

# Infective endocarditis (IE)

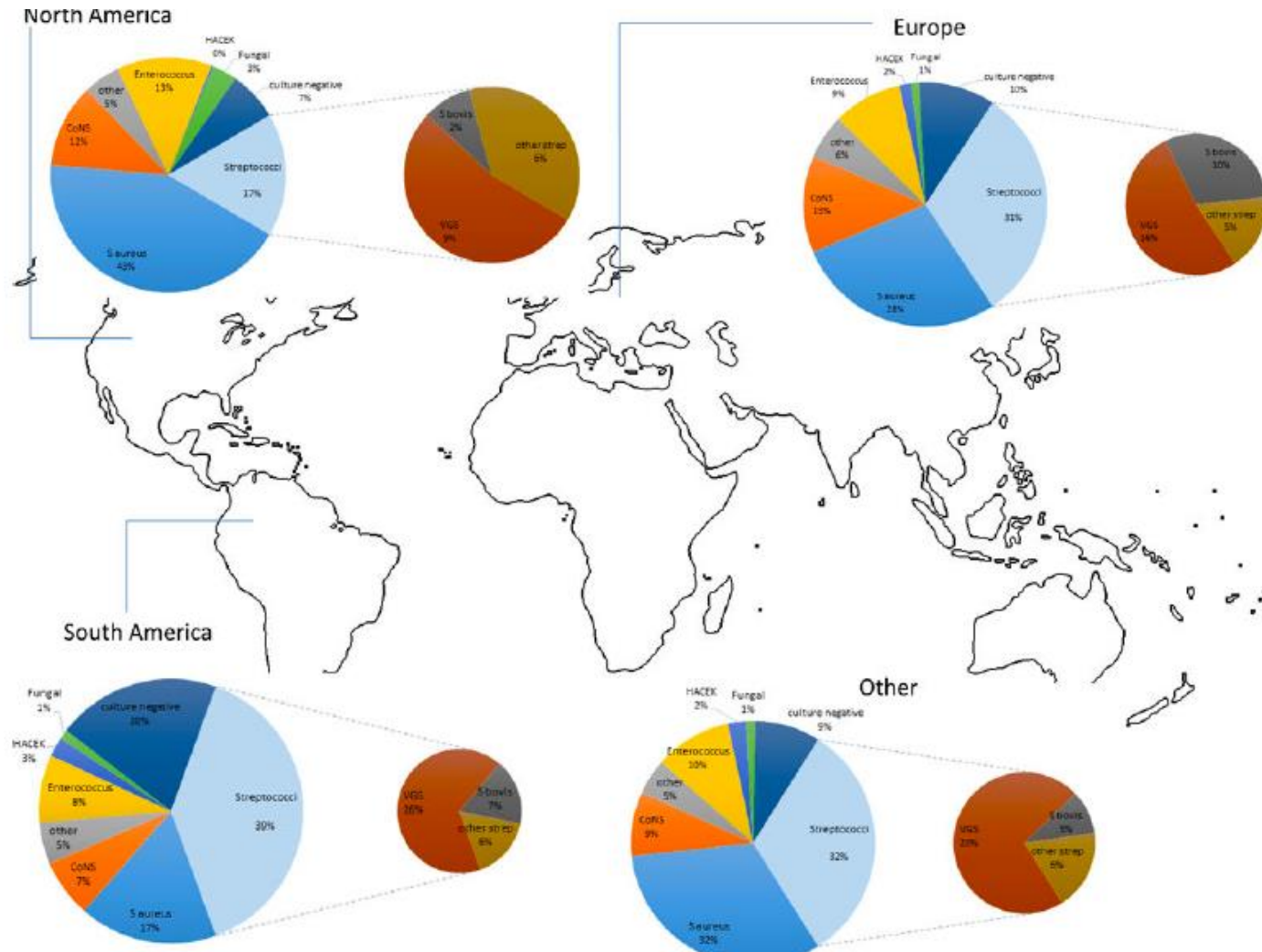
By Assis. Prof. Nader Alaridah MD , PhD

- Infective endocarditis (IE) is an inflammation of the endocardium.. inner of the heart muscle & the epithelial lining of heart valves.
- Infective endocarditis is a rare, life-threatening disease that has long-lasting effects even among patients who survive and are cured
- Infective endocarditis is caused by damage to the endocardium of the heart followed by microbial, usually bacterial, colonization.
- Once established, IE can involve almost any organ system in the body and can be fatal if left untreated.

