Infective Endocarditis

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Infective Endocarditis

- **Acute**
  - **Toxic presentation**
  - **Progressive valve destruction & metastatic infection developing in days to weeks**
  - **Most commonly caused by S. aureus**
- **Subacute**
  - **Mild toxicity**
  - **Presentation over weeks to months**
  - **Rarely leads to metastatic infection**
  - **Most commonly S. viridans or enterococcus**

Infective Endocarditis

- **Case rate may vary between 2-3 cases /100,000 to as high as 15-30/100,000 depending on incidence of i.v. drug abuse and age of the population**
  - **55-75% of patients with native valve endocarditis (NVE) have underlying valve abnormalities**
    - **MVP**
    - **Rheumatic**
    - **Congenital**
    - **or: i.v. drug abuse**

Infective Endocarditis

- **Case rates**
  - **7-25% of cases involve prosthetic valves**
  - **25-45% of cases predisposing condition can not be identified**

Infective Endocarditis

- **Pediatric population**
  - **The vast majority (75-90%) of cases after the neonatal period are associated with an underlying congenital abnormality**
    - **bicuspid Aortic valve**
    - **VSD**
    - **Tetralogy of Fallot**
  - **Risk of post-op infection in children with IE is 50%**
- **Microbiology**
  - **Neonates: S. aureus, coagulase negative staph, group B strep**

Infective Endocarditis

- **Adult population**
  - **1- MVP – prominent predisposing factor**
    - **High prevalence in population 2 - 4%**
      - **20% in young women**
    - **Accounts for 7 – 30% NVE in cases not related to drug abuse or nosocomial infection**
  - **Relative risk in MVP, largely confined to patients with murmur, but also increased in men and patients >45 years old**
    - **MVP with murmur – incidence IE 52/100/000 pt. years**
    - **MVP w/o murmur – incidence IE 4.6/100,000 pt. years**

Infective Endocarditis

- **Adult population**
  - **2 - Rheumatic Heart Disease**
    - **20 – 25% of cases of IE in 1970's & 80's**
    - **7 – 18% of cases in recent reported series**
    - **Mitral site more common in women**
    - **Aortic site more common in men**
  - **3 - Congenital Heart Disease**
    - **10 – 20% of cases in young adults**
    - **8% of cases in older adults**
    - **PDA, VSD, bicuspid aortic valve (esp. in men>60)**

Infective Endocarditis

- **4 - Intravenous Drug Abuse**
  - Risk is 2 – 5% per pt./year
  - Tendency to involve right-sided valves
    - Distribution in clinical series
      - 46 – 78% tricuspid
      - 24 – 32% mitral
      - 8 – 19% aortic
  - Underlying valve normal in 75 – 93%
  - S. aureus predominant organism (>50%, 60-70% of tricuspid cases)

Infective Endocarditis

- **Intravenous Drug Abuse**
  - **Increased frequency of gram negative infection such as P. aeruginosa & fungal infections**
  - **High concordance of HIV positivity & IE (27-73%)**
    - **HIV status does not in itself modify clinical picture**
    - **Survival is decreased if CD4 count < 200/mm^3**

Infective Endocarditis

- **5 - Prosthetic Valve Endocarditis (PVE)**
  - **10 – 30% of all cases in developed nations**
  - **Cumulative incidence**
    - **1.4 – 3.1% at 12 months**
    - **3.2 – 5.7% at 5 years**
  - **Early PVE – within 60 days**
    - **Nosocomial (staf. epidearmal predominates)**
  - **Late PVE – after 60 days**
    - **Community (same organisms as NVE)**

Infective Endocarditis

- **Pathology**
  - **NVE infection is largely confined to leaflets**
  - **PVE infection commonly extends beyond valve ring into annulus/periannular tissue**
    - **Ring abscesses**
    - **Septal abscesses**
    - **Fistulae**
    - **Prosthetic dehiscence**
  - **Invasive infection more common in aortic position and if onset is early**

Distinction between Acute and Subacute Bacterial Endocarditis

Feature	Acute	Subacute
Underlying Heart Disease	Heart may be normal	RHD,CHD, etc.
Organism	*S. aureus*, Pneumococcus *S. pyogenes*, Enterococcus	viridans Streptococci, Entercoccus
Therapy	Prompt, vigorous and initiated on empirical ground	Can often be delayed until culture reports and susceptibilities available

Bacterial Endocarditis
Predisposing Factors

1. Dental manipulation
2. Dental disease (caries, abscess)
3. Extracardiac infection (lung, urinary tract, skin, bone, abscess)
4. Instrumentation (urinary tract, GI tract, IV infusions)
5. Cardiac surgery
6. Injection drug use
7. None apparent

Clinical Features

1. **Fever**. Antibiotics, salicylates, steroids, severe CHF, uremia , elderly / debilitated pt. may mask temp elevate

- **Murmurs** present in 80 – 85% or Changing murmur
  - Generally indication of underlying lesion
  - Frequently absent in tricuspid IE

1. **Petechiae and cutaneous manifestations**. Roth spots conjunctival and mucosal petechiae, splinter hemorrhages, Osler nodes and Janway lesions.
2. **Splenomegaly**
3. **Embolism**. Septic or sterile. CNS, spleen, lung, retinal vessels, coronary artery, large vessels , Splenic inf .
4. **Renal disease**, infarction. Multiple abscesses. Glomerulonephritis and uremia

5 . **CHF** Due to mechanical disruption ,High mortality without surgical intervention

6 .**General**. Weight loss, anorexia, debilitation, loss of libido.

