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Infective Endocarditis

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Handouts available in PDF format at www.drstultz.com

Topics to be covered

- Epidemiology
 - Microbiology
 - Clinical presentation
 - Physical Exam Findings
 - Diagnostic Imaging
- ❖ Overview of Treatment
 - ❖ Complications
 - ❖ Indications for Surgery
 - ❖ Prognosis
 - ❖ Pearls for the Boards

Epidemiology

- Incidence of 2.4-11.6 per 100,000 patient years
- Stable or increasing in incidence
- Higher incidence in urban populations
- Elderly at 4-6x risk
- Median age 47-69
- Male:Female ratio of about 2:1
- Up to 75% of patients with native valve involvement have identifiable risk factors

Risk factors for native valve endocarditis

- Rheumatic heart disease
- Congenital heart disease
- Mitral valve prolapse
- Degenerative heart disease
- Asymmetrical septal hypertrophy
- Intravenous drug abuse

Mitral Valve Prolapse

- High prevalence
 - 2-4% of general healthy population
 - 20% of young women
- 7-30% of Native valve endocarditis without IVD
- Relative risk of 3.5-8.2 for endocarditis
- **HOWEVER** – most risk is confined to patients with prolapse **AND** a mitral regurgitation murmur

Rheumatic Heart Disease

- Declining in incidence
 - 20-25% of endocarditis cases in 1970's
 - 7-18% of endocarditis cases in 1980's
- Commonly involves
 - Mitral valve in women
 - Aortic valve in men

Congenital Heart Disease

- Accounts for
 - 10-20% of endocarditis cases in young adults
 - 8% of cases in older adults
- Common lesions
 - Patent ductus arteriosus
 - Ventricular septal defect
 - Bicuspid aortic valve

Intravenous drug use

- Risk of endocarditis 2-5 per 100 patient years
 - Higher risk than rheumatic disease or prosthetic valve
- 65-80% of IVD endocarditis population is male
- Average age 27-37
- Commonly involves tricuspid valve (46-78% of cases)

Braunwald, 1724-25

- *S. Aureus* involved in over 50% of cases

Prosthetic Valves

- Account for 10-30% of all endocarditis cases
- Risk is greatest in first 6 months after implant
 - “Early” endocarditis occurs in first 60 days
- Incidence about 5% at 5 years
- Risk declines over time
- Mechanical valve has higher risk than bioprosthesis initially
- After 1 year bioprosthesis is more risky than mechanical valve

Microbiology in a nutshell

- Any pathogen can cause endocarditis
- Common organisms
 - *Strep viridians* – 28%
 - *Staph aureus* – 28%
 - Other *Strep* species – 23%
 - Coag negative *Staph* – 7%
 - Gram-negatives – 4%
 - Other – 5%
 - No growth – 5%
- Drug resistance seen more commonly in IV drug use

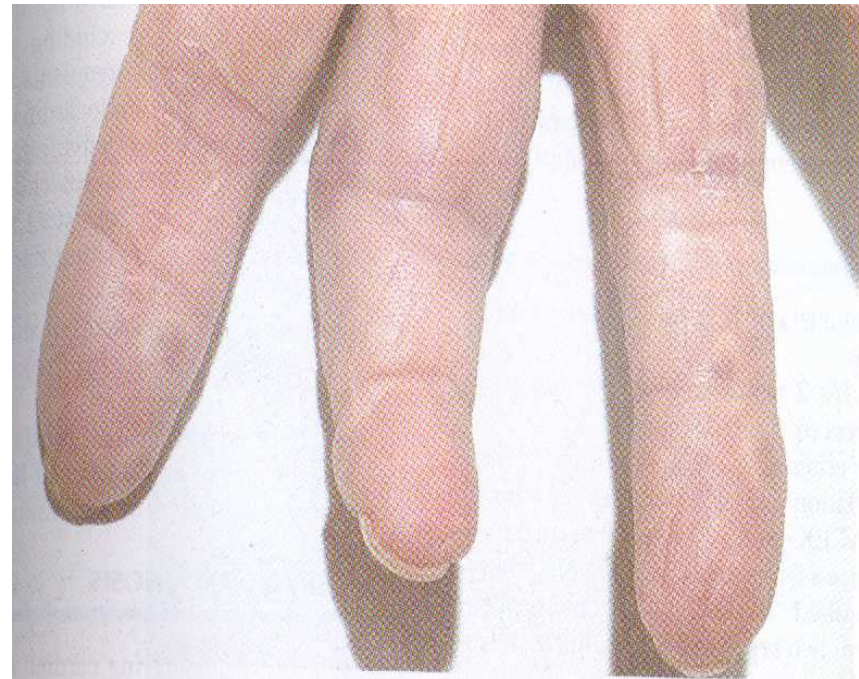
Clinical presentation

Nonspecific symptoms and signs

- Fever
- Mitral or aortic regurgitation murmurs
- Splenomegaly (50% of cases)
- Microscopic hematuria
- Sepsis – especially in acute infective endocarditis
- Joint arthritis and arthralgias
- Chronic wasting –in subacute endocarditis
- Cutaneous signs are infrequent

Osler's Nodes

- Tender violaceous nodules in pulp of fingers or toes
- Due to infective emboli or immune complex deposits



Petechial Lesions

- Petechiae may appear on extremities, chest, or mucous membranes



Splinter Hemorrhage

- Due to rupture of fine subungual capillaries
- Usually 2-3mm long in long axis of nail
- Initially blue-purple in color, change to brown or black in 1-2 days
- Move distal with nail growth
- Trauma most common cause; 20% of population have them



