Infective Endocarditis

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AGENDA

- Definition
- Path-physiology
- The risk factors
- Clinical features
- Diagnosis
- Treatment
- Complication
- Prevention

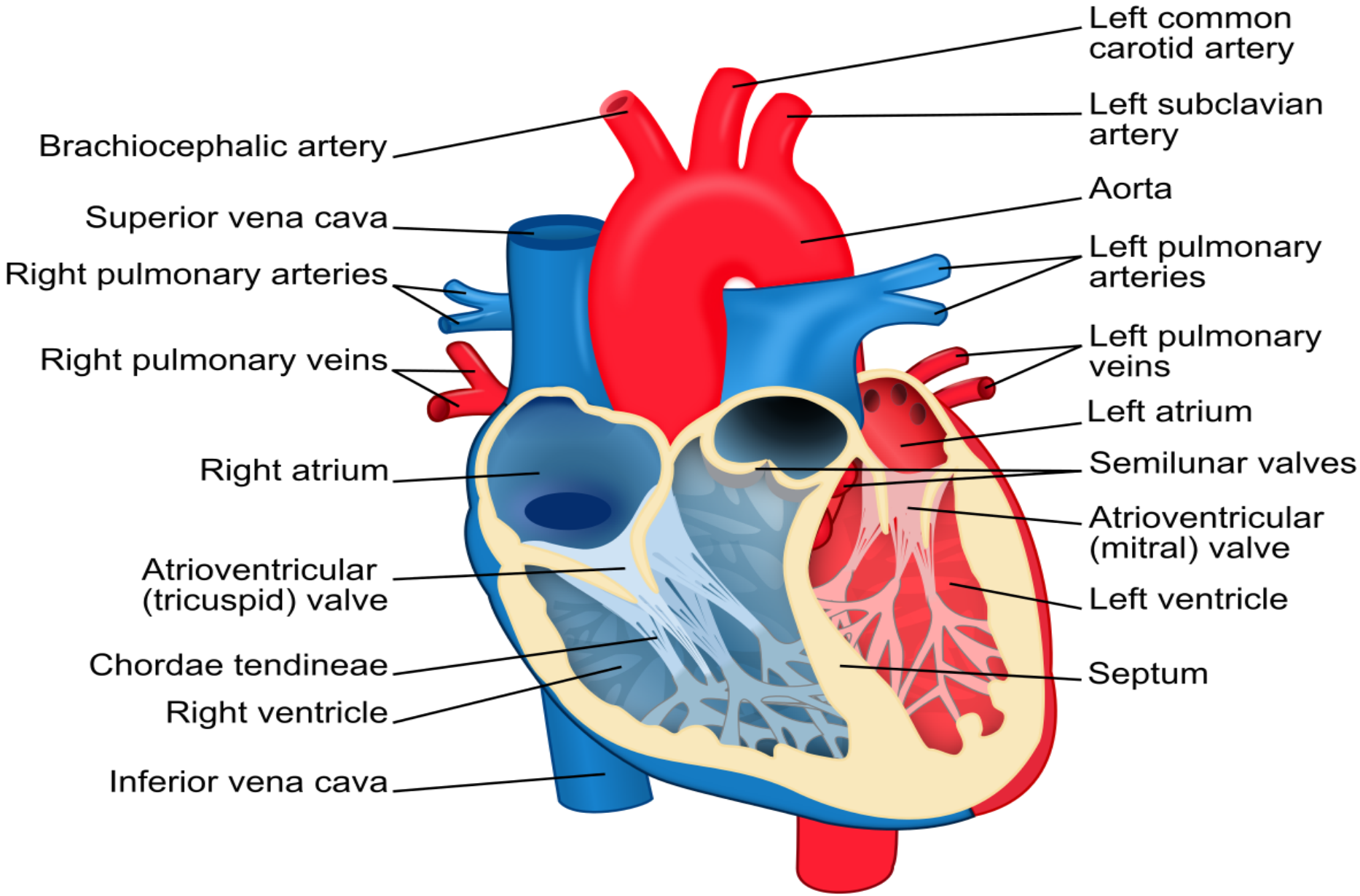
Infective Endocarditis

Definition : Discovered more than 350 years ago.

Infection of endothelium surface of heart either of

1. Heart valves .
2. Septal defects.
3. Chordae tendine.
4. A.V shunt.

- It occurs in 5-7 per 100,000 person-years before 2000 and now 15 per 100,000 persons-years.
- Male more affected than women.
- It remains a life-threatening disease with significant mortality (about 20%) and morbidity.


Left common carotid artery
Left subclavian artery
Aorta
Left pulmonary arteries
Left pulmonary veins
Left atrium
Semilunar valves
Atrioventricular (mitral) valve
Left ventricle
Septum
Brachiocephalic artery
Superior vena cava
Right pulmonary arteries
Right pulmonary veins
Right atrium
Atrioventricular (tricuspid) valve
Chordae tendineae
Right ventricle
Inferior vena cava

Pathogenesis of IE-1

The IE is the net result of the complex interaction between the

Blood stream pathogen with

Matrix-molecules and platelets at sites of

Endocardial cells damage.

Pathogenesis of IE-2

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 ,then result in Proliferation of bacteria within a vegetation and form IE.

Pathogenesis of IE-3

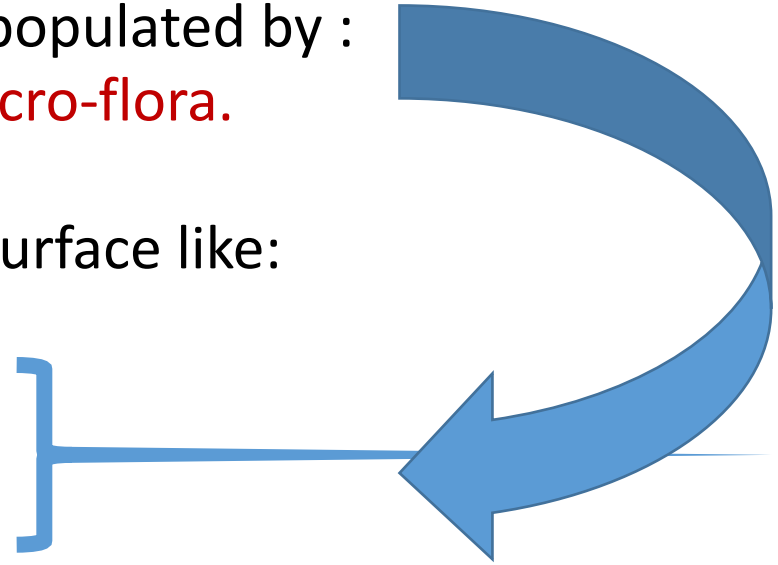
Transient Bacteremia

Mucosal surfaces are populated by :

Dense endogenous micro-flora.

Trauma to a mucosal surface like:

Gingiva around teeth,
Oro-pharynx,



This will releases many different microbial species transiently into the bloodstream which will leads to Transient bacteremia caused by organisms e.g. Veridans group streptococci

Pathogenesis: summery-1

Endothelial damage

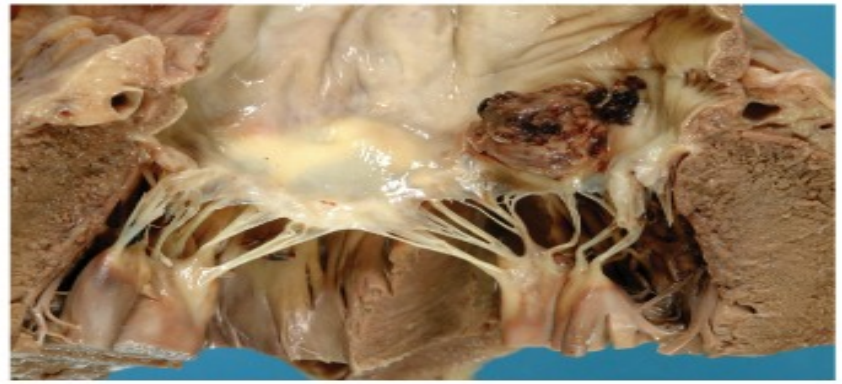
Platelet-fibrin thrombi
(Nonbacterial Thrombotic endocarditis)
(NBTE)