Janeway Lesions

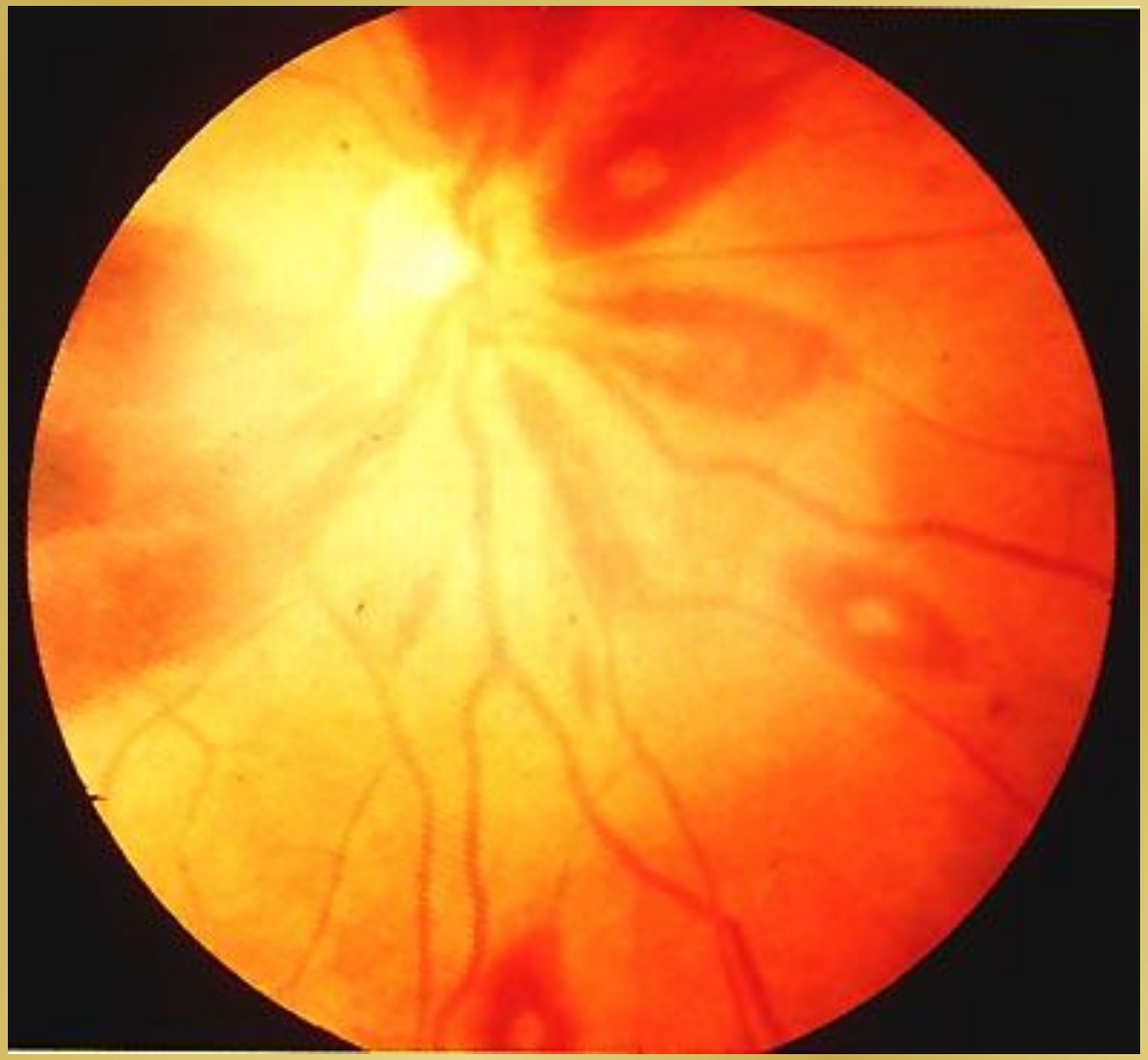
Splinter Hemorrhage

Osler's Nodes: Painful erythmatous nodular lesions resulting from infective endocarditis

Zitelli & Davis, Pediatric Physical Diagnosis Electronic Atlas, Mosby 2004

Subconjunctival Hemorrhages

Roth's Spots



Noncardiac Manifestations

Septic emboli with hemorrhage and infarction due to acute *Staphylococcus aureus* endocarditis.

Noncardiac Manifestations

Vasculitis

Clubbing.

Seen in patients with chronic lung disease, cyanotic heart disease, cirrhosis and infective endocarditis.

Bacterial Endocarditis
Laboratory Features

1. Anemia
2. Most commonly elevated WBC
3. ESR & CRP elevated, ↓ C′ in patients with glomerulonephritis
4. Microscopic hematuria
5. Bacteremia. Persistent.≥ 3, ≤ 5 blood cultures. Aerobic and anaerobic. Different sites.

