INFECTIVE ENDOCARDITIS

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ADVANCED HEART FAILURE & TRANSPLANT

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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?

1. Amoxicillin 2g orally
2. Cephalexin 2g orally
3. Clindamycin 600mg orally
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?

1. Definitive infective endocarditis
2. Possible infective endocarditis
3. Unlikely infective endocarditis
4. Rejected infective endocarditis

A 50yo lady 3 years s/p mechanical MVR presents with fever and malaise. She is hospitalized after blood cultures x2 grow viridans group streptococci. TEE shows a small vegetation on the mechanical MV. She receives appropriate antibiotics. On the 3rd hospital day, she develops transient left-sided visual loss that resolves after 7 minutes. MRI shows a small focus of occipital ischemia. She is on warfarin. INR is 2.9. How do you manage her anticoagulation?

1. Continue warfarin uninterrupted
2. Stop warfarin, start aspirin 81mg daily
3. Stop warfarin, bridge with IV unfractionated heparin.
4. Stop warfarin, start rivaroxaban
5. Stop warfarin.

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 on 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?

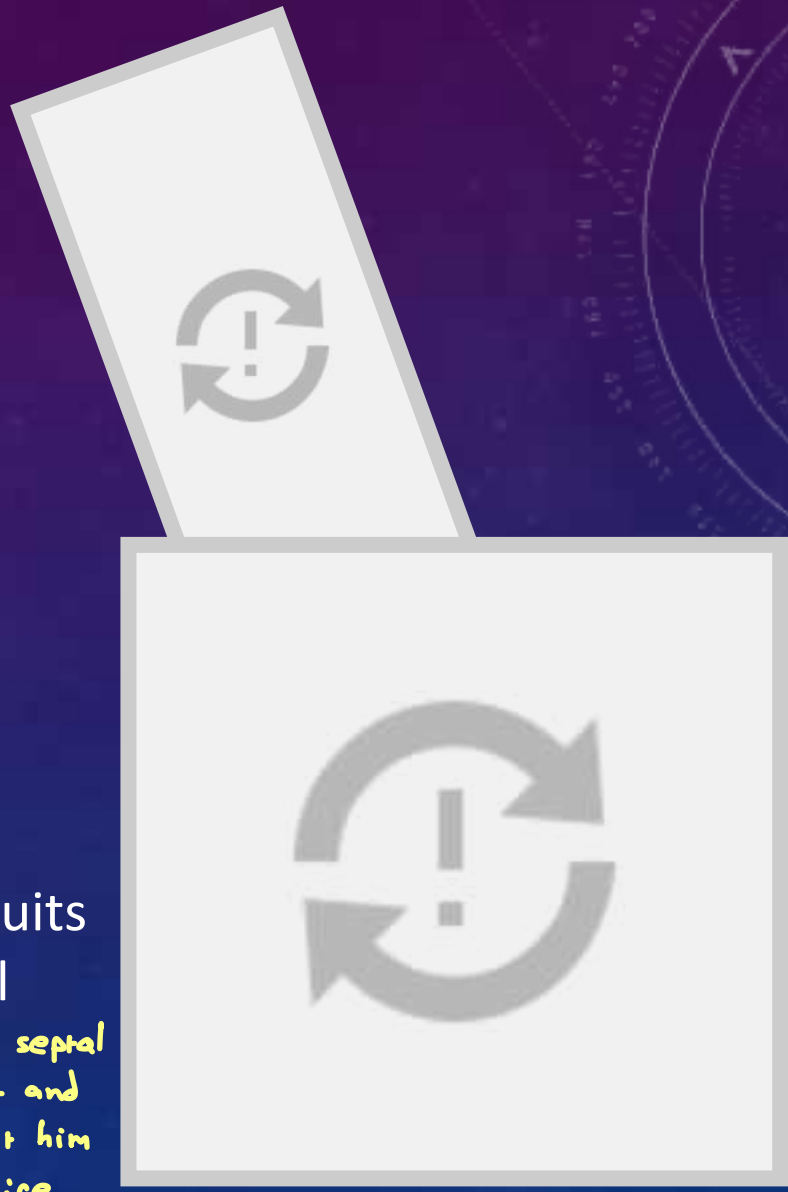
Infective endocarditis

Which patients?