Microorganism adherence (BTE)

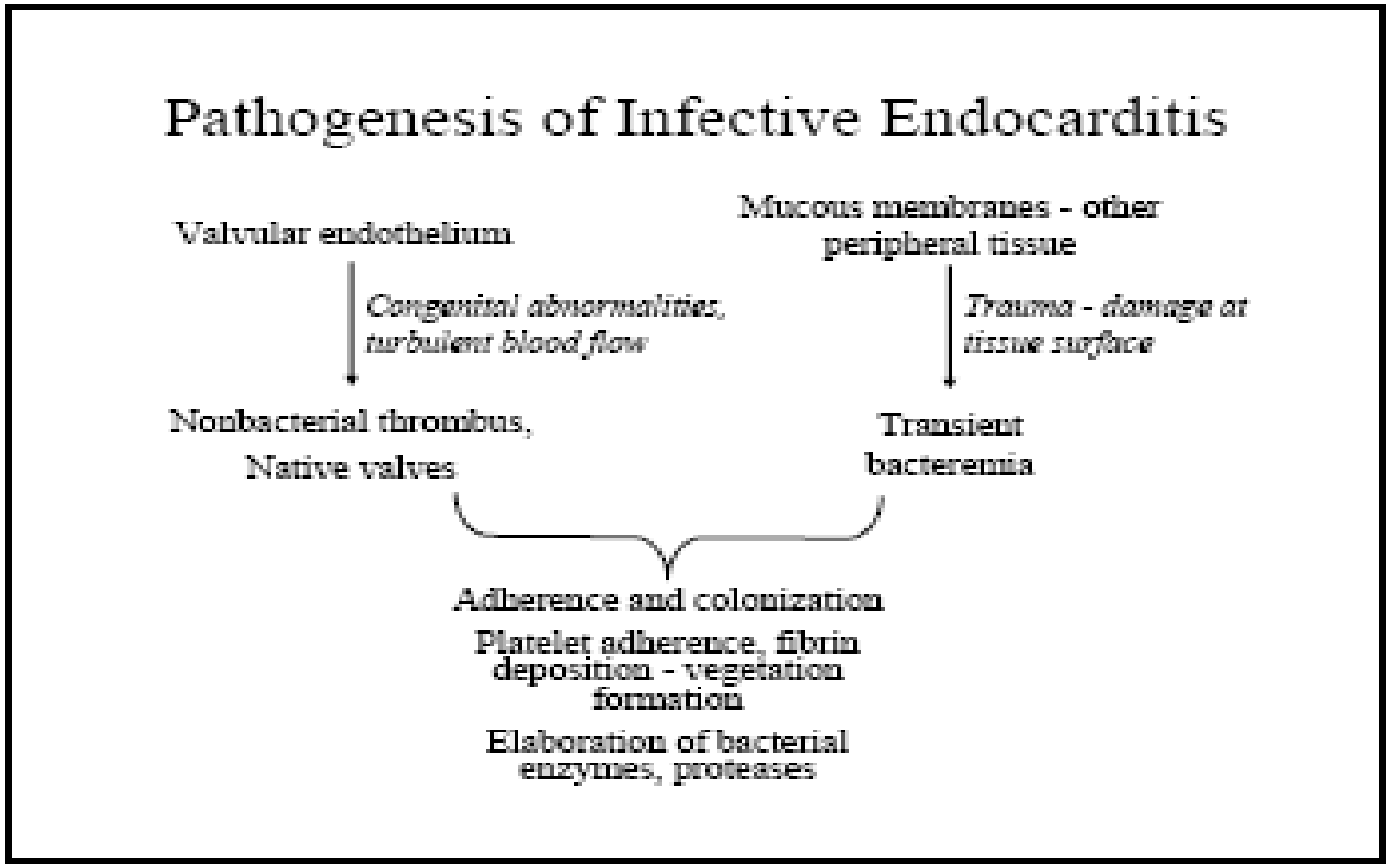
Local vegetation

EXTENSON , Peri-valvular, Destructive valve, fistula **and embolization**

1.High velocity jet
2.Flow from high pressure to low pressure chamber
3.Flow across narrow orifice of high velocity



Pathogenesis: summery-2



Risk determination

Cardiac conditions:

- Intravenous drug abuser(IVDU)
- Degenerative valve disease.
- Prosthetic valves.
- Indwelling catheters.
- Implanted cardiac devices(ICD).
- Diabetes, immunosuppression.
- Congenital Heart Disease (CHD).
- Rheumatic heart disease (RHD)
- Previous endocarditis

Type of Procedure

Cardiac conditions at highest risk of IE

recommendations 2015

Recommendations	Class	Level
Antibiotic prophylaxis should only be considered for patients at highest risk of IE: 1. Patients with any prosthetic valve, including a transcatheter valve, or those in whom any prosthetic material was used for cardiac valve repair. 2. Patients with previous IE. 3. Patients with congenital heart disease. a. Any cyanotic congenital heart disease. b. Any type of congenital heart disease repaired with a prosthetic material whether placed surgically or by percutaneous techniques, up to 6 months after the procedure or lifelong if residual shunt or valvular regurgitation remains.	IIa	C
Antibiotic prophylaxis is not recommended in other forms of valvular or congenital heart disease.	III	C

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Prophylaxis against IE ACC 2017

Is reasonable before dental procedures that involve manipulation of:

Gingival tissue, Peri-apical region of teeth, or perforation of the oral mucosa

in patients with the following:

1.Prosthetic cardiac valves, including trans-catheter-implanted prostheses & homograft.

2. Prosthetic material used for cardiac valve repair, such as annulo-plasty rings & chords.

3. Previous IE.

4. Unrepaired cyanotic congenital heart disease or repaired congenital heart disease, with residual shunts or Valvular regurgitation at the site of or adjacent to prosthetic patch or prosthetic device.

5. Cardiac transplant with valve regurgitation due to a structurally abnormal valve.

Cardiac Conditions – High Risk[1] Old recommendation

- Prosthetic Valves (400x risk[2])
- Previous endocarditis
- Congenital heart disease
  - Complex cyanotic disease (Tetralogy, Transposition, Single Ventricle)
  - Patent Ductus Arteriosus
  - VSD
  - Coarctation of aorta
- Valveular: not included as per now
  - Aortic Stenosis/ Aortic Regurgitations
  - Mitral Regurgitation
  - Mitral Stenosis with Regurgitations

Mod Risk per 1997 AHA guidelines

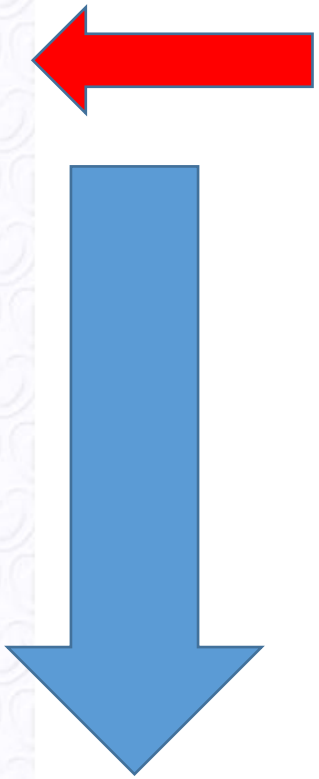
[1]Durack, et al. NEJM 1995

[2]Steckleberg, et al. Inf Dis Clin N Amer 1993

Procedures at highest-risk of IE

recomendations 2015

Recommendations	Class	Level
A. Dental procedures • Antibiotic prophylaxis should only be considered for dental procedures requiring manipulation of the gingival or periapical region of the teeth or perforation of the oral mucosa.	IIa	C
	III	C
	III	C
	III	C
	III	C



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CLASSIFICATION OF IE

- Type of lesion
  - *Native.*
  - *Congenital*
  - *Prosthetic.*
- Onset & progress
  - *Acute.* *Symptoms up to 6 week*
  - *Sub acute.* *Up to 6 w-3m*
  - *Chronic* *symptoms >3 m*
- Acquire of infection
  - *Nosocomial* .
  - Community