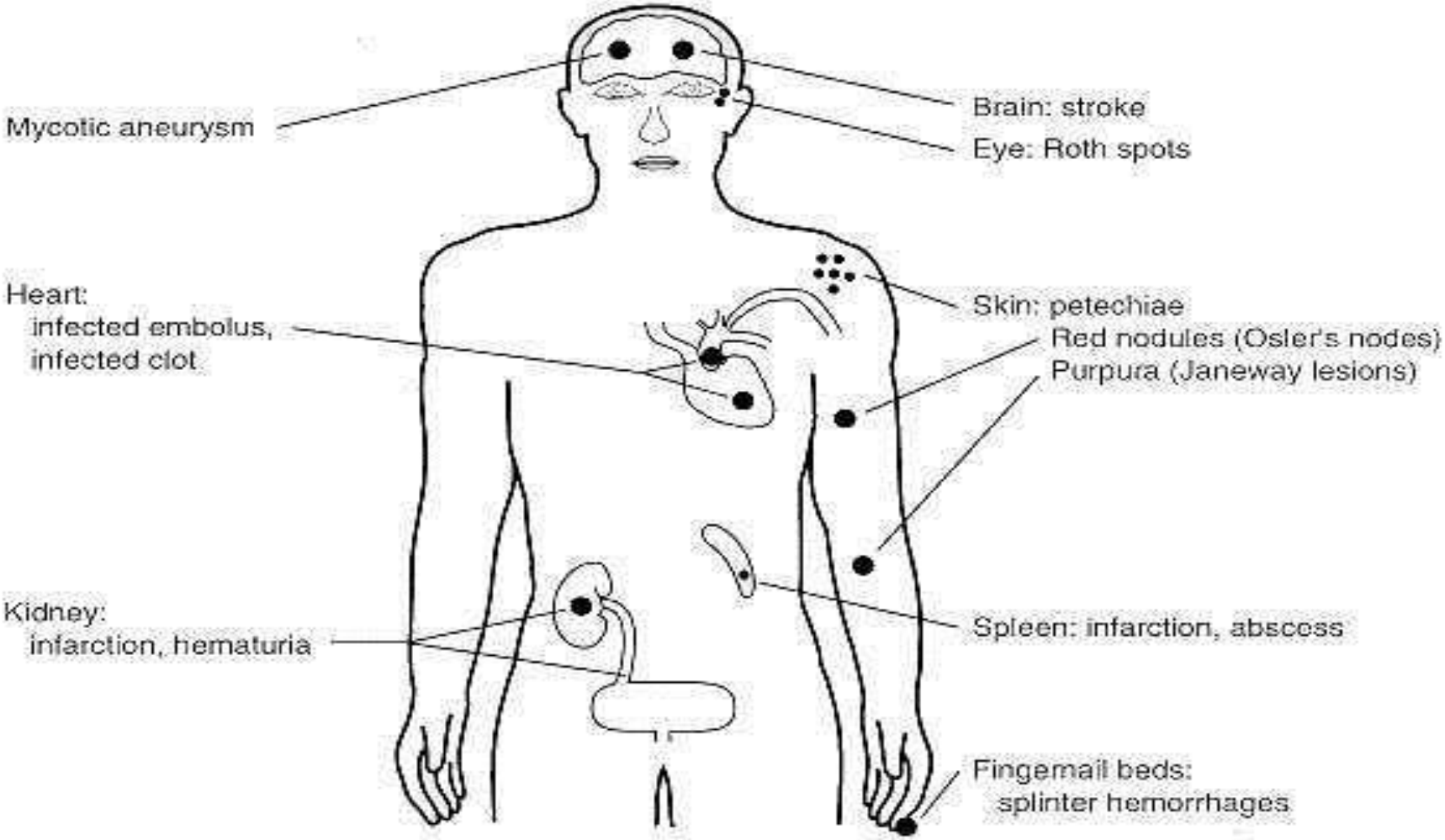
Infective Endocarditis

- Majority of cases caused by streptococcus, staphylococcus, enterococcus, or fastidious gram negative cocco-bacillary forms
- Gram negative organisms
  - P. aeruginosa most common
  - HACEK - slow growing, fastidious organisms that may need 3 weeks to grow out of culture
    - Haemophilus sp.
    - Actinobacillus
    - Cardiobacterium
    - Eikenella
    - Kingella