# Epidemiology

- The crude incidence ranged from 1 to 10 cases per 100,000 person-years .
- Rheumatic heart disease remains the key risk factor for infective endocarditis in low-income countries and underlies up to two-thirds of cases.
- In high income countries, However, degenerative valve disease, diabetes, cancer, intravenous drug use, and congenital heart disease have replaced rheumatic heart disease as the major risk factors for infective endocarditis.
- The mean age of patients with IE has increased significantly (past <30 Now >50 years old).
- Untreated, mortality from IE is uniform. Even with best available therapy, contemporary mortality rates from IE are approximately 25%

# The causative agents



# Predisposing Factors for Endocarditis

- Historically, **Rheumatic Disease** ..**caused by** Group A Streptococci was considered a frequent pre-disposing factor 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.. associated with mucosal commensal flora.. May cause endogenous infections. Thus Antibiotic Prophylaxis is recommended.

# Microbiology Overview

- The microbiology of the disease has also changed, and staphylococci, most often associated with health-care contact and invasive procedures, have overtaken streptococci as the most common cause of the disease.
- streptococci and staphylococci have collectively accounted for approximately 80% of IE cases, the proportion of these two organisms varies by region.

# Microbiology outline

- The Gram-positive cocci of the staphylococcus, streptococcus, and enterococcus species account for 80–90% of infective endocarditis.
- *S aureus* is the most frequently isolated microorganism associated with infective endocarditis in high-income countries and is reported in up to 30% of cases.
- Streptococcal infective endocarditis caused by the oral viridans group remains most common in low-income countries.
- Enterococci account for 10% of cases overall.
- The HACEK bacteria (*Haemophilus*, *Aggregatibacter*, *Cardiobacterium*, *Eikenella corrodens*, *kingella*), which cause about 3% of cases.
- Fungal endocarditis, usually *Candida* or *Aspergillus*, is rare but often fatal, arising in patients who are immunosuppressed or after cardiac surgery, mostly on prosthetic valves.

	Catalase	Coagulase	Hemolysist	Distinguishing Features	Disease Presentations
<b><i>Staphylococcus</i> Species</b>					
<i>S. aureus</i>	+	+	$\beta$	Ferments mannitol Salt tolerant	Infective endocarditis (acute) Abscesses Toxic shock syndrome Gastroenteritis Suppurative lesions, pyoderma, impetigo Osteomyelitis
<i>S. epidermidis</i>	+	-	$\gamma$	Novobiocin <sup>S</sup> Biofilm producer	Endocarditis in IV drug users Catheter and prosthetic device infections
Viridans group (not groupable)	-	-	$\alpha$	Optochin <sup>R</sup>	Infective endocarditis Dental caries
<i>Enterococcus</i> sp. (Group D)	-	-	$\alpha, \beta, \text{ or } \gamma$	PYR <sup>†</sup> Esculin agar	Infective endocarditis Urinary and biliary infections
<i>S. bovis</i>	-	-	$\gamma$	Bile esculin <sup>†</sup>	Endocarditis, especially in patients with colon cancer



# 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 their hemolytic reaction on blood agar in vitro & by serotypes according to surface cell wall specific carbohydrate antigens.