Splinter Hemorrhage



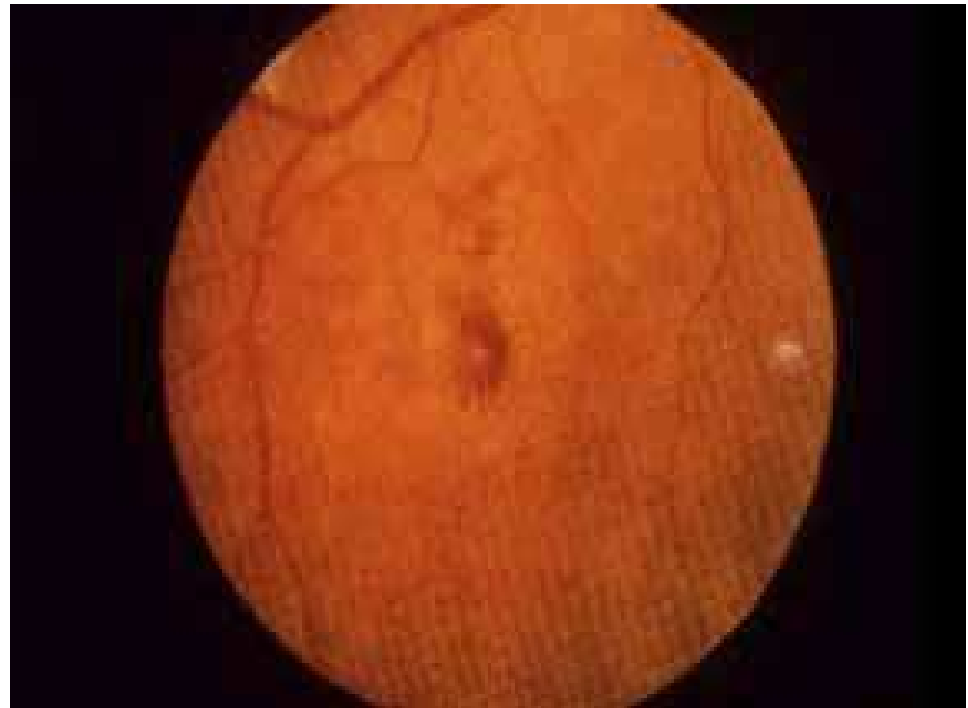
Janeway Lesions



- Nontender
- Small hemorrhagic macules or nodules
- Commonly on palms or soles

Roth Spots

- Red retinal hemorrhage
- Pale center



Clinical presentation

Cardiac signs and symptoms

- Heart failure – especially unexplained in young pt
- Pericarditis – uncommon, often the result of abscess or fistulous tract formation
- Abnormal echocardiogram

Clinical Presentation

Complications of endocarditis

- Septic pulmonary emboli
 - Commonly in tricuspid valve endocarditis due to IV drug use
 - May cause chest pain and dyspnea
 - Pulmonary fleeting patchy infiltrates on chest xray
- Stroke – due to embolism of vegetation or thrombus
- Renal failure – rare complication due to sepsis, embolism, or immune complex reaction
- Peripheral vascular embolism

Endocarditis and Embolism

- Up to 75% of embolic events occur prior to diagnosis or treatment
- 50-65% of clinically evident emboli involve the CNS, especially in middle cerebral artery distribution
- Embolism risk decreases after 1 week of antibiotics
- Surgery indicated for 2 or more embolic events

Prosthetic Valve Endocarditis

- Early endocarditis occurs within 60 days of surgery
 - More common in patients needing reoperation or long ventilator support
 - Commonly involves *S. aureus* or fungal species
 - Acute presentation, 65% mortality
- Late endocarditis occurs more than 60 days postop
 - Subacute presentation
 - Typical subacute organisms
- Prosthetic valve endocarditis can cause mechanical failure due to abscess, valve dehiscence, paravalvular leaks

Duke criteria - Major

- 1) More than one positive blood culture typical for endocarditis
- 2) Evidence of endocardial involvement
 - New regurgitation murmur
 - Echocardiogram with oscillating mass, abscess or valve dehiscence

Duke criteria - Minor

- 1) Cardiac risk factor including IV drug use
- 2) Fever $\geq 100.4^{\circ}$ F
- 3) Vascular manifestation
- 4) Immunologic phenomena
- 5) Echocardiogram consistent with endocarditis but not meeting major criterion
- 6) Positive blood culture not meeting major criterion or serologic evidence of organism

Duke Criteria - Diagnosis

- Definite Endocarditis
 - Positive histology or culture from vegetation
 - Two major criteria
 - One major and three minor criteria
 - Five minor criteria
- Rejected
 - Firm alternative diagnosis
 - Resolution after ≤ 4 days of antibiotics
- Possible Endocarditis

Diagnostic Imaging

- Echocardiography
- Chest Xray
- CT
- MRI
- Nuclear

Chest Xray

- Nonspecific findings
- Cardiomegaly
- Nodular infiltrates
 - Tricuspid valve endocarditis causing septic emboli



CT and MRI

Still Mostly Experimental

- Primarily evaluate brain for complications
- Isolated CT case reports
 - Large aortic root abscess and AV fistula
- MRI can potentially diagnose complications of aortic root aneurysms or abscesses

