Infective Endocarditis

Introduction

- Endocarditis, irrespective of the underlying cardiac condition, is a serious, life-threatening disease that was always fatal in the preantibiotic era.
- Advances in antimicrobial therapy
- Early recognition and management of complications of IE
- Improved surgical technology have reduced the morbidity
- and mortality of IE.
- Numerous comorbid factors, may complicate IE such as
  - older age, diabetes mellitus
  - immunosuppressive conditions or therapy
  - dialysis.

DEFINITION

- Infection or colonization of endocardium , heart valves , congenital defects by bacteria , rickettsiae , fungi

.

- **Low grade persistent bacteraemia**

IMPORTANCE

- Serious disease
- mortality : 30 %
- Damage of heart or other organs
- Follow dental procedures (tooth extraction)
  - Rheumatic heart disease
  - Congenital heart disease

Calssification

- Classified into four groups:
  - Native Valve IE
  - Prosthetic Valve IE
  - Intravenous drug abuse (IVDA) IE
  - Nosocomial IE

Classification

- Acute
  - Affects normal heart valves
  - Rapidly destructive
  - Metastatic foci
  - Commonly Staph.
  - If not treated, usually fatal within 6 weeks
- Subacute
  - Often affects damaged heart valves
  - Indolent nature
  - If not treated, usually fatal by one year

ETIOLOGY

- SUSCEPTIBLE PATIENT
- BACTEREMIA

FACTORES AFFECTING SEVERITY AND OUTCOME

- BACTERIAL FACTORS
  - VIRULENCE
  - No BACTERIA IN THE BLOOD

- HOST FACTORS :
  - . FACTORS INCREASING SUSCEPTIBILITY
    - LOCAL
      - CONGINITALOR RHEUMATIC HEART DISEASE
      - PROSTHETIC HEART VALVES
      - OTHER CARDIOVASCULAR DISEASE
      - HEART SURGERY
    - GENIRAL
      - UNDERLYING DISEASE (DIABETES.M)
    - DRUGS
      - IATROGENIC:
        - IMMUNOSUPPRESSIVE TREATMENT
        - CYTOTOXIC AGENTS
      - SELF- INFLICTED
        - ALCOHOLISM
        - ADDICTION (INJECTED DRUGS)
  - PROTECTIVE FACTORS
    - ANTIMICROBIAL CHEMOTHERAPY

SOURCES OF INFECTION

- Dental extraction and other dental procedures
- Cardiac surgery (prosthetic valves)
- Intravenous medication
- Iv. Drug addiction
- Intracardiac or intravenous catheters
- Obstetric or gynaecologic procedures

PREDISPOSING FACTORS

- A- cardiac lesions
  - Chronic rheumatic valvular disease
  - Congenital heart disease and defects
  - Atherosclerosis
  - Prosthetic valves
    - Immediate
    - Delayed
  - Distorted shape causes stasis of blood flow and settee of bacteria on the endocardium
  - Virulent bacteria`, staph. aureus and strept. Pneumoniae can infect normal heart

- B. systemic factors
  - Immunosuppressive treatment
  - Immune defects (disease)
  - Alcoholism
  - Iv. Drug abuse

PORTAL OF ENTRY

- Dental extraction bleeding bacteraemia
  - Rocking the tooth in the socket pumping effect on the vessels of periodontal ligament , forces bacteria from gingival pockets into blood stream 40 – 80 % bacteraemia
    - Sensitivity of blood culture techniques
    - Severity of gingival infection
- Oral irrigation device

