

The background features a dark blue gradient with a subtle pattern of white dots. On the left side, there are several overlapping circular elements. A prominent one is a large circle with a scale around its perimeter, marked with numbers from 140 to 260 in increments of 10. Other circles are smaller and some have dashed lines or arrows, suggesting a technical or scientific theme.

INFECTIVE ENDOCARDITIS

AHMAD ZIAD TURK, MD, FACC

ADVANCED HEART FAILURE & TRANSPLANT

A 65yo gentleman underwent AVR with a St. Jude mechanical prosthesis for bicuspid aortic regurgitation 5 years ago. The patient is scheduled for a screening colonoscopy +/- polypectomy. He is asymptomatic. He has a soft, short early systolic ejection murmur on examination with a crisp closing click and no diastolic murmurs. He has no allergies. What is the appropriate regimen for infective endocarditis prophylaxis prior to his colonoscopy?

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4. Ceftriaxone 1g IV
5. No pharmacological prophylaxis necessary

A previously healthy 45yo gentleman presents with 3-4 days of malaise and fever to 38.8 C. His primary provider detects a diastolic murmur. TTE shows a tricuspid aortic valve with moderate-severe aortic regurgitation. A TTE 3 years prior showed only trivial AR. TEE confirms the AR but shows no vegetation or abscess. Blood cultures remain negative. Exam demonstrates no embolic or immunological sequelae. What is the diagnosis?

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A 75yo lady underwent pacemaker implantation for complete heart block 2 years ago. She presents with fever and malaise. Blood cultures x2 grow *Staphylococcus aureus*. TEE reveals a small vegetation on the aortic valve with minimal aortic regurgitation and normal device leads. Exam of the device pocket is normal. The patient receives antibiotics, her symptoms resolve, and blood cultures clear. How should you manage her pacemaker?

1. Complete antibiotics and retain the device as long as blood cultures remain negative
2. Completely remove the device generator and leads
3. Exchange the device generator and retain the leads
4. Observe for development of device lead vegetations with serial TEE's.

Learning Objectives

1. Apply current guidelines for prophylaxis to prevent infective endocarditis
2. Describe the diagnosis and management of a patient with suspected or known endocarditis
3. Recognize complications of endocarditis and select appropriate treatment strategies, including need for and timing of surgical intervention.
4. Discuss the epidemiology and management of cardiovascular implantable electronic device infections.

Infective endocarditis

Prophylaxis

1. Which patients?
2. Which procedures?
3. Which drugs?

Infective endocarditis

Which patients?

Patients at highest risk for complications

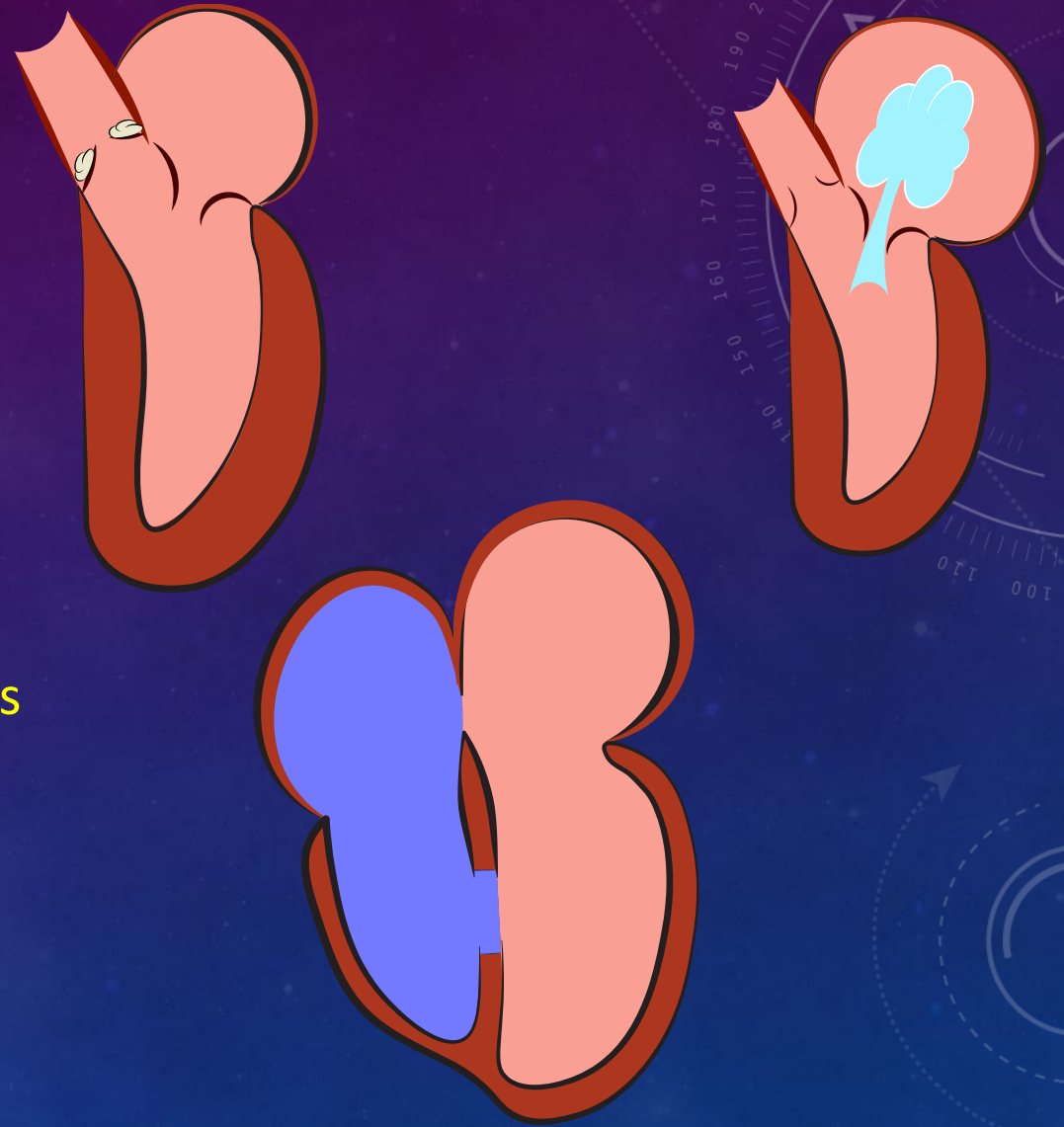
- Prosthetic cardiac valves
- Transcatheter valves
- Prosthetic material used for valve repair
- Previous infective endocarditis
- Transplant recipients with valvulopathy
- Congenital heart disease AND:
 - Unrepaired cyanotic lesions
 - Cyanotic lesions with palliative shunts or conduits
 - Repair ≤ 6 months ago with prosthetic material
 - Repaired lesions with residual defects



Infective endocarditis

Who does NOT require prophylaxis?

