

Lecture ~ 01

Infective Endocarditis



Microbiology Team - 430

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Introduction:

- Endocarditis. Regardless of the underlying cardiac condition, is a serious, life-threatening disease that was always fatal in the pre-Antibiotic era.
- Advances in anti-microbial therapy, early recognition and management of complications of IE and Improved surgical technology has reduced the morbidity and mortality of IE.
- Numerous co-morbid factors, may complicate IE such as
 - Older age, diabetes mellitus
 - Immunosuppressive conditions or therapy
 - Dialysis.

Definition:

- Infection or colonization of endocardium , heart valves , congenital defects by Bacteria, Rickettsiae (Gram –ve bacteria) , Fungi
- Low grade persistent bacteraemia (this low grad of bacteria in the blood will be not harmful if it affects normal heart; however, if it affects abnormal heart, it is going to be harmful.)

Importance:

- Serious disease
- mortality : 30 % (Death rate)
- Damage of heart or other organs
- Follow dental procedures (tooth extraction) epically with a history of :
 - Rheumatic heart disease.
 - Congenital heart disease.

Classification:

- **Classified into four groups:**

1. Native Valve IE
2. Prosthetic Valve IE
3. **Intravenous drug abuse (IVDA) IE**
4. Nosocomial IE.

- **Or into :**

| <u>Acute</u> | <u>Subacute</u> |
|---|--|
| <ul style="list-style-type: none">• Affects normal heart valves• Rapidly destructive• Metastatic foci | <ul style="list-style-type: none">• Affects damaged heart valves• Indolent nature• If not treated, usually fatal by one year |
| <ul style="list-style-type: none">• Commonly Staph. Aureus• If not treated, usually fatal within 6 weeks. | <ul style="list-style-type: none">• Commonly sterc.viridans |

Etiology:

- Susceptible patient
- Bacteraemia

Factors Affecting Severity and Outcome:

1. Bacterial Factors :

- **Virulence**
- **Number of bacteria in the blood**

2. Host Factors:

A. Factors Increasing Susceptibility

■ Local:

- congenital rheumatic heart disease
- prosthetic heart valves
- other cardiovascular disease
- heart surgery

■ General:

- underlying disease (diabetes m)

■ Drugs:

- Iatrogenic:(drugs that use for therapeutic purpose)
 1. immunosuppressive treatment
 2. cytotoxic agents
- Self- inflicted:
 1. alcoholism
 2. addiction (injected drugs)

B. Protective Factors

- Antimicrobial chemotherapy. (When we use antimicrobial chemotherapy as a prophylactic, it could be a risk factor).

Sources of Infection:

- Dental extraction and other dental procedures
- Cardiac surgery (prosthetic valves)
- Intravenous medication
- Iv. Drug addiction
- Intracardiac or intravenous catheters
- Obstetric or gynaecologic procedures

Predisposing Factors:

■ Cardiac Lesions:

- Chronic rheumatic valvular disease
- Congenital heart disease and defects
- Atherosclerosis
- Prosthetic valves (Immediate or Delayed)

- ☒ Distorted shape causes stasis of blood flow and settle of bacteria on the endocardium
- ☒ Virulent bacteria, staph.aureus and strept.Pneumoniae can infect normal heart

■ Systemic Factors:

- Immunosuppressive treatment
- Immune defects (disease)
- Alcoholism
- **Iv. Drug abuse.**

Portal of Entry:

- Dental extraction → bleeding → bacteraemia → Heart

➤ Rocking the tooth in the socket → pumping effect on the vessels of periodontal ligament , forces bacteria from gingival pockets into blood stream 40 – 80 % bacteraemia

1. Sensitivity of blood culture techniques
2. Severity of gingival infection

(1 & 2 are factors that contribute in the severity of bacteraemia)

- Oral irrigation device.

