

Infective endocarditis

Notes:

- damage in endocardium after a microbial colonization.
- its rare, highly fatal and has long lasting effects even among patients who survive it.
- it becomes systemic

It has 3 factors that occur simultaneously:

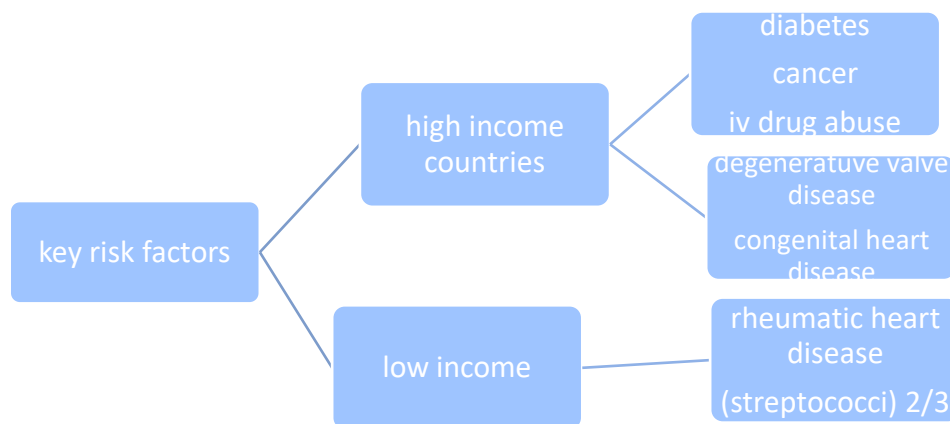
1-microbes in systemic circulation

2-structural defect in heart/ valves

3-vegetations(bacteria+leukocytes+platelets+fibrin), they can cause embolus and infarction.

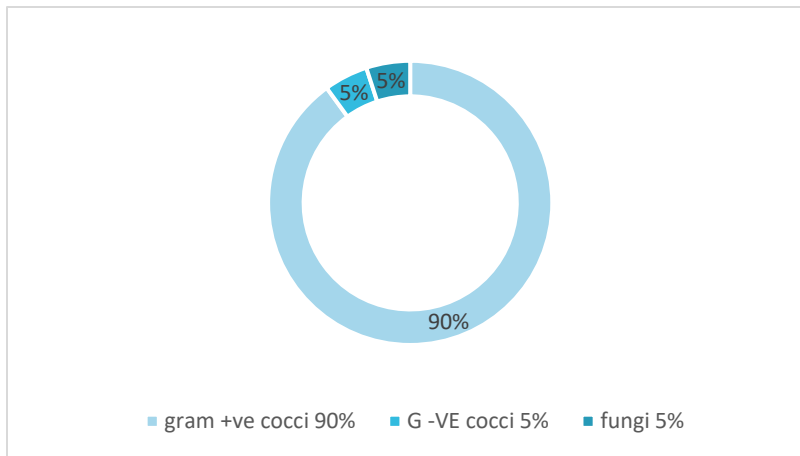
Notes:

- it affects prosthetic heart valves & native valves(when superimposed with inflammation)
- 1-10 cases per 100000 person-year.



- mean age of patients was <30 now its >50.

- mortality rates are 25%



gram +ve 90%

1-streptococci A
(mostly) developing

2-staphylococcus aureus (developed)

3-enterococcus (10%)

- staphylococci is associated with healthcare contact and invasive procedures more than streptococci.+ (it causes 30% of developed country EI cases)

Predisposing factors of endocarditis

- 1- Rheumatic disease (caused by group A streptococci)
- 2- Congenital heart disorders , prosthetic heart valves
- 3- Periodontal (surrounding teeth) procedures/diseases , damaged gingival tissues due to plaque accumulation
- 4- Dental extractions or implants
- 5- Hemodialysis, tonsillectomy, esophageal dilation
- 6- Skin infections, iv drug abusers
- 7- Cystoscopy, colonoscopy, urethral dilation

- Basically anything that can allow commensal bacteria to enter circulation. That's why antibiotic prophylaxis are always recommended during these procedures.

- Note: antibiotic prophylaxis aren't proven to protect people who are at risk of IE, & they also can cause antibiotic resistance.

• **IV drug abusers have 2 distinctive characteristics :**

1-organism coagulase -ve staph (staph epidermis)

2-most common valve involved is tricuspid valve

Valve Notes:

•the most common affected valve is the mitral valve (except for iv drug abusers its tricuspid valve)

•most common cause that affects **native** valves is group A beta hemolytic streptococci and streptococci viridians.

•**prosthetic** valves are mostly affected by staphylococci.

