**INFECTIVE ENDOCARDITIS**

**Definition**

Infective endocarditis is defined as a microbial colonization of the inner lining of the heart.

-Can involve valves, the mural endocardium, or a septal defect.

-The prototypic lesion is *vegetation*-is a mass of platelets, fibrin, microcolonies of microorganisms, and scant inflammatory cells.

-Endocarditis can be classified as:

1. Native valve (acute and subacute) endocarditis
2. Prosthetic valve (early and late) endocarditis
3. Endocarditis related to intravenous drug use

**Native valve endocarditis (acute and subacute)**

-Native valve acute endocarditis usually has an aggressive course.

-Virulent organisms, such as *Staphylococcus aureus* and group B streptococci

-Underlying structural valve disease may not be present.

-Sub acute endocarditis usually has a more indolent course than the acute form.

-Alpha-hemolytic streptococci or enterococci, usually in the setting of underlying structural valve disease, typically are the causative agents of this type of endocarditis.

**Prosthetic valve endocarditis (early and late)**

-Early prosthetic valve endocarditis occurs within 60 days of valve implantation. Staphylococci aureus and epidermidis, gram-negative bacilli, and *Candida* species are the common infecting organisms.

-Late prosthetic valve endocarditis occurs 60 days or more after valve implantation. Alpha-hemolytic streptococci, enterococci, and staphylococci are the common causative organisms.

**Endocarditis related to intravenous drug use**

-Endocarditis in intravenous drug abusers commonly involves the tricuspid valve.

-*S. aureus* is the most common causative organism.

-Fungal colonization’s also common eg Candida albicans.

*Acute* ***endocarditis*** is a hectically febrile illness, rapidly damages cardiac structures, hematogenously seeds extracardiac sites, and, if untreated, progresses to death within weeks.

*Subacute* ***endocarditis*** follows an indolent course; causes structural cardiac damage only slowly, if at all; rarely causes metastatic infection; and is gradually progressive unless complicated by a major embolic event or ruptured mycotic aneurysm.

**Pathophysiology:** : Occur by-

1.Formation of thrombi on endocardium

2.Bacteremia (nosocomial or spontaneous) that delivers the organisms to the valve's surface

3.Adherence of the organisms

4.Eventual invasion of the valvular leaflets

-Infective endocarditis generally occurs as a consequence of nonbacterial thrombotic endocarditis, which results from turbulence or trauma to the endothelial surface of the heart.

-Transient bacteremia then leads to seeding of lesions with adherent bacteria, and infective endocarditis develops.

4- Petechiae - Common but nonspecific finding

5-Splinter hemorrhages - Dark red linear lesions in the nailbeds

6-Finger clubbing

7-Immunologic phenomena

* Osler nodes - Tender subcutaneous nodules usually found on the distal pads of the digits cal phenomena
* Roth spots( Retinal hemorrhages)

8-Vascular phenomena-

* Conjunctival hemorrhage
* Janeway lesions - Nontender maculae on the palms and soles

9-Tender Splenomegaly

10-Neurologic disease due to embolic stroke with focal neurologic deficits- Other etiologies include intracerebral hemorrhage and multiple microabscesses

* Paralysis ,Hemiparesis
* aphasia
* Stiff neck
* Delirium

11-Signs of systemic septic emboli are due to left heart disease and are more commonly associated with mitral valve vegetations.

* Multiple embolic pulmonary infections or infarctions are due to right heart disease.

**Investigations**

**Lab Studies:**

**1.FBC**- Anemia of chronic disease is common in subacute endocarditis

Leukocytosis is observed in acute endocarditis

**ESR and C-reactive protein**

2.**U/E/Cr**

3.**Urinalysis**

Proteinuria and microscopic hematuria are present in approximately 50% of cases

4. **Blood cultures**-Two sets of blood cultures have greater than 90% sensitivity when bacteremia is present.

5.. **Serology** for Chlamydia, Q fever (Coxiella), and Bartonella may be useful in culture-negative endocarditis

5.. **Rheumatoid factor** is noted in subacute endocarditis

5. Decreased C3, C4, and CH50 are evident in subacute endocarditis.

**Imaging Studies:**

**1.Echocardiography**

-Transthoracic echocardiography –more sensitive

-This test is particularly indicated with culture-negative cases, such as in fungal endocarditis.

-Visible vegetation suggests a worse prognosis.local complications, such as abscesses.

2**.Chest radiography**

-Features of CCF-cardiomegaly and pulmonary edema

-Pulmonary embolic phenomena strongly suggest tricuspid disease.