NOTE:

- Bacteraemia may follow (scaling, tooth brushing, endodontic therapy).
- Lack of clinical effect of many bacteraemia is due to small number or low virulence
- They are rapidly cleared by normal body defence (leucocytes)
- **Strept.Faecalis may cause endocarditis after genitourinary or gut procedures**

Causative Organisms:

■ Viridans streptococci:

- Most common cause of sub-acute bacterial endocarditis (SBE)
- Produce glucagons → adhere to endocardium
- E.g : - **Streptococcus mutans** (oral cavity)
 - **Streptococcus sanguis** (oral cavity)
 - **Enterococcus faecalis**.(GIT)
 - Streptococcus faecium.
 - Streptococcus pneumonia.
 - **Staphylococcus aureus** (Acute endocarditis) (Drug addiction).
 - **Staphylococcus epidermidis**.(prosthetic heart valve).(sub acute endocarditis)

Causes of IE:

1. Sterpt

- ✓ Strept Viridans (mutans& sanguis)
- ✓ GDC* (faecalis).

* Group Day Care.

2. Staph.

- ✓ Normal heart valve (aorous)
- ✓ Prosthetic valve (epidermidis).

Pathogenesis:

■ Formation Of Vegetations (abnormal growth)

- Fibrin, platelets (thrombi) ,bacteria colonies → Attached to heart valves
- Break off → infected emboli → distant organs (kidney , brain)
- Immune complex formation causes glomerular damage →Haematuria
- Valves infection →destruction → Heart Failure.
- Drug addicts → tricuspid, pulmonary valves of right side of heart → lung emboli pneumonia.

Clinical Features:

- Onset is insidious (Subacute bacterial endocarditis) - 3 weeks after extraction
- **Fever** (mild and prolonged)
- Malaise, weight loss, weakness
- **Changing murmurs**
- Anaemia , leucocytosis
- Microscopic **Haematuria** (RBCs in urine)
- **Petechiae**
- **Splenomegaly** (spleen enlargement)
- **Splinter haemorrhage** (tiny lines under nails)
- Hypergammaglobulinemia

Petechiae: (red spots on the body)

1. Nonspecific
2. Often located on extremities or mucous membranes

Osler's Nodes:

1. **More specific**
2. Painful and erythematous nodules
3. Located on pulp of fingers and toes
4. **More common in subacute IE**

Mortality: (Death Rate)■ **With antibiotic treatment:**

- 30%

■ **High mortality:** (factors that increase the mortality)

- Virulence of organism or severe infection (staph. aureus is a very virulence organism)
- Presence of underlying disease
- Elderly
- Inadequate treatment

■ **poor prognosis:** (there is no response to the treatment)

- Candidal
- **Staphylococcus.**
- Gram-negative

Diagnosis:**Laboratory Diagnosis:****A. serial blood culture** (**2-3 sets** before antibiotic therapy) (to distinguish between)

- Aerobic
- Anaerobic

■ Additional tests:

- CBC, ESR and CRP, Complement levels (C3, C4, CH50)
- RF (rheumatoid factor)
- Urinalysis

B. serological tests

- CFT (coxiella burniti) (we do CFT* test to look for the antigen coxiella burniti)

C. sensitivity test (we do it to the bacteria itself to determine the best treatment)

*(complement fixation test)

Imaging:

■ Chest x-ray

- ✓ Look for multiple focal infiltrates and calcification of heart valves

■ ECG

- ✓ Rarely diagnostic
- ✓ Look for evidence of ischemia, conduction delay, and arrhythmias

■ Echocardiography.

Endocarditis Causes: Continuous Bacteraemia

There are three clinical patterns of bacteraemia:

■ Transient:

☐ lasts minutes to hours:

- ☒ Following manipulation of infected tissues (abscess, furuncle, or during a surgical procedure)
- ☒ Instrumentation of contaminated "colonized" mucosal surfaces (dental procedures, cytосcopy, or sigmoidoscopy)
- ☒ And at the onset of bacterial pneumonia, arthritis, osteomyelitis, and meningitis.