DIAGNOSIS OF IE

Clinical suspension

Blood culture

Echocardiography

Clinical Features-1

Onset usually within 2 weeks of infection

Indolent course:

-fever

- Malaise
- Fatigue
- Night sweats
- Anorexia
- Weight loss

Explosive course:

CCF , murmur new onset or changing characters,
with severe systemic sepsis

Other Clinical Features-2

- Spleeno-megaly ~ 30%
- Petechia 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)

Immunological

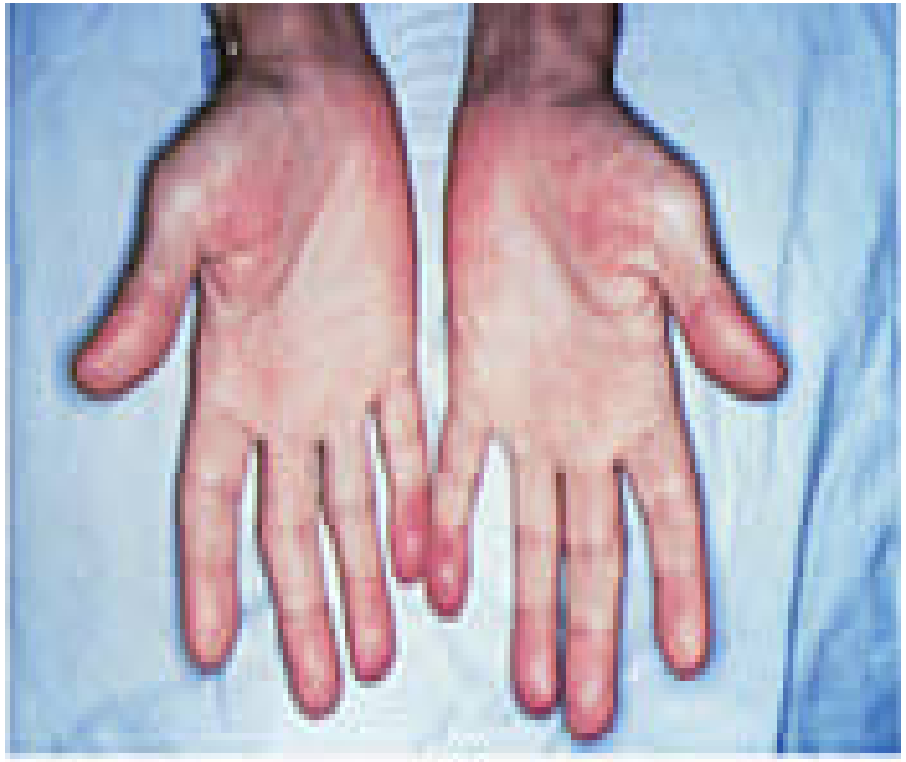
- Osler nodes
- Roth spot
- Glomerulo-nephritis
- Rheumatoid factor +

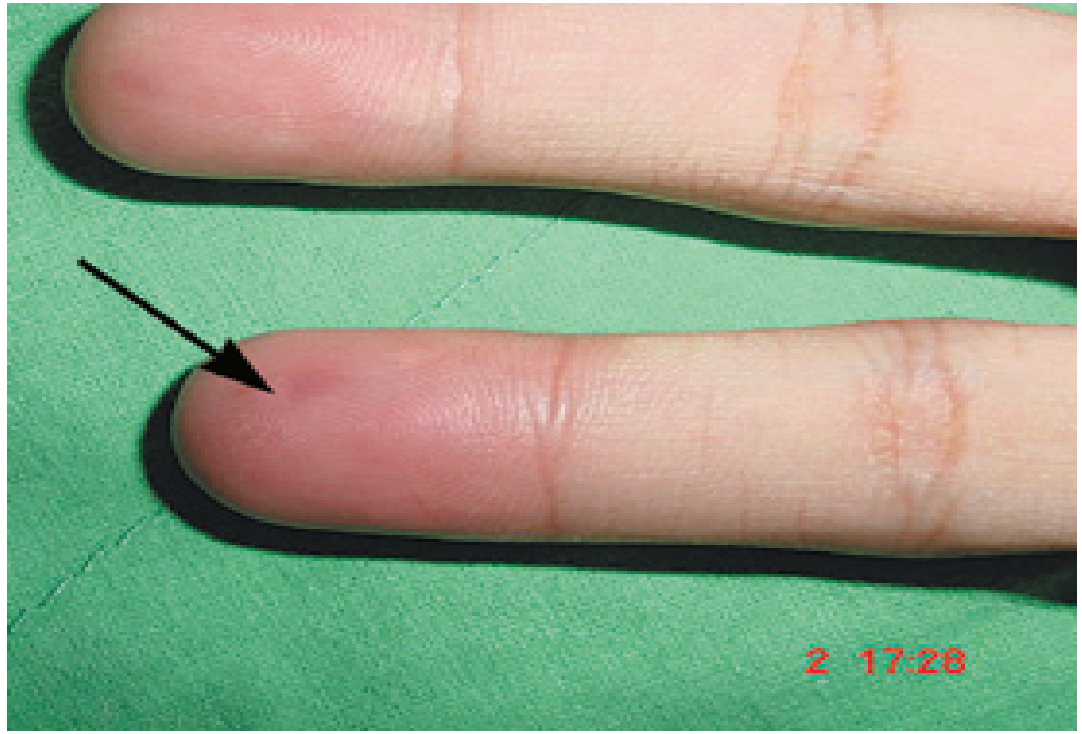
Vascular and septic emboli

- Splinter hemorrhage
- Janway lesion : painless skin lesion in the palm and sole.
- Sub-conjuctival hemorrhage
- Mycotic aneurysm
- Arthritis
- hematuria

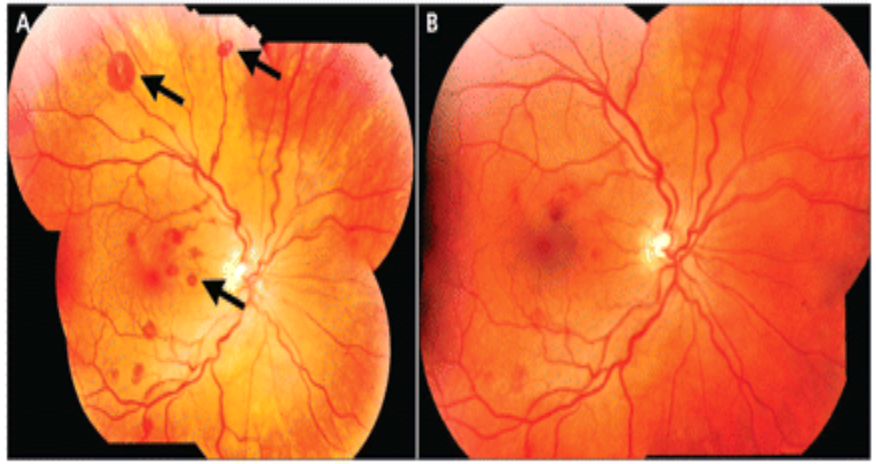
Clinical features- immunological phenomena (glomerulonephritis, osler nodes, Roth spot , RF +ve)