3. **Ventilation/perfusion (V/Q) scanning**:

This may be useful in right-sided endocarditis.

4. **CT scanning**:

This imaging modality is helpful for localizing abscesses

**Causes:**

a)**Native valve endocarditis**

* Rheumatic valvular disease (30%)
* Congenital heart disease (15% of NVE)
* Mitral valve prolapse with an associated murmur (20% of NVE)
* Degenerative heart disease - Including calcific aortic stenosis due to a bicuspid valve, Marfan syndrome, or syphilitic disease

Up to 70% of cases are caused by *Streptococcus* species including *Streptococcus viridans, Streptococcus bovis*, and enterococci. *Staphylococcus* species cause 25% of cases and generally demonstrate a more aggressive acute course.

b)**Endocarditis in intravenous drug use**

-This condition most commonly involves the tricuspid valve, followed by the aortic valve.

-Pulmonary manifestations may be prominent in patients with tricuspid infection: pleuritic chest pain, e chest radiographic abnormalities.

*-S aureus* is the most common (<50% of cases) etiologic organism. Other\ organisms include streptococci, fungi, and gram-negative rods (eg, pseudomonads, *Serratia* species).

**c)Prosthetic valve endocarditis**

Early disease, which presents shortly after surgery, has a different bacteriology and prognosis than late disease, which presents in a subacute fashion similar to native valve endocarditis.

Infection associated with aortic valve prostheses may lead to: local abscess, fistula formation and valvular dehiscence.

This may lead to shock, heart failure, heart block, shunting of blood to the right atrium, pericardial tamponade, and peripheral emboli to the central nervous system and elsewhere.

Endocarditis can occur in association with intravascular devices.

Infection that occurs early after surgery may be caused by a variety of pathogens, including *S aureus* and *S epidermidis*.

Late disease is most commonly caused by streptococci.

Fungal endocarditis- found in intravenous drug users and intensive care unit patients who receive broad-spectrum antibiotics. Blood cultures are often negative, and diagnosis frequently is made after microscopic examination of large emboli.

**Prevention of IE**

Reduce the predisposing factors

1. Adequate treatment of URTI to prevent most common cause of valvular damage-RHD.
2. .IV drug use –Drug abuse prevention
3. Aseptic technique in IV line insertion and therapeutic IV drug admin.
4. Early surgical correction for the congenital heart disease as VSD,ASD
5. Those with damaged valve deg RHD should get antibiotic prophylaxis before surgical manipulation of dentals, GIT or GU system

Dental-Admin 3g amoxicillin ½ hour before procedure then 1.6 g 6 hours after the procedure.

NB. Monthly Benyl Penicillin in RHD patients is not to prevent IE but to prevent recurrence or Acute rheumatic fever.

-Pathologic effects due to infection can include local tissue destruction and embolic phenomena.

-In addition, secondary autoimmune effects, such as immune complex glomerulonephritis and vasculitis, can occur

-In acute IE, the thrombus may be produced by the invading organism (i.e., S aureus) or by valvular trauma from intravenous catheters or pacing wires (i.e., NIE). S aureus can invade the endothelial cells (endotheliosis) and increase the expression of adhesion molecules and of procoagulant activity on the cellular surface.

-Nonbacterial thrombotic endocarditis may result from stress, renal failure, malnutrition, systemic lupus erythematosus, or neoplasia.

-IE develops most commonly on the mitral valve, closely followed in descending order of frequency by the aortic valve, the combined mitral and aortic valve, the tricuspid valve, and, rarely, the pulmonic valve.

-Mechanical prosthetic and bioprosthetic valves exhibit equal rates of infection.

-The microorganisms that most commonly produce endocarditis (ie, S aureus; S viridans; group A, C, and G streptococci; enterococci) resist the bactericidal action of complement and possess fibronectin receptors for the surface of the fibrin-platelet thrombus.

**Clinical presentation**

**History-** Highly variable

-Constitutional - Fever and chills are the most common symptoms

-Others- Anorexia, weight loss, malaise, headache, myalgias, night sweats, shortness of breath, cough, or joint pains are common complaints

-Symptoms may be due to primary cardiac effects or secondary embolic phenomena.

-Primary cardiac disease may present with signs of CCF

-Secondary phenomena -Focal neurologic complaints due to an embolic stroke or back pain associated with vertebral osteomyelitis.

**-**As many as 20% of cases present with focal neurologic complaints and stroke syndromes.

**-**Dyspnea, cough, and chest pain are common complaints of intravenous drug users.

-This is likely related to the predominance of tricuspid valve endocarditis in this group and secondary embolic showering of the pulmonary vasculature.