■ Intermittent:

- ☐ Commonly occurs with undrained abscesses.

■ Continuous:

- ☐ Reflects an endovascular infection such as: endocarditis or endarteritis, suppurative (septic) thrombophlebitis, or an infected aneurysm. It also occurs in the first two weeks of typhoid fever and brucellosis.

Technique for Collection of Blood for Culture:

■ Blood for culture contaminated by normal skin flora e.g.

- A. *Staphylococcus epidermidis*
- B. *Diphtheroids*
- C. *Propionibacteria* (anaerobic diphtheroides)

☒ So first clean the site (mainly antecubital fossa) with alcohol 70% and leave for (1-1½ minutes) or chlorhexidine or iodine

■ Blood culture by automated machines e.g.

Bactec or Bactalert

- ☒ Up to 5 days when signal positive, the specimen is gram stained → reported to clinician then cultured identified and tested for antimicrobial susceptibility.

Local Spread of Infection:

■ Heart failure

- Extensive valvular damage

■ Paravalvular abscess (30-40%)

- Most common in aortic valve, IVDA, and *S. aureus*
- May extend into adjacent conduction tissue causing arrhythmias
- Higher rates of embolization and mortality

■ Pericarditis

■ Fistulous Intracardiac connections

Complications:

● Embolic Complications :

- Stroke.
- Myocardial Infarction
- Fragments of valvular vegetation or vegetation-induced stenosis of coronary ostia
- Ischemic limbs
- Hypoxia from pulmonary emboli
- Abdominal pain (splenic or renal infarction)

● Septic Emboli

Metastatic Spread of Infection:

- Metastatic abscess
 - ✓ Kidneys, spleen, brain, soft tissues
- Meningitis and/or encephalitis
- Vertebral osteomyelitis
- Septic arthritis

Treatment:

- Disk diffusion test (not sufficient)
- MIC , MBC

- **Criteria of antibiotic**

- Bactericidal
- Parenteral
- High dose
- Prolonged (at least 2 -4 weeks)

- Mic (minimum inhibitory concentration)
 - Mbc (minimum bactericidal concentration)
- They are important in diagnostic laboratories to confirm resistance of microorganisms to an antimicrobial agent (it is part of serological test).

- Viridans streptococci

- ☒ Benzyl penicillin I.V (4 MU I.V. every 4 hrs for 4 weeks)
- ☒ Or penicillin + gentamicin (it has to be a combination of both)

- Streptococcus faecalis:

ampicillin + gentamicin I.V

- ☐ **Recurrence after cure is common in:**

- drug addicts
- immunodeficient patients

- ❖ **Regimens for Dental Procedures:**

- ✓ We give Amoxicillin " orally "

Summary

- ❖ **Infective Endocarditis:** Infection or colonization of endocardium, **heart valves**, congenital defects by Bacteria, Rickettsiae, Fungi.
- ❖ **Factors Increasing Susceptibility:** **congenital rheumatic heart disease ,prosthetic heart valves ,heart surgery**
- ❖ **Cardiac lesions cause:** Distorted shape which causes stasis of blood flow and **settle of bacteria on the endocardium** (IE)
- ❖ **Laboratory Diagnosis:** the best specimen is : **Blood and we do serial blood culture (2-3 sets)**
- ❖ **How bacteria enter the blood :** brushing the mouth, exertion of tooth (along with damaged heart)
- ❖ **Clinical Features:** Fever, Malaise, Fatigue
- ❖ **Causative Organisms:** **Viridans streptococci**, especially with tooth extraction. However in GIT tract the most common is **E. faecalis**
- ❖ **Treatment of Viridans streptococci:** Penicillin
- ❖ **Antibiotic prophylaxis:** recommended for all **dental procedures**. Therefore we use **amoxicillin " orally "**

Pathogenesis