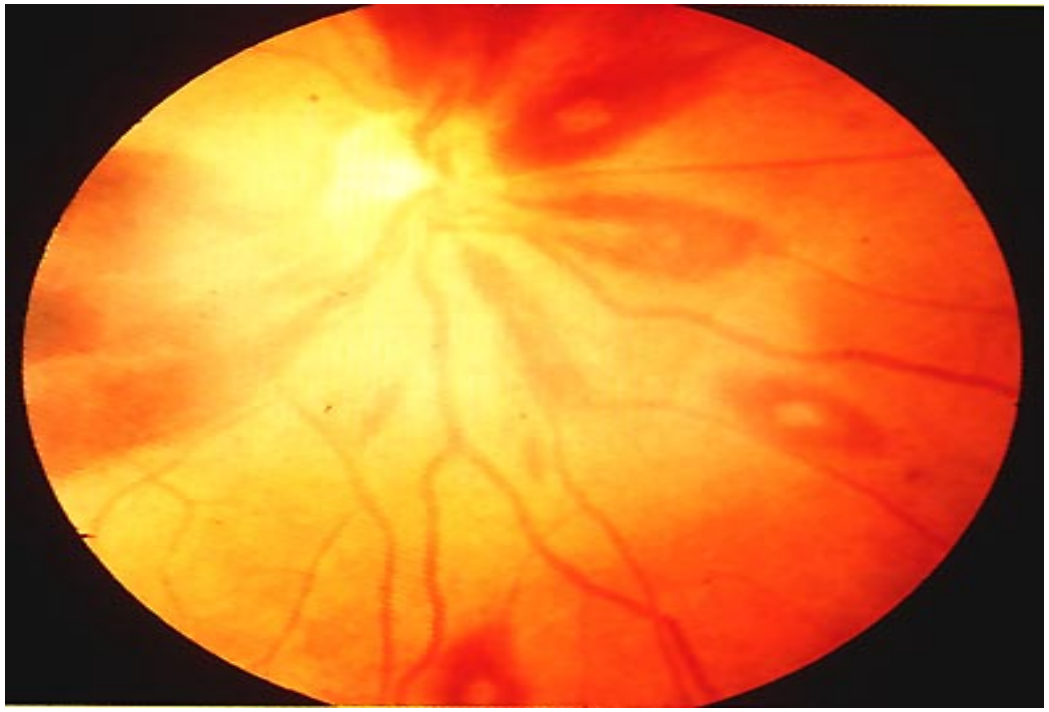
- Osler nodes : painful lesion in distal finger