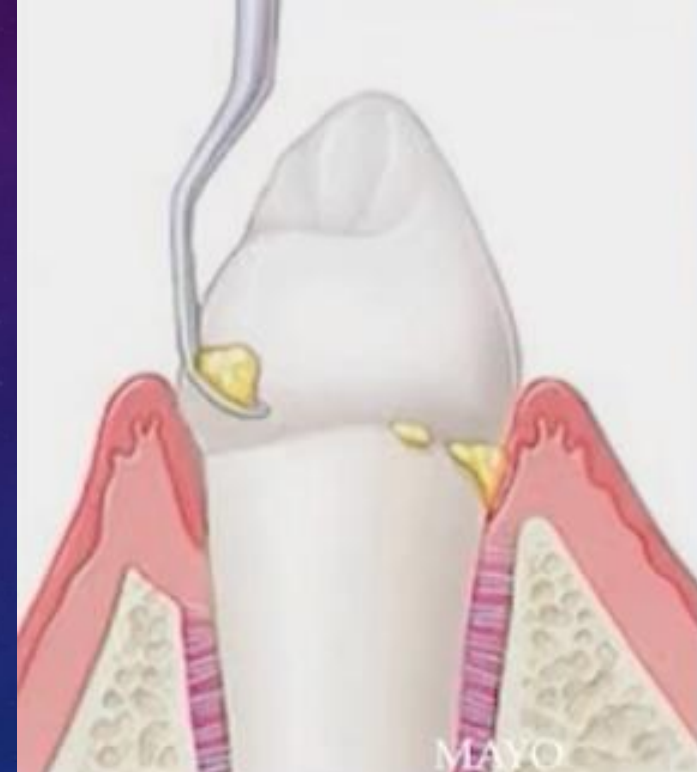
- Mitral valve prolapse with:
 - Regurgitation
 - Thickened leaflets
- Acquired valvular heart disease
- Prior rheumatic fever
- Hypertrophic cardiomyopathy
- Uncorrected, non-high risk congenital defects
 - Bicuspid aortic valve
 - Patent ductus arteriosus
 - VSD
 - Primum ASD
 - Aortic coarctation



Infective endocarditis

Which procedures require prophylaxis?

- Dental procedures
 - Manipulation of gingival tissue or root of teeth
 - Perforation of oral mucosa
 - Cleaning, extraction, root canal
- Incision into active skin/soft tissue infection
- Incision or biopsy in respiratory tract
 - Tonsillectomy/adenoidectomy
 - Bronchoscopy with biopsy



Nishimura RA, et al. JACC 2014; 63(22): e57-185

Wilson W, et al. Circulation 2007; 116(15): 1736-54

Infective endocarditis

Which procedures DO NOT require prophylaxis?

- Dental injections or X-rays
- Placement or adjustment of orthodontic appliances
- Bleeding from trauma to lips or oral mucosa
- Shedding of deciduous teeth
- Bronchoscopy without biopsy
- GI or GU procedures without active infection



Infective endocarditis

Drugs for PROPHYLAXIS

Situation	Drug	Dose
Oral	Amoxicillin	2 grams PO
Unable to take oral	Ampicillin	2 grams IM or IV
	Cefazolin	1 gram IM or IV
	Ceftriaxone	1 gram IM or IV
β -lactam allergy	Clindamycin	600 mg PO
	Azithromycin	500 mg PO
	Clarithromycin	500 mg PO
β -lactam allergy AND unable to take oral	Clindamycin	600 mg IM or IV

Infective endocarditis

Prophylaxis

- **Which patients?**
 - Highest risk for adverse outcomes
 - Low/moderate risk → No prophylaxis
- **Which procedures?**
 - Most dental procedures
 - GI/GU procedures → No prophylaxis
- **Which drugs?**
 - Cover viridans group streptococci
 - Single dose 30-60 minutes before procedure

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Infective endocarditis

Active Infection

- When should you suspect infective endocarditis?

Risk Factors
Valvular heart disease
Prosthetic valves
IV drug use
Congenital heart disease
Immunocompromised state

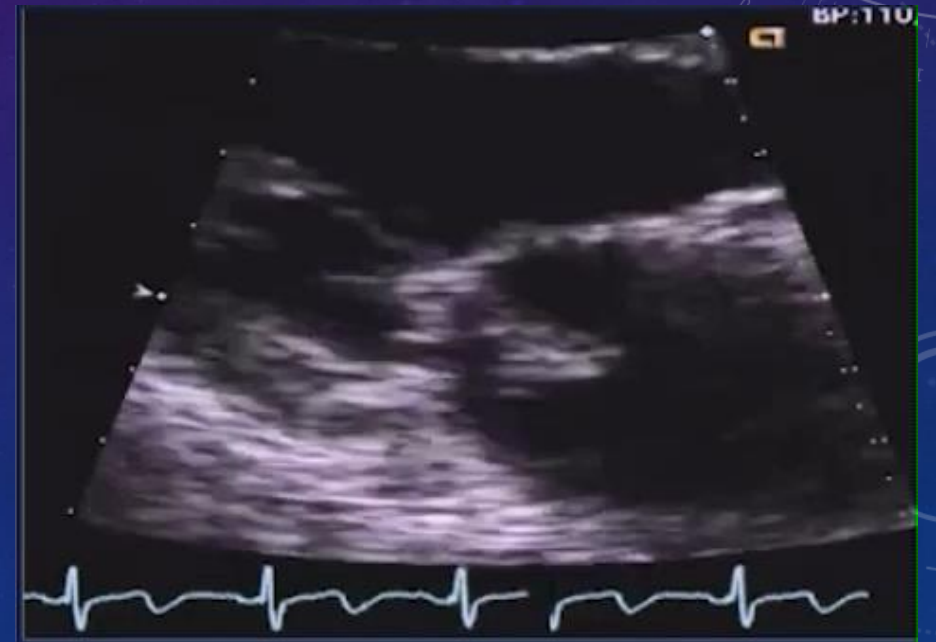
Unexplained fever ≥ 48 hours

OR

New left-sided valvular regurgitation

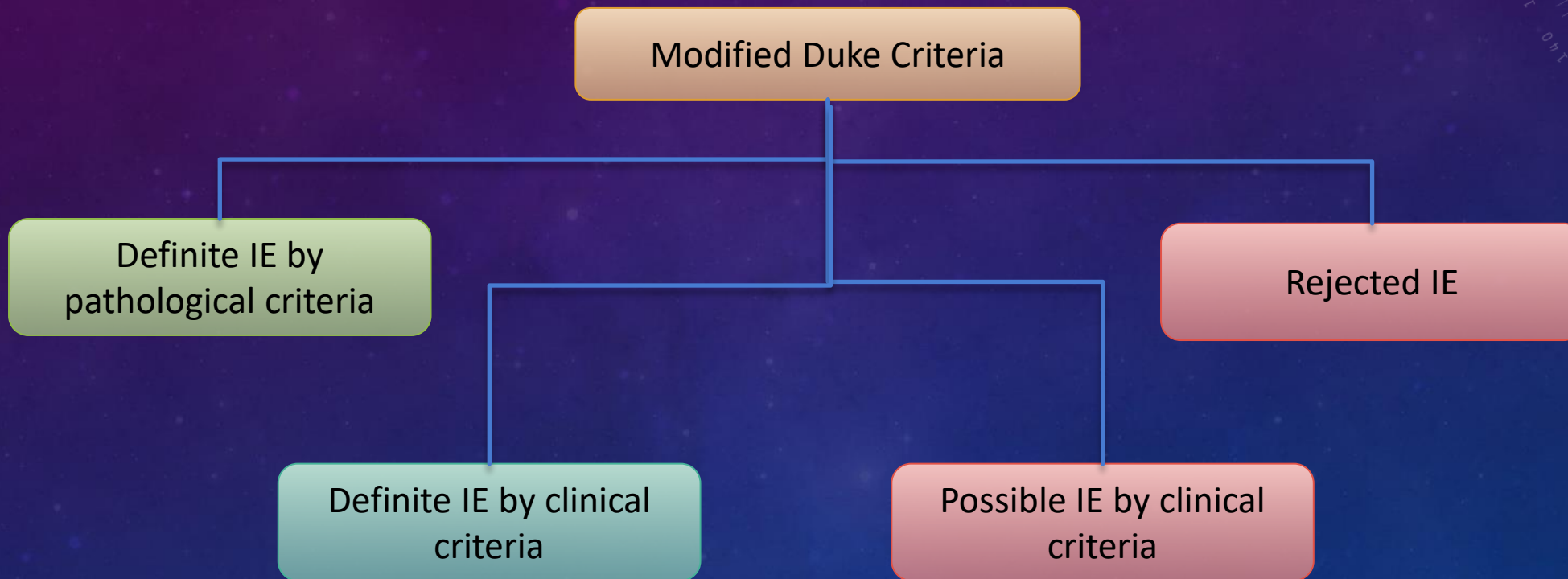
Evaluation of suspected IE

- Blood cultures
 - 2-3 sets >1 hour apart if acute, 3 sets >6 hours apart if subacute
 - Before initiation of antibiotics.
- Transthoracic echocardiogram
- Transesophageal echocardiogram
 - If non-diagnostic TTE
 - Complications suspected
 - Intra-cardiac lead
 - *S. aureus* bacteremia
 - Prosthetic valve + persistent fever
- Cardiac CT: if perivalvular involvement



