

L7: Infective Endocarditis

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MEDICINE 433

objectives

1. Definition of endocarditis.
2. Path-physiology of endocarditis.
3. Presentation of patients with endocarditis.
4. Treatment of endocarditis.
5. Prevention of endocarditis.

Definition of endocarditis

- **Infection of endothelium** surface of heart either of **Heart valves** , Septal defects, Chordae Tendinea , A.V shunt and intracardiac foreign bodies, e.g. prosthetic valves, pacemaker leads
- It remains a life-threatening disease with significant mortality (**about 20%**) and morbidity.

Pathophysiology of endocarditis

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

1-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.

2- 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.

3- Bacteremia

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

NOTE: Bacteraemia may occur due to patient specific reasons e.g (poor dental hygiene, intravenous drug) or be associated with diagnostic or therapeutic procedures (dental treatment, cardiac surgery or permanent pacemakers).

Differences between

Nonbacterial Thrombotic Endocarditis (Marantic Endocarditis)

- Associated with debilitating illnesses such as **metastatic cancer** (found in up to 20% of cancer patients)
- Sterile deposits of fibrin and platelets form **along the closure line of cardiac valve leaflets.**
- Vegetations can **embolize to the brain or periphery.**
- Although the use of **heparin** may be appropriate, no studies have confirmed its efficacy.

Nonbacterial Verrucous Endocarditis (Libman–Sacks Endocarditis)

- Typically involves the aortic valves in individuals **with SLE**
- Characterized by the formation of small warty vegetations on **both sides** of valve leaflets and may present with regurgitant murmurs
- Rarely gives rise to infective endocarditis, but can be a source of **systematic Embolization**
- Treat **underlying SLE and anticoagulate**

Organisms

1- Native valve endocarditis	2- Prosthetic valve endocarditis	3- Endocarditis in IV drug users
<ul style="list-style-type: none"> • S. viridans is the most common organism in native valve endocarditis. • Other common organisms include Staphylococcus species (S. aureus more commonly than S. epidermidis) and Enterococci. • HACEK group of organisms: Haemophilus, Actinobacillus, Actinomycetemcomitans, Cardiobacterium, Eikenella, and Kingella 	<ul style="list-style-type: none"> • Staphylococci are the most common causes of <u>early-onset</u> endocarditis; symptoms appear <u>within 60 days of surgery</u> (S. epidermidis more commonly than <i>S. aureus</i>). • Streptococci are the most common cause of <u>late-onset</u> endocarditis; symptoms appear <u>60 days after surgery</u>. 	<p>Frequently presents with right-sided endocarditis</p> <ul style="list-style-type: none"> • S. aureus is the most common cause • Other organisms include Enterococci and Streptococci. Fungi (mostly <i>Candida</i>) and gram-negative rods (mostly <i>Pseudomonas</i>) are less common causes.

The different sites lead to the infection of specific organisms:

- 1- (Mouth): dental disease or procedure “*streptococcus viridans*”.
- 2- (Skin): vascular catheter or IV drug users “*staphylococcus aureus*”.
- 3- (Gut and perineum) : “*Enterococci*”.

Risk Factors

- **Acquired valvular heart disease** with stenosis or regurgitation
- **Valve replacement**
- Congenital heart disease
- Hypertrophic cardio-myopathy
- Previous infective endocarditis
- I V drug abuser.
- **oral/dental Procedure –high risk-**
- GU/Pulmonary Procedure -Intermediate risk-
- GI Procedure –low risk-

Cardiac conditions predispose to IE

- Based on risk of progression to severe Endocarditis with substantial morbidity and mortality Classified into :

1- High risk *prophylaxis*	2- Moderate risk *prophylaxis*	3- Negligible risk * no prophylaxis*
<ul style="list-style-type: none"> Prosthetic Valves (400x risk²) Previous endocarditis Congenital <ul style="list-style-type: none"> Complex cyanotic disease (Tetralogy, Transposition, Single Ventricle) Patent Ductus Arteriosus VSD Coarctation of aorta 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 <ul style="list-style-type: none"> MVP + regurgitation and/or thickened leaflets Pure Mitral Stenosis TR/TS Pulmonary Stenosis Bicuspid AV/ Aortic Sclerosis degenerative valve disease in Elderly Asymmetrical 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

