Infective Endocarditis

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Fever of unknown origin (FUO) is caused by a wide variety of bacteria.. rarely a fungus or virus.

Infective Endocarditis (IE) commonly associated with FUO.. It is an infection caused by bacteria that enter the bloodstream and settle in the heart lining, a heart valve or a blood vessel.

Any person with some congenital heart disease have a greater risk of developing IE.. A formation of bacterial vegetation.. A Biofilm composed of accumulation Bacteria, platelets, fibrin and few leucocytes.

The result: Host defensive immune mechanisms including WBCs can’t directly reach the infected valves via the bloodstream.. prevent development.
The lack of blood supply to the valves also has implications on treatment, since antimicrobial drugs have difficulty reaching the infected valve.

Results in congestive heart failure and myocardial abscesses... Fatal outcome.

The incidence of infective endocarditis in a general healthy population has been estimated between 3-9 cases per 100,000 patient/year in western countries.

Endocarditis is twice as common among men, than women. It can strike at any age, most cases occur with people over the age of 50.

It is higher in patients with underlying congenital & valvular heart disease... intravenous drug abuse... invasive surgery & oral dental procedures.
Historically, Rheumatic Disease caused by Group A Streptococci was considered a frequent pre-disposing factor for endocarditis.

Recently Prosthetic valvular heart disease accounts for about 1/3 of all cases of endocarditis. Occurs in 1% to 3% of patients after valvular heart surgery.

All invasive procedures may cause bloodstream infections and result in acute or subacute endocarditis.
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- **Acute endocarditis** followed bacteremia..mostly Staphylococci / *S. aureus* & Viridans Streptococci .. Few Bacteria cells settle on normal or deformed heart valves.. multiply, interact & cause rapid destruction ..Fatal cardiac failure.. days-weeks.

- **Subacute endocarditis** .. often developed by presence abnormal valves.. congenital deformities & rheumatic lesions..caused by mostly Strept. Viridans group less Enterococcus spp. causing first subacute bacteremia..Low grade fever & other nonspecific symptoms.
Predisposing Factors for Endocarditis

- Congenital heart disorders, Prosthetic heart valves
- Pacemaker, following pneumonia and meningitis
- Periodontal procedures/disease, Damaged gingival tissue due to plaque accumulation on teeth
- Dental extractions, Dental implants
- Hemodialysis, Tonsillectomy, Esophageal dilation
- Skin infections, Intravenous drug users
- Cystoscopy, Colonoscopy, Urethral dilation
- All these procedures may cause endogenous infections. Antibiotic Prophylaxis is recommended before these procedures.
Microbial Causes-1

- **Gram-positive cocci** facultative anaerobes, diplococci chains/clusters or pairs cocci. **Catalase+ve/Staphylococci group**. **catalase-ve/Streptococci & Enterococci groups**.

- **Streptococci** subdivided into groups according to their hemolytic reaction on blood agar in vitro & by serotypes according to **surface cell wall specific carbohydrate antigens**.

- **Viridans streptococci** Normal oral-intestinal flora do not possess a specific carbohydrate antigens. Carry certain **M proteins**. Deposit dextran, adhesins, Fibronectin-binding protein..attract platelets.
Microbial Causes-2

- Development Common causes of Dental plaque, Gingivitis, Caries.. Oral abscesses.

- Responsible for the largest percentage of Endocarditis cases (30-40%).. Certain species Viridans streptococci, like St. mutans, St. mitis accounted for most cases, and tend to be less susceptible to penicillins.

- Group A Streptococci (S. pyogenes).. Repeat Sore throat infection.. Less skin infection.. Develop Post-streptococcal Diseases.. Rheumatic heart disease developed in Children..observed later in Jung adults.
Streptococci - Staphyloccoci
Growth Viridans streptococci & S.aureus
Microbial Causes-3

- **Group A Streptococci**. Virulence substance *M-protein* (80 types). Found in fimbriae. Part of cell wall antigens is strongly **anti-phagocytic**. Cross-react with the **cardiac muscle tissues**. Causing damage. Responsible for **rheumatic myocarditis**. *M-protein Specific Antibodies* normally developed. Protecting host to some extent.

- **Enterococcus species** (*E. fecalis, E. faecium*). Are responsible for up to 5-10% of cases; some strains may be resistant to **Penicillin, Vancomycin**.

- The treatment of choice for infections caused by **Viridans streptococci** is still **penicillin or vancomycin** / **Teicoplanin** in case of resistance.
Microbial Causes-5

- **S. aureus** is a common cause of **acute endocarditis**, may result in a severe sepsis syndrome with a fatal outcome...many virulence factors...coagulase

- **Chronic staphylococci focus** spread to the brain, lungs, liver, and kidneys. These complications result in a very high mortality rate.

- Most endocarditis cases occurred within 2-month-1 year following **surgery, skin injury/ invasive dental procedures and others.**

- Infections from **vascular catheters & surgical wounds** are more frequent sources of Staphylococcus infection.
# Infective agents of Native Valve Endocarditis

<table>
<thead>
<tr>
<th>Organisms</th>
<th>Cases %</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Streptococcus viridans</em></td>
<td>30-40</td>
</tr>
<tr>
<td><em>Enterococcus species</em></td>
<td>5-10</td>
</tr>
<tr>
<td>Other streptococci</td>
<td>10-25</td>
</tr>
<tr>
<td><em>Staphylococcus aureus / Coagulase-negative staphylococci</em></td>
<td>10-40 / 1-3</td>
</tr>
<tr>
<td>Gram-negative bacilli</td>
<td>2-13</td>
</tr>
<tr>
<td>Brucella, Salmonella</td>
<td></td>
</tr>
<tr>
<td>Fungi (Candida), Aspergillus</td>
<td>2-4</td>
</tr>
<tr>
<td>Others</td>
<td>5</td>
</tr>
</tbody>
</table>
A group of fastidious gram-negative bacteria can cause rarely endocarditis: Gram-ve bacteria: *Brucella, Salmonella, Haemophilus, Cardiobacterium, Eikenella, Gram+ve Actinobacillus*.. Part of Normal oral flora.

Clinically, these bacteria spp. causing *subacute or chronic course*, and often present with *embolic lesions* from large **biofilm vegetations** in heart valves.

Most cases of fungal endocarditis occur in patients who are receiving **prolonged antibiotics or intravenous nutrition** through central vascular catheters.. Immuno-compromised patients.
Yeast & Filamentous Fungi

- The most common species is *Candida albicans*, followed by other less common *Candida spp.* (C. glabrata, C. krusei, C. tropicals).
- Candida part of human normal flora. Oral-intestinal-Urinary tract (Vagina). Infection often followed often using catheters or respiratory intubation.
- Endocarditis due to *Histoplasma capsulatum / Aspergillus* species is very rare. Immuno-suppressed patients.
Candida albicans Pseudohyphae
Diagnosis & Treatment

- **Clinical Diagnosis** is usually suspected based upon the patient's history, symptoms, and findings. Mild continues fever.

- **Echocardiogram & Ultrasound** study of the heart muscle and valves may be helpful in identifying a **vegetation of bacteria** on the heart valve.


- Antibiotic failure indicates fungal infection.
About 10-50% of patients with clinically-suspected endocarditis will have negative blood cultures for any organism due to *Previous/partial antibiotic treatment*. 

Antibiotic treatment according to type of bacteria & susceptibility test in vitro.

*Antibiotic therapy* must continue for at least a month. Most patients respond rapidly to appropriate antibiotics and becoming fever free within 1-2 weeks.

Beta-lactam antibiotic/ vancomycin combined with gentamicin is recommended for Gram-positive cocci.