

Team Medicine

Infective Endocarditis

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Definition:

Infection of endothelium surface of heart either of heart valves , septal defects, chordae tendinea & A.V shunt.
It remains a life-threatening disease with significant mortality (about 20%) and morbidity.

Pathophysiology:

-The IE is the net result of the complex interaction between the bloodstream pathogen with matrix molecules and platelets at sites of endocardial cell damage.

-Endothelial damage :Turbulent blood flow produced by certain types of congenital or acquired heart disease, such as flow from a high- to a low-pressure chamber or across a narrowed orifice, traumatizes the endothelium.

-Formation of nonbacterial thrombotic endocarditis NBTE .Endothelial damage creates a predisposition for deposition of platelets and fibrin on the surface of the endothelium, which results in NBTE.

-Bacteremia: Invasion of the bloodstream with a microbial species that has the pathogenic potential to colonize this site can then result in Proliferation of bacteria within a vegetation and form IE.

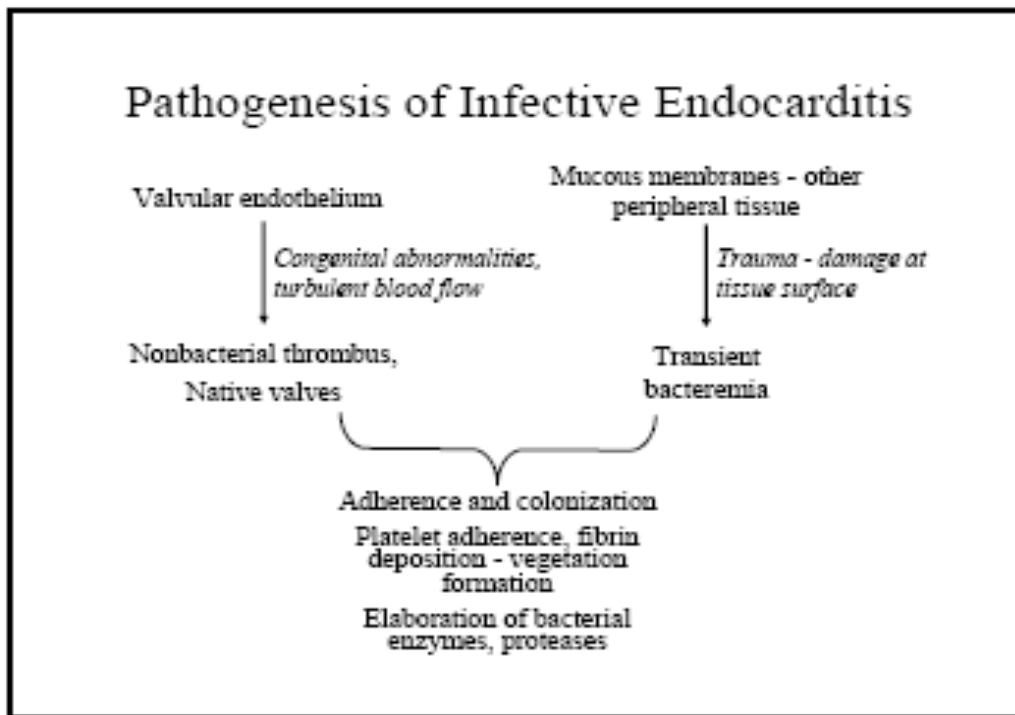
-Transient Bacteremia: Mucosal surfaces are populated by a dense endogenous microflora. Trauma to a mucosal surface like Gingiva around teeth, Oropharynx, GI tract, Urethra, Vagina, This will releases many different microbial species transiently into the bloodstream which will leads to Transient bacteremia caused by organism e,g viridans group streptococci .

In other words :

Endocarditis is usually the consequence of two factors :

- 1- bacteremia due to injury by trauma(skin injury) or by any procedures (dental or urogenital).
- 2- endothelial injury (endocardial) which cause platelet and fibrin deposition leading to adherence and growing of the organism and cause the infection .

***Recommended videos:**
Dr. najeeb videos on Infective endocarditis .
***Exam questions** on this lec will be on clinical manifestations of the disease & complications according to what the doctor said.