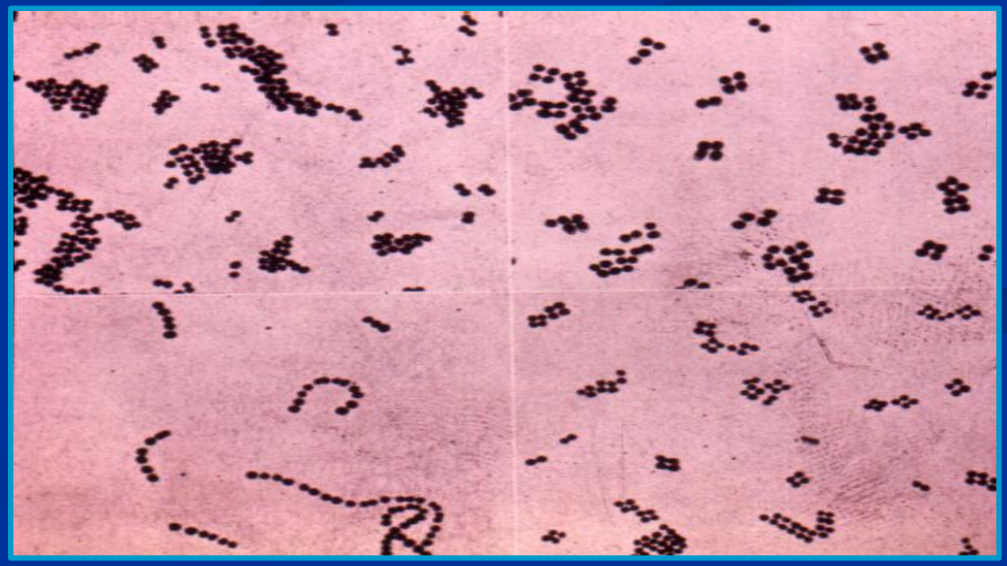
NOTE

- Bacteraemia may follow scaling , tooth brushing, endodontic therapy .
- Lack of clinical effect of many bacteraemia is due to small number or low virulence
- They are rapidly cleared by normal body defence (leucocytes)
- Strept. Faecalis may cause endocarditis after genitourinary or gut procedures

CAUSATIVE ORGANISMS

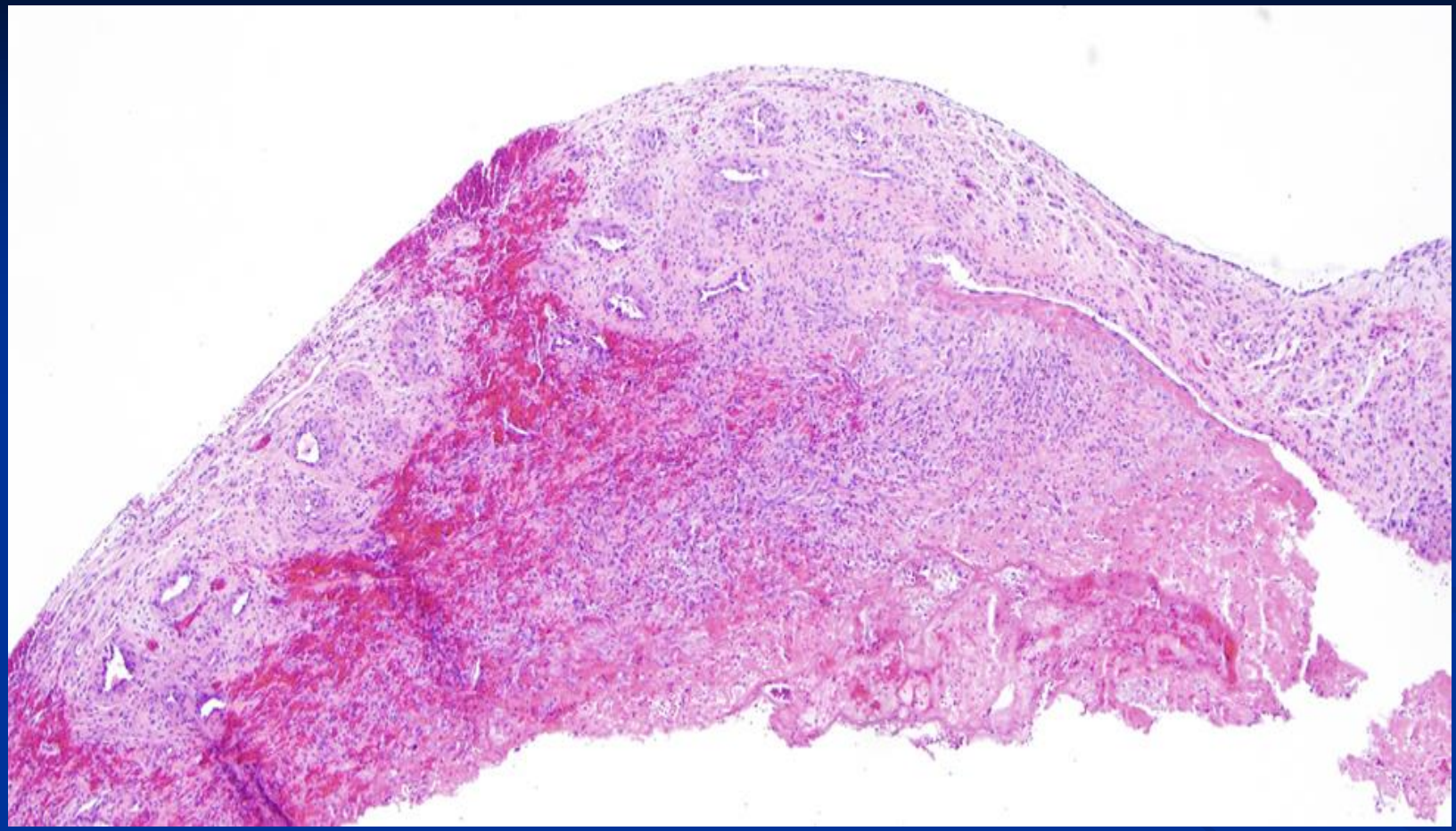
- Viridans streptococci
  - Most common cause of sub- acute bacterial endocarditis (SBE)
  - Produce glucagons → adhere to endocardium
  - E.g :
    - Streptococcus mutans
    - Streptococcus sanguis

