# ~~Dentistry-related infections~~
# ~~Endocarditis for dummies~~
# Everything you needed to know about infective endocarditis ... well, almost

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March 20, 2002  15:15-16:15

Medicine Residents' Half-Day

Hamilton Health Sciences
EXEMPLARY CARE • ACADEMIC EXCELLENCE

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# Infective Endocarditis

*Infection of the endocardial surface, usually involving the heart valves.*


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# Infective Endocarditis
## *Microbiology*

- ***Staphylococcus aureus* and viridans streptococci are most common**
- other less common organisms are:
  - *enterococci*, group D streptococci (*Strep. bovis*), HACEK organisms, coagulase-negative staphylococci (e.g. *Staph. epidermidis*)
- other gram-negatives, anaerobes, and fungi are rare causes


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# Infective Endocarditis
## *Microbiology*

- viridans streptococci and HACEK come from mouth
- *S. aureus* and coagulase-negative staph. come from skin
- *Enterococcus* and group D strep come from gut (and/or GU tract)


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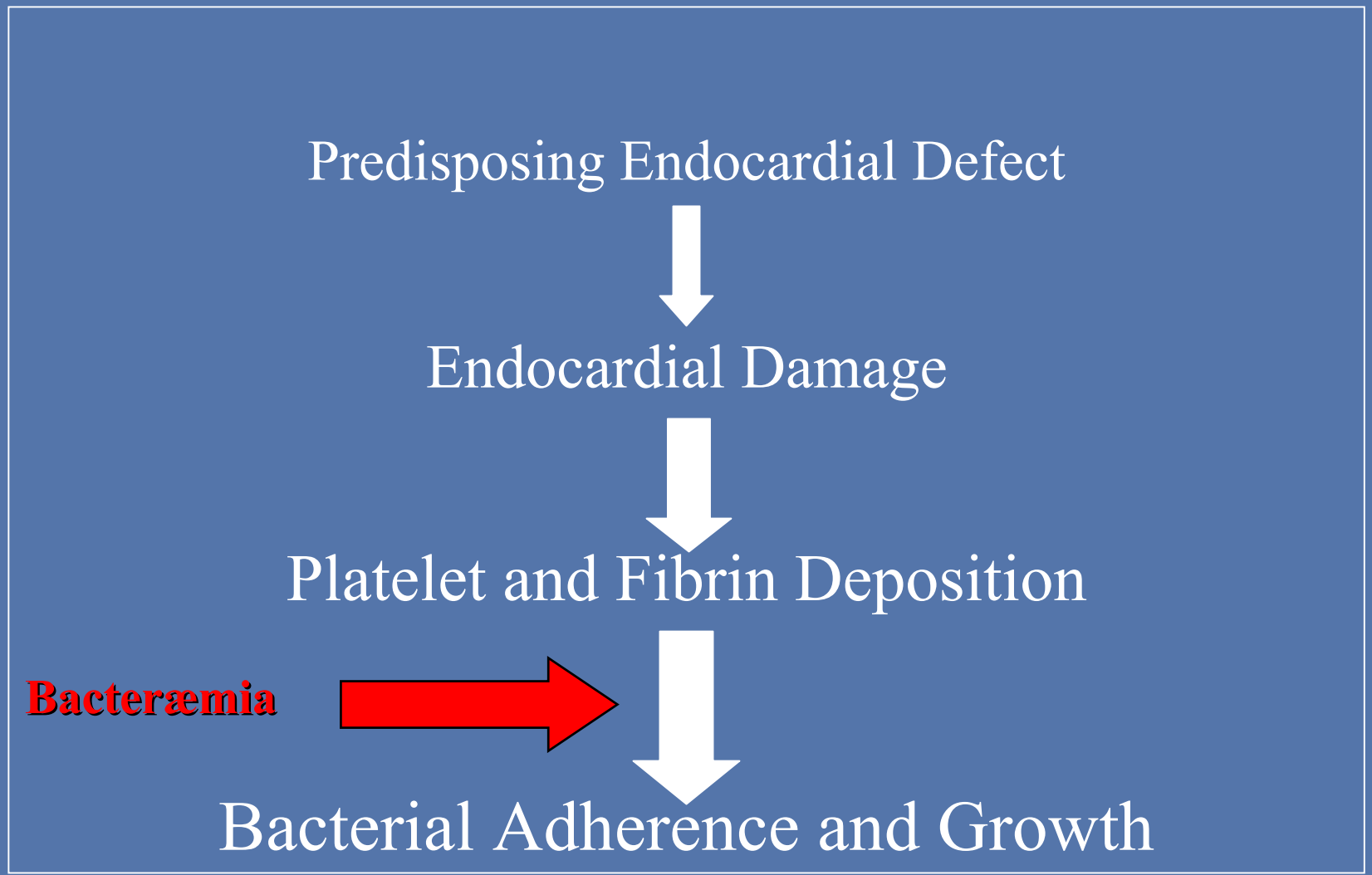
# Infective Endocarditis
## *Epidemiology*