General notes:

1- Streptococcal IE caused by oral viridians remain most common in low income countries

2- The HACEK bacteria (haemophilus, aggregatibacter, Cardiobacterium, Eikenella corrodens, Kingella) cause 3% of cases (G-ve)

3- Fungal endocarditis (usually :Candida, Aspergillus & histoplasma) is rare but fatal, it affects prosthetic heart valves in immunosuppressed patients or after cardiac surgery.

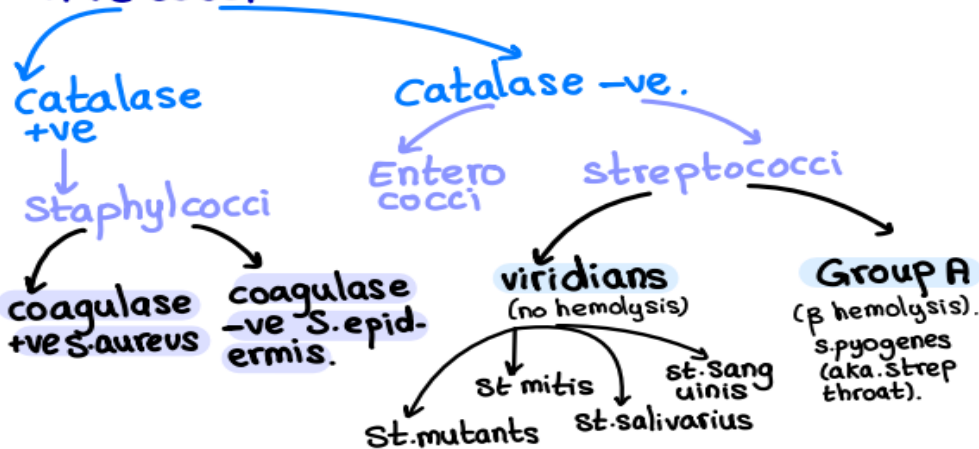
4- Always remember that in fungal IE the patient is usually in ICU with a central catheter & they are given IV nutrition with a broad spectrum antibiotic

5- Most endocarditis cases occur within 2 months-1year following a vascular catheter / surgical wounds/ skin injury/invasive dental

bacteria	hemolysis	Disease presentations
Staphylococcus aureus	Beta hemolysis	Acute IE
Staphylococcus epidermis (viridians group)	No hemolysis	-Endocarditis in iv drug abusers -Dental carries
Streptococci bovis (resistant to vancomycin)	No hemolysis	Colon cancer & endocarditis

causes of IE

① G+ve cocci



② Gram -ve (rare <5%)

- Brucella, salmonella, bartunella, Eikenella
- tropherymawhipplei, coxiella burnetti (Q fever)
- Cardiobacterium, Haemophilus.
- Gram+ve Actinobacillus.

③ Yeast & filamentous fungi:

- most common: Candida albicans.
- Least common: Candida Spp. (C.glabrata, C.Krusei, C.Tropicalis & C.parapsilosis).

1-Streptococci :

Remember : they're g+ve ,catalase -ve

1-viridians streptococci group:

Non hemolytic

- They are normal oral-intestinal flora
- They cause dental caries, oral abscesses gingivitis
- when they get access to circulation they deposit: dextran , adhesins & fibronectin binding proteins (these help in their adhesion to valves so they could start forming vegetations and causing bacteremia).
- they include: St.mutants & St.mitis
- they are less susceptible to **penicillins.**

2-group A streptococci:

Beta hemolytic

- they include S.pyogenes (strep throat)
 - they can cause sore throat infection(pharyngitis mainly in children) and less commonly skin infection (impetigo).
- a few weeks later some patients may develop post-streptococcal disease syndromes and they are:**
- 1-rheumatic heart disease (cuz of their ability of molecular mimicry)
 - 2-post streptococcal glomerulonephritis

2-S.aureus:

Remember they are +ve gram +coagulase

- a common cause of acute endocarditis
- in developed countries may result in severe sepsis syndrome with a fatal outcome (progression happens from 2weeks to months)

3-enterococcus:

Remember; they are gram +ve , -ve coagulase.

- Some strains are resistant to penicillin & vancomycin, so its treated with teicoplanin

Streptococci

Long Chains



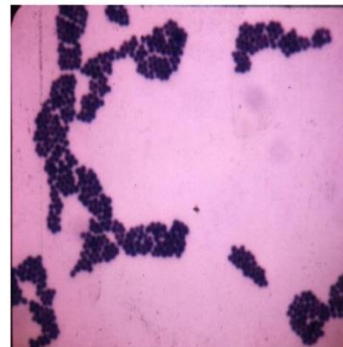
- Blood agar is used to determine the type of hemolysis.

- This is alpha hemolysis = viridians.



Staphylococci

Grape like clusters



- Mannitol salt agar.
- Differential & selective medium for s. aureus due to its ability to ferment mannitol turning it into deep yellow.