Patients at highest risk for complications

Who has:

- 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 (right to left)
  - Repair ≤6 months ago with prosthetic material
  - Repaired lesions with residual defects



↳ atrial septal defect and we put him a device

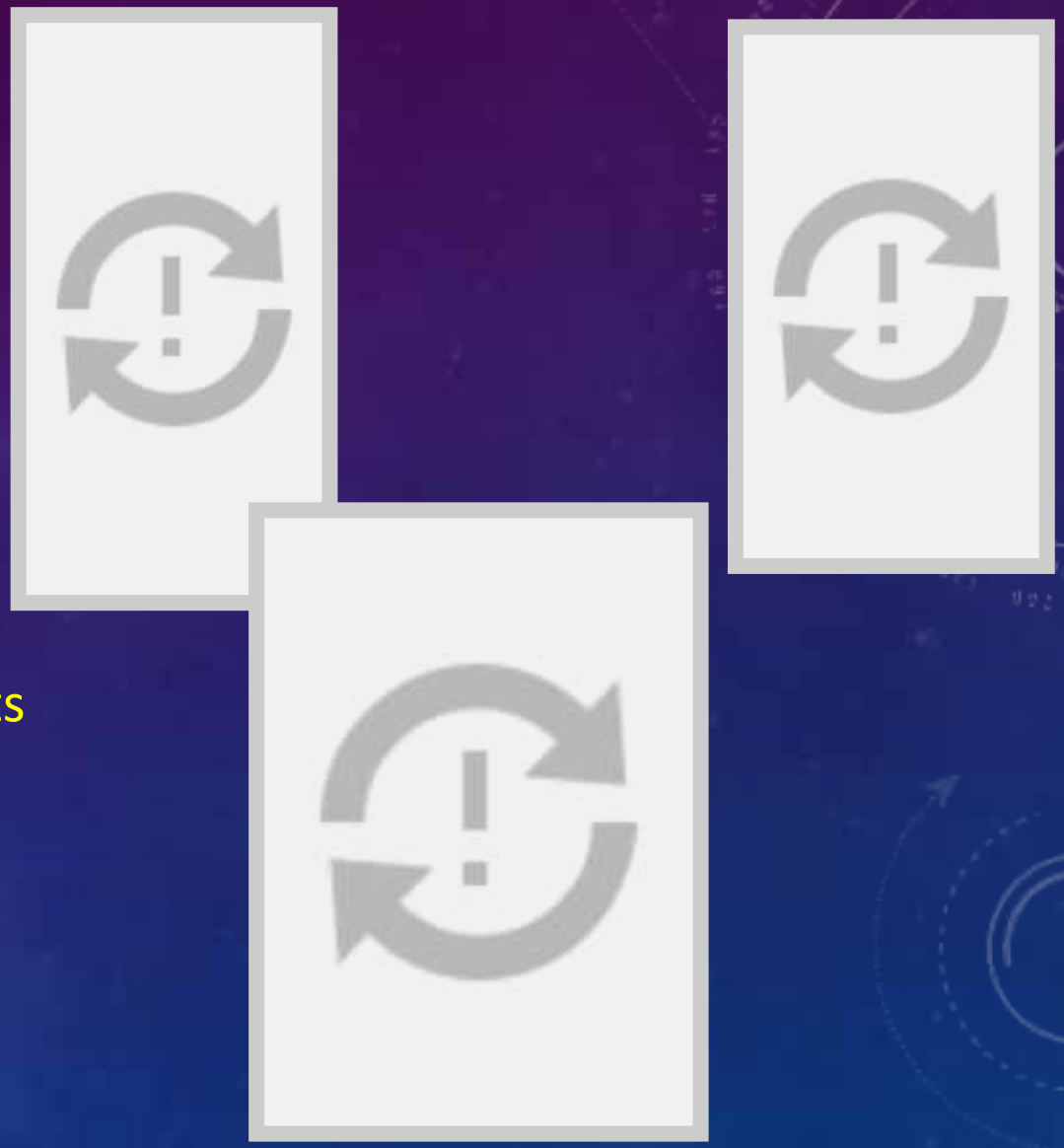
after 6 month there ↵ Will be epithelization

Nishimura RA, et al. JACC 2014; 63(22): e57-185
Wilson W, et al. Circulation 2007; 116(15): 1736-54