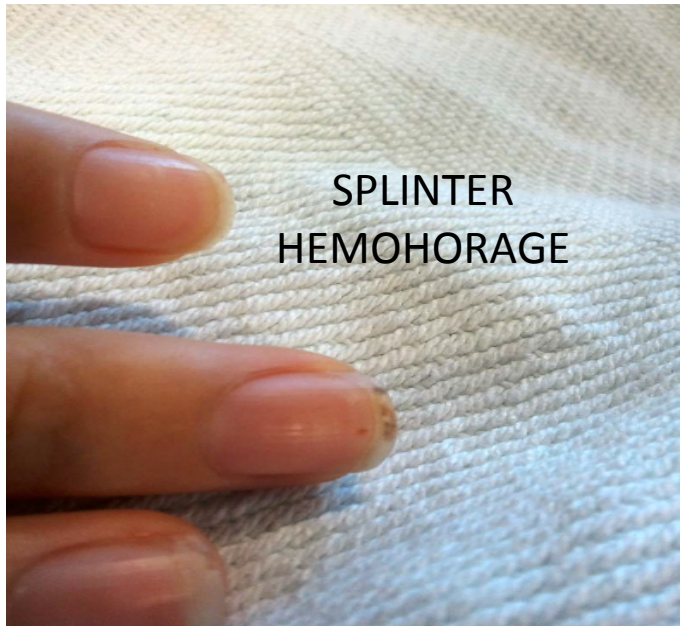


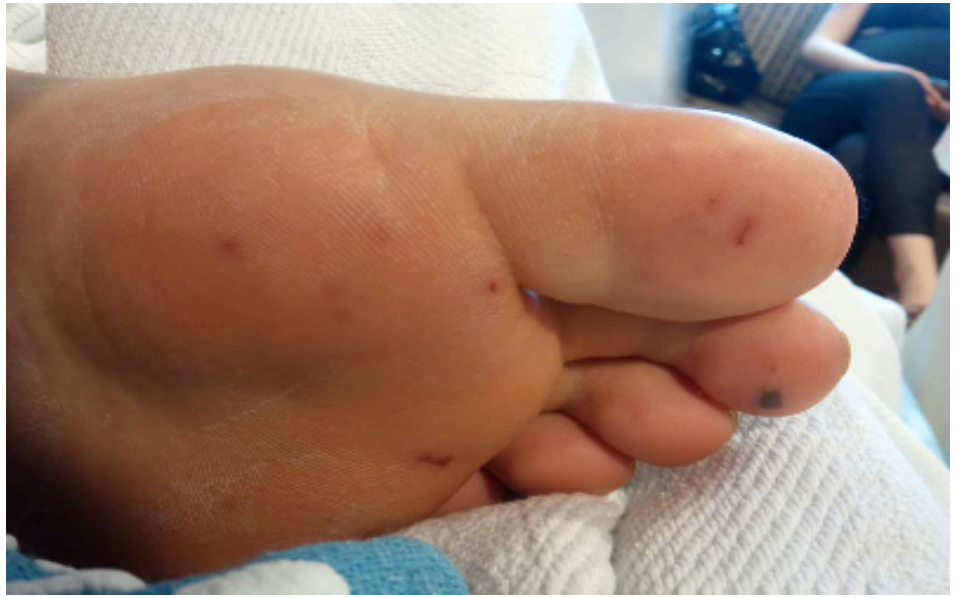
Roth Spots





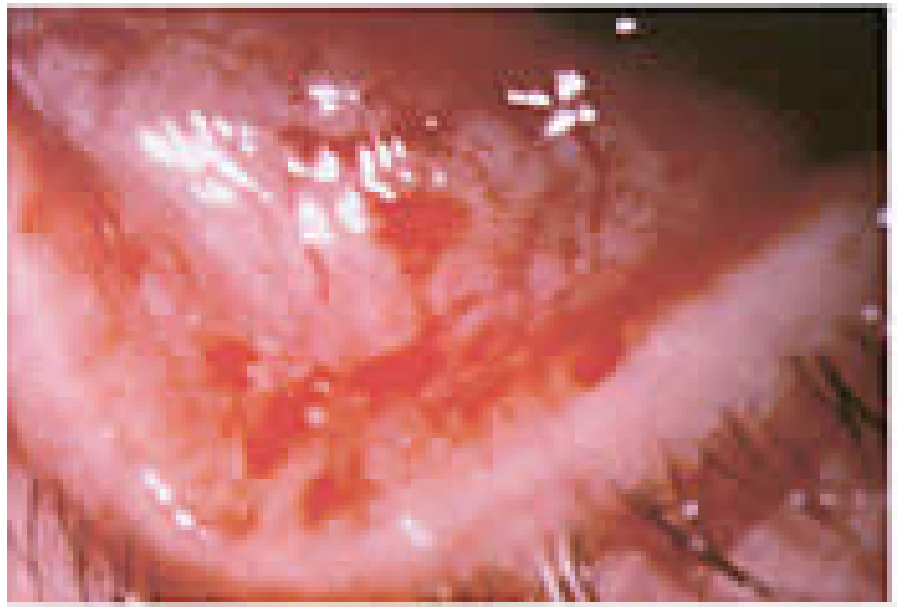
Vascular Phenomena -Septic emboli





JANWAY LESION
painless vascular cutaneous hemorrhage under the skin

Subconjunctival Hemorrhages

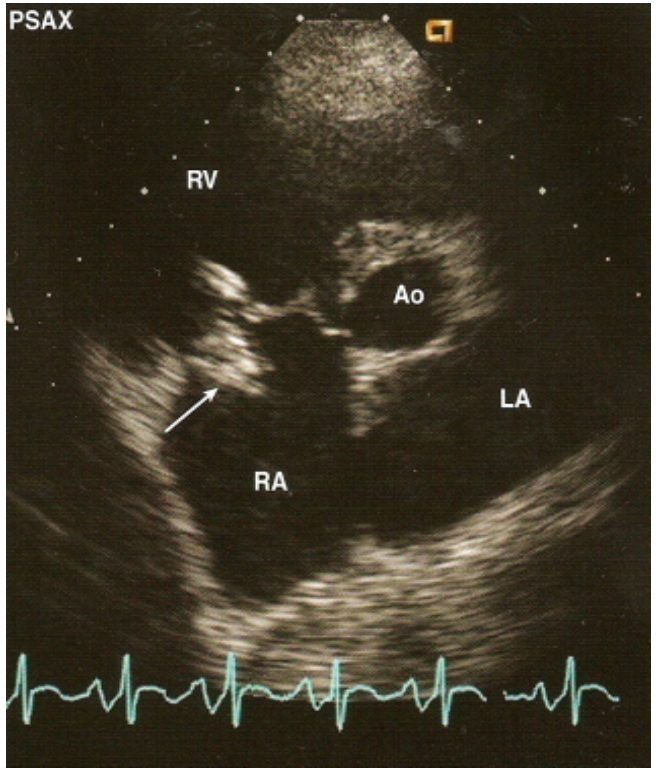


A common mnemonic for the signs and symptoms of endocarditis FROM JANE

- F FEVER
- R ROTH
- O OSLER
- M MURM
- J- JEANWAY
- A ANEMIA
- N NAIL HG (SPLINTER)
- E EMBOLI

INVESTIGATIONS

- C.B.C
- ESR
- Blood cultures
- RFT
- URINE
- ECG
- CXR
- ECHO



Anatomic and echographic definitions

	Surgery/necropsy	Echocardiography
Vegetation	Infected mass attached to an endocardial structure or on implanted intracardiac material.	Oscillating or non-oscillating intracardiac mass on valve or other endocardial structures, or on implanted intracardiac material.
Abscess	Perivalvular cavity with necrosis and purulent material not communicating with the cardiovascular lumen.	Thickened, non-homogeneous perivalvular area with echodense or echolucent appearance.
Pseudoaneurysm	Perivalvular cavity communicating with the cardiovascular lumen.	Pulsatile perivalvular echo-free space, with colour-Doppler flow detected.
Perforation	Interruption of endocardial tissue continuity.	Interruption of endocardial tissue continuity traversed by colour-doppler flow.
Fistula	Communication between two neighbouring cavities through a perforation.	Colour-Doppler communication between two neighbouring cavities through a perforation.
Valve aneurysm	Saccular outpouching of valvular tissue.	Saccular bulging of valvular tissue.
Dehiscence of a prosthetic valve	Dehiscence of the prosthesis.	Paravalvular regurgitation identified by TTE/TOE, with or without rocking motion of the prosthesis.

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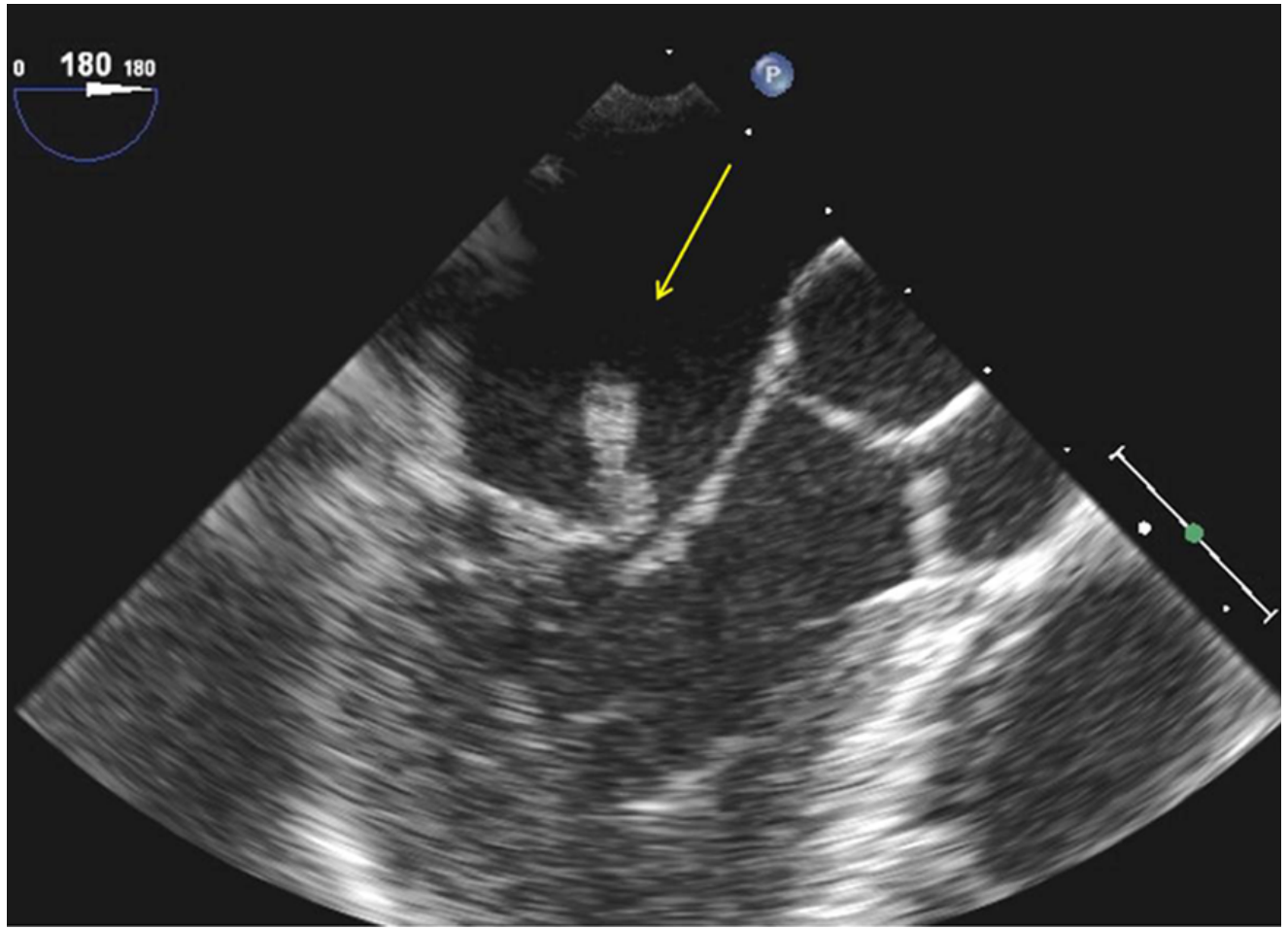
TEE=TOE



Native Valve Endo-carditis

Streptococci **50 - 70%**

Viridians Streptococci (50% of all Strep)

Staphylococci **~ 25%**

Mostly Coagulase +ve Staph. Aureus

Staph. Epidermidis

Enterococci **~ 10%**

HACEK

Haemophilus species,

Actinobacillus

Actinomycetemcomitans,

Cardio-bacterium hominis,

Eikenella,

Kingella

IE in IV Drug Abusers

- Skin most predominant source of infection
- 70 - 100% of Rt. sided IE results in pneumonia and septic emboli
- Microbiology
  - Staph aureus ~60%
  - Streptococci and Enterococci ~20%
  - Gram -ve bacilli ~10%
  - Fungi (Candida and Aspergillus ~5%

Prosthetic Valve Endocarditis

Classification

- **Early (< 60 days)**

- Reflects perioperative contamination
- Incidence around 1%
- Microbiology
  - Staph (45 - 50%)
    - Staph. Epiderm (~ 30%)
    - Staph. Aureus (~ 20%)
  - Gram -ve aerobes (~20%)
  - Fungi (~ 10%)
  - Strep and Entero (5-10%)

Late (> 60 days)

After endothelialisation

Incidence 0.2 -0.5 % / pt. year

Transient bacteraemia from dental

:Microbiology

Resembles native valve endocarditis

and Modified in 2000 1994

ESC 2015 modified criteria for diagnosis of IE:

Major criteria

1. Blood cultures positive for IE

a. Typical microorganisms consistent with IE from 2 separate blood cultures:
- *Viridans streptococci, Streptococcus gallolyticus (Streptococcus bovis), HACEK group, Staphylococcus aureus*; or
- Community-acquired enterococci, in the absence of a primary focus; or

b. Microorganisms consistent with IE from persistently positive blood cultures:
- ≥2 positive blood cultures of blood samples drawn >12 h apart; or
- All of 3 or a majority of ≥4 separate cultures of blood (with first and last samples drawn ≥1 h apart); or

c. Single positive blood culture for *Coxiella burnetii* or phase I IgG antibody titre >1:800

2. Imaging positive for IE

a. Echocardiogram positive for IE:
- Vegetation
- Abscess, pseudoaneurysm, intracardiac fistula
- Valvular perforation or aneurysm
- New partial dehiscence of prosthetic valve

b. Abnormal activity around the site of prosthetic valve implantation detected by ^{18}F-FDG PET/CT (only if the prosthesis was implanted for >3 months) or radiolabelled leukocytes SPECT/CT.

c. Definite paravalvular lesions by cardiac CT.