**Physical:**

**1-**Mild-moderatePallor

**2-**Fever, possibly low-grade and intermittent, is present in 90% of patients.

**3** Heart

**-**Heart murmurs –esp. Change in the characteristics of a previously noted murmur occurs

-Gallop rhythm.

-Signs of CCF, frequently are due to acute left-sided valvular insufficiency

* Distended neck veins
* Rales
* Cardiac arrhythmia-Pulse irregularity
* Pericardial rub
* Pleural friction rub

**5.Electrocardiography**

-Nonspecific changes are common

-First-degree AV block and new interventricular conduction delays may signal septal involvement in aortic valve disease; both are poor prognostic signs.

**Procedures:**

Cardiac catheterization may be indicated to determine the degree of valvular damage

**Modified** **Dukes Criteria**

**Major Criteria**

**1.Positive blood culture for Infective Endocarditis**

Typical microorganism consistent with IE from 2 separate blood cultures, as noted below:

•  viridians streptococci, *Streptococcus bovis*, or HACEK group

•  community-acquired *Staphylococcus aureus* or enterococci, in the absence of a primary focus

*or*

Microorganisms consistent with IE from persistently positive blood cultures defined as:

•  2 positive cultures of blood samples drawn >12 hours apart, or

•  all of 3 or a majority of 4 separate cultures of blood (with first and last sample drawn 1 hour apart)

**2.Evidence of endocardial involvement**

Positive echocardiogram for IE defined as :

•  Vegetations on the valve

•  abscess, or

•  new partial dehiscence of prosthetic valve

*Or*

New valvular regurgitation (worsening or changing of preexisting murmur not sufficient)

**Minor Criteria**

**1.Predisposition**:

Predisposing heart condition or intravenous drug use

**2.Fever**: > 38.0° C (100.4° F)

**3.Vascular phenomena**:

* Conjunctival hemorrhages
* Janeway lesions
* Major arterial emboli eg septic pulmonary infarcts
* Mycotic aneurysm
* Intracranial hemorrhage

**4.Immunologic phenomena**:

* Osler's nodes
* GN
* Roth spots
* rheumatoid factor

**5.Microbiological evidence**: positive blood culture but does not meet a major criterion as noted above

**6. Echocardiographic findings**: consistent with IE but do not meet a major criterion as noted above.

Excludes single positive cultures for coagulase-negative staphylococci, diphtheroids, and organisms that do not commonly cause endocarditis.

**Clinical criteria for infective endocarditis requires:**

• Two major criteria, or

• One major and three minor criteria, or

• Five minor criteria

Histologic and/or microbiologic evidence of infection at surgery or autopsy

**MANAGEMENT**

Goals to maximize treatment success are

 (1) Early diagnosis

(2) Accurate microorganism identification

(3) Reliable susceptibility testing

(4) Prolonged intravenous administration of bactericidal antimicrobial agents

 (5) Proper monitoring of potentially toxic antimicrobial regimens

(6) Aggressive surgical management of correctable mechanical complications.

**Refer to Notes -3rd year.**

**Empirical therapy**

**-Benyl Penicillin plus Gentamycin for 4 -6 weeks**

-Penicillin given for the 4 weeks but the Gentamycin given the first 2 weeksexcept in enterococcus where both are given full length.

**Benyl Pen. 4 mega units QID**

**Gentamycin given at 1mg/kg TID**

**Modifications**

**-**Penicillin can be substituted with ceftriaxone as appropriate after sensitivity results plus Gentamycin

**-**Incase of Penicillin allergy admin Vancomycin

30 mg/Kg/day in three divided doses but don’t exceed 2g/day plus gentamycin.

-Staph endocardidtis use oxacillin or Nafcillin

Dose-2g IV 4-hourly for 4-6 weeks

Fungal organisms

Candida albicans use amphotericin B but urgent surgical intervention required.

**Indications for surgery**

**1.**Fungal endocarditis

2. Extensive native valvular damage with large vegetations.

3.Early form of prosthetic valve IE with valve dehiscence

4.Persistent infection despite aggressive and appropriate antibiotic therapy-failed medical management

5.Associated progressive Heart failure not responding to therapy

6.Presence of embolization

**Complications:**

* Myocardial infarction, pericarditis, cardiac arrhythmia
* Cardiac valvular insufficiency
* Congestive heart failure
* Sinus of Valsalva aneurysm
* Aortic root or myocardial abscesses
* Arterial emboli, infarcts, mycotic aneurysms
* Arthritis, myositis
* Glomerulonephritis, acute renal failure
* Stroke syndromes
* Mesenteric or splenic abscess or infarct