- Affects ~ 4/100 000 pop. annually
- Highest risk: previous endocarditis, prosthetic valve disease, complex cyanotic congenital heart disease, IV drug use
- Moderate risk: patent ductus arteriosus, VSD, ASD-primum, bicuspid aorta, aortic coarctation, **acquired valvular disease (e.g. rheumatic** or lupus), hypertrophic cardiomyopathy, **mitral valve prolapse (esp. with regurgitation or thickened leaflets)**
- **Negligible risk: MVP without regurgitation, murmurs without cardiac disease; pacemakers**

# Pathogenesis of IE



# Dentists Good. Dentists Bad.

patients at risk of IE "*should take all precautions to prevent infections of the teeth … and should have existing foci of infection removed*"[1]

1923: Lewis and Grant conceptualize:

dental surgery ⇨ bacteræmia ⇨ IE

- 1930s: Which dental procedures cause bacteræmia? (Which ones don't?)

[1]Christian, HA The Diagnosis and Treatment of Diseases of the Heart. New York, 1940.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# When are you bacteræmic?

| | |
|---|---|
| Tooth brushing | 0-26% |
| Rocking teeth | 27% |
| Chewing candy/paraffin | 17-51% |
| Oral irrigation | 27-50% |
| Tooth extraction | 18-85% |
| Periodontal surgery | 32-88% |


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# Endocarditis, dental procedures, and antibiotic prophylaxis[2]

- 138 records of pts. with IE over a 17-year span reviewed
  - 17% had a history of dental extractions
- sulfa shown to reduce bacteremia in healthy subjects undergoing dental extractions

*"in patients with valvular disease, the possibility of ensuing [endocarditis] is greatly diminished by premedication with sulfathiazole."*

[2]Northrop PM, Crowley MC. *J Oral Surg*. 1943; 1; 19-29


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# Dental procedures don't appear to cause endocarditis

- only 15% (64/427) patients with IE in the Netherlands had **any procedure** (dental or otherwise) in the preceding 3 months

*Arch Int Med* 1992; **152**; 1869-1873

- compared to age-/sex-/valve-matched controls, 173 cases with IE were no more likely to have had a prior dental procedure (OR 1.2, 95% CI 0.7-2.1)

*Eur Heart J* 1995; **16**; 1968-1974

- compared to age-/sex-matched controls, 273 cases with IE were no more likely to have had a prior dental procedure (OR 0.9, 95% CI 0.4-1.5)

*Ann Intern Med* 1998; **129**; 761-769

# Present State of Knowledge/Reality

- 3 sizeable studies (total ~ 900 cases) have all failed to show dental procedures $\Rightarrow$ IE
- an RCT of dental prophylaxis is not likely in the foreseeable future
- AHA guidelines exist but …

… there is

a) no evidence to support this practice
b) no evidence that this is the standard of care
c) risk associated with antibiotic use
d) potential harm from scaring patients away from the dentist


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# Prophylactic Regimens for Dental, Oral, Respiratory Tract, or Esophageal Procedures[1]

| Situation | Agent | Regimen |
|---|---|---|
| Standard general prophylaxis (for procedures "where bleeding is expected to occur", such as extractions, periodontal procedures, teeth cleaning) | Amoxicillin | 2 g p.o., 1hr prior to procedure |
| Unable to take oral medications | Ampicillin | 2 g i.m. or i.v., within 30 min before procedure |
| Allergic to penicillin | Clindamycin | 600 mg p.o.; OR |
| | Cephalexin/Cefadroxil | 2 g p.o.; OR |
| | Azithromycin/Clarithromycin | 500 mg p.o., 1hr prior to procedure |

[1]Prevention of Bacterial Endocarditis. *JAMA*. 1997;**277**:1794-1801. *Circulation*. 1997;**96**:358-366.


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# But what happens next?

- "**Infective**" causes ...
  - Constitutional symptoms
  - Continuous bacteræmia
- "**Endocarditis**" causes ...
  - Local (heart) problems
  - Distal (embolic) problems
  - Distal (immune) problems


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# Local Disease from IE

- Most common: new valvular regurgitation
  - perforation of the valve leaflet
  - rupture of the chordae tendinae or papillary muscles
  - rupture of the interventricular septum
- Less common:
  - intracardiac abscesses

*Recall the basic heart structure (and figure out the consequences)*


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# Embolic Disease from IE

- emboli can go anywhere!!!
- most common sites:
  - brain
  - kidney
  - spleen
  - skin/nails (splinter haemorrhages, Janeway lesions)
  - lung (only from right-sided)
  - bone

# Immune-mediated Disease from IE

- constant antigenic challenge results in antibody upregulation
- immune-complexes form, resulting in:
  - vasculitis (can affect anywhere)
    - Osler nodes (hands/feet)
    - Roth spots (retina)
  - glomerulonephritis
- splenic enlargement (from lymphoid hyperplasia)