- Streptococcus faecalis
- Streptococcus faecium
- Streptococcus pneumoniae
- Staphylococcus aureus
  - Acute endocarditis
- Staphylococcus epidermidis
  - Prosthetic heart valves
- Brucella species
- Actinobacillus actinomycetes comitans
- Rickettisae
- Fungi
- Coxiella burneti
- Candida albicans

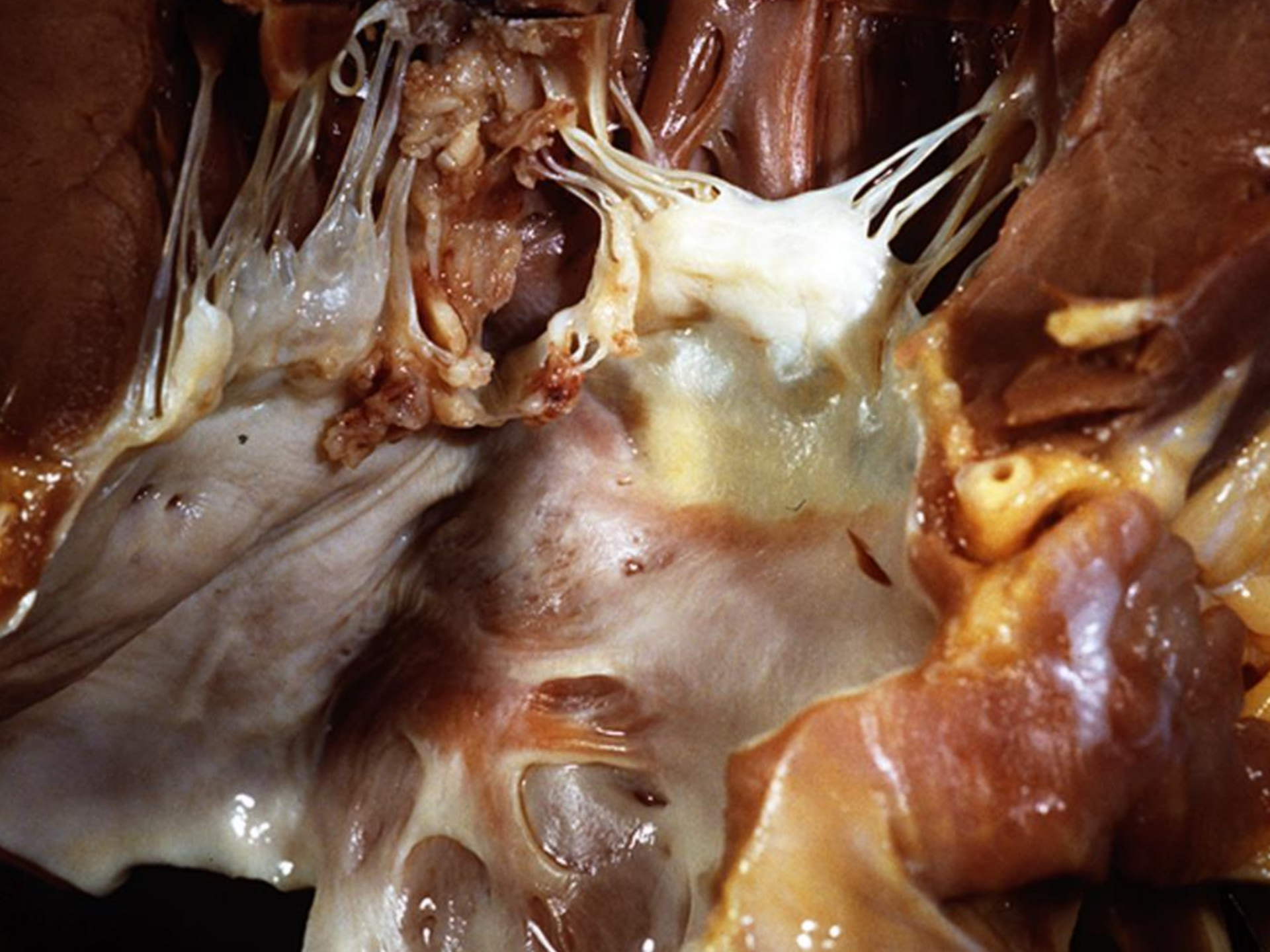


PATHOGENESIS

- Formation of vegetations
  - Fibrin , platelets (thrombi) , bacteria colonies Attached to heart valves
  - Break off → infected emboli → distant organs (kidney , brain)
  - Immune complex formation causes glomerular damage → haematuria