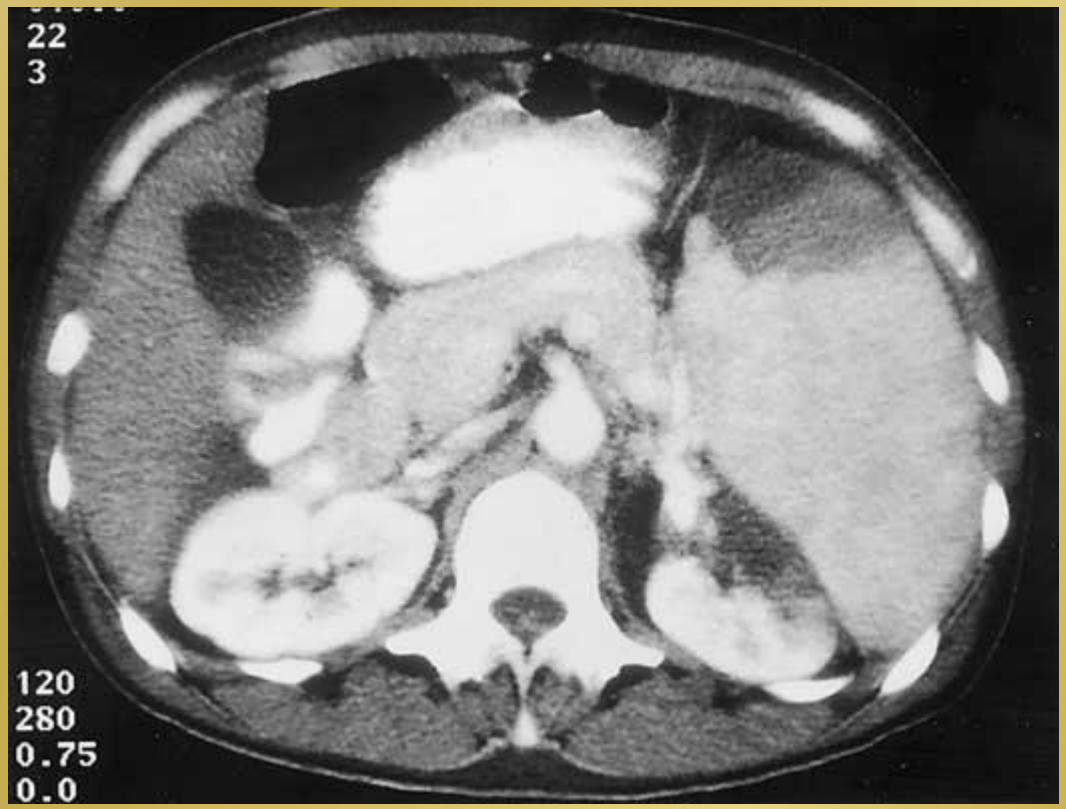
Pathophysiology

- **Embolization**
  - **Clinically evident 11 – 43% of patients**
  - **Pathologically present 45 – 65%**
  - **High risk for embolization**
    - » **Large > 10 mm vegetation**
    - » **Hypermobile vegetation**
    - » **Mitral vegetations (esp. anterior leaflet)**
  - **Pulmonary (septic) – 65 – 75% of i.v. drug abusers with tricuspid IE**

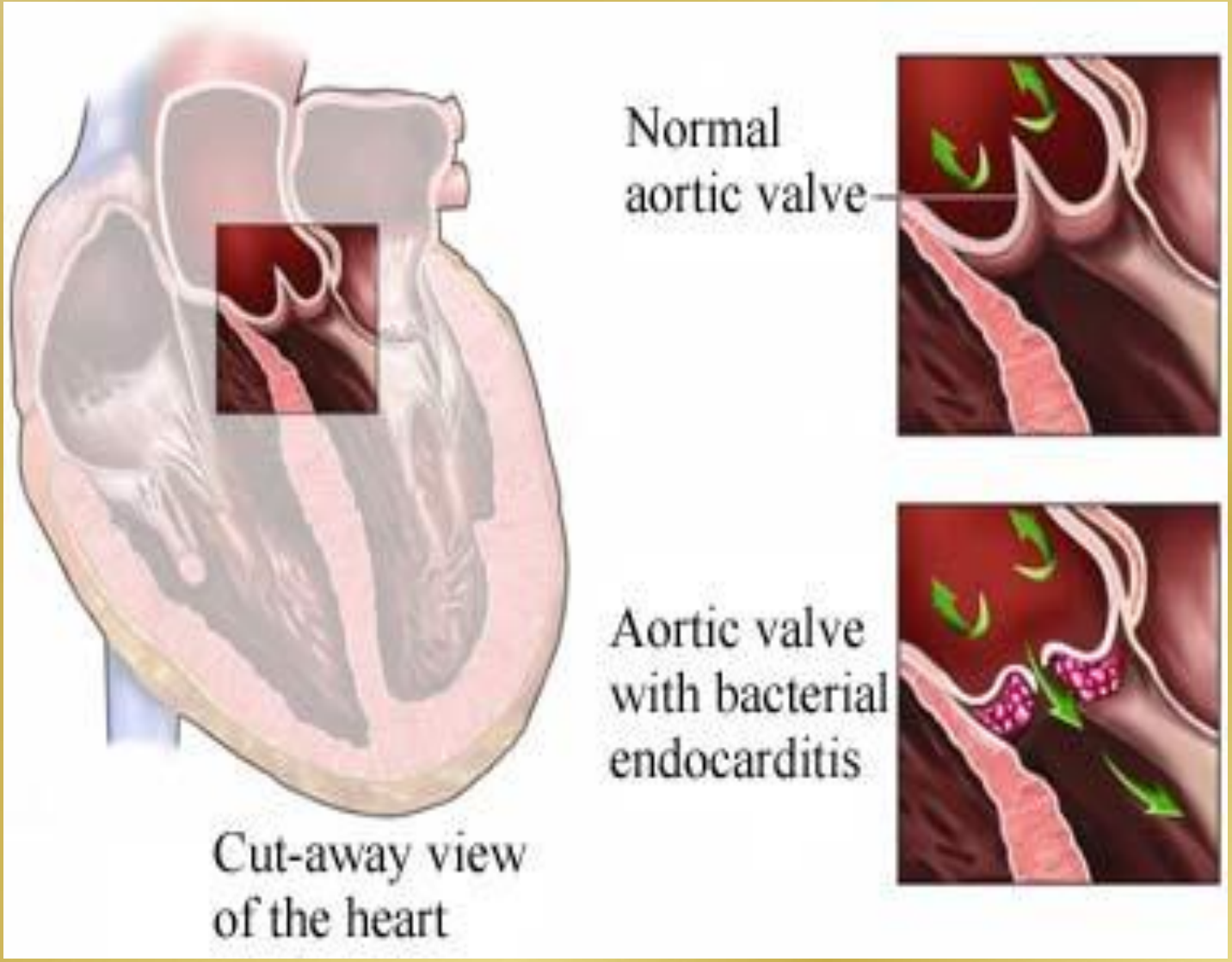
Infective endocarditis: metastatic infections due to emboli.