4-gram-ve bacteria:

- brucella, salmonella, haemophilus, cardiobacterium, eikenella & gram+ve actinobacillus. (part of normal flora)
- they don't respond to vancomycin and gentamycin, so we prescribe Ceftriaxone or 3rd generation cephalosporins.
- they cause subacute or chronic endocarditis and are often present with embolic lesions from large biofilm vegetations in heart valves.
- they mostly occur in elderly patients, patients receiving prolonged antibiotics or iv nutrition through central vascular catheters or immune compromised patients

5-yeast & filamentous fungi:

Most common: candida albicans

Least: candida spp

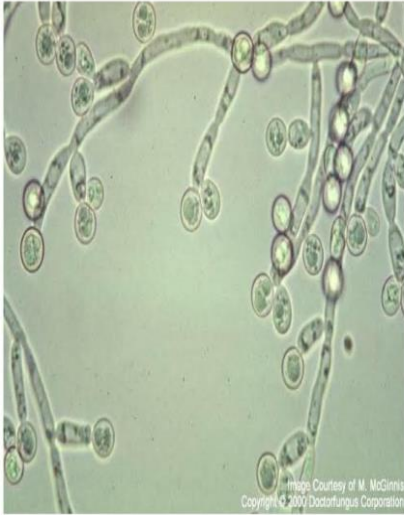
Candida is a normal oral-intestinal-urinary tract-vagina flora, infection follows catheters or respiratory intubation

Notes:

1-endocarditis due to Histoplasma capsulatum/aspergillus species is very rare (only in immunocompromised)

2-there is an increase in the likelihood of developing fungal endocarditis in immunocompromised patients especially ones with HIV.

Candida albicans Pseudohyphae



- Corn meal agar causes pseudo-hyphae with chlamydospore formation.

- Candida are morphologically yeast, but they can also form pseudo-hyphae or true hyphae.

- Candida albicans are responsible of 90% of human infection.
- We can mix it with human serum and wait until germ tubes formed.



- On a universal fungal agar (Sabouraud dextrose agar), they show this **white creamy waxy colonies** (candida).

Pathophysiology:

- A healthy cardiac endothelium is resistant to frequent bacteremia caused by daily activities.
- Blood stream infection is prerequisite for IE development.
- The development of IE requires simultaneous occurrence of:
 - 1-bacteremia with an organism capable of attaching and colonizing valve tissue.
 - 2-alteration of cardiac valve endothelium (to produce a suitable site for bacterial colonization and attachment).
 - 3-creation of vegetations (platelets, fibrin & neutrophils burry they bacteria which appears as vegetations)

Note: 1) vegetations can disseminate and result in systemic emboli.

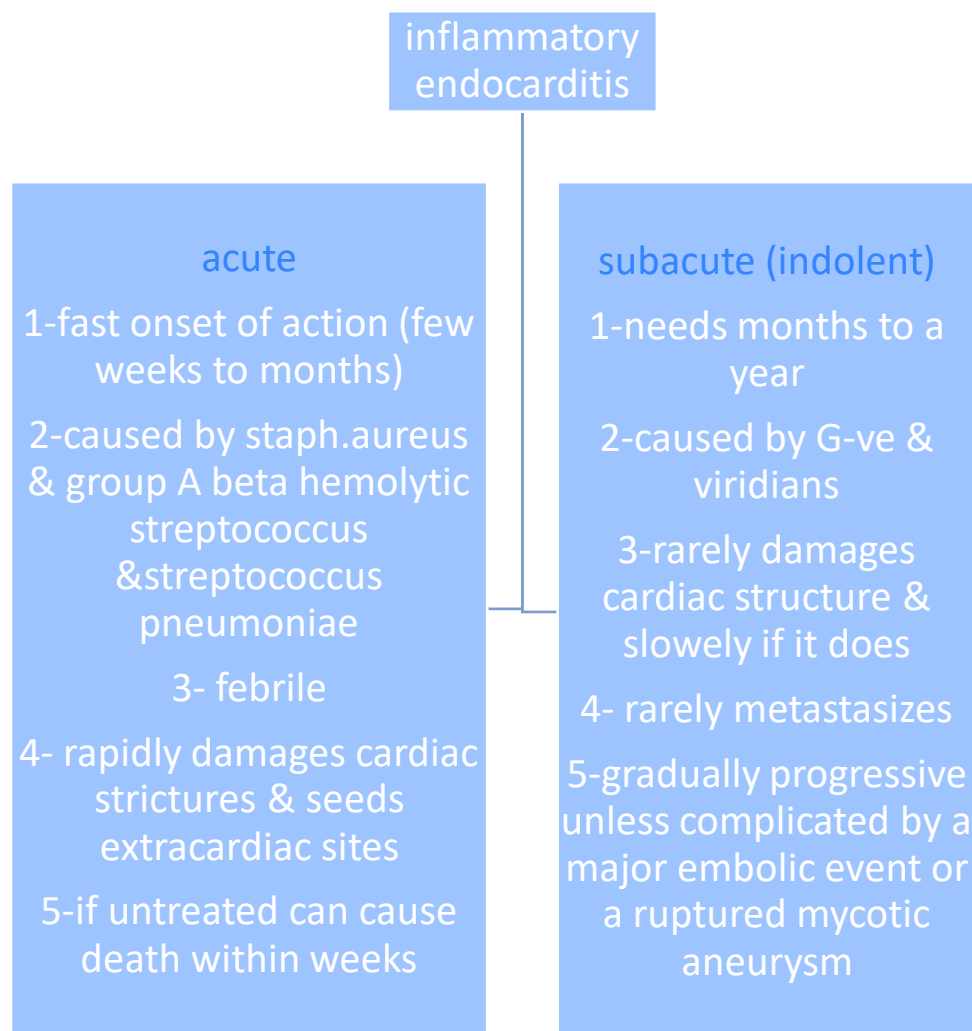
2)patients are given a long term antibiotic because the bacterial colonization can multiply (but are metabolically inactive)