  - Valves infection → destruction → heart failure .
  - Drug addicts tricuspid,pulmonary valves of right side of heart → lung emboli → pneumonia



PATHOLOGICAL CHANGES IN IE



CLINICAL FEATURES

Onset is insidious (SBE) – 3 weeks after extraction

Fever (mild and prolonged)

Malaise , weight loss , weakness

Changing murmurs

Anaemia , leucocytosis

Microscopic haematuria

Petechiae

Spleenomegaly

Splinter haemorrhage

Hypergammaglobulinaemia

Age young , elderly

Petechiae

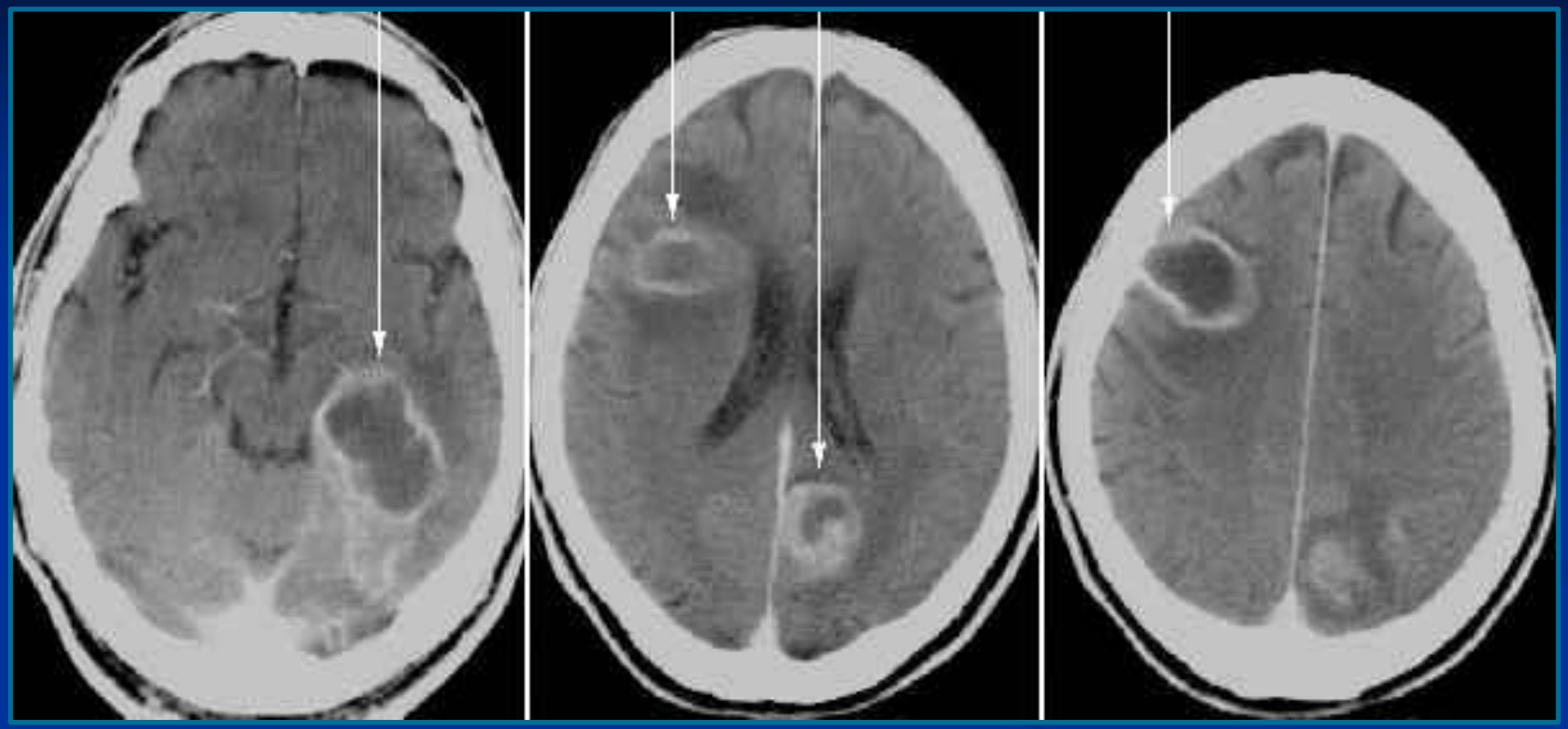
1. Nonspecific
2. Often located on extremities or mucous membranes