- Determining Risk**
 - Cardiac conditions
 - high risk
 - moderate risk
 - negligible risk
 - Type of Procedure

Cardiac Conditions

High risk "need prophylaxis"	Moderate risk "need prophylaxis"	Negligible risk "no need for prophylaxis"
<ul style="list-style-type: none"> • Prosthetic Valves (400x risk²) • Previous endocarditis • Congenital <ul style="list-style-type: none"> - Complex cyanotic dz (Tetralogy, Transposition, Single Vent) - Patent Ductus Arteriosus - VSD - Coarctation • Valvular: <ul style="list-style-type: none"> Aortic Stenosis > Aortic Regurg Mitral Regurgitation Mitral Stenosis with Regurg • Surgically constructed systemic pulmonary shunts or conduits 	<ul style="list-style-type: none"> • Valvular MVP (mitral valve prolapse) + regurgitation and/or thickened leaflets • pure Mitral Stenosis • TR/TS • Pulmonary Stenosis • Bicuspid AV/ Aortic Sclerosis • degenerative valve disease in Elderly <ul style="list-style-type: none"> • Asymmetric Septal Hypertrophy/HOCM • Surgically repaired intra-cardiac lesions without hemodynamic abnormality, < 6 months after surgery 	<ul style="list-style-type: none"> • MVP no regurgitation • Physiologic/innocent murmur • Pacemaker/ICD • Isolated Secundum ASD • Previous CABG • Surgical repair ASD/VSD/PDA, no residua > 6mos after surgery

Procedure:

High risk : oral / dental

Moderate risk : **genitourinary** / pulmonary (e.g. bronchoscopy)

Low risk: GI (don't give prophylaxis before it)

Classification:

- 1- type of lesion: native or prosthetic
- 2- onset and progress (original classification , before antibiotic era):
 - acute: virulent organism, normal valve , **death < 6 weeks**
 - sub acute :relatively avirulent organism , abnormal valve , **indolent course**
- 3- acquire of infection : nosocomial or community

Clinical features: (important)

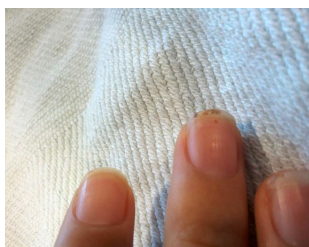
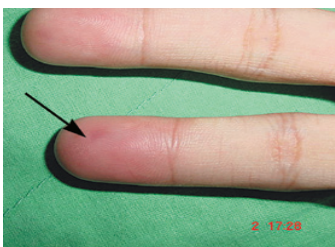
Onset usually within 2 weeks of infection .

- indolent course : (not specific)
Fever – malaise – fatigue - night sweat – anorexia – Wight loss.
- explosive course :
- CCF , **murmur new onset or changing characters** ,with severe systemic sepsis

Others :

- - **Spleno-megaly** ~ 30%
- Petechiae 20 - 40%
 - Conjunctivae
 - Buccal mucosa
 - palate
 - skin in supra-clavicular regions
- Osler's Nodes 10 - 25%
- Splinter Haemorrhages 5 - 10%
- Roth Spots~ 5%
- Musculoskeletal (arthritis)

Manifestations occur either due to embolization of infective material or due to autoimmune process (antibody antigen reaction)



Osler nodes : small , painful nodules on the pads of the fingers and toes.

Janeway lesions : septic emboli (hemorrhage) that appear as painless lesion on the palms and soles . (not painful)

Roth's spot: pale lesions surrounded by erythema and are usually near the optic disc.

Splinter hemorrhage: linear red to brown streaks found in the nail beds.

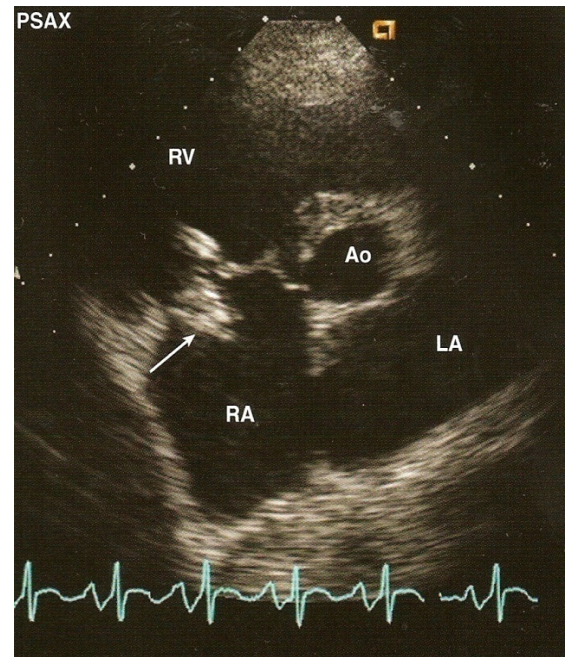
Petechiae :local vasculitis or emboli.