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ESC 2015 modified criteria for diagnosis of IE:

Minor criteria
1. Predisposition such as predisposing heart condition, or injection drug use.
2. Fever defined as temperature >38°C.
3. Vascular phenomena **(including those detected only by imaging)**: major arterial emboli, septic pulmonary infarcts, infectious (mycotic) aneurysm, intracranial haemorrhage, conjunctival haemorrhages, and Janeway's lesions.
4. Immunological phenomena: glomerulonephritis, Osler's nodes, Roth's spots, and rheumatoid factor.
5. Microbiological evidence: positive blood culture but does not meet a major criterion as noted above or serological evidence of active infection with organism consistent with IE.

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DUKE CRITERIA BE-FEVEER(SUMMARY)

MAJOR

- B BLOOD CULTURE +VE
- E ENDOCARDIAL INVOLVEMENT

MINOR CRITERIA

- F FEVER
- E ECHO FINDING
- V VASCULAR PHENOMINA
- EE EVIDENCE FROM MICROBIAL STUDY

- R RISK FCTOR FOR IE VALVE DISEASE

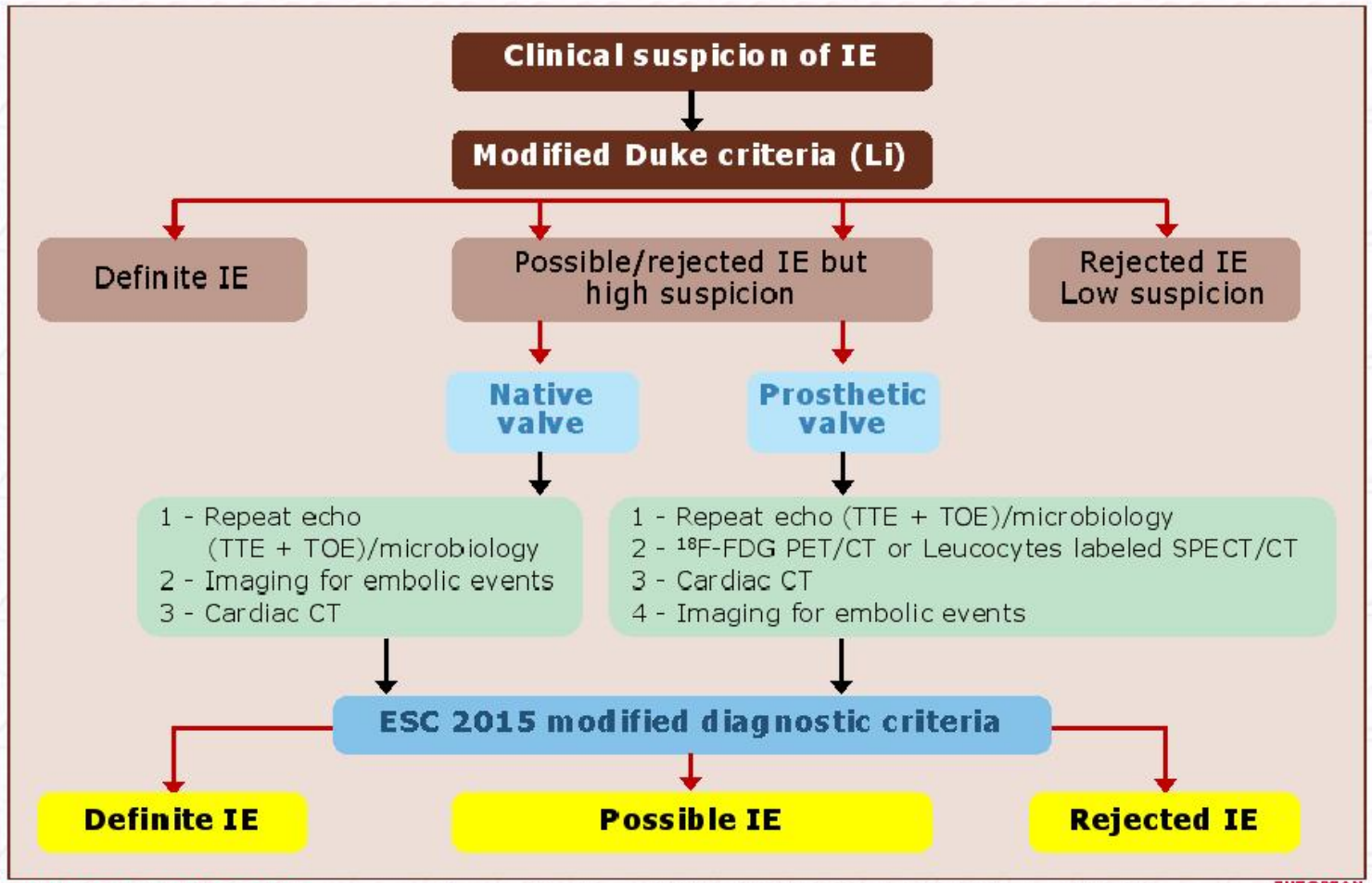
Diagnostic (Duke) Criteria

- 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 intra-cardiac abscess
  - Clinical criteria (as above)
    - Two major criteria, or
    - One major and three minor criteria, or
    - Five minor criteria

Diagnostic (Duke) Criteria

- Possible infective endocarditis
  - findings consistent of IE that fall short of “definite”, but not “rejected”
  - IE considered in presence of 1 major + 1 minor or 3 minor
- Rejected
  - Firm alternate Diagnosis 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

ESC 2015 algorithm for diagnosis of IE



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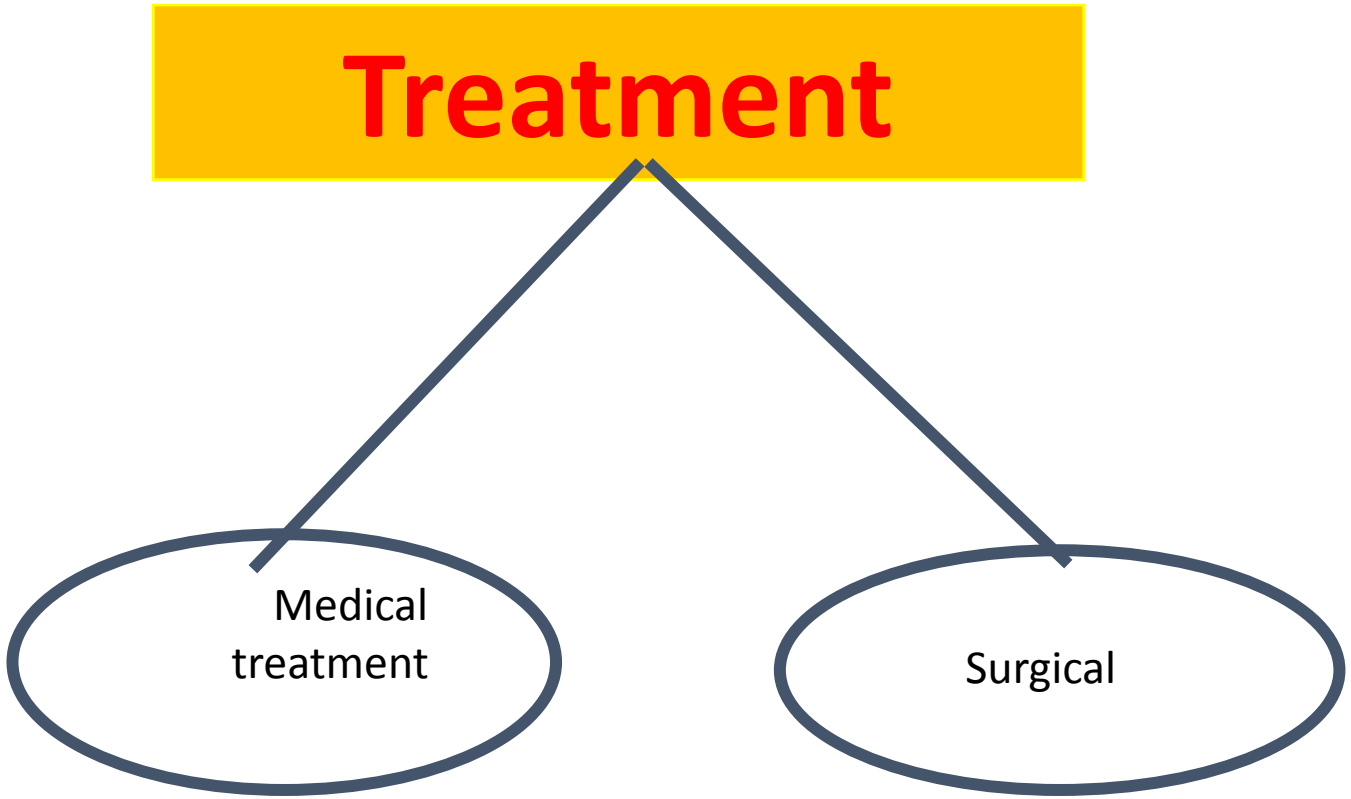

Treatment
Medical treatment
Surgical

Principles of Medical Management

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.