Embolic manifestations of endocarditis

Splinter hemorrhage

Osler's Nodes

1. More specific
2. Painful and erythematous nodules
3. Located on pulp of fingers and toes
4. More common in subacute IE



CNS manifestations of endocarditis

MORTALITY

With antibiotic treatment

- 30%

- High mortality
  - Virulance of organism or sever infection
  - Presence of underlying disease
  - Elderly
  - Inadequate treatment
- *poor prognosis*
  - *Candidal*
  - *Staphylococcus*
  - *Gram-negative*

LABORATORY DIAGNOSIS

- *A – serial blood culture* (2-3 sets before antibiotic therapy)
  - Aerobic
  - Anaerobic
- *Additional tests*
  - CBC, ESR and CRP, Complement levels (C3, C4, CH50)
  - RF
  - Urinalysis
- *B- serological tests*
  - CFT (coxiella burniti)
- *C- sensitivity test*

Endocarditiis causes: continuous Bacteraemia

There are three clinical patterns of bacteremia:

- Transient-
  - lasts minutes to hours: following manipulation of infected tissues(abscess,furuncle,or during a surgical procedure);instrumentation of contaminated mucosal surfaces (dental procedures,cytoscopy,or sigmoidoscopy);and at the onset of bacterial pneumonia,arthritis,osteomylitis,and meningitis.
- Intermittent
  - commonly occurs with undrained abscesses.
- Contineous
  - reflects an endovascular infection such as endocarditis or endarteritis,suppurative thrombophlebitis,or an infected aneurysm. It also occurs in the first two weeks of typhoid fever and brucellosis.

Technique for collection of blood for culture

- Blood for culture contaminated by normal skin flora e.g.

A. *Staphylococcus epidermidis*
B. Diphtheriods and
C. Propioniobacteria(anaerobic diphtheroides)

So first clean the site(mainly anticubital fossa)with alcohol 70%and leave for 1-1$_{1/2}$ minutes)or cholorhexidine or iodine

- Blood culture by automated machines e.g. Bactec or Bactalert- upto 5 days when signal positive, the specimen is gram stained →

  reported to clinician then cultured identified and tested for antimicrobial susceptibility

Imaging

- Chest x-ray
  - Look for multiple focal infiltrates and calcification of heart valves
- ECG
  - Rarely diagnostic
  - Look for evidence of ischemia, conduction delay, and arrhythmias
- Echocardiography

Table 4. Definition of terms used in the proposed modified Duke criteria for the diagnosis of infective endocarditis (IE), with modifications shown in boldface.