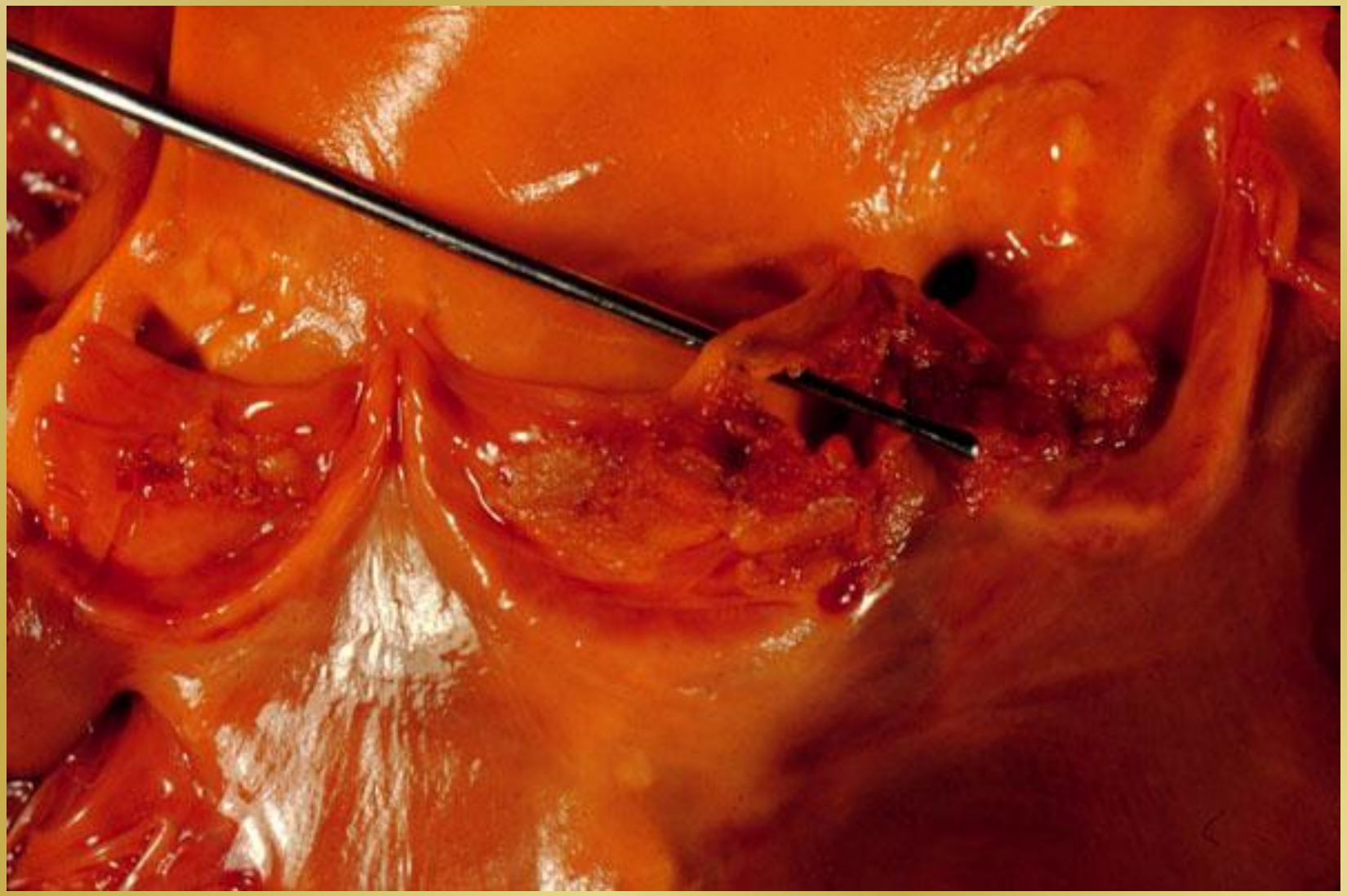


Noncardiac Manifestations



Computed tomography of the abdomen showing large embolic infarcts in the spleen and left kidney of a patient with *Bartonella* endocarditis.


Normal
aortic valve
Aortic valve
with bacterial
endocarditis
Cut-away view
of the heart



Echocardiogram of Mitral Valve Vegetation

This picture is of an echocardiogram of a vegetation on the mitral valve from a patient with endocarditis.

LA = Left Atrium, LV = Left Ventricle,
RA = Right Atrium, RV = Right Ventricle

Diagnosis

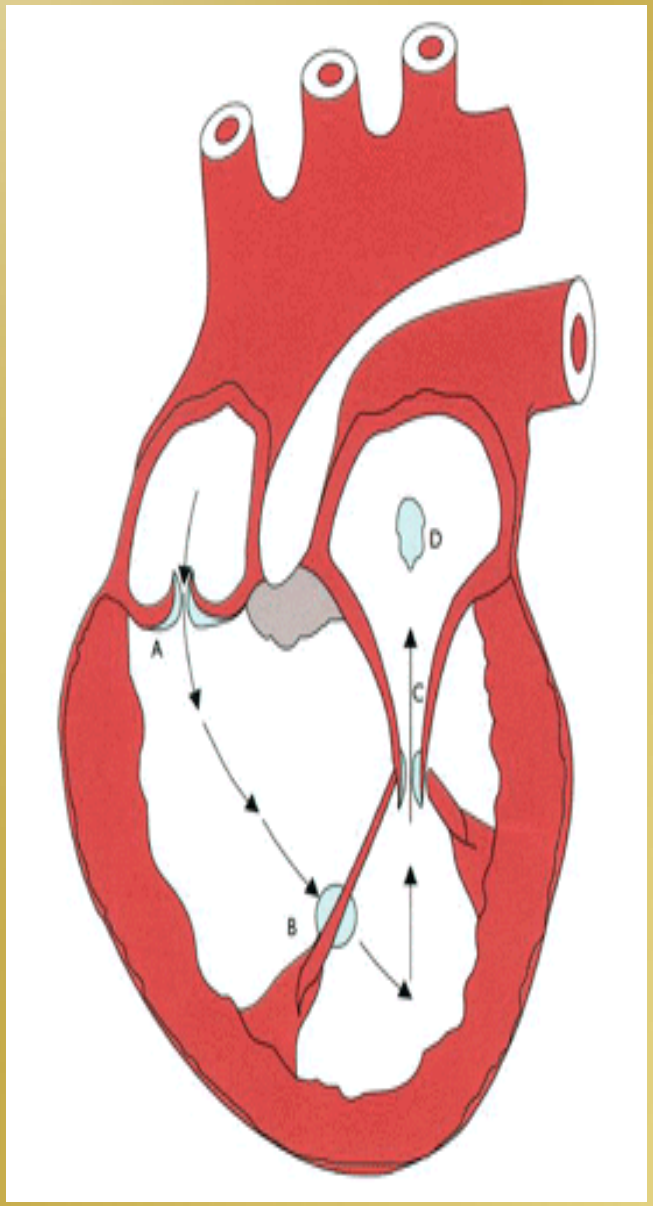
- **Blood cultures**
- **Echocardiography**
  - **TTE – 60% sensitivity**
  - **TEE – 80 – 95% sensitive**