# Microbial Causes-1A

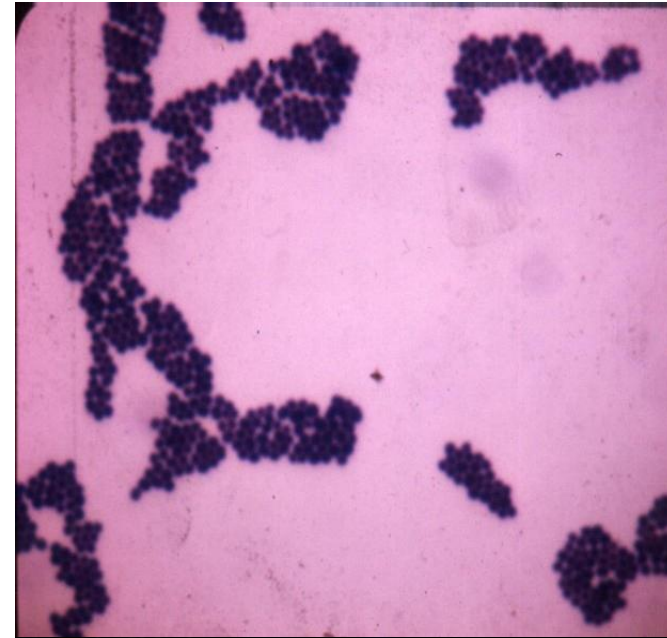
## ❖ Viridans streptococci Group (VGS)

- Normal oral-intestinal flora.. Common causes of dental caries.. Oral abscesses Gingivitis Deposit dextran, adhesins, Fibronectin-binding protein.
  - *St. mutans*, *St. mitis* accounted for many cases, and tend to be less susceptible to penicillins.
- ## ❖ Group A Streptococci (*S. pyogenes*).. Repeat Sore throat infection.. Less skin infection.. Develop Pos-streptococcal Diseases ..Rheumatic heart disease.. Children. Observed later in young adults

# Microbial Causes-1B

- ❖ *S. aureus* is a common cause of acute endocarditis, may result in a severe sepsis syndrome with a fatal outcome.
- Most endocarditis cases occurred within 2-month-1 year following vascular catheters & surgical wounds, skin injury/ invasive dental procedures and others.
- ❖ *Enterococcus* species ( *E. fecalis*, *E. faecium*) are responsible for up to 5-10% of cases; some strains may be resistant to penicillin, vancomycin.

# Streptococci-Staphylococci



# Microbial Causes-2

- 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. tropicalis*).
- *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.