There are favorable conditions for microorganisms to colonize and they are :

1-absence of continuous endothelial cells (ex ;mechanical injuries)

2-inflammed continuous endothelial cells (ex; in rheumatic fever)

In both cases its easier for microorganisms to attach and colonize



Note: the main differences between acute and subacute endocarditis are: level of toxicity ,onset of action & disease progression.

Modified duke criteria:

It's a criteria that helps us identify IE, by giving us major and minor points that if present can determine the possibility of IE existence.

•major criteria:

- 1-+ve blood culture of an IE causing organism
- 2-transthoracic echocardiography showing any evidence of heart vegetations (or structural damage)

•Minor criteria:

- 1-fever
- 2-predisposition factors
- 3-IV drug abuse
- 4-vascular phenomena (Janeway lesions)
- 5-immunological phenomena (Osler's node)

•depending on the patients findings or risk factors we classify IE diagnosis to : definite , possible or rejected diagnosis

- 1-if 2 major criterias were found =definite
- 2- 1 major criterion & 3 minor = definite
- 3- 5 or more minor criterion =definite

Note: the most common presentations are :

- 1- Fever (90-95% of cases)
- 2- Murmur (90-95% of cases) : it could be newly onset or a verification in an already existing murmur.

manifestations

cardiac manifestations:

1-vulvar damage & ruptured chordae may result in regurgitant murmurs.

2-congestive heart failure : develops in (30-40%) of patients as a result of vulvar dysfunction.

non-cardiac manifestations (minor criteria):

1-non suppurative peripheral manifestations of subacute endocarditis (ex; janeway lesions, non tender and painless (vascular phenomena))

2-septic embolization mimicking some of these lesions (ex; Osler's node in acute S.aureus endocarditis its tender and painful (immunological phenomena))

- subungual hemorrhages are a painless vascular phenomena , sometimes the emboli can reach to other places in the body and cause infarctions ex; in lungs or brain or periphery.



Subungual hemorrhage



Janeway lesions



Osler's nodes

Note : 1-fever & murmurs for the first time : IE until proven otherwise

2-fever & change in existing murmurs : IE until proven otherwise

3-IE patients will have a good amount of medical history

Diagnosis:

We mainly use duke criteria

- 1- Blood culture (most imp): +ve for IE causing organisms
- 2- Echocardiography showing evidence of structural heart defect
- 3- Non-blood culture tests (if we got a -ve blood culture we use them):
 - a- Serologic test culture
 - b- Microscopic examination with special stains
 - c- Direct fluorescence antibody techniques
 - d- Pcr encoding 16s or 28s ribosomal units

Management:

- 1- **Antimicrobial therapy** : (we use it because 90% of IE cases are caused by G+ve bacteria , however if patient didn't respond then it might be a fungal IE).

We use IV vancomycin +Gentamicin (initiated immediately after blood samples are taken for cultures)

Note: extended courses of parenteral therapy with bactericidal or fungicidal agents are typically required.

- 2- **Surgical treatment** : for vegetations

Remember: G+ve = vancomycin+gentamycin

Enterococci= teicoplanin

G-ve= 3rd generation cephalosporins

Fungi=amphotericin B + sometimes surgery

Prevention:

- Systemic antibiotic administration prior to many bacteremia -inducing procedures.
- you have to give patients with a high risk factor (IHD, structural defect in heart & in invasive surgeries) prophylaxis!