The Duke Criteria for the Clinical Diagnosis of Infective Endocarditis

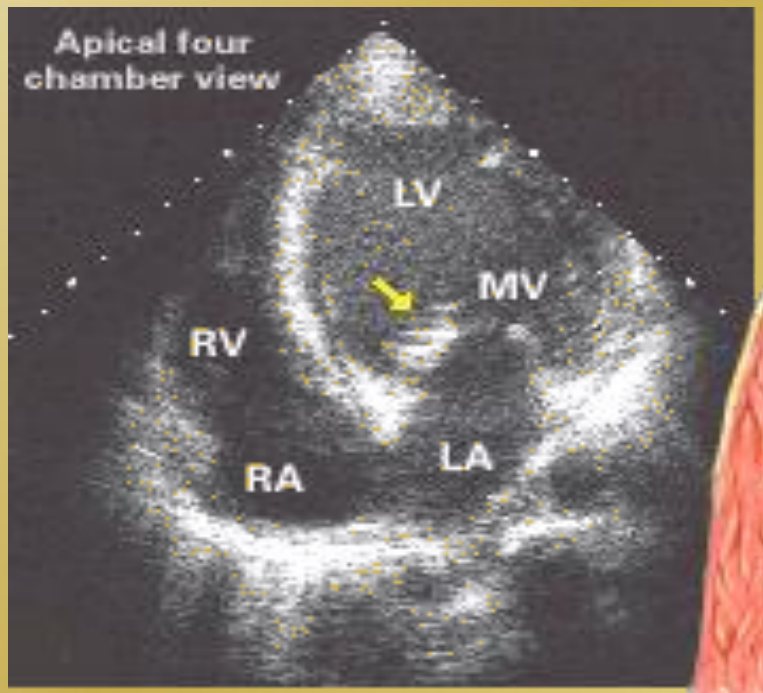
- **MAJOR CRITERIA:**

- **Positive blood culture for Infective Endocarditis**
- **Evidence of endocardial involvement**