Classification of Endocarditis

1- Acute endocarditis	2- Subacute endocarditis
<ul style="list-style-type: none"> • Most commonly caused by S. aureus (virulent) • Occurs on a normal heart valve • If untreated, fatal in less than 6 weeks 	<ul style="list-style-type: none"> • Caused by less virulent organisms, such as Streptococcus viridans and Enterococcus • Occurs on damaged heart valves • If untreated, takes much longer than 6 weeks to cause death



Infective endocarditis is almost always fatal if left untreated

Signs & symptoms

Onset usually within 2 weeks of infection		others
Indolent course <ul style="list-style-type: none"> -fever - Malaise - Fatigue - Night sweats - Anorexia - Weight loss 	Explosive course <ul style="list-style-type: none"> -CCF -murmur new onset or changing characters, -with severe systemic sepsis 	Spleno-megaly Petechiae <ul style="list-style-type: none"> – Conjunctivae – Buccal mucosa – palate – Skin in supra-clavicular regions Osler's Nodes, jenny and jet lesion , Splinter Haemorrhages, Roth Spots, Musculoskeletal(arthritis)

How To Diagnose

1- Modified Duke Criteria

Major Criteria	Minor criteria
<p>1. positive blood cultures</p> <p>a. Typical organisms for 2 separated blood cultures</p> <p>b. Persist positive blood culture</p> <p>c. Positive blood culture for coxella burniti</p> <p>2. Evidence of Endocardial involvement</p> <p>a. Positive Echocardiogram</p> <ul style="list-style-type: none"> – Oscillating intra cardiac mass – Abscess – Dehiscence of prosthetic valve – New Valvular regurgitation 	<p>a. Predisposition (heart condition or IV drug use)</p> <p>b. Fever of 100.4⁰F or higher</p> <p>c. Vascular(Arterial emboli, septic pulmonary infarcts, intracranial hemorrhage, Janeway lesion)</p> <p>d. Immunologic phenomena(Osler, Roth spots, Rheumatoid Factor)</p> <p>e. Microbiologic or echocardiographic evidence not meeting major criteria</p>

BE-FEVER

- B- BLOOD CULTURE +VE >2 TIMES 12 HOUR APART
- E- ENDOCARDIAL INVOLVEMENT FROM ECHO

MINOR CRITERIA

- F- FEVER
- E- ECHO FINDING NOT MAJOR
- V- VASCULAR PHENOMINA
- EE- EVIDENCE FROM MICROBIAL /IMMUNOLOGICAL- 2 EVIDENCE
- R- RISK FCTOR FOR IE VALVE DISEASE

How To Diagnose

2- Diagnostic (Duke) Criteria

1- Definitive infective endocarditis <u>"confirmed"</u>	2- Possible infective endocarditis	3- Rejected
<p>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</p> <p><u>Clinical criteria (as above)</u> -<u>Two major criteria, or</u> -<u>One major and three minor criteria, or</u> -<u>Five minor criteria</u></p>	<p>-findings consistent of IE that fall short of "definite", but not "rejected"</p> <p>-IE considered in presence of 1 major + 1 minor or 3 minor</p>	<p>-Firm alternate Dx for manifestation of IE</p> <p>-Resolution of manifestations of IE, with antibiotic therapy for ≤ 4 days</p> <p>-No pathologic evidence of IE at surgery or autopsy, after antibiotic therapy for ≤ 4 days</p>

Investigation of endocarditis

-C.B.C

-ESR

-Blood cultures

-RFT

-URINE

-ECG

-CXR

-**ECHO** “Echocardiography” : it’s an extremely useful tool and the test of choice for infective endocarditic.



FOR YOUR INFORMATION

An **echocardiogram** (echo) uses high-frequency sound waves to produce a graphic outline of the heart's movement.

A **transesophageal echo** (TEE) test is a type of echo test in which the ultrasound transducer, positioned on an endoscope, is guided down the patient's throat into the esophagus (the "food pipe" leading from the mouth into the stomach).



TEE is better than transthoracic echocardiography in the diagnosis of endocarditis.

Management of endocarditis

1. Parenteral antibiotics based on culture results for extended periods (4 to 6 weeks)


-Acute onset:

blood culture and start treatment within three hours.

- Sub acute onset:

Blood culture then antibiotic can be started within three days

2. If cultures are negative but there is high clinical suspicion, treat empirically with a penicillin (or vancomycin) plus an aminoglycoside until the organism can be isolated.