Nuclear Imaging

- Tagged WBC scans have been used
 - Can identify vegetations
 - Nonspecific
 - High false negative
- Case reports suggest that positive scan can be used to detect local complications of endocarditis
- Useful to detect metastatic septic embolism

Echocardiography

- Major Duke criteria
- Diagnose and management of infective endocarditis
- Vegetations – detected in 67% of “definite” cases by Duke criteria
 - Irregular shape
 - Occur on low-pressure side of turbulent jet
 - Atrial side in mitral and tricuspid regurgitation
 - Ventricular side in aortic and pulmonic regurgitation
 - May occur on other nonvalvular locations

Vegetation characteristics

- Large vegetation (>10mm) has 3 times risk of embolization compared to small ones¹
- Prolapsing vegetations or extravalvular involvement carries higher risk of heart failure, brain embolization, need for valve replacement²
- However, poor interobserver reproducibility of these characteristics

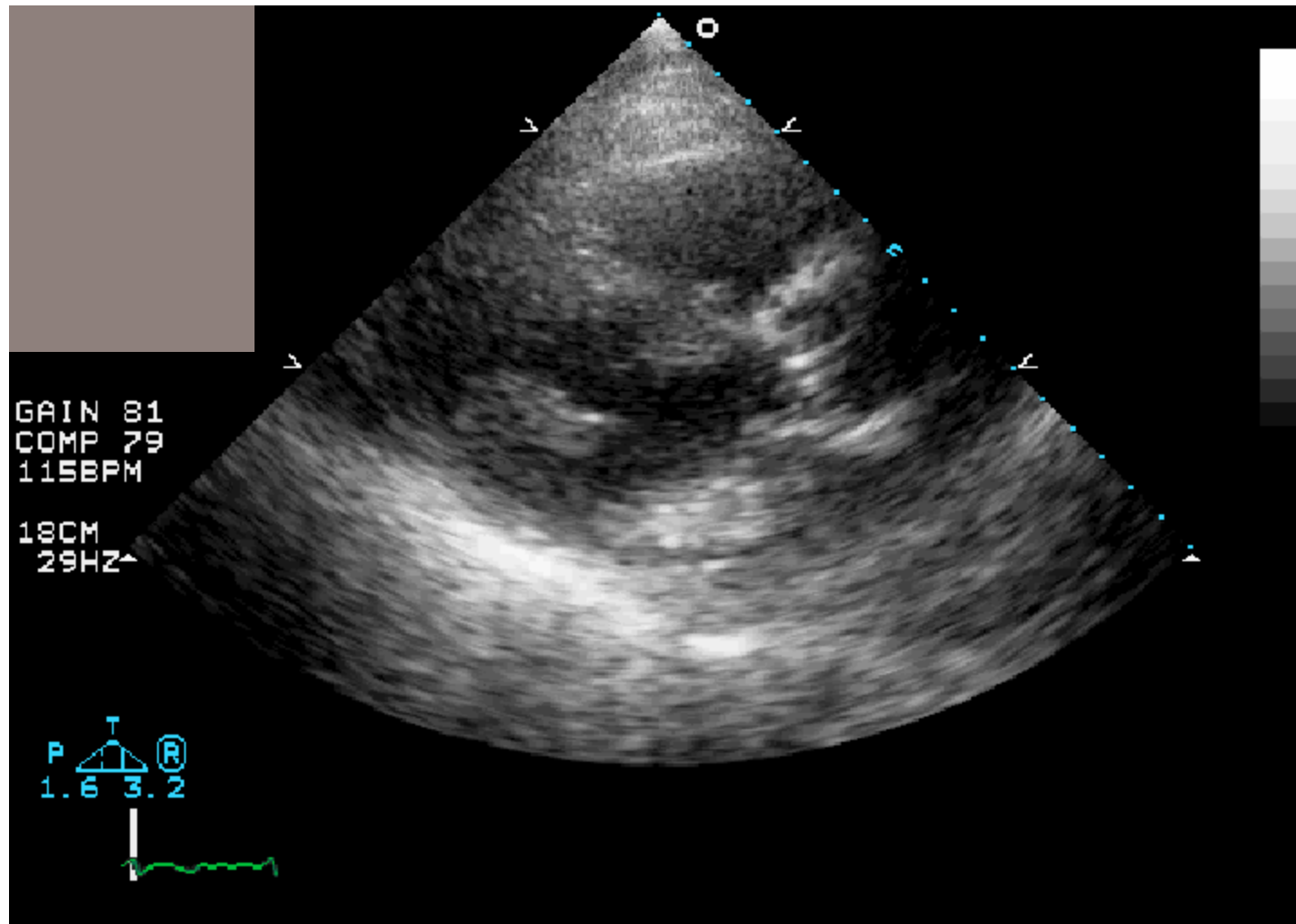
¹Tischler M, Vaitkus P. The ability of vegetation size on echocardiography to predict complications: a meta-analysis. J Amer Soc Echo 1997; 10:562-8.

²Sanfillipo A, Picard M, Newell J, et al. Echocardiographic assessment of patients with infectious endocarditis: prediction of risk for complication. J Am Coll Cardiol 1991; 18:1191-9.