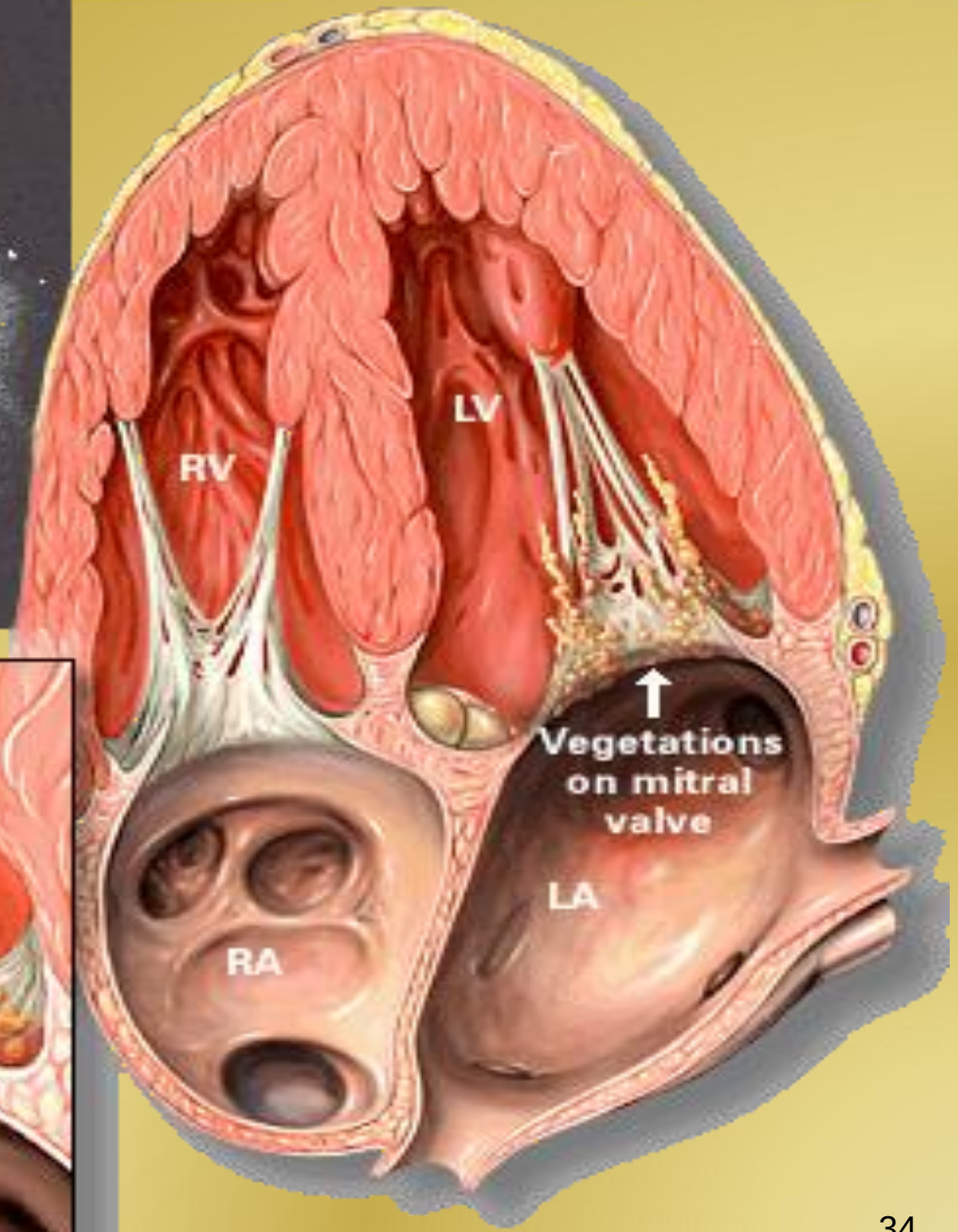
- **Positive echocardiogram**



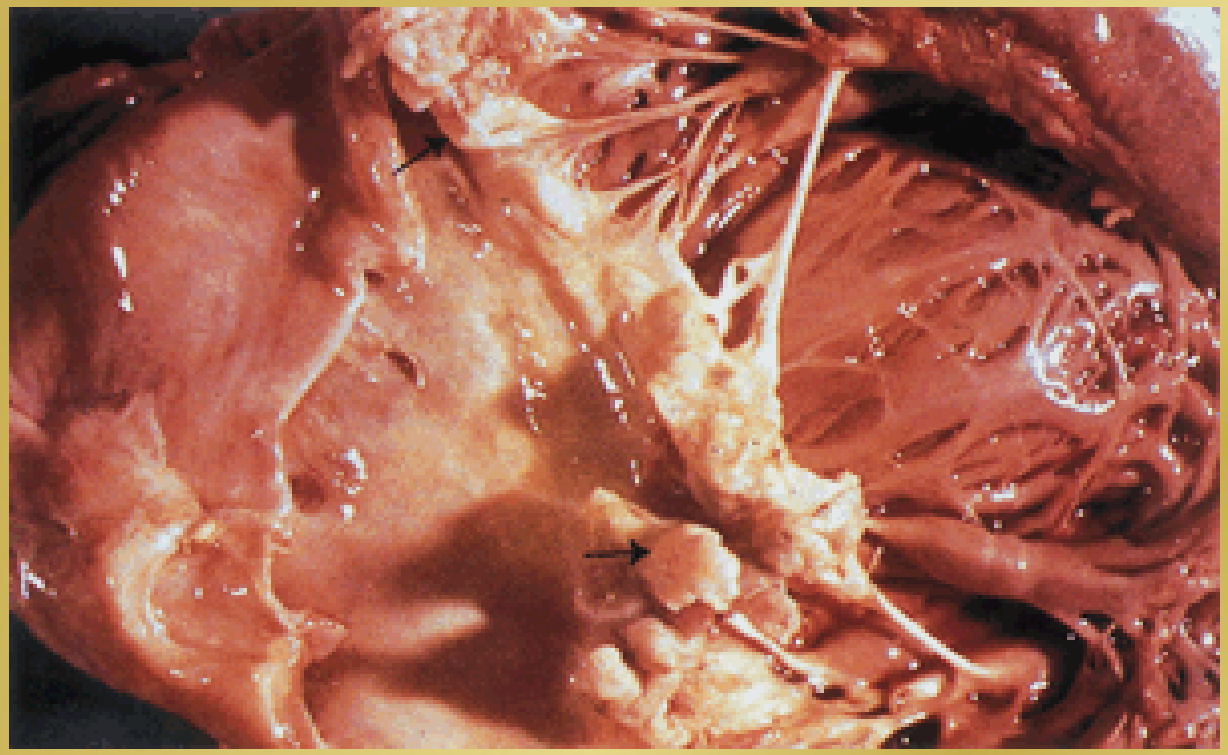
Characteristic sites of vegetations within the heart. In the presence of aortic insufficiency, vegetations characteristically occur on the ventricular surface of the aortic valve (A) or on the chordae tendinae or papillary muscles (B). In mitral regurgitation, the vegetations characteristically are located on the atrial surface of the mitral valve (C) or at sites of jet lesions (D) on the atrial wall.