Major criteria
- Blood culture positive for IE
  - Typical microorganisms consistent with IE from 2 separate blood cultures:
    - Viridans streptococci, *Streptococcus bovis,* HACEK group, *Staphylococcus aureus;* or
    - Community-acquired enterococci, in the absence of a primary focus; or
  - Microorganisms consistent with IE from persistently positive blood cultures, defined as follows:
    - At least 2 positive 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 sample drawn at least 1 h apart)
  - **Single positive blood culture for *Coxiella burnetii* or antiphase I IgG antibody titer >1 : 800**
- Evidence of endocardial involvement
- Echocardiogram positive for IE (**TEE recommended in patients with prosthetic valves, rated at least "possible IE" by clinical criteria, or complicated IE [paravalvular abscess]; TTE as first test in other patients**), defined as follows :
  - Oscillating intracardiac mass on valve or supporting structures, in the path of regurgitant jets, or on implanted material in the absence of an alternative anatomic explanation; or
  - Abscess; or
  - New partial dehiscence of prosthetic valve
- New valvular regurgitation (worsening or changing of pre-existing murmur not sufficient)

Minor criteria
- Predisposition, predisposing heart condition or injection drug use
- Fever, temperature >38°C
- Vascular phenomena, major arterial emboli, septic pulmonary infarcts, mycotic aneurysm, intracranial hemorrhage, conjunctival hemorrhages, and Janeway's lesions
- Immunologic phenomena: glomerulonephritis, Osler's nodes, Roth's spots, and rheumatoid factor
- Microbiological evidence: positive blood culture but does not meet a major criterion as noted above[a] or serological evidence of active infection with organism consistent with IE
- **Echocardiographic minor criteria eliminated**

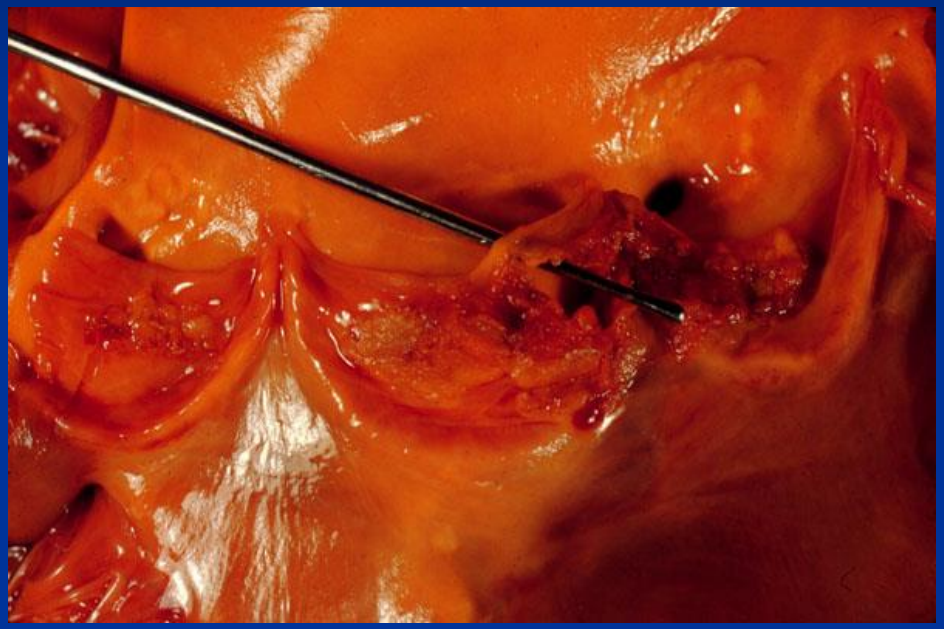
NOTE. TEE, transesophageal echocardiography; TTE, transthoracic echocardiography.

[a] Excludes single positive cultures for coagulase-negative staphylococci and organisms that do not cause endocarditis.