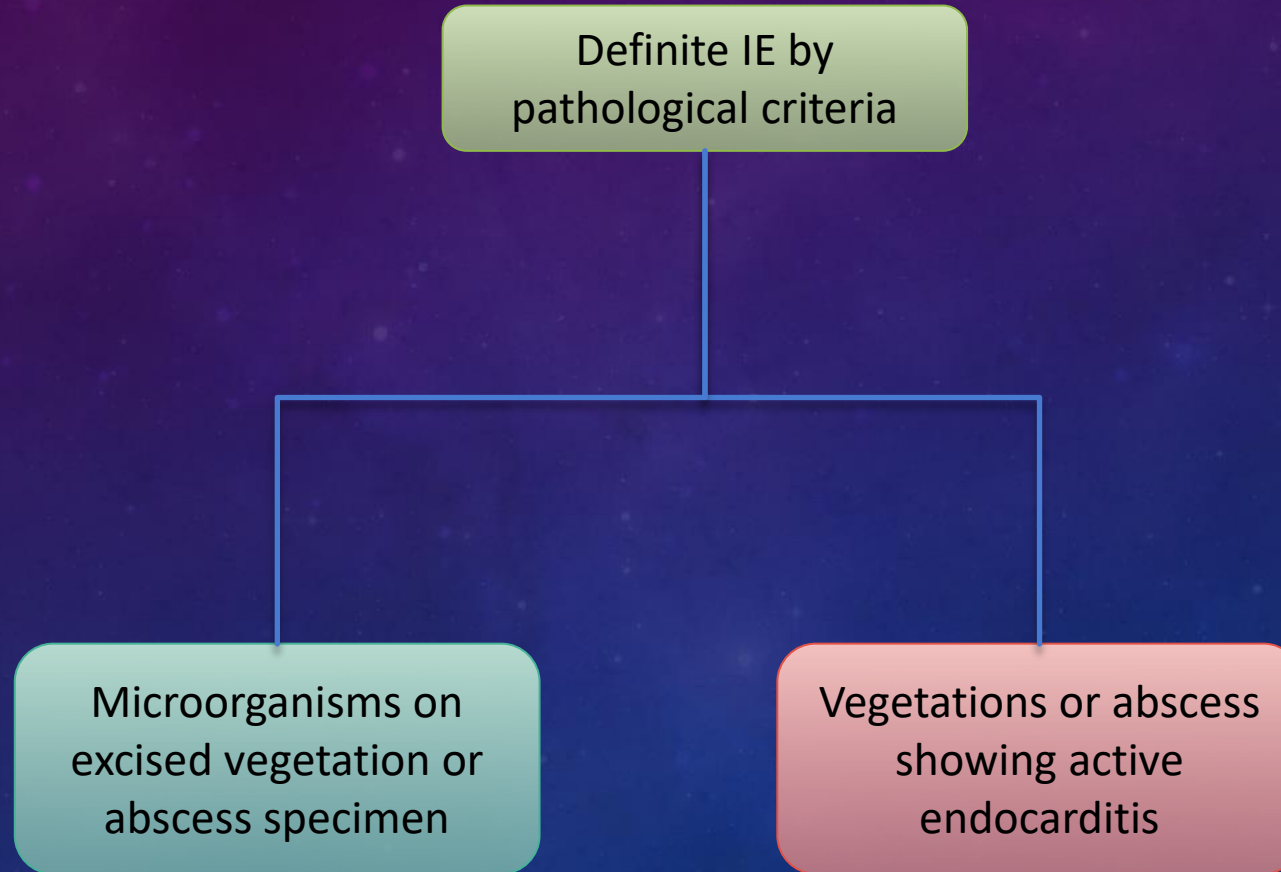
Infective Endocarditis

Diagnosis



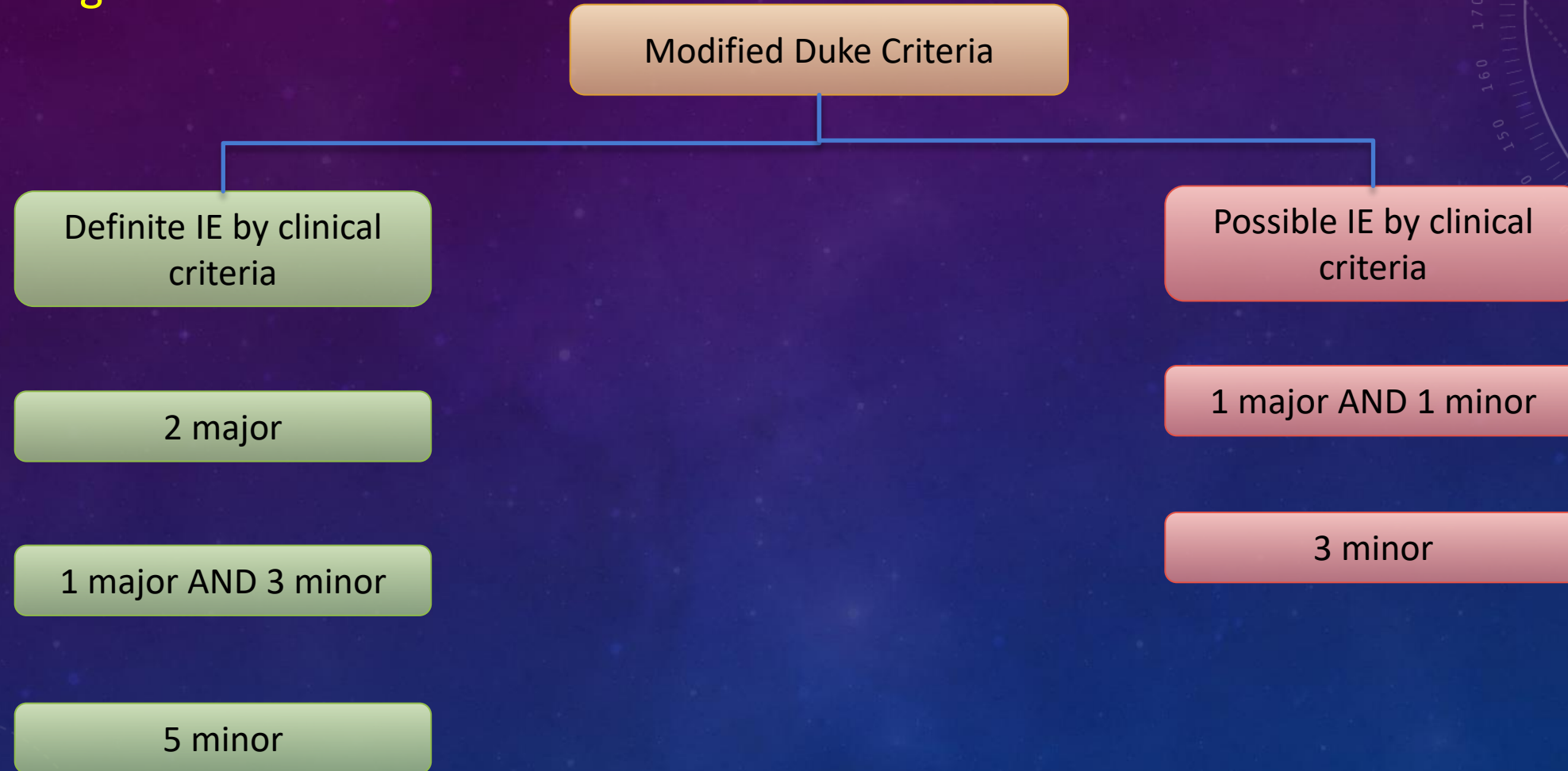
Infective Endocarditis

Diagnosis



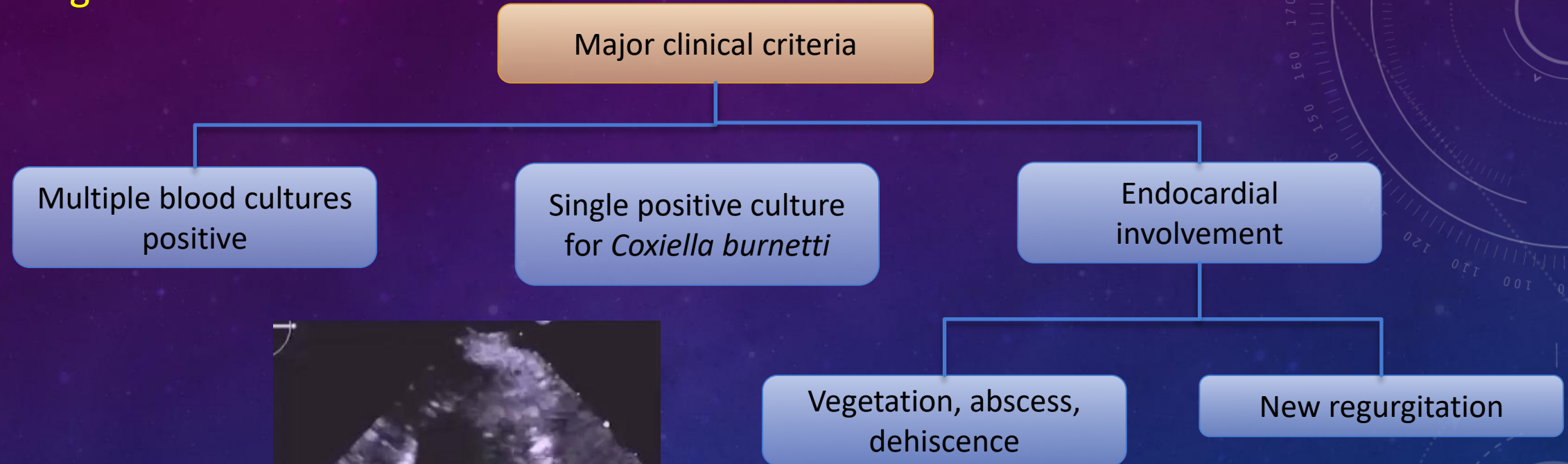
Infective Endocarditis

Diagnosis



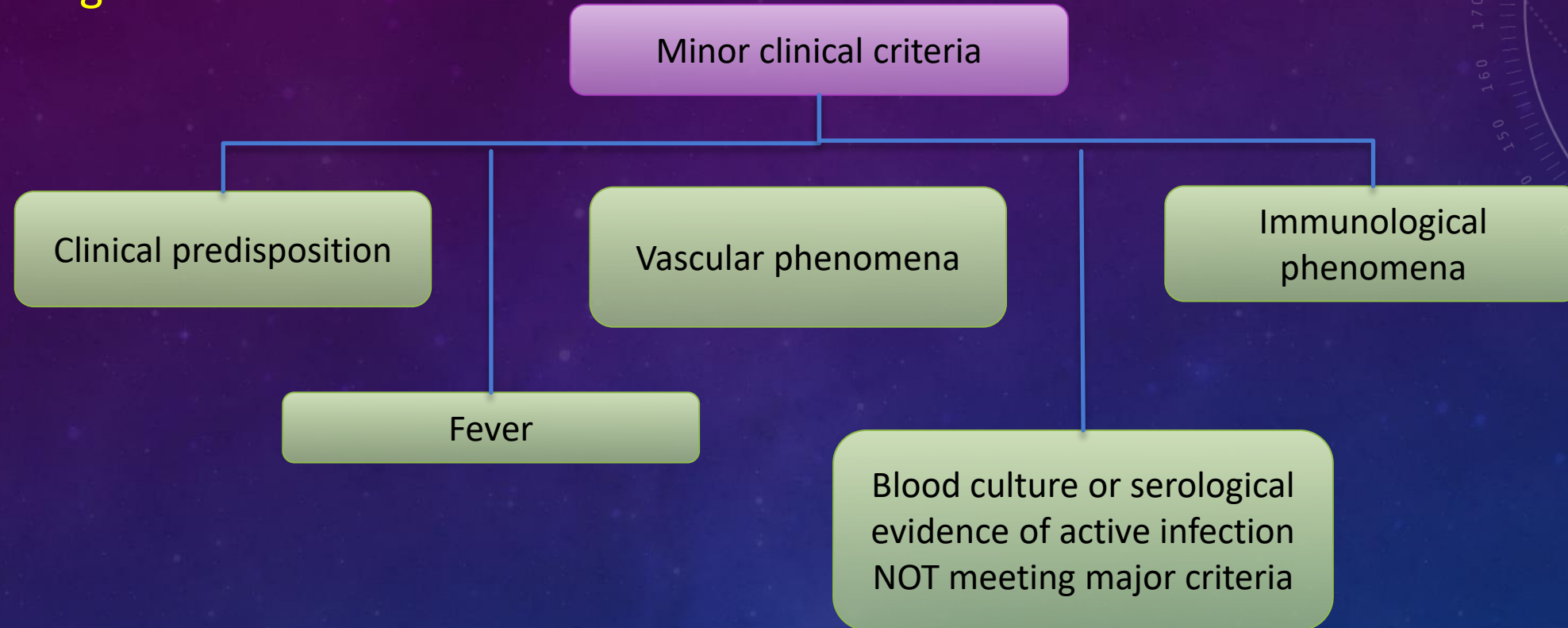
Infective Endocarditis

Diagnosis



Infective Endocarditis

Diagnosis



Vascular Phenomena