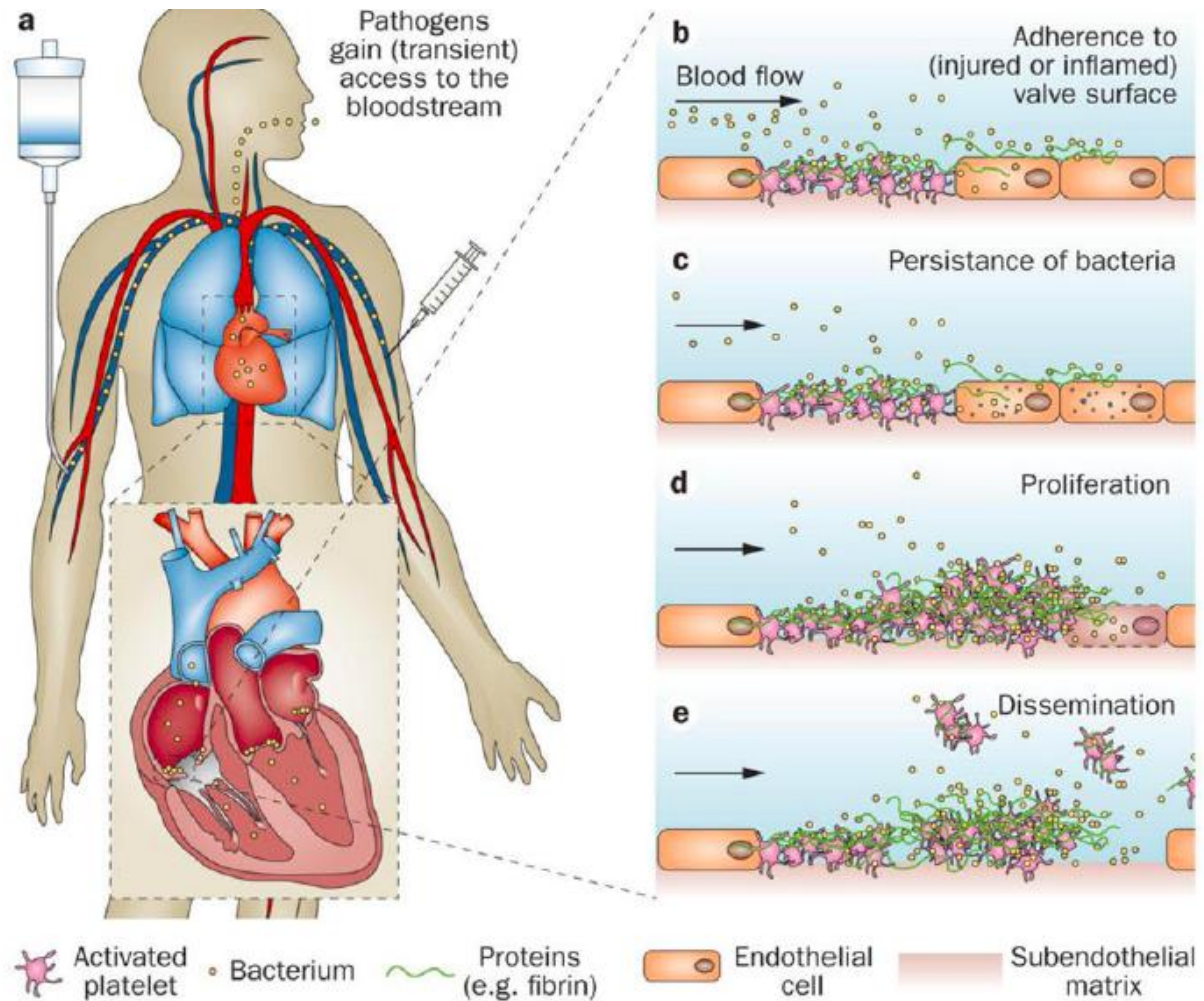
# Candida albicans Pseudohyphae

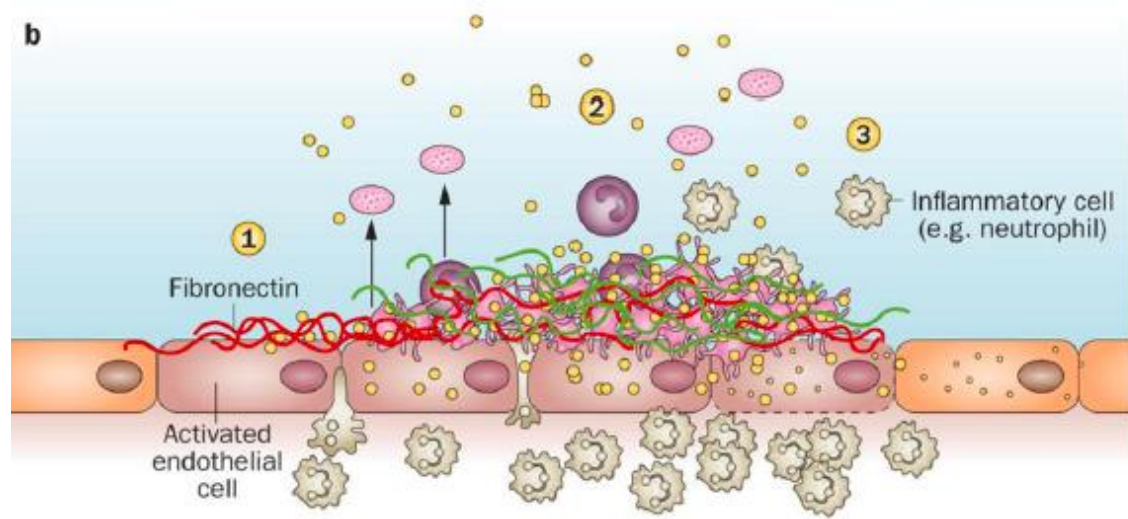
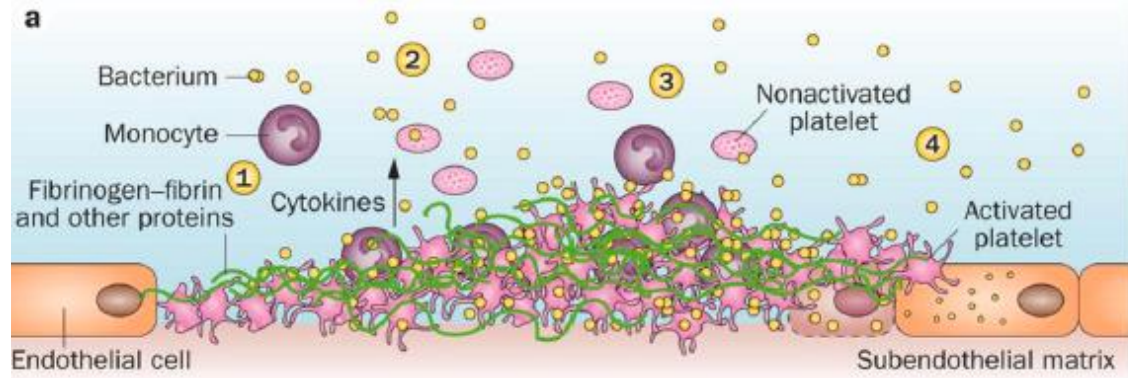