Treatment

- Pre-antibiotic era - a death sentence
- Antibiotic era

  -Microbiologic cure in majority of patient

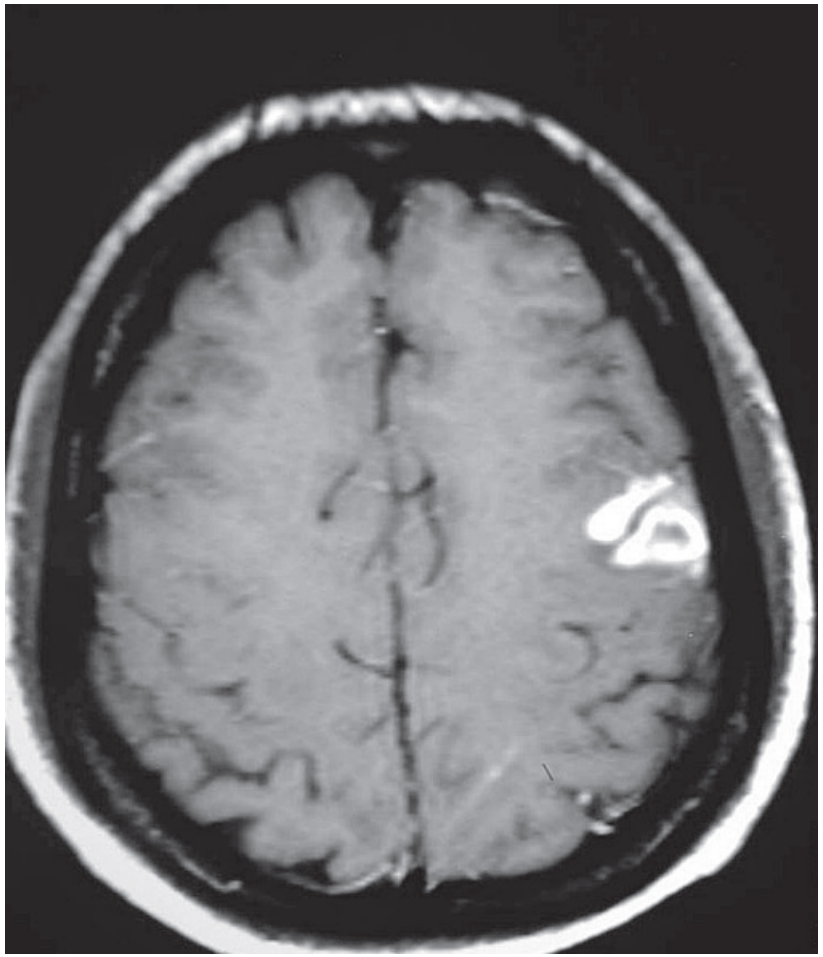
  -Highly penicillin-susceptible Streptococcus viridans or bevies

  – Once-daily ceftriaxone for 4 weeks
    - cure rate > 98%
  – Once-daily ceftriaxone 2 g for 2wks followed by oral amoxicillin qid for 2 weeks
  – Prosthetic valve may need longer treatment durations.

Complications-1

- **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%

Neurological Complication



Complications-2

- **Metastatic infections**
  - **Rt. Sided vegetation**
    - Lung abscesses
    - Pyothorax / Pyo-pneumothorax
  - **Lt. Sided vegetation**
    - Pyogenic Meningitis
    - Splenic Abscesses
    - Pyelonephritis
    - Osteomyelitis
- **Renal impairment , Glomerulonephritis**

Indications and timing of surgery

Indications for surgery	Timing	Class	Level
1. Heart Failure			
Aortic or mitral NVE or PVE with severe acute regurgitation, obstruction or fistula causing refractory pulmonary oedema or cardiogenic shock.	Emergency	I	B
Aortic or mitral NVE or PVE with severe regurgitation or obstruction causing symptoms of HF or echocardiographic signs of poor haemodynamic tolerance.	Urgent	I	B
2. Uncontrolled infection			
Locally uncontrolled infection (abscess, false aneurysm, fistula, enlarging vegetation).	Urgent	I	B
Infection caused by fungi or multiresistant organisms.	Urgent/elective	I	C
Persisting positive blood cultures despite appropriate antibiotic therapy and adequate control of septic metastatic foci.	Urgent	IIa	B
PVE caused by staphylococci or non-HACEK Gram negative bacteria.	Urgent/elective	IIa	C
3. Prevention of embolism			
Aortic or mitral NVE or PVE with persistent vegetations >10 mm after one or more embolic episode despite appropriate antibiotic therapy.	Urgent	I	B
Aortic or mitral NVE with vegetations >10 mm, associated with severe valve stenosis or regurgitation, and low operative risk.	Urgent	IIa	B
Aortic or mitral NVE or PVE with isolated very large vegetations (>30 mm).	Urgent	IIa	B
Aortic or mitral NVE or PVE with isolated large vegetations (>15 mm) and no other indication for surgery.	Urgent	IIb	C

Prevention

Main principles of prevention in IE

1. The principle of antibiotic prophylaxis when performing procedures at risk of IE in patients with predisposing cardiac conditions is maintained.
2. Antibiotic prophylaxis must be limited to patients with the highest risk of IE undergoing the highest risk dental procedures.
3. Good oral hygiene and regular dental review are more important than antibiotic prophylaxis to reduce the risk of IE.
4. Aseptic measures are mandatory during venous catheter manipulation and during any invasive procedures in order to reduce the rate of health care-associated IE.
5. Whether the reduced use of antibiotic prophylaxis is really associated with a change in the incidence of IE needs further investigations

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Non-specific prevention measures

These measures should ideally be applied to the general population and particularly reinforced in high-risk patients.
• Strict dental and cutaneous hygiene. Dental follow-up should be performed twice a year in high-risk patients and yearly in the others.
• Disinfection of wounds.
• Eradication or decrease of chronic bacterial carriage: skin, urine.
• Curative antibiotics for any focus of bacterial infection.
• No self-medication with antibiotics.
• Strict infection control measures for any at-risk procedure.
• Discourage piercing and tattooing.
• Limit the use of infusion catheters and invasive procedure when possible. Favour peripheral over central catheters, and systematic replacement of the peripheral catheter every 3–4 days. Strict adherence to care bundles for central and peripheral cannulae should be performed.

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Prophylaxis for dental procedures at risk

Situation	Antibiotic	Single-dose 30–60 minutes before procedure	
		Adults	Children
No allergy to penicillin or ampicillin	Amoxicillin or Ampicillin[a]	2 g orally or i.v.	50 mg/kg orally or i.v.
Allergy to penicillin or ampicillin	Clindamycin	600 mg orally or i.v.	20 mg/kg orally or i.v.

[a]Alternatively, cephalexin 2 g i.v. for adults or 50 mg/kg i.v. for children, cefazolin or ceftriaxone 1 g i.v. for adults or 50 mg/kg i.v. for children.

"Cephalosporins should not be used in patients with anaphylaxis, angio-oedema, or urticaria after intake of penicillin or ampicillin due to cross-sensitivity".