Janeway Lesions



Painless septic emboli

Vascular Phenomena

Conjunctival Hemorrhage



Vascular Phenomena

Splinter Hemorrhage



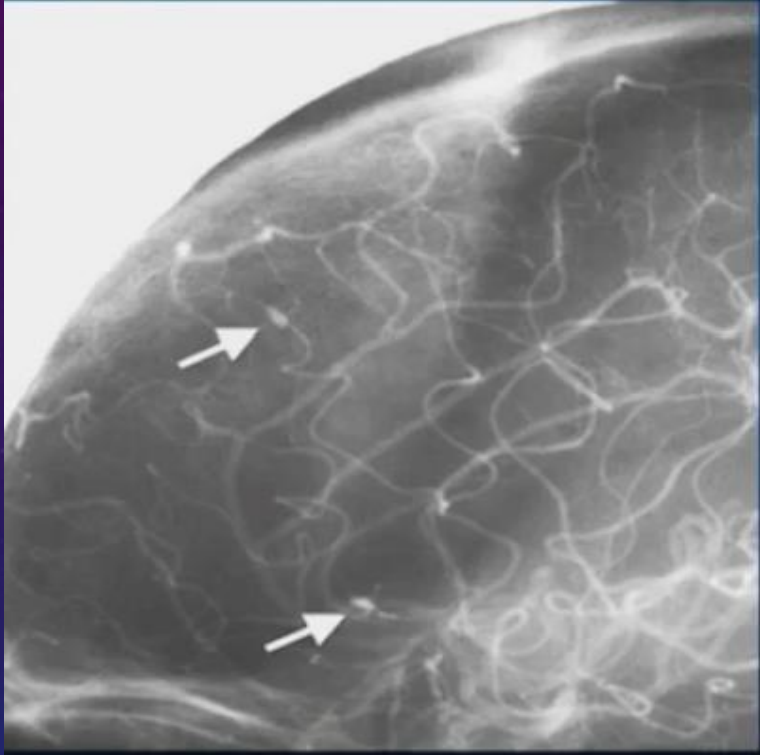
Traumatic



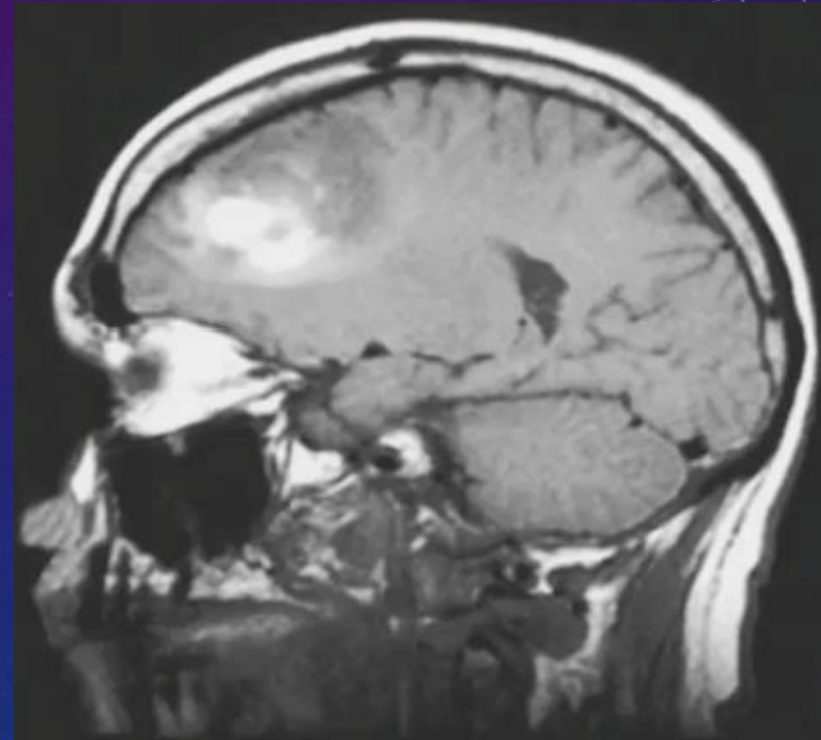
Embolic

Vascular Phenomena

Cerebral Involvement



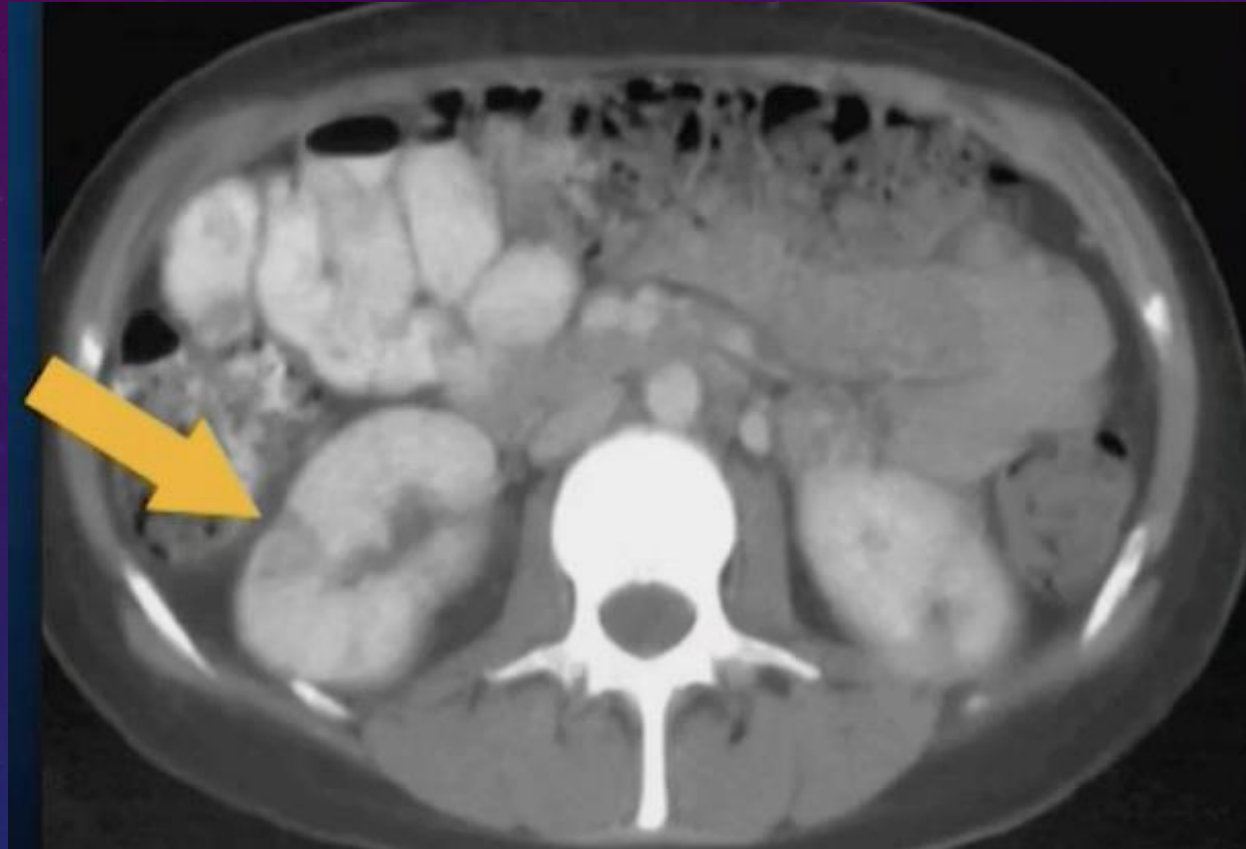
Mycotic Aneurysms



Cerebral Hemorrhage

Vascular Phenomena