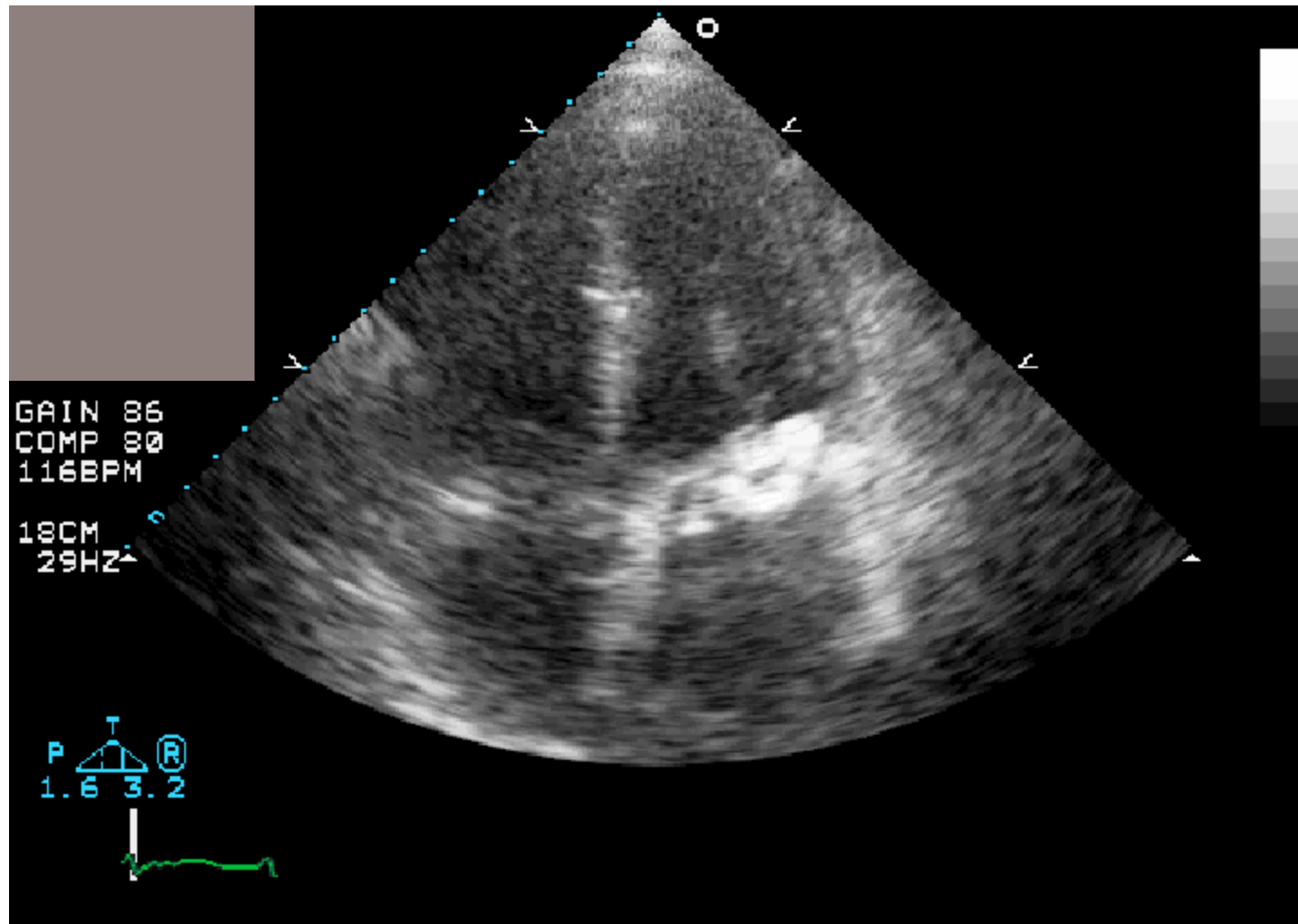
Valvular location

- Small series show 26% mortality of aortic location vs. 16% with mitral location
- Aortic valve endocarditis more resistant to antibiotic therapy, more likely to need surgery
- Mitral valve endocarditis, especially anterior leaflet, has highest incidence of embolization