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# Clinical Manifestations

## Infection

Symptoms/Signs

- **fever**/chills/sweats
- anorexia +/- weight loss

Investigations

- multiple + blood cultures
- (acute phase reactants such as CRP)


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# Clinical Manifestations

## Local Disease

Symptoms/Signs

- valve regurgitation
  - heart failure (shortness of breath, cough, orthopnea, right heart failure)
  - regurgitant murmur

Investigations

- echocardiogram (vegetation, valve dysfunction, abscess)
- ECG (heart block)


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# Clinical Manifestations

## Embolic Disease

Symptoms/Signs

- stroke
- pain at site of embolism
- localized infections (e.g. meningitis, kidney abscess, etc.)
- petechiae (fingernails, Janeway lesions, conjunctiva, palate)

Investigations

- usually none unless symptoms/signs suggest need for investigation


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# Clinical Manifestations

## Immunologic Disease

Symptoms/Signs

- usually asymptomatic
- Osler nodes
- Roth spots seen on retina
- abdominal pain from splenomegaly

Investigations

- renal function tests (urinalysis, creatinine)
- usually nothing else unless symptoms/signs suggest need for investigation


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# Janeway Lesions and Osler's Nodes

- ***Janeway lesions*** are painless, macular, hemorrhagic lesions of long-term duration that occur on the palms of the hands (lesion on the thumb) likely due to septic emboli.
- ***Osler's nodes*** are described as small, painful, nodular lesions usually found in the pads of fingers or toes and occasionally in the thenar eminence (lesion on the index finger), likely due to vasculitis.

# Diagnosis of IE (Duke Criteria)

- according to **revised** Duke Criteria

  *Am J Med* 1994; **96**: 200-209

  *CID* 2000; **30**: 633-638

- considers the quality of evidence for **infection** and **endocardial disease**


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# Duke Criteria

- pathological evidence or alternate explanations given highest value
- evidence of continuous bacteræmia (incl. Q fever serology), new valvular regurgitation, and echo findings of IE given next highest value (Major Clinical Criteria)
- clinical evidence of the syndrome of IE (e.g. risk factors, fever, immunologic disease, vascular disease, and “suspicious” microbiology) given lowest priority

# Important Caveats to Duke Criteria

- the clinical epidemiology of the Duke criteria are suspect (despite “validation”)
- although the negative predictive value for rejected cases and the positive predicted value of definite cases are very good …

… the number of “possible” cases leaves much decision-making in the hands of the clinician

# Duke Criteria - Pathological Criteria

- **Confirmed:** pathology from valve or vegetation showing microorganisms or active IE
- **Rejected:** negative pathology (<5 days of therapy)


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# Duke Criteria - Major

**Infective** endocarditis:

- 2 separate cultures with *S. aureus*[*], viridans strep, *Strep. bovis*, HACEK, community-acquired enterococci
- majority of cultures (**2 or more drawn over 12hrs apart** or **3 or more with first/last drawn over an hour apart**) growing organisms consistent with IE
- positive Q fever serology

[*] previously required "community-acquired" *S. aureus bacteremia*

# Duke Criteria - Major

Infective **Endocarditis:**

- ECHO:
  - oscillating intracardiac mass:
    - on valve/supporting structures
    - in path of regurgitant jets
    - on implanted material (without an alternative explanation)
  - abscess
  - new partial dehiscence of prosthetic valve
- Clinical: new valvular regurgitation


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# Duke Criteria - Minor

- **Predisposition**: IVDU or predisposing heart condition
- **Fever**: T ≥ 38.0 C
- **Vascular phenomena**: major arterial emboli, septic pulmonary infarcts, mycotic aneurysm, intracranial hemorrhage, conjunctival hemorrhage, Janeway lesions
- **Immunologic phenomena**: GN, Osler's nodes, Roth spots, RF
- **Microbiological evidence**: positive culture but not Major


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# Duke Criteria - Clinical

- **Definite IE**
  - 2 major criteria
  - 1 major and 3 minor criteria
  - 5 minor criteria
- **Possible IE**
  - 1 major and 1 or 2 minor
  - 3 minor or 4 minor
- **Rejected**
  - 1 or 2 minor with no major criterion
  - resolution of syndrome (<5 days of therapy)
  - firm alternate diagnosis for IE manifestations


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# Treatment of Infective Endocarditis

- there is usually no rush to treat--hold off antibiotics unless

  a) you have a microbiological diagnosis, or

  b) the patient is decompensating due to sepsis (as opposed to CHF)

- appropriate treatment requires a bactericidal antibiotic **above the isolate's MIC** for a prolonged period of time

- *appropriate treatment usually requires a bactericidal antibiotic **above the isolate's MIC** for a prolonged period of time*


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# Expect the Worst, Hope for the Best

- most common cause of death are:
  - neurologic complications
  - septic complications
  - CHF
  - embolic phenomena
  - peri-operative complications
  - antimicrobial failure


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