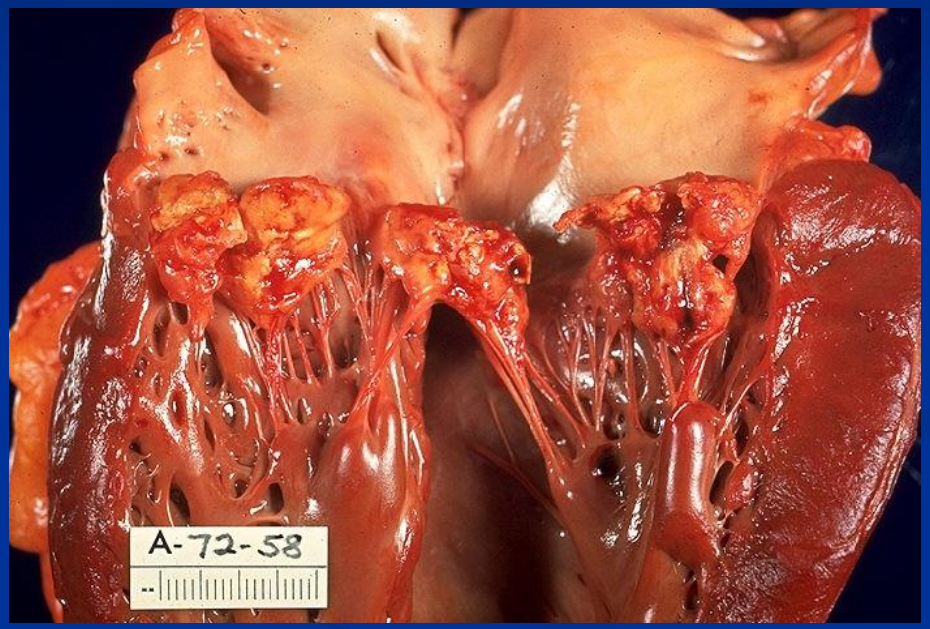
Local Spread of Infection

- Heart failure
  - Extensive valvular damage
- Paravalvular abscess (30-40%)
  - Most common in aortic valve, IVDA, and S. aureus
  - May extend into adjacent conduction tissue causing arrythmias
  - Higher rates of embolization and mortality
- Pericarditis
- Fistulous intracardiac connections

Local Spread of Infection



Acute *S. aureus* IE with perforation of the aortic valve and aortic valve vegetations.