Apical four chamber view
LV
MV
RV
LA
RA


P. Lynch


RV
LV
Vegetations on mitral valve
LA
RA

INFECTIVE ENDOCARDITIS



Vegetations *(arrows) due to viridans streptococcal endocarditis involving the mitral valve.*

The Duke Criteria for the Clinical Diagnosis of Infective Endocarditis

- **MINOR CRITERIA :**
- **Predisposition: predisposing heart condition or injection drug use**
- **Fever ≥38.0◦C**
- **Vascular phenomena: major arterial emboli, septic pulmonary infarcts, mycotic aneurysm, intracranial hemorrhage, conjunctival hemorrhages, Janeway lesions**
- **Immunologic phenomena: glomerulonephritis, Osler's nodes, Roth's spots, rheumatoid factor**

The Duke Criteria for the Clinical Diagnosis of Infective Endocarditis

- **MINOR CRITERIA :**
- **Microbiologic evidence: positive blood culture but not meeting major criterion as noted previously or serologic evidence of active infection with organism consistent with infective endocarditis**
- **Echocardiogram: consistent with infective endocarditis but not meeting major criterion**

The Duke Criteria for the Clinical Diagnosis of Infective Endocarditis

- **Documentation of two major criteria, of one major and three minor criteria, or of five minor criteria allows a clinical diagnosis of definite endocarditis.**

Further 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

Goals of Therapy

- **Eradicate infection**
- **Definitively treat sequelae of destructive intra-cardiac and extra-cardiac lesions**

Antibiotic Therapy

- **Treatment tailored to etiologic agent**
  - **High serum concentration of antibiotic necessary to penetrate avascular vegetation**

Antibiotic Therapy

- **Treatment before blood cultures turn positive**
  - **Suspected ABE**
  - **Hemodynamic instability**

  – **Neither appropriate nor necessary in patient with suspected SBE who is hemodynamically stable**

Antibiotic Therapy

- **Persistent fever in:**
  - **IE due to staph, pseudomonas, culture negative**
  - **IE with microvascular complications/ major emboli**
  - **Intracardiac/extracardiac septic complications**
  - **Drug reaction**

Antibiotic Treatment for Infective Endocarditis Caused by Common Organisms

- **Streptococci Penicillin-susceptible streptococci, *S. bovis***
- **Penicillin G 2-3 million units IV q4h for 4 weeks**
- **Penicillin G 2-3 million units IV q4h *plus* gentamicin 1 mg/kg IM or IV q8h, both for 2 weeks**
- **Ceftriaxone 2 g/d IV as single dose for 4 weeks**
- **Vancomycin*d* 15 mg/kg IV q12h for 4 weeks**

Surgical Treatment of Intra-Cardiac Complications

- **NYHA Class III/IV CHF due to valve dysfunction**
  - **Surgical mortality – 20-40%**
  - **Medical mortality – 50-90%**
- **Unstable prosthetic valve**
  - **Surgical mortality – 15-55%**
  - **Medical mortality – near 100% at 6 months**
- **Uncontrolled infection**

Surgical Treatment of Intra-Cardiac Complications

- **Difficult to cure:**
  - **Fungal endocarditis**
  - **Brucella**
- **S. aureus PVE with any intra-cardiac complication**
- **Relapse of PVE after optimal therapy**

Surgical Treatment of Intra-Cardiac Complications

- **Relative indications**
  - **Perivalvular extension of infection**
  - **Poorly responsive S. aureus NVE**
  - **Relapse of NVE**
  - **Culture negative NVE/PVE with persistent fever (> 10 days)**
  - **Large (> 10mm) or hypermobile vegetation**
  - **Endocarditis due to highly resistant enterococcus**
  - **Embolism despite therapy**

Prevention

- **Prophylactic regimen targeted against likely organism**
  - **Strep. viridans – oral, respiratory, eosphogeal**
  - **Enterococcus – genitourinary, gastrointestinal**
  - **S. aureus – infected skin, mucosal surfaces**

Prevention – the procedure

- Dental procedures known to produce bleeding
- Tonsillectomy
- Surgery involving GI, respiratory mucosa
- Esophageal dilation
- ERCP for obstruction
- Gallbladder surgery
- Cystoscopy, urethral dilation
- Urethral catheter if infection present
- Urinary tract surgery, including prostate
- I&D of infected tissue

Prevention – the underlying lesion

- **High risk lesions**
  - Prosthetic valves
  - Prior IE
  - Cyanotic congenital heart disease
  - PDA
  - AR, AS, MR,MS with MR
  - VSD
  - Coarctation
  - Surgical systemic-pulmonary shunts
- **Intermediate risk**
  - MVP with murmur
  - Pure MS
  - Tricuspid disease
  - Pulmonary stenosis
  - Bicuspid Ao valve with no hemodynamic significance

Prevention – the underlying lesion

- **Low/no risk**
  - **MVP without murmur**
  - **Trivial valvular regurg.**
  - **Isolated ASD**
  - **Implanted device (pacer, ICD)**
  - **CAD**
  - **CABG**

Chemoprophylaxis

Adult Prophylaxis: Dental, Oral, Respiratory, Esophageal
Standard Regimen

Amoxicillin 2g PO 1h before procedure or
Ampicillin 2g IM/IV 30m before procedure
Penicillin Allergic
Clindamycin
600 mg PO 1h before procedure or
600 mg IV 30m before
Cephalexin OR Cefadroxil 2g PO 1 hour before
Cefazolin 1.0g IM/IV 30 min before procedure
Azithromycin or Clarithromycin 500mg PO 1h before

Adult Genitourinary or Gastrointestinal Procedures

High Risk Patients

Standard Regimen

Before procedure (30 minutes):

Ampicillin 2g IV/IM AND

Gentamicin 1.5 mg/kg (MAX 120 mg) IM/IV

After procedure (6 hours later)

Ampicillin 1g IM/IV OR

Amoxicillin 1g PO

Penicillin Allergic

Complete infusion 30 minutes before procedure

Vancomycin 1g IV over 1-2h AND

Gentamicin 1.5 mg/kg IV/IM (MAX 120 mg)

Moderate Risk Patients

Standard Regimen

Amoxicillin 2g PO 1h before OR

Ampicillin 2g IM/IV 30m before

Penicillin Allergic

Vancomycin 1g IV over 1-2h, complete 30m before

The End