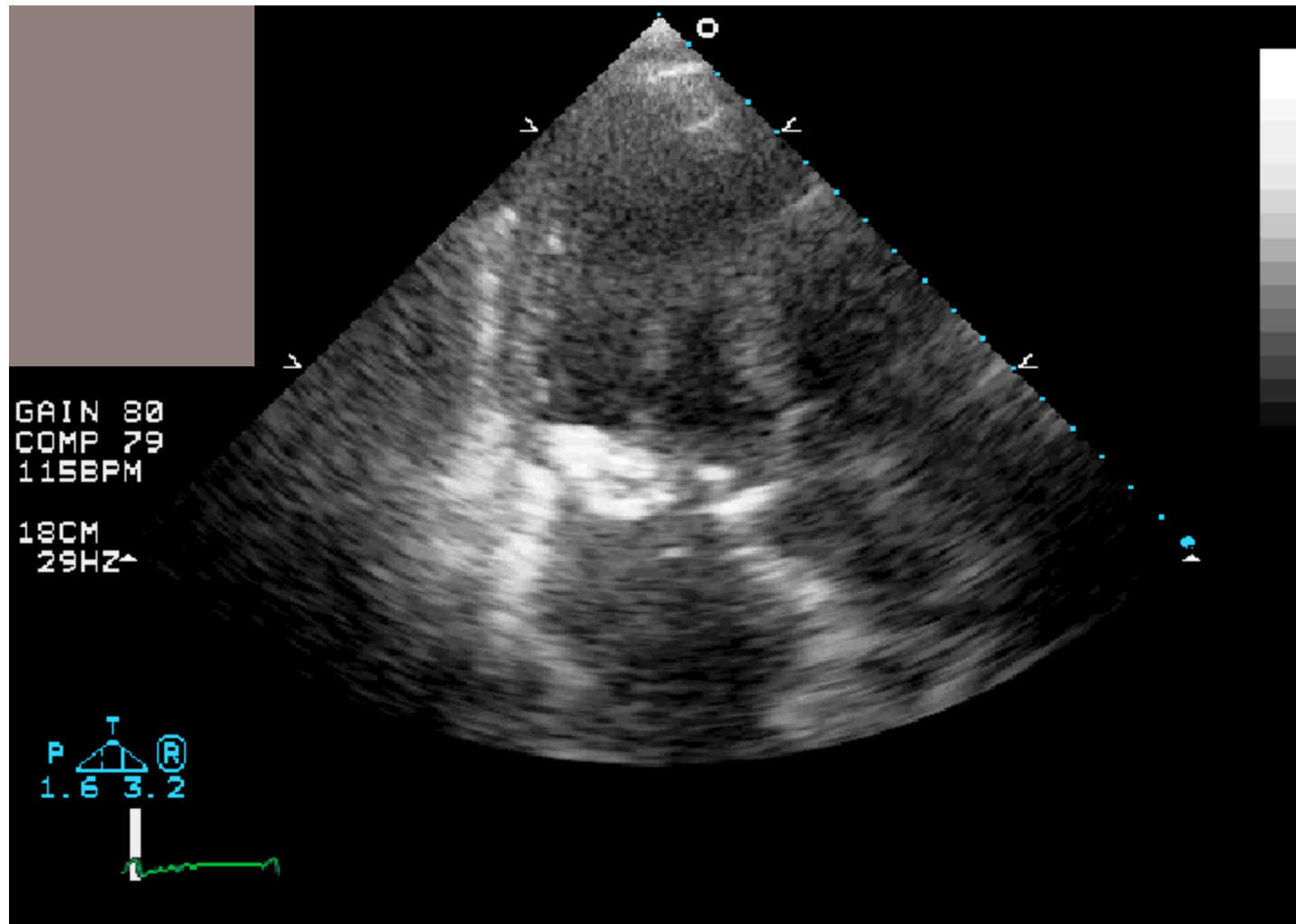
Mitral valve vegetation posterior leaflet



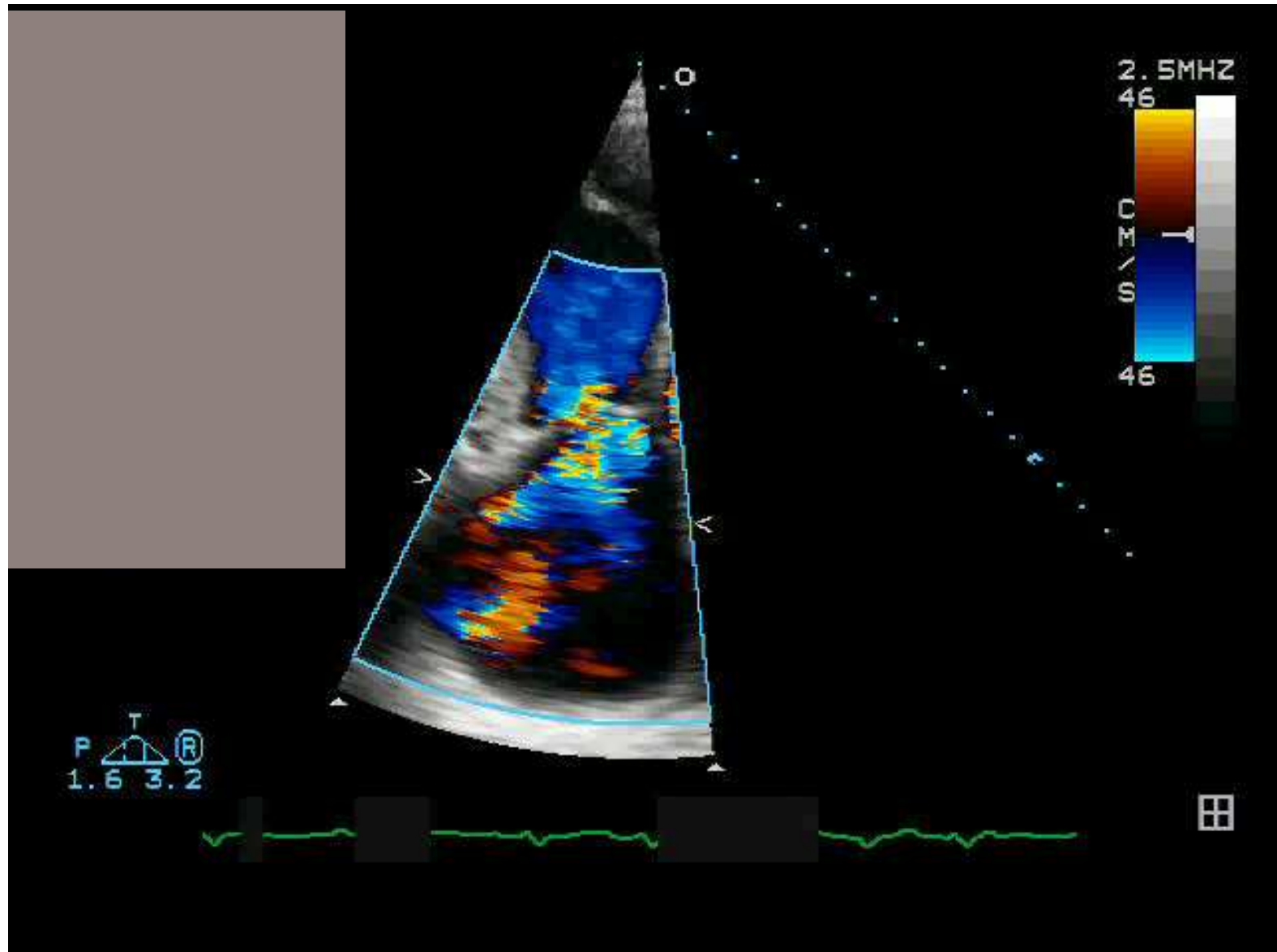
Mitral valve vegetation posterior leaflet