Embolic Infarcts



Renal Infarct

Immunological Phenomena

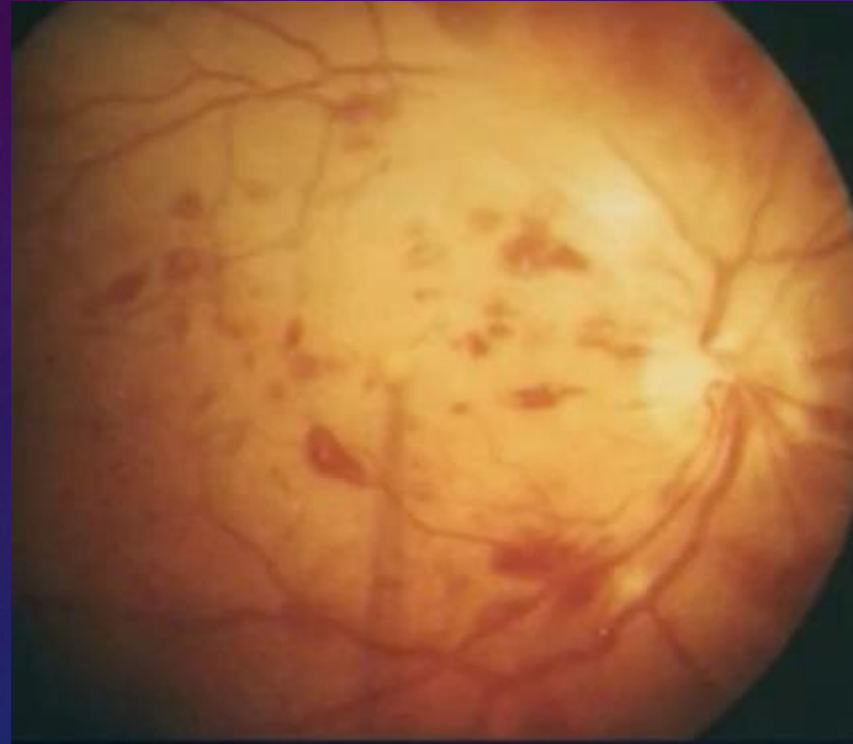
Osler's Nodes



Immune complex deposition → Necrotizing vasculitis

Immunological Phenomena

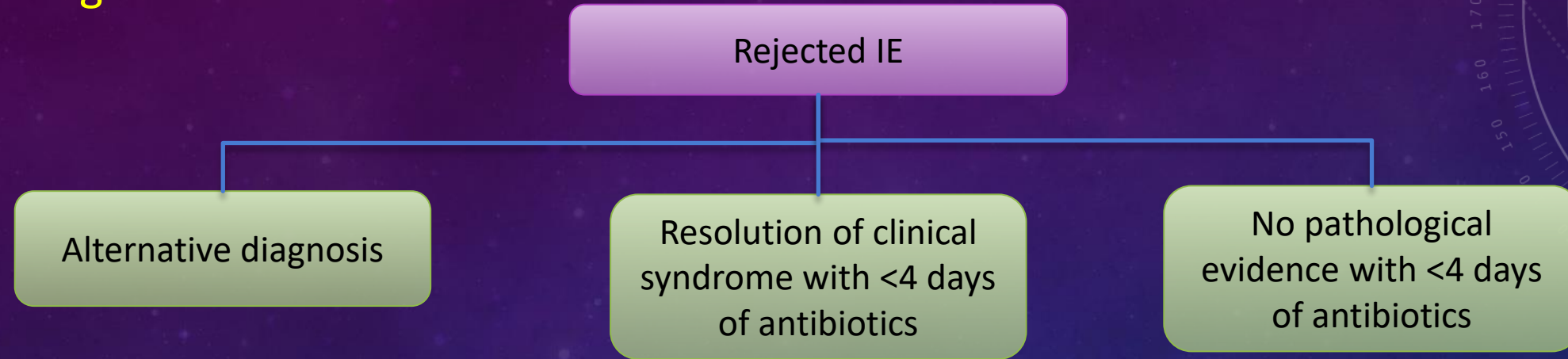
Roth Spots



Exudative retinal lesions with pale center
Immune-mediated vasculitis

Infective Endocarditis

Diagnosis