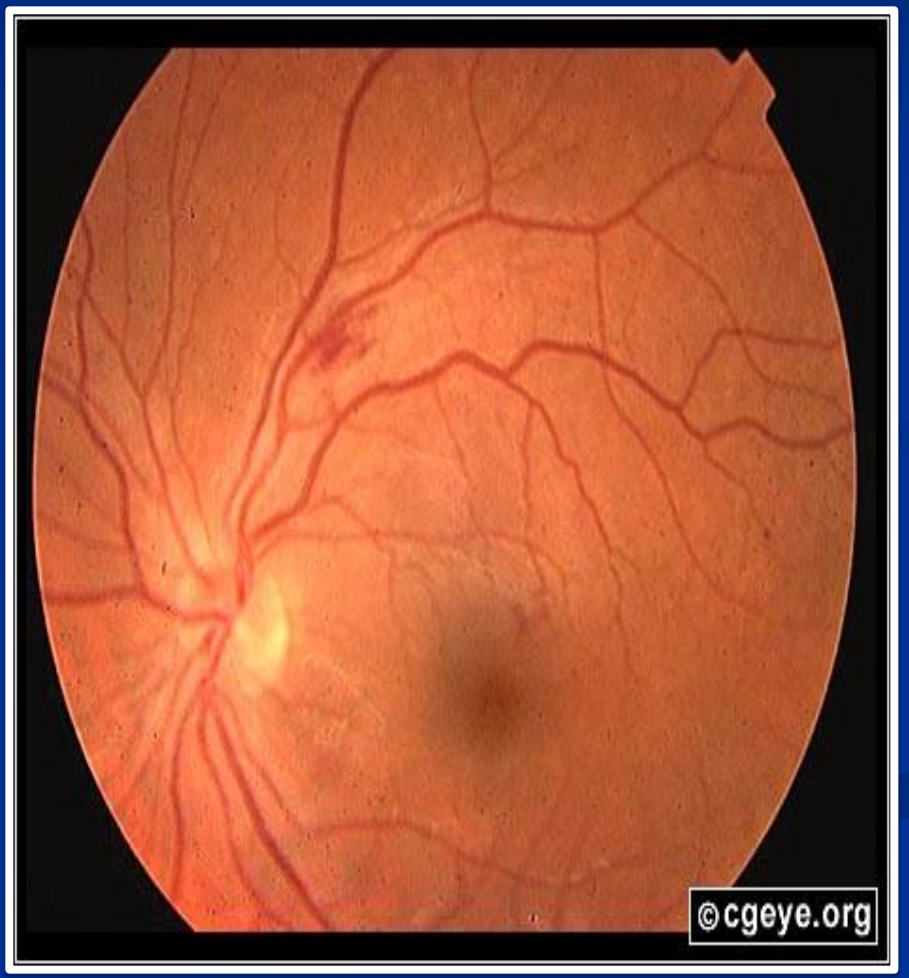


Acute *S. aureus* IE with mitral valve ring abscess extending into myocardium.

Embolic Complications

- Stroke
- Myocardial Infarction
  - Fragments of valvular vegetation or vegetation-induced stenosis of coronary ostia
- Ischemic limbs
- Hypoxia from pulmonary emboli
- Abdominal pain (splenic or renal infarction)

Septic Emboli



Metastatic Spread of Infection

- Metastatic abscess
  - Kidneys, spleen, brain, soft tissues
- Meningitis and/or encephalitis
- Vertebral osteomyelitis
- Septic arthritis

TREATMENT

- Disk diffusion test (not sufficient)
- MIC , MBC
- *Criteria of antibiotic*
  - Bactericidal
  - Parenteral
  - High dose
  - Prolonged

- **Viridans streptococci** –Benzyl penicillin I.V
  4 MU I.V. every 4 hrs for 4 weeks

  or

  penicillin + gentamicin

Streptococcus faecalis
ampicillin + gentamicin I.V

Recurrence after cure is common in:

- drug addicts
- immunodeficient patients

BOX 5

Summary of major changes in updated document.

- We concluded that bacteremia resulting from daily activities is much more likely to cause infective endocarditis (IE) than bacteremia associated with a dental procedure
- We concluded that only an extremely small number of cases of IE might be prevented by antibiotic prophylaxis even if prophylaxis is 100 percent effective
- Antibiotic prophylaxis is not recommended based solely on an increased lifetime risk of acquisition of IE
- Limit recommendations for IE prophylaxis only to those conditions listed in Box 3
- Antibiotic prophylaxis is no longer recommended for any other form of congenital heart disease, except for the conditions listed in Box 3
- Antibiotic prophylaxis is recommended for all dental procedures that involve manipulation of gingival tissues or periapical region of teeth or perforation of oral mucosa only for patients with underlying cardiac conditions associated with the highest risk of adverse outcome from IE (Box 3)
- Antibiotic prophylaxis is recommended for procedures on respiratory tract or infected skin, skin structures or musculoskeletal tissue only for patients with underlying cardiac conditions associated with the highest risk of adverse outcome from IE (Box 3)
- Antibiotic prophylaxis solely to prevent IE is not recommended for gastrointestinal or genitourinary tract procedures
- Endocarditis prophylaxis is not recommended for other common procedures including ear piercing and body piercing, tattooing, and vaginal delivery and hysterectomy

BOX 3

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 palliative shunts and conduits
  - Completely repaired congenital heart defect with prosthetic material or device, whether placed by surgery or by catheter intervention, during the first six 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 CHD.

† Prophylaxis is recommended because endothelialization of prosthetic material occurs within six months after the procedure.

TABLE 2

Regimens for a dental procedure.

SITUATION	AGENT	REGIMEN: SINGLE DOSE 30-60 MINUTES BEFORE PROCEDURE	
		Adults	Children
Oral	Amoxicillin	2 grams	50 milligrams per kilogram
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 600 mg 500 mg	50 mg/kg 20 mg/kg 15 mg/kg
Allergic to Penicillins or Ampicillin and Unable to Take Oral Medication	Cefazolin or ceftriaxone§ OR Clindamycin	1 g IM or IV 600 mg IM or IV	50 mg/kg IM or IV 20 mg/kg IM or IV

* IM: Intramuscular.
† IV: Intravenous.
‡ Or other first- or second-generation oral cephalosporin in equivalent adult or pediatric dosage.
§ Cephalosporins should not be used in a person with a history of anaphylaxis, angioedema or urticaria with penicillins or ampicillin.