(Medicine recall , 113- 114)

Diagnosis:

- ❑ C.B.C (anemia due to:chronic illness or hemolytic process due to autoimmune process)
- ❑ ESR (elevated)
- ❑ Blood cultures (do it in 3 different sites in different times , because IE is a continuous low-grade bacteremia)
- ❑ Renal function test.
- ❑ URINE (proteinuria and hematuria due to glomerulonephritis)
- ❑ ECG (conduction defect or emboli)
- ❑ CXR (may show evidence of HF , pulmonary emboli, abscesses)
- ❑ ECHO (**diagnostic test** , shows vegetation clearly , TEE is more sensitive 90% than TTE 60-75%)

(medicine recall 114, kumar & clark's 772)



Microbiology:

Native Valve (LT sided)	IV Drug Abusers (RT sided)	Prosthetic Valve
<p>Streptococci 50 - 70% Viridans Streptococci (50% of all Strep) » Staphylococci ~ 25% Mostly Coagulase +ve Staph. Aureus Staph. Epidermidis » Enterococci ~ 10% HACEK(difficult to diagnose ,time to culture) Haemophilus species, Actinobacillus Actinomycetemcomitans, Cardiobacterium hominis, Eikenella, Kingella</p>	<ul style="list-style-type: none"> • Skin most predominant source of infection • 70 - 100% of Rt. sided IE results in pneumonia and septic emboli • Microbiology <p>Staph aureus ~60% Streptococci and Enterococci~20% Gram -ve bacilli ~10% Fungi (Candida and Aspergillus ~5%</p>	<ul style="list-style-type: none"> • Early (< 60 days) • Reflects perioperative contamination • Incidence around 1% • Microbiology <p>Staph (45 - 50%) Staph. Epiderm (~ 30%) Staph. Aureus (~ 20%) Gram -ve aerobes (~20%) Fungi (~ 10%) Strep and Entero (5-10%)</p> <ul style="list-style-type: none"> • Late (> 60 days) • After endothelialization • Incidence 0.2 -0.5 % / pt. year • Transient bacteraemia from dental, GI or GU • Microbiology resembles native valve endocarditis

Modified Duke Criteria:

*Major Criteria

1. positive blood cultures

- a. Typical organisms for 2 separated blood cultures
- b. Persist positive blood cultures
- c. Positive blood culture for coxella burneti

2. Evidence of Endocardial involvement

*Positive Echocardiogram

Oscillating intra cardiac mass

Abscess

Dehiscence of prosthetic valve

New Valvular regurgitation

*Minor criteria

-Predisposition (heart condition or IV drug use)

-Fever of 100.4°F or higher

-Vascular(Arterial emboli, septic pulmonary infarcts, intracranial hemorrhage, Osler, Janeway)

-Immunologic phenomena(GN, Osler, Roth spots, Rheumatoid Factor)

-Microbiologic or echocardiographic evidence not meeting major criteria

*Definitive infective endocarditis

-Pathologic criteria:

Microorganisms or pathologic lesions: demonstrated by culture or histology in a vegetation, or in a vegetation that has embolized, or in an intracardiac abscess

-Clinical criteria (as above)

-Two major criteria, or

-One major and three minor criteria, or

-Five minor criteria

*Possible infective endocarditis

Findings consistent of IE that fall short of “definite”, but not “rejected”

*Rejected

- Firm alternate Dx for manifestation of IE
- Resolution of manifestations of IE, with antibiotic therapy for ≤ 4 days
- No pathologic evidence of IE at surgery or autopsy, after antibiotic therapy for ≤ 4 days

Treatment:

Medical or surgical .

Principles of Medical Management:

Sterilization of vegetations with antibiotics prolonged , high dose and bactericidal.

Acute onset:

blood culture and start treatment **within three hours**.

Sub acute onset ;

Blood culture then antibiotic can be started **within three days**.