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Infective Endocarditis

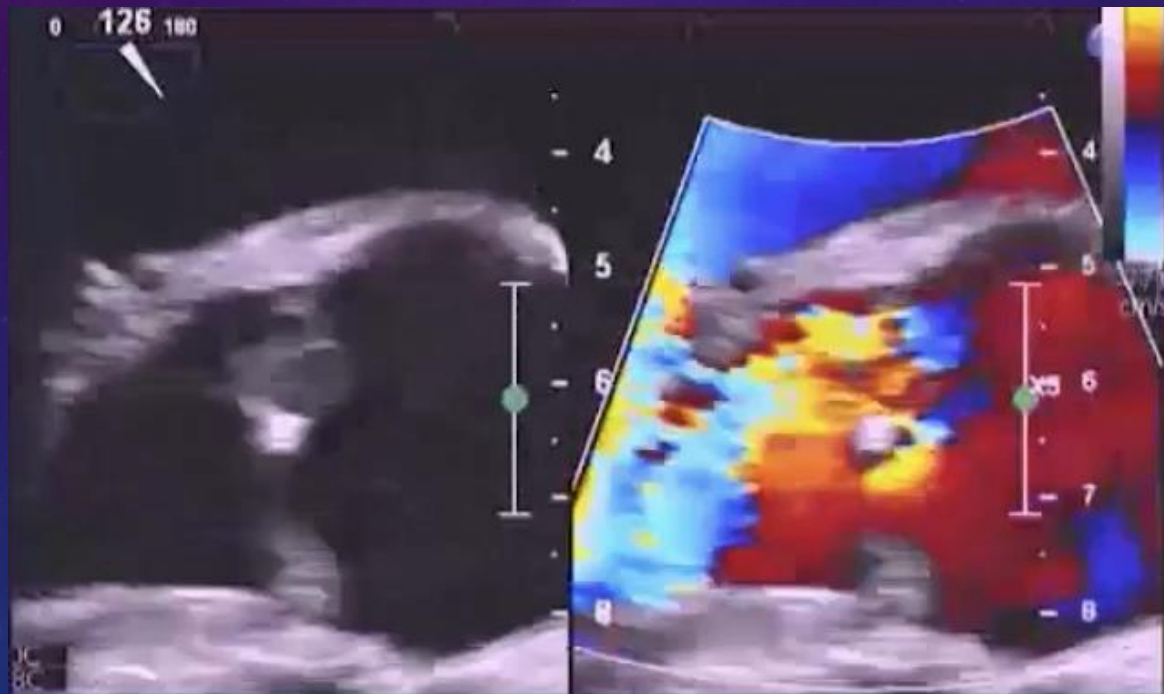
Complications

1. Local
2. Systemic
3. Immunological

Infective Endocarditis

Complications

Valvular destruction, HF



Infective Endocarditis

Complications

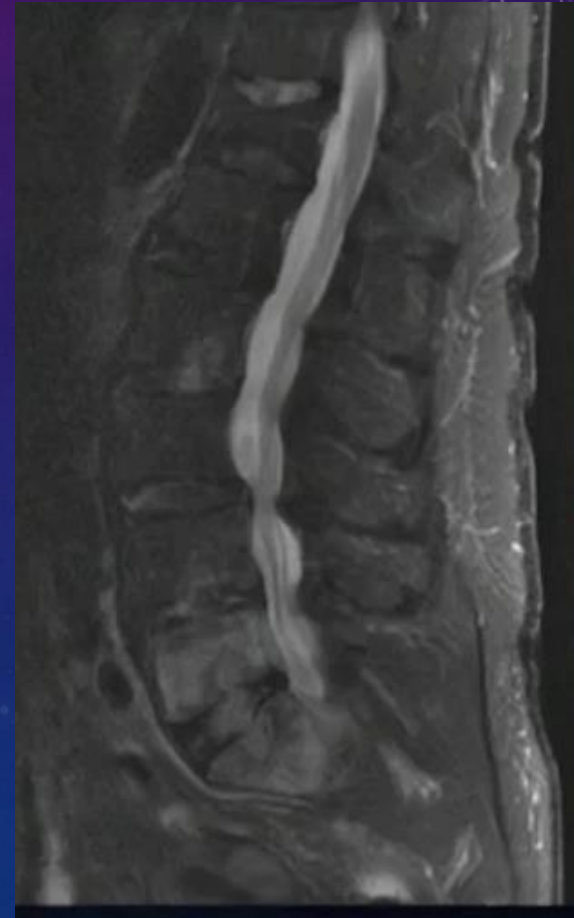
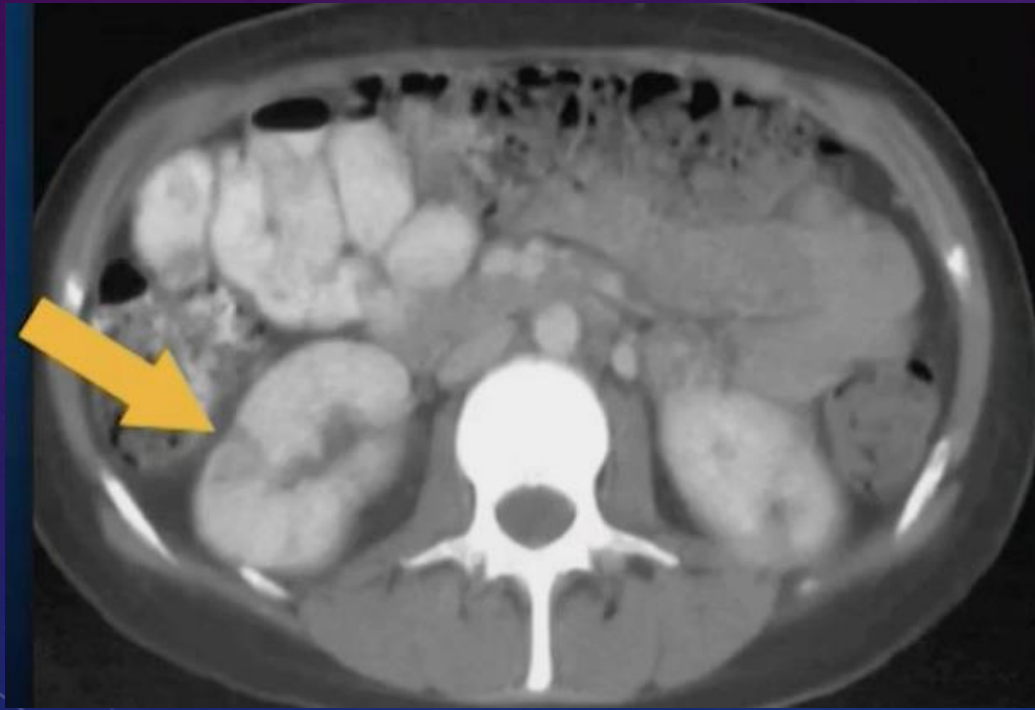
Perivalvular Extension