Mitral valve vegetation posterior leaflet



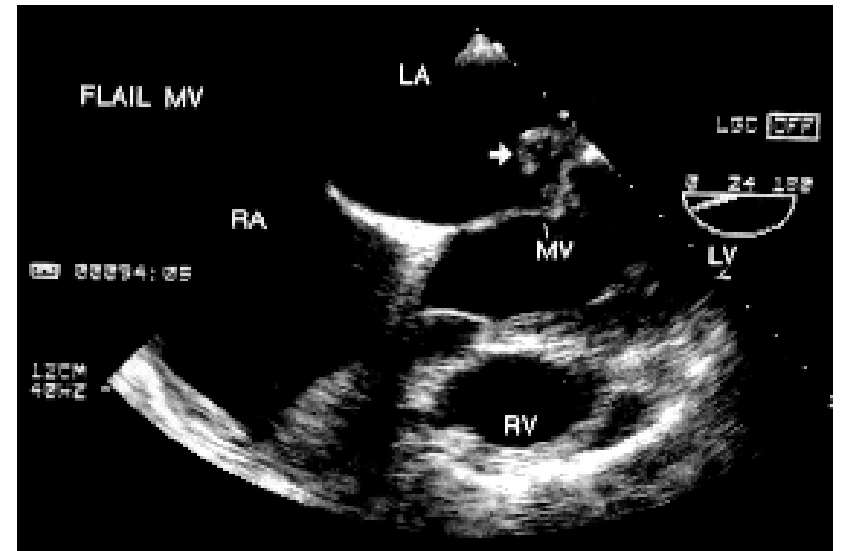
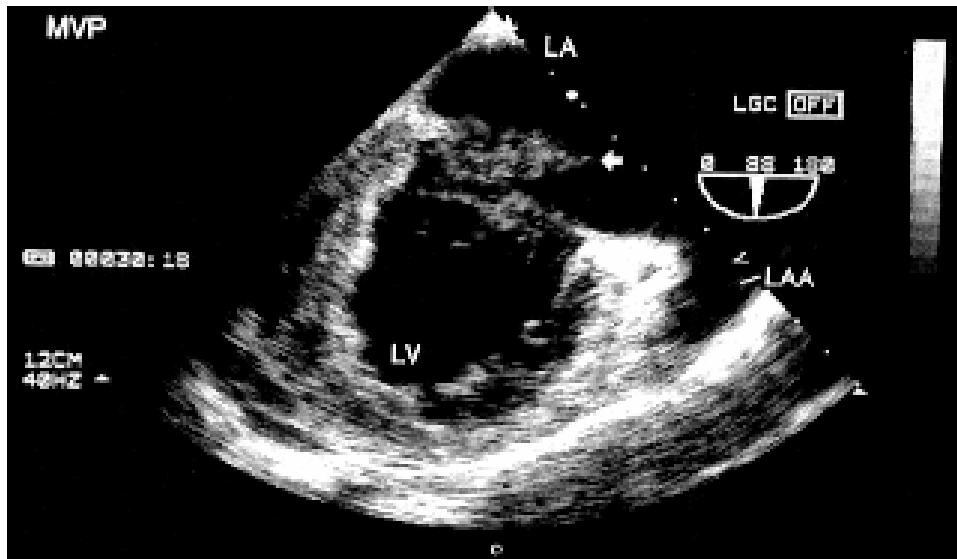
Tricuspid regurgitation



