defect
- A history of a recent dental procedure or tonsillectomy is occasionally present, but a history of toothache (from dental or gingival disease) is more frequent than a history of a procedure
- Endocarditis is rare in infancy; at this age, it usually follows open heart surgery
- The onset is usually insidious with prolonged low-grade fever and somatic complaints, including fatigue, weakness, loss of appetite, pallor, arthralgia, myalgias, weight loss, and diaphoresis

Physical Examination

- Heart murmur is universal (100%).
- Fever is common (80%–90%). Fever fluctuates between 101° and 103°F (38.3° and 39.4°C)
- Splenomegaly is common (70%).
- Skin manifestations (50%) (either secondary to microembolization or as an immunologic phenomenon) may be present in the following forms:

a.Petechiae on the skin, mucous membranes, or conjunctivae are the most frequent skin lesions

b.Osler's nodes (tender, pea-sized red nodes at the ends of the fingers or toes) are rare in children

C. Janeway's lesions (small, painless, hemorrhagic areas on the palms or soles) are rare

d.Splinter hemorrhages (linear hemorrhagic streaks beneath the nails) also are rare

- Embolic or immunologic phenomena in other organs are present in 50% of cases

a. Pulmonary emboli may occur in patients with VSD, PDA, or a systemic to-PA shunt

b. Seizures and hemiparesis are the result of embolization to the central nervous system (CNS)

c. Hematuria and renal failure may occur

d. Roth's spots (oval, retinal hemorrhages with pale centers located near the optic disc) occur in fewer than 5% of patients

- Clubbing of fingers in the absence of cyanosis develops rarely Signs of heart failure may be present as a complication of the infection

Laboratory Studies

- Positive blood cultures are found in more than 90% of patients in the absence of previous antimicrobial therapy. Antimicrobial pretreatment reduces the yield of positive blood culture to 50% to 60%
- A complete blood cell count shows anemia, with hemoglobin levels lower than 12 g/100 mL (present in 80% of patients), and leukocytosis with a shift to the left. Patients with polycythemia preceding the onset of IE may have normal hemoglobin
- The sedimentation rate is increased unless there is polycythemia.
- Microscopic hematuria is found in 30% of patients.

- **Echocardiography**

Two-dimensional echocardiography is the main modality for detecting endocardial infection . It detects the site of infection, extent of valvular damage, and cardiac function

Diagnosis

- Recently, the American Heart Association has recommended the modified Duke Criteria in the diagnosis and management of IE

Definite Infective Endocarditis

A. Pathological criteria

Microorganisms demonstrated by culture or histologic examination of vegetation,

B. Clinical criteria

Two major criteria or

One major criterion and three minor criteria or

Five minor criteria.

- **Major Criteria**

A. Blood culture positive for IE

B. Evidence of endocardial involvement ,echocardiogram positive for IE

Minor Criteria

- predisposing heart condition, or injection drug users
- 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

Management

- Initial empirical therapy is started with the following antibiotics while awaiting the results of blood cultures
- The usual initial regimen is an antistaphylococcal semisynthetic penicillin (nafcillin, oxacillin, or methicillin) and an aminoglycoside
- This combination covers against *S. viridans, S. aureus,*). Gentamicin for gram-negative organisms. Some experts add penicillin to the initial regimen to cover against *S. viridans,* although a semisynthetic penicillin is usually adequate for initial therapy
- If a methicillin-resistant *S. aureus* is suspected, vancomycin should be substituted for the semisynthetic penicillin

- The final selection of antibiotics depends on the organism isolated and the results of an antibiotic sensitivity test

a. Streptococcal IE

- In general, patients with native cardiac valve IE caused by a highly sensitive *S. viridans* can be successfully treated with IV penicillin (or ceftriaxone given once daily) for 4-6 weeks,combined with gentamicin for 2 weeks

a. Staphylococcal endocarditis

- The drug of choice for native valve IE by methicillin-susceptible) (nafcillin, oxacillin, or methicillin) for a minimum of 6 weeks
- Patients with methicillin-resistant native valve IE are treated with vancomycin for 6 weeks (with or without gentamicin for the first 3–5 days)

Prevention

- The estimated frequency of bacteremia during routine daily activities. (e.g., chewing, toothbrushing, flossing, used of toothpicks, use of water irrigation devices, and other activities) far exceeds that occurring during dental procedures. For example, tooth brushing and flossing result in bacteremia 20% to 40% of the time and chewing food results in bacteremia 7% to 51% of the time
- Therefore, an emphasis should be on maintaining good oral hygiene and eradicating dental disease to decrease the frequency of bacteremia from routine daily activities.
- Note that prophylaxis is no longer recommended for routine bronchoscopy; it is recommended for tonsillectomy and adenoidectomy only in high-risk patients. Prophylaxis is no longer recommended for GI or genitourinary procedures, such as diagnostic esophagogastroduodenoscopy or colonoscopy