Infective Endocarditis

Complications

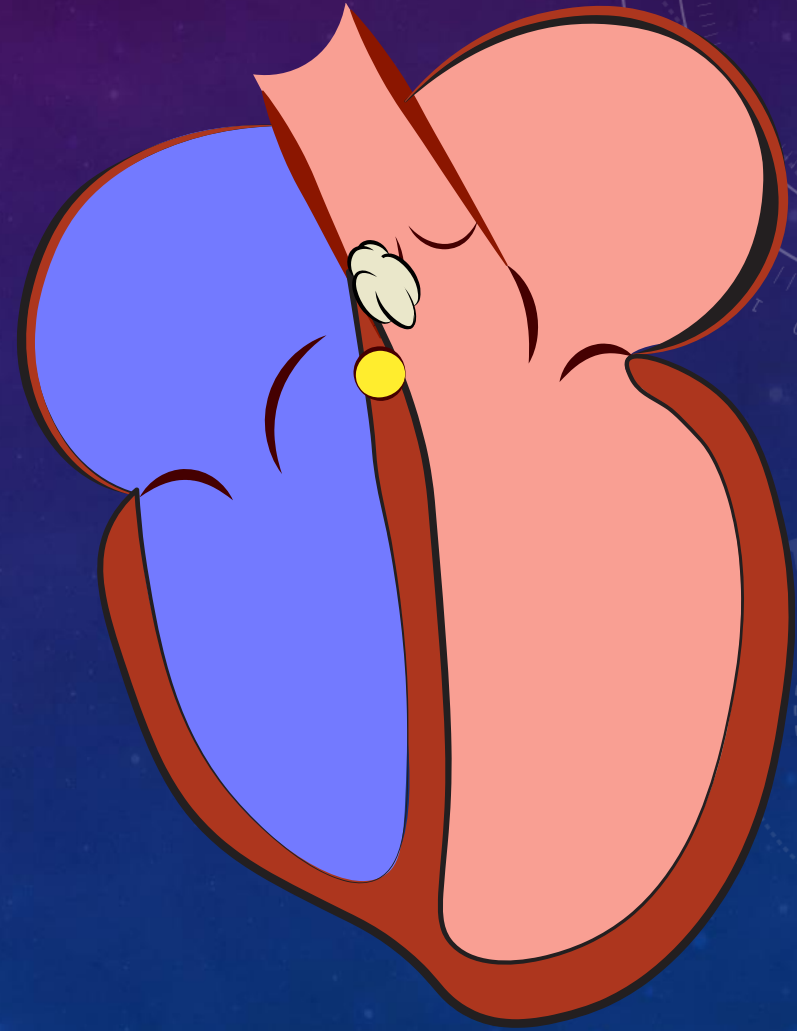
Embolism/metastasis



Infective Endocarditis

Complications

Electric Abnormalities



Infective Endocarditis

Complications

1. Local

- Valvular destruction → Heart failure
- Peri-valvular extension → Heart block

2. Systemic

- Embolism to any vascular territory
- Distant infection

3. Immunological

- Osler nodes, Roth spots
- Glomerulonephritis, rheumatoid

Infective Endocarditis

Management

1. Medical
2. Surgical



Infective Endocarditis

Antimicrobial therapy

- *viridans* group *Streptococci*
- *Staphylococcus* species
- *Enterococcus* species



- Therapy should be:
 - Prolonged
 - Parenteral
 - Bactericidal

Infective Endocarditis

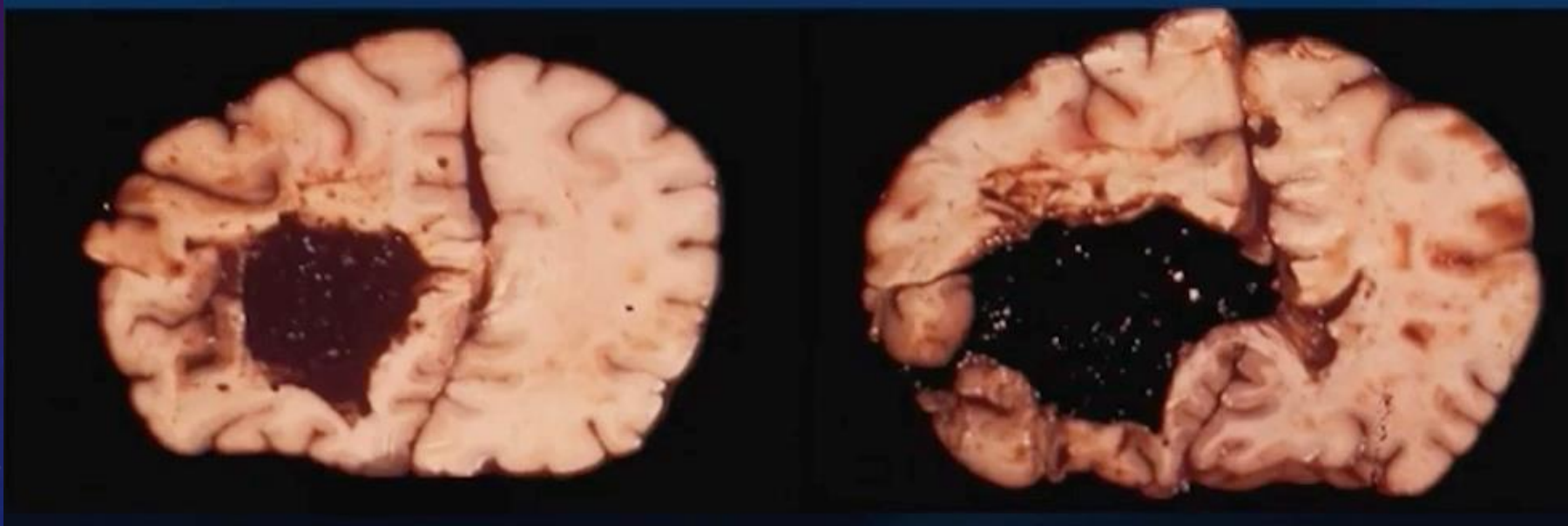
Antimicrobial therapy

	Viridans group streptococci	Staphylococcus	Enterococcus
	Penicillin susceptible	Penicillin resistant	
Native valve	<u>4 weeks</u> Penicillin OR Ceftriaxone	<u>4 weeks</u> Penicillin OR Ceftriaxone	<u>4-6 weeks</u> Pen / Amp + Gentamicin
	<u>2 weeks</u> Above + Gentamicin	AND <u>2 weeks</u> Gentamicin	<u>6 weeks</u> Amp + Ceftriaxone
Prosthetic valve	<u>6 weeks</u> Penicillin OR Ceftriaxone ± <u>2 weeks</u> Gentamicin	<u>6 weeks</u> Penicillin OR Ceftriaxone AND Gentamicin	<u>6 weeks</u> Pen / Amp + Gentamicin <u>6 weeks</u> Amp + Ceftriaxone
			<u>6 weeks</u> Above + Rifampin AND <u>2 weeks</u> Gentamicin