Echocardiographic mimics

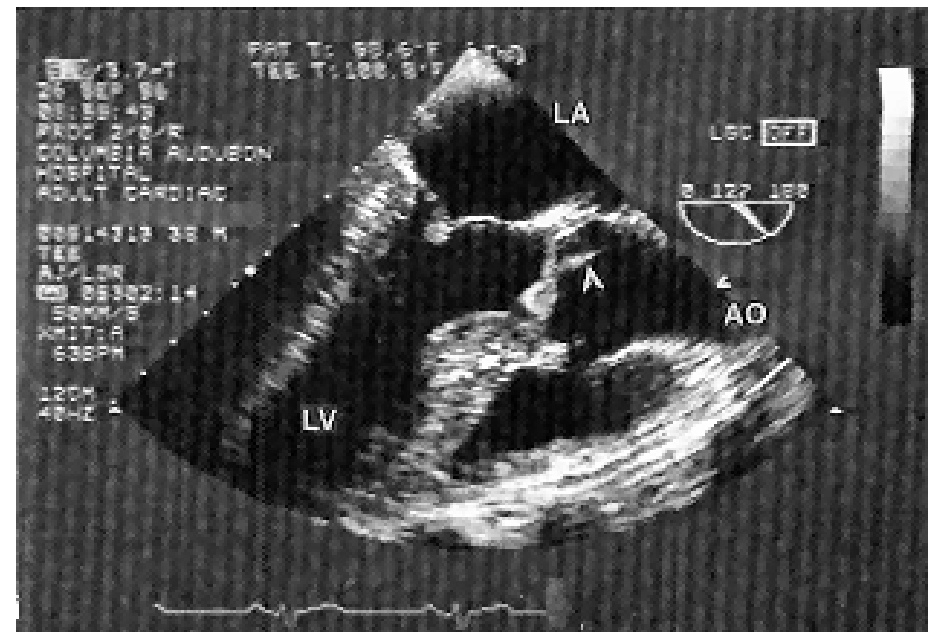
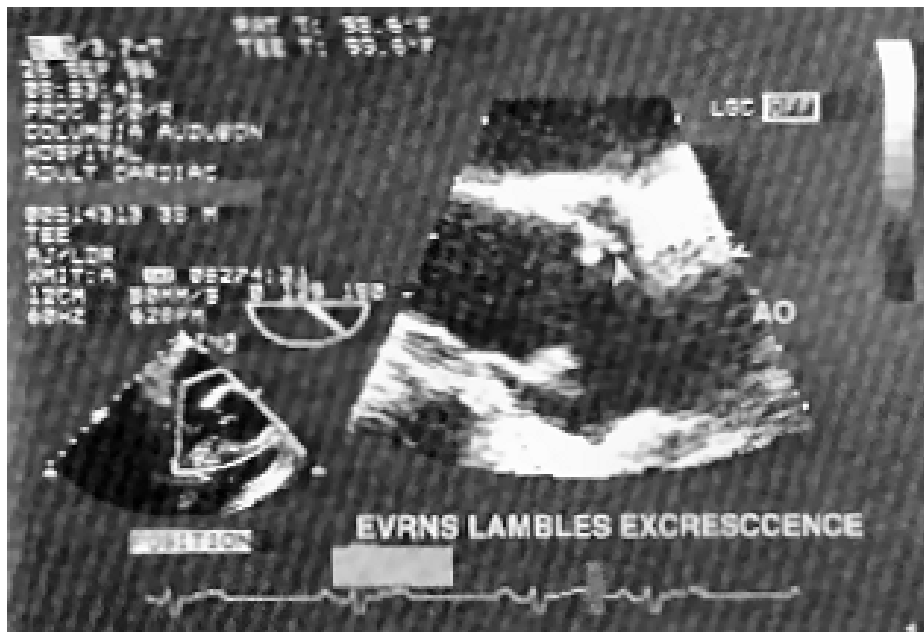
- Sterile vegetations (marantic endocarditis)
 - Libman-Sacks endocarditis
 - Systemic malignancy
- Myxomatous valves
- Cardiac tumors
- Degenerative thickening
- Lambl's excrescence – small, multiple filamentous tags on heart valves found in 70-90% of adults at autopsy

Myxomatous mitral valve



Flail myxomatous mitral valve prolapsing into left atrium

Lambert's Excrescence



Echocardiography

TTE vs. TEE

- Transthoracic
 - 18-63% sensitivity
 - Can rule out endocarditis only with good quality images and a low pre-test probability
 - Low sensitivity for detecting complications of endocarditis
- Transesophageal
 - 48-100% sensitive
 - Indicated in all cases of suspected prosthetic valve endocarditis

Overview of Medical Treatment

- Target therapy to blood culture
- Bactericidal antibiotics
 - β -lactam preferred
 - Monotherapy for MRSA with 1st generation cephalosporin is feasible
 - Vancomycin less bactericidal than penicillins
- Therapy for >4 weeks
 - Studies involving 2 week courses generally not as efficacious

Anticoagulation and Endocarditis

somewhat controversial

- Anticoagulation not indicated in native valve endocarditis
- In prosthetic valve endocarditis due to *Staph Aureus*, it may be beneficial to stop anticoagulation during the acute phase
- Aspirin therapy does not reduce embolic complications, and may increase bleeding

Chan KL, Dumesnil JG, Cujec B et al. A randomized trial of aspirin on the risk of embolic events in patients with infective endocarditis. J Am Coll Cardiol. 2003 Sep 3;42(5):775-80

Sexton, 280

Indications for Surgery

- Heart failure refractory to medical treatment
 - NYHA class 3-4 due to endocarditis
 - Caused by aortic or mitral regurgitation (acute or subacute)
- Prosthetic valve endocarditis (most cases)
 - Medical management may suffice if
 - Late onset infection (>12 months after prosthesis)
 - Low virulence organism (viridians step, HACEK, enterococci)
 - No evidence of invasive infection
- Local invasive complications
 - Periannular extension, abscess, mycotic aneurysm, pseudoaneurysm, fistula
 - Heart block may herald local extension

Indications for Surgery

- 2 or more Major embolic events
 - A recent stroke presents higher operative risk (CVA extension)
 - Prefer to perform surgery at least 10-14 days after CVA
- Major valve dysfunction
 - Valve obstruction
 - Regurgitation
 - Leaflet perforation
- Resistance to antibiotic therapy
 - Persistent bacteremia after 7 days of antibiotics
 - Exclude extracardiac foci of infection
 - Recurrent fever is common, not necessarily an indication of antibiotic failure