- Microbiologic cure in majority of patient
 - Highly penicillin-susceptible Streptococcus viridans or bovis
- Once-daily **ceftriaxone for 4 wks** cure rate > 98%
- Once-daily **ceftriaxone 2 g for 2wks followed by oral amoxicillin qid for 2 wks**

Indications for Surgery:

- Valvular disruption leading to severe insufficiency and CCF
- **Extra valvar extension**
- **Embolization of vegetations**
- Failure of medical management: Positive blood culture and systemic signs of infection after “adequate” antibiotic therapy
- Resistant organisms such as MRSA, Fungi , Pseudomonas
- Echo detected vegetation > 1 cm

Complications:

- **Congestive Cardiac Failure** (Commonest complication)
- Valve Destruction
- Myocarditis
- Coronary artery embolism and MI
- Myocardial Abscesses
- Neurological Manifestations (1/3 cases)
- Major embolism to MCA territory ~25%
- Mycotic Aneurysms 2 - 10%
- Metastatic infections
- Rt. Sided vegetations
- Lung abscesses
 - Pyothorax / Pyo-pneumothorax
- Lt. Sided vegetations
- Pyogenic Meningitis
 - Splenic Abscesses
 - Pyelonephritis
 - Osteomyelitis
- Renal impairment , **Glomerulonephritis**

(Most common sites of emboli caused by infective endocarditis: CNS- Myocardium- Kidney) - @med431

Prevention:

Amoxicillin or penicillin 2 gm., one hour before the procedure for patient with high or moderate risk only.

Cardiac Conditions Associated with the Highest Risk of Adverse Outcome from Endocarditis for Which Prophylaxis with Dental Procedures is Recommended

- Prosthetic cardiac valve
- Previous infective endocarditis
- Congenital heart disease (CHD)*
 - Unrepaired cyanotic CHD, including those with palliative shunts and conduits
 - Completely repaired CHD with prosthetic material or device either by surgery or catheter intervention during the first 6 months after the procedure**
 - Repaired CHD with residual defects at the site or adjacent to the site of a prosthetic patch or prosthetic device (which inhibit endothelialization)
- Cardiac transplantation recipients who develop cardiac valvulopathy

*Except for the conditions listed above, antibiotic prophylaxis is no longer recommended for any other form of congenital heart disease.

**Prophylaxis is recommended because endothelialization of prosthetic material occurs within 6 months after the procedure.

Endocarditis Prophylaxis for Dental Procedures

Highest-risk patients require endocarditis prophylaxis for all dental procedures that involve manipulation of gingival tissue or the periapical region of teeth or perforation of the oral mucosa.

Exceptions that do not require prophylaxis:

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- Routine anesthetic injections through noninfected tissue
 - Taking of dental radiographs
 - Placement of removable prosthodontic or orthodontic appliances
 - Adjustment of orthodontic appliances
 - Placement of orthodontic brackets
 - Shedding of deciduous teeth and bleeding from trauma to the lips or oral mucosa

Regimens for a Dental Procedure

Situation	Agent	Regimen – Single Dose (30-60 Minutes Before Procedure)	
		Adults	Children
Oral	amoxicillin	2 gm	50 mg/kg
Unable to take oral medication	ampicillin or cefazolin or ceftriaxone	2 g IM or IV 1 g IM or IV	50 mg/kg IM or IV 50 mg/kg IM or IV
Allergic to penicillins or ampicillin (oral)	cephalexin*† or clindamycin or azithromycin or clarithromycin	2 g	50 mg/kg
		600 mg 500 mg	20 mg/kg 15 mg/kg
Allergic to penicillins or ampicillin (unable to take oral meds)	cefazolin or ceftriaxone† or clindamycin	1 g IM or IV	50 mg/kg IM or IV
		600 mg IM or IV	20 mg/kg IM or IV

*Or other first or second generation oral cephalosporin in equivalent adult or pediatric dosage.

†Cephalosporins should not be used in an individual with a history of anaphylaxis, angioedema, or urticaria with penicillins or ampicillin. IM = intramuscular; IV = intravenous.

Summary

IE is an infection of the endocardium.

Endocarditis is usually the consequence of two factors :

- 1- bacteremia due to injury by trauma (skin injury) or by any procedures (dental or urogenital).
- 2- endothelial injury (endocardial) which cause platelet and fibrin deposition leading to adherence and growing of the organism and cause the infection .

It is manifested by fever , malaise , new changing murmur ...ect

The most important complication is CCF and embolization in many sites like brain and kidney.

Patients are classified to 3 risk groups : high: need prophylaxis – moderate: need prophylaxis – negligible: don't need prophylaxis.

The causative organism in native valve is strep. viridians , in IV users is staph. Aureus .

HACEK are group of organisms can cause IE but are difficult to diagnose and take time for culture.

Treat the patient with ceftriaxone 2 gm. For 4-6 weeks

Prophylaxis is require prior to any high risk patient in oral / GU / pulmonary procedures .