# Pathophysiology

- The healthy cardiac endothelium is resistant to frequent bacteremia caused by daily activities such as chewing and tooth brushing.
- Bloodstream infection is a prerequisite for development.
- The development of IE requires the simultaneous occurrence of several independent factors: alteration of the cardiac valve surface to produce a suitable site for bacterial attachment and colonization; bacteraemia with an organism capable of attaching to and colonizing valve tissue; and creation of the infected mass or 'vegetation' by 'burying' of the proliferating organism within a protective matrix of serum molecules (for example, fibrin) and platelet A **Biofilm** .. Accumulation Bacteria, platelets, fibrin and few leucocytes.









# Clinical features

- The clinical presentation of infective endocarditis is particularly diverse and non-specific.
- Acute endocarditis is a hectically febrile illness that rapidly damages cardiac structures, 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 metastasizes; and is gradually progressive unless complicated by a major embolic event or a ruptured mycotic aneurysm

# Cardiac Manifestations

- Although heart murmurs are usually indicative of the predisposing cardiac pathology rather than of endocarditis, valvular damage and ruptured chordae may result in new regurgitant murmurs.
- Congestive heart failure (CHF) develops in 30–40% of patients as a consequence of valvular dysfunction.



# Noncardiac Manifestations

- The classic nonsuppurative peripheral manifestations of subacute endocarditis (e.g., Janeway lesions are related to prolonged infection).
- In contrast, septic embolization mimicking some of these lesions (subungual hemorrhage, Osler's nodes) is common in patients with acute *S. aureus* endocarditis.



# DIAGNOSIS

- The diagnosis of IE typically requires a combination of clinical, microbiological and echocardiography results .
- Blood culture is the most important initial laboratory test in the workup of IE. Bacteremia is usually continuous and the majority of patients with IE have positive blood cultures.
- Echocardiography is the second cornerstone of diagnostic efforts and should be performed in all patients in whom IE is suspected.
- A highly sensitive and specific diagnostic schema—known as the modified Duke criteria—is based on clinical, laboratory, and echocardiographic findings commonly encountered in patients with endocarditis

- Non-Blood-Culture Tests : Serologic tests culture, microscopic examination with special stains, (i.e., the periodic acid–Schiff stain for *T. whipplei*), direct fluorescence antibody techniques and by the use of polymerase chain reaction to recover unique microbial DNA or DNA encoding the 16S or 28S ribosomal unit.
- Echocardiography



# Management

## ❖ ANTIMICROBIAL THERAPY

- Vancomycin plus Gentamicin initiated immediately after blood samples are taken for cultures.
- Extended courses of parenteral therapy with bactericidal (or fungicidal) agents are typically required.

## ❖ Surgical Treatment.

# PREVENTION

- To prevent endocarditis (long a goal in clinical practice), past expert committees have supported systemic antibiotic administration prior to many bacteremia-inducing procedures.

The End