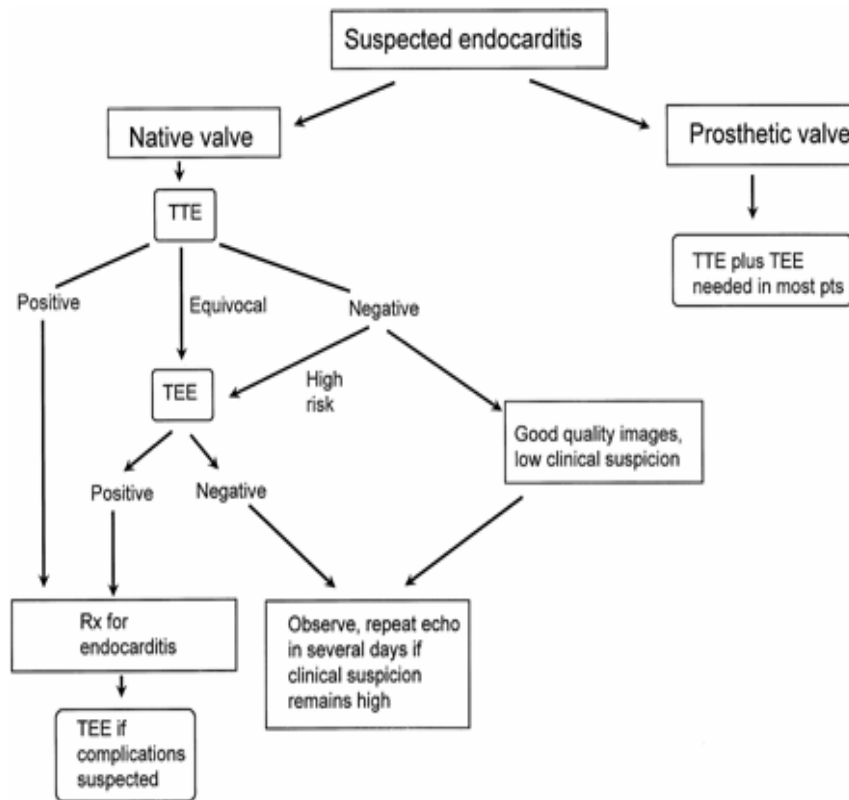
Surgical Considerations

- Surgery needed in 25-30% in acute phase, 20-40% in subacute phase
- No prerequisite for antibiotics before surgery
 - Equivalent mortality (8.5%) for patients having surgery before 10 days and after 10 days of antibiotics
- Consider early surgical intervention with aggressive pathogen (*Staph Aureus*, fungal sp.)

Prognosis

- Overall mortality of 20-25%
- Patients with surgical intervention have 61% survival at 10 years
- Risks of high mortality
 - Elderly
 - Aggressive pathogen (*S. Aureus*)
 - Presence of embolism
 - More extensive valve damage
 - Renal involvement
 - Longer duration of endocarditis

Diagnostic Algorithm



- TEE indicated for suspected prosthetic valve endocarditis
- TTE can rule in endocarditis
- TTE can only rule out endocarditis with good quality images and a low pre-test probability

Endocarditis prophylaxis

A brief summary

- Procedures needing prophylaxis
 - Dental procedures which cause bleeding
 - Surgery involving GI or upper respiratory mucosa
 - Esophageal dilatation
 - Sclerotherapy for varices
 - ERCP with biliary obstruction
 - Urologic procedures
 - Cystoscopy
 - Urethral dilatation
 - Catheterization in presence of UTI
 - Prostate surgery

Endocarditis prophylaxis

- Procedures that do not need prophylaxis
 - Dental procedures which do not cause bleeding
 - Intubation
 - Flexible bronchoscopy (with or without biopsy)
 - TEE
 - Cardiac catheterization, PCI
 - GI endoscopy (with or without biopsy)
 - Most gynecologic procedures performed in the absence of infection

Endocarditis prophylaxis

- High risk – always use ampicillin/vancomycin + gentamicin
 - Prosthetic valves
 - Prior endocarditis
 - Cyanotic congenital heart disease
 - Surgical systemic-pulmonary shunts
 - Mitral or aortic regurgitation or stenosis
 - Ventricular septal defect
 - Coarctation of aorta
 - Patent ductus arteriosus

Endocarditis prophylaxis

- Medium risk – use amoxicillin, ampicillin or vancomycin
 - MVP with regurgitation or leaflet thickening
 - Tricuspid or pulmonary disease
 - Bicupsid aortic valve
 - Aortic valve sclerosis with hemodynamic abnormality
 - Surgically repaired intracardiac lesions without hemodynamic abnormality (for 6 months post-op)

Endocarditis prophylaxis

- Low risk – no prophylaxis
 - MVP without regurgitation
 - Isolated atrial septal defect (secundum)
 - Trivial regurgitation lesions
 - CAD
 - Pacemaker
 - CABG
 - Prior rheumatic fever without valve disease

Pearls for the Boards

- Association of *Strep. Bovis* with GI malignancy, especially colon cancer
- *Candida* bacteremia should have ophthalmologic evaluation (endophthalmitis)
- Identify patients who should and should not receive endocarditis prophylaxis
 - MVP without regurgitation does not need prophylaxis
 - ASD (secundum) does not need prophylaxis
- Recognize that a prosthetic valve will most likely need surgical treatment

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