Infective Endocarditis

Anticoagulation

Neurological complications in infective endocarditis



Infective Endocarditis

Anticoagulation

Neurological complications in infective endocarditis



- Guideline Recommendations:

1. Discontinue all forms of anticoagulation in patients with mechanical valve infective endocarditis and a CNS embolic event for ≥ 2 weeks
2. Do not start aspirin or other antiplatelet agents as adjunctive therapy in infective endocarditis

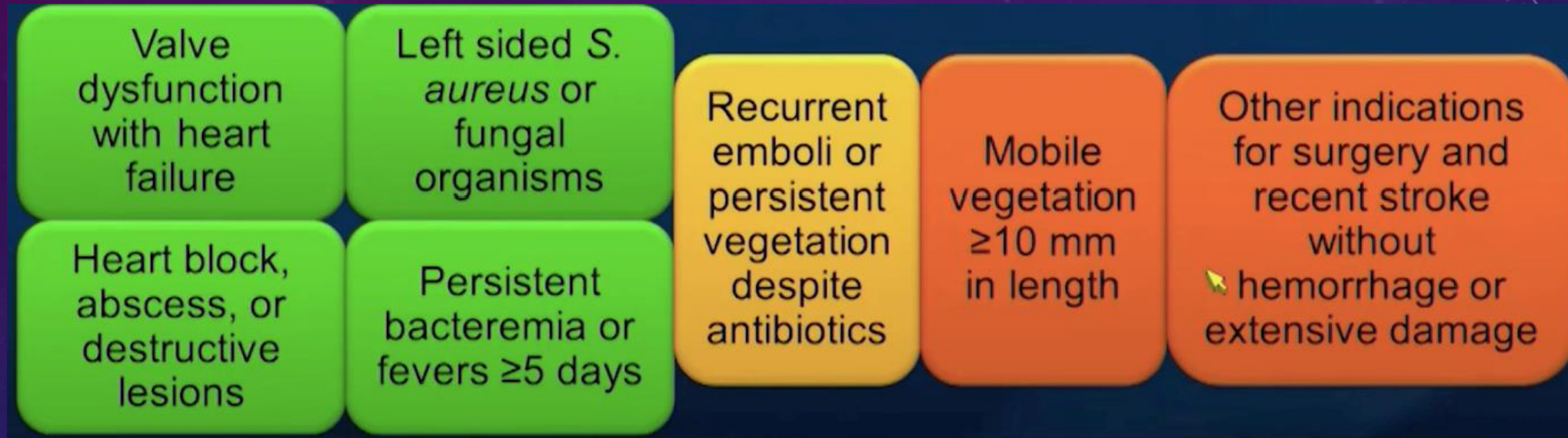
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Infective Endocarditis

Surgical Management

Which patients need surgical intervention?



Operate during initial hospitalization before completion of antibiotics

Infective Endocarditis

Surgical Management

- Extensive stroke or hemorrhage → Delay surgery 4 weeks
- Relapsing prosthetic valve endocarditis:
 - Exclude alternative portal
 - Timing of operation unclear
- Device involved → Remove
- Device present but leads and pocket not clearly infected:
 - *S. aureus* or fungal infection → remove
 - Valve surgery → remove

Infective Endocarditis

Management

1. Medical

- Prolonged, parenteral targeted antibiotics
- Withhold anticoagulation with CNS events

2. Surgical

- Operate early if complications
- Remove any intra-cardiac devices



Infective Endocarditis

Right-sided endocarditis

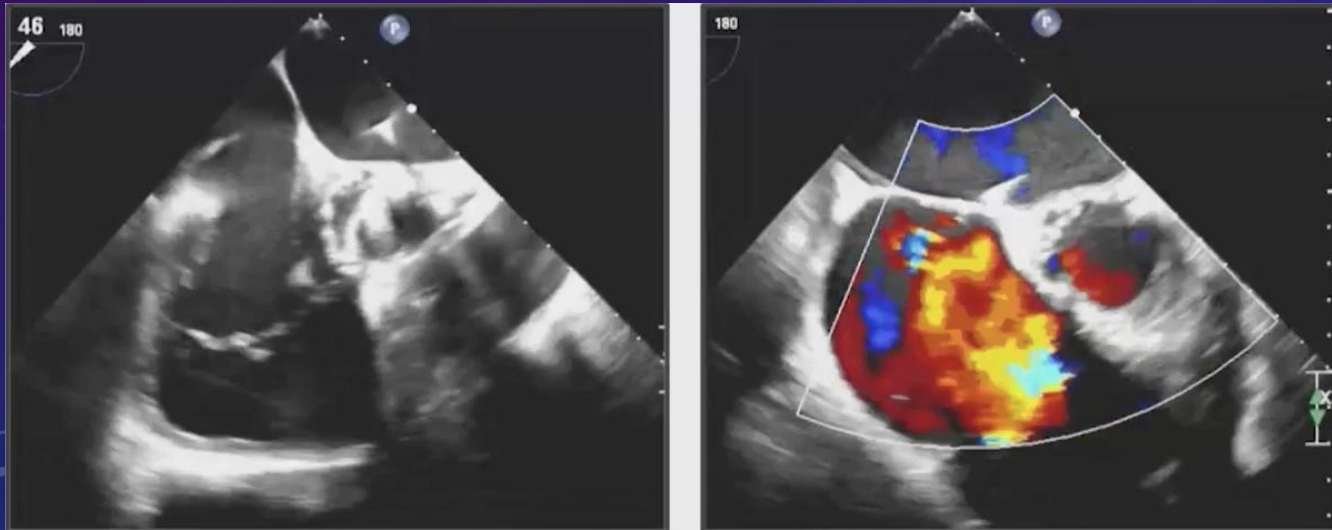
RV IE = *S. aureus* + IV drug use

1. Medical

- Uncomplicated MSSA → B-lactam x2-6 weeks
- MRSA → Vancomycin x6 weeks

2. Surgical

- RV failure + severe TR + ↓ Rx response
- Prolonged infection + resistant or fungal organism
- ≥20 mm vegetation + recurrent PE despite Rx



Infective Endocarditis

Device infections

Incidence and outcomes

- ~1-5% rate of device infections
- Risk higher with ICDs vs. permanent pacemakers
- Mortality ~5% at 30 days, ~15% at 1 year

Infective Endocarditis

Device infections: risk factors

1. Immunosuppression
2. Co-morbid conditions
3. Anticoagulant use
4. Operator inexperience
5. Amount of hardware
6. Lack of pre-procedure prophylaxis
7. Device manipulation

Infective Endocarditis

Device infections: management

1. Suspect device infection

- Fever, WBCs up, ESR up
- Erythema, swelling and erosion at generator site

2. Hx, physical exam, device interrogation

3. Blood cultures followed by antibiotics

Complete removal of the device

Infective Endocarditis

Device infections: management

When might the device remain?

1. Superficial infection at incision site
2. No pocket involvement
3. Bacteremia alone with ALL of the following:
 - Clinical stability, established alternative source
 - TEE negative for lead involvement
 - No involvement of pocket or recent manipulation
 - No valvular involvement or endocarditis
 - Resolution of bacteremia with antibiotics

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Device infections: management

When can the device be re-implanted?

1. Does the patient need a new device
2. Select new site, preferably contralateral
3. Wait for negative blood cultures
 - 72 hours after device removal
 - 14 days if valves involved

Infective Endocarditis

Device infections: summary

1. Epidemiology

- Device manipulation is a strong risk factor
- *Staphylococcus* sp. Are most common bugs

2. Management

- Established infection requires device removal
- Re-assess candidacy for new device before re-implantation

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Thank You