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Antibiotic treatment
Oral *Streptococci* and *Streptococcus bovis* group

Antibiotic	Dosage and route	Duration (weeks)	Class	Level
Strains penicillin-susceptible (MIC ≤0.125 mg/L) oral and digestive streptococci				
Standard treatment: 4-week duration				
Penicillin G	12–18 million U/day i.v. either in 4–6 doses or continuously	4	I	B
	or			
Amoxicillin	100–200 mg/kg/day i.v. in 4–6 doses	4	I	B
	or			
Ceftriaxone	2 g/day i.v. or i.m. in 1 dose	4	I	B
In beta-lactam allergic patients				
Vancomycin	30 mg/kg/day i.v. in 2 doses	4	I	C

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Staphylococcus

Flocloxacilline
Or
Vancomycine

summery

High clinical suspension

Pathophysiology

Endocardial damage

NBTE

Transient bacteremia

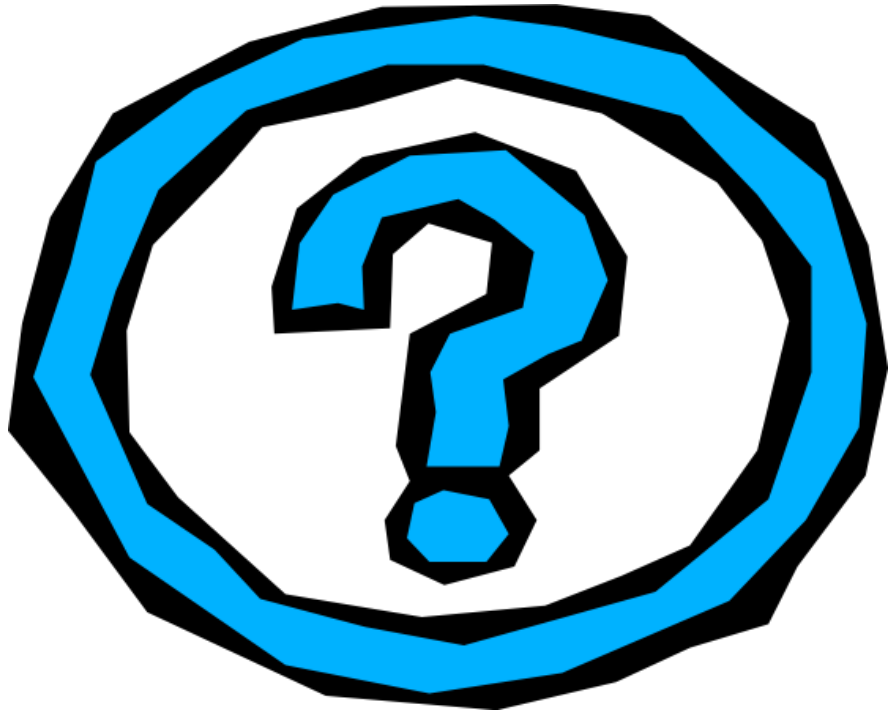
Clinical and investigational criteria

Complication

Prophylaxis

Treatment

!Thanks for your Attention



History of endocarditis

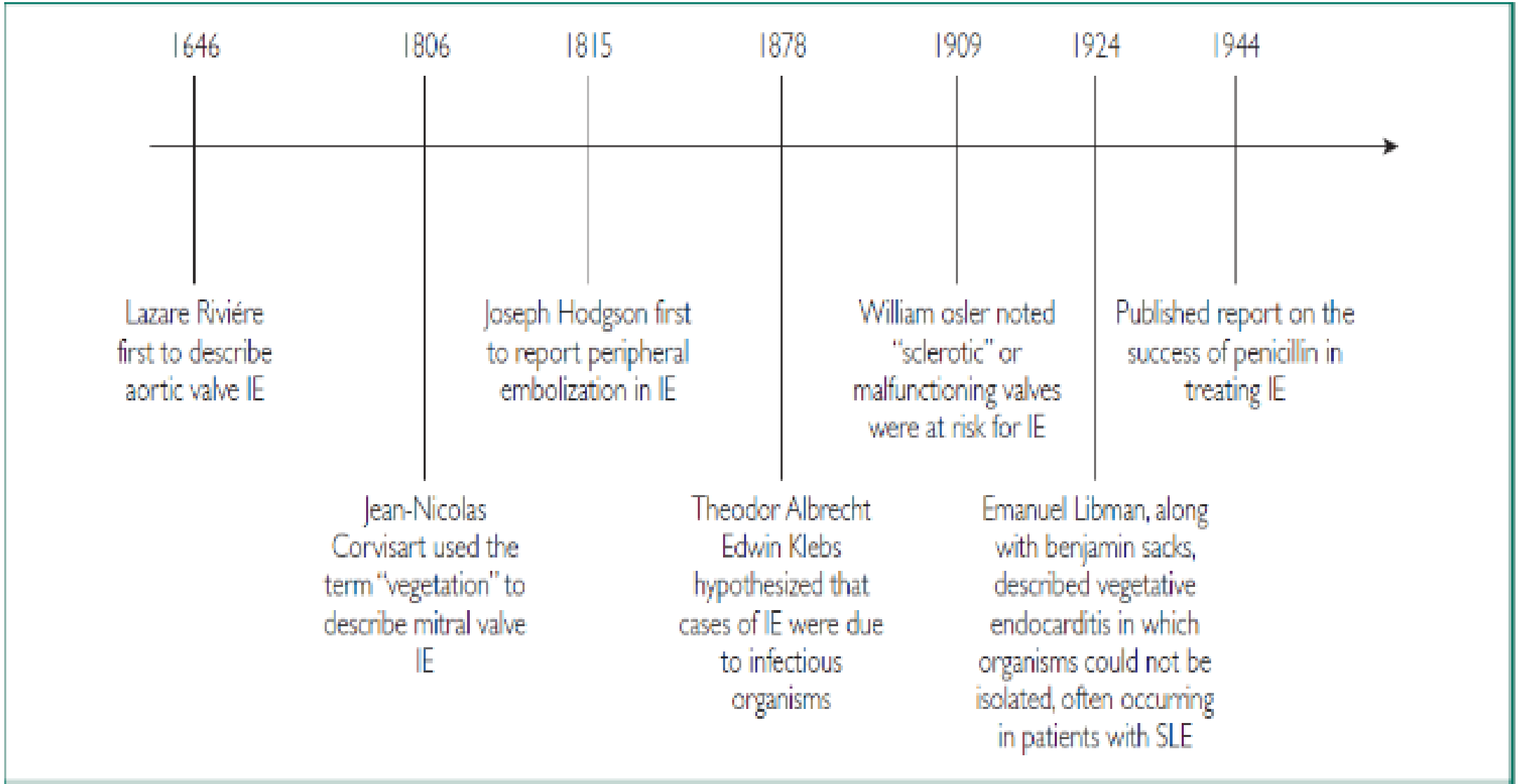


FIGURE 1. Timeline featuring major events in the history of IE. IE = infective endocarditis; SLE = systemic lupus erythematosus.

Antibiotic treatment
Staphylococcus spp. Native valves

Antibiotic	Dosage and route	Duration (weeks)	Class	Level
Native valves				
Methicillin-susceptible staphylococci				
(Flu)cloxacillin or oxacillin	12 g/day i.v. in 4–6 doses	4–6	I	B
Alternative therapy				
Cotrimoxazole WITH Clindamycin	Sulfamethoxazole 4800 mg/day and Trimethoprim 960 mg/day (i.v. in 4–6 doses) 1800 mg/day IV in 3 doses	1 i.v. + 5 oral intake 1	IIb	C
Penicillin-allergic patients or methicillin-resistant staphylococci				
Vancomycin	30–60 mg/kg/day i.v. in 2–3 doses	4–6	I	B
Alternative therapy				
Daptomycin	10 mg/kg/day i.v. once daily	4–6	IIa	C
Alternative therapy				
Cotrimoxazole WITH Clindamycin	Sulfamethoxazole 4800 mg/day and Trimethoprim 960 mg/day (i.v. in 4–6 doses) 1800 mg/day IV in 3 doses	1 i.v. + 5 oral intake 1	IIb	C

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