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- Highly penicillin-susceptible *Streptococcus viridans* or *bovis*
 - Once-daily ceftriaxone for 4 wks
 - Once-daily ceftriaxone for 2 wks followed by oral amoxicillin for 2 wks

Management of endocarditis

3. Indications for Surgery

Left sided native valve endocarditis

- Valvular disruption leading to severe insufficiency and CCF
- Extra valvular 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 ??



Endocarditis prophylaxis (amoxicillin) is indicated for patients with known valvular heart disease or prosthetic valves who are about to undergo oral surgery or GI/ GU surgery.

Complications of endocarditis

1. Congestive Cardiac Failure (Commonest complication)

- Valve Destruction
- Myocarditis
- Coronary artery embolism and MI
- Myocardial Abscesses

2. Neurological Manifestations (1/3 cases)

- Major embolism to MCA territory
- Mycotic Aneurysms

3. Metastatic infections

- **Rt. Sided vegetations**
 - Lung abscesses
 - Pyothorax / Pyo-pneumothorax
- **Lt. Sided vegetations**
 - Pyogenic Meningitis
 - Splenic Abscesses
 - Pyelonephritis
 - Osteomyelitis

4. Renal impairment , Glomerulonephritis

Prevention of endocarditis

- Antibacterial prophylaxis is not recommended for prevention of endocarditis in patient undergoing dental, UR and LR tracts or GI tract procedures. BUT if the patient at risk and is undergoing a procedure, the patient should receive an appropriate antibacterial to the organism that's related to the site of the procedure.

for example: If the patient at risk and undergoing a dental procedure, should receive anti-streptococci.

- Advices for patient at risk of endocarditis:
 1. should be treated from any infection.
 2. Maintain good oral hygiene.
 3. Has to know how recognize sings of IE.

MCQs

1/ patient came to hospital with Rt. Sided vegetations Which of the following complications will you expect to see ?

- A. Lung abscesses
- B. Pyogenic Meningitis
- C. Osteomyelitis

2/Which of the following is not considered as a risk of IE Hypertrophic cardio-myopathy

- A. Valve replacement
- B. Previous CABG
- C. Oral dental procedure

3/ Which of the following is considered as a risk of IE

- A. Roth spots
- B. Osler's Nodes
- C. Pure Mitral Stenosis
- D. fever

4/ Which of the following is considered as a minor Duke Criteria?

- A. Positive blood culture for coxellaburniti
- B New Valvular regurgitation
- C. Oscillating intra cardiac mass
- D. IV drug abuse

5/Pulmonary Stenosis considered as?

- A. High risk procedure for Infective endocarditis
- B. Intermediate risk procedure for Infective endocarditis
- C. Low risk procedure for Infective endocarditis
- D. No relation at all between the procedure and Infective endocarditis

6/ The strongest indication for surgery in IE is:

- A. Persistence of fever
- B. Embolization of vegetations
- C. Perivalvular invasive disease

7/ The composition of vegetation includes:

- A. Fibrin + Platelet
- B. Platelet + Inflammatory cells + smooth muscle cells
- C. Inflammatory cells + Fibrin + Platelet
- D. lymphocyte + fibrin

8/ Patient underwent a major surgery 3 weeks ago , came to hospital complaining of Fever , Fatigue and Osler's Nodes after investigation they diagnosed him with IE

What is the most likely organism ?

- Viridans Streptococci
- Haemophilus species
- Enterococci
- Staph. Aureus

9 / the patient has 4 chamber dilatation with a left ventricular EF of 15% he has moderate mitral regurg and moderate tricuspid regurg, with an estimated pulmonary artery pressure of 70mm Hg. He has a moderate pleural effusion, elevated Liver Function Tests, hypokalemia and hypomagnesaemia, his bb is 115/60, HR 110 bpm, respiratory rate is 30, Oxygen saturation on room air is 88%, initial therapy should include all of the following except:

- A. IV loop diuretics
- B. Digoxin
- C. ACE inhibitors
- D. Beta blockers

10/ A 28-year-old man with a history of intravenous drug abuse presents to the emergency department with a 2-day history of fever, chills, and shortness of breath. On physical examination the patient has a new heart murmur, small retinal hemorrhages, and subungual petechiae. Which of the following is the most likely causative organism?

- (A) Group A Streptococcus
- (B) Mycobacterium tuberculosis
- (C) Staphylococcus aureus
- (D) Staphylococcus epidermidis
- (E) Streptococcus viridans

Answers:

1/a
2/c
3/c
4/d
5/b
6/b
7/c
8/d
9/d
10/c



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*Medicine is a science of uncertainty
and an art of probability*



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