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

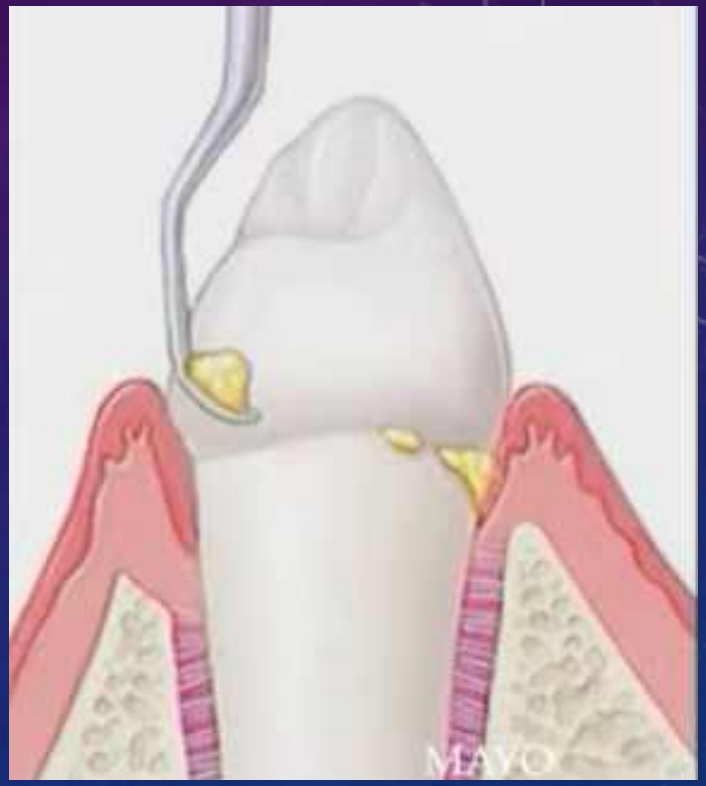


Dajani AS, et al. JAMA 1997; 227(22): 1794-1800

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
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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

↳ colonoscopy, cystoscopy

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

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

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

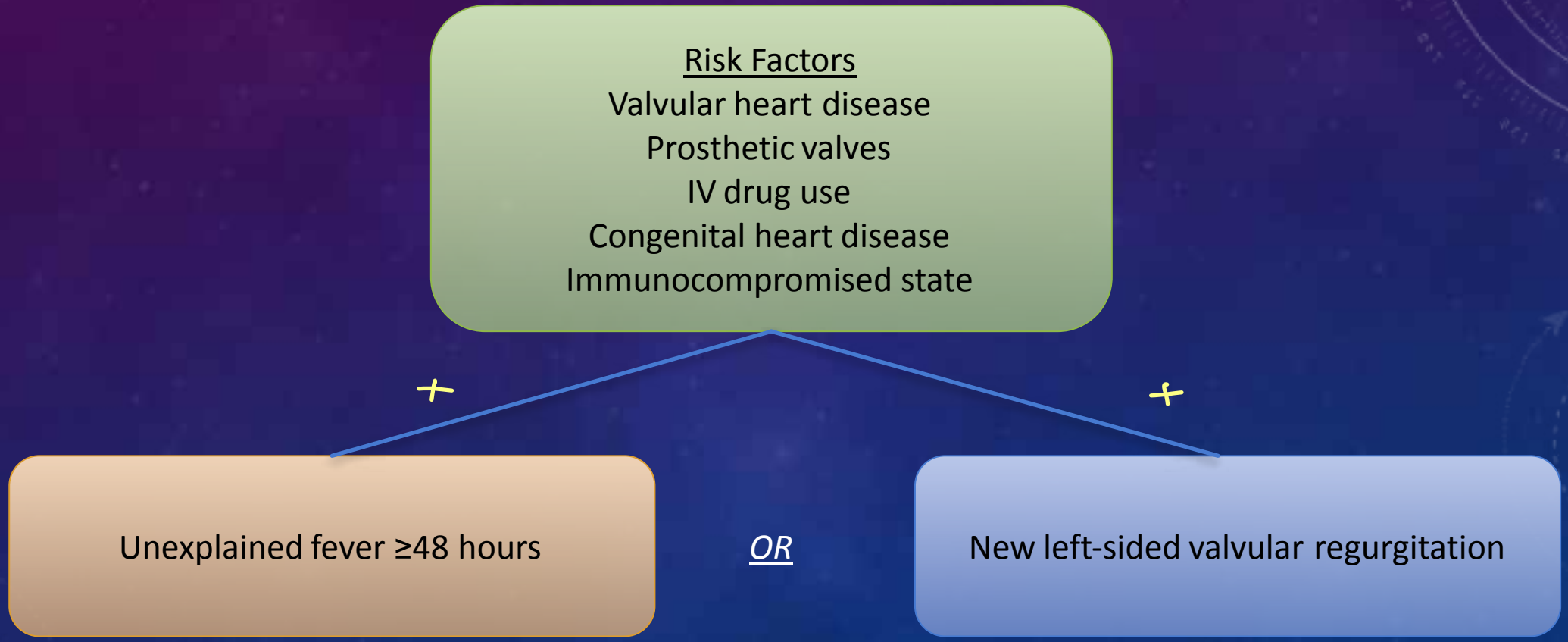
A 65yo gentleman underwent AVR with a St. Jude mechanical prosthesis for bicuspid aortic regurgitation 5 years ago. The patient is scheduled for a screening colonoscopy +/- polypectomy. He is asymptomatic. He has a soft, short early systolic ejection murmur on examination with a crisp closing click and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

1. Amoxicillin 2g orally if tooth extraction
2. Cephalexin 2g orally
3. Clindamycin 600mg orally if pencillin allergy
4. Ceftriaxone 1g IV
5. No pharmacological prophylaxis necessary

Infective endocarditis

Active Infection

- When should you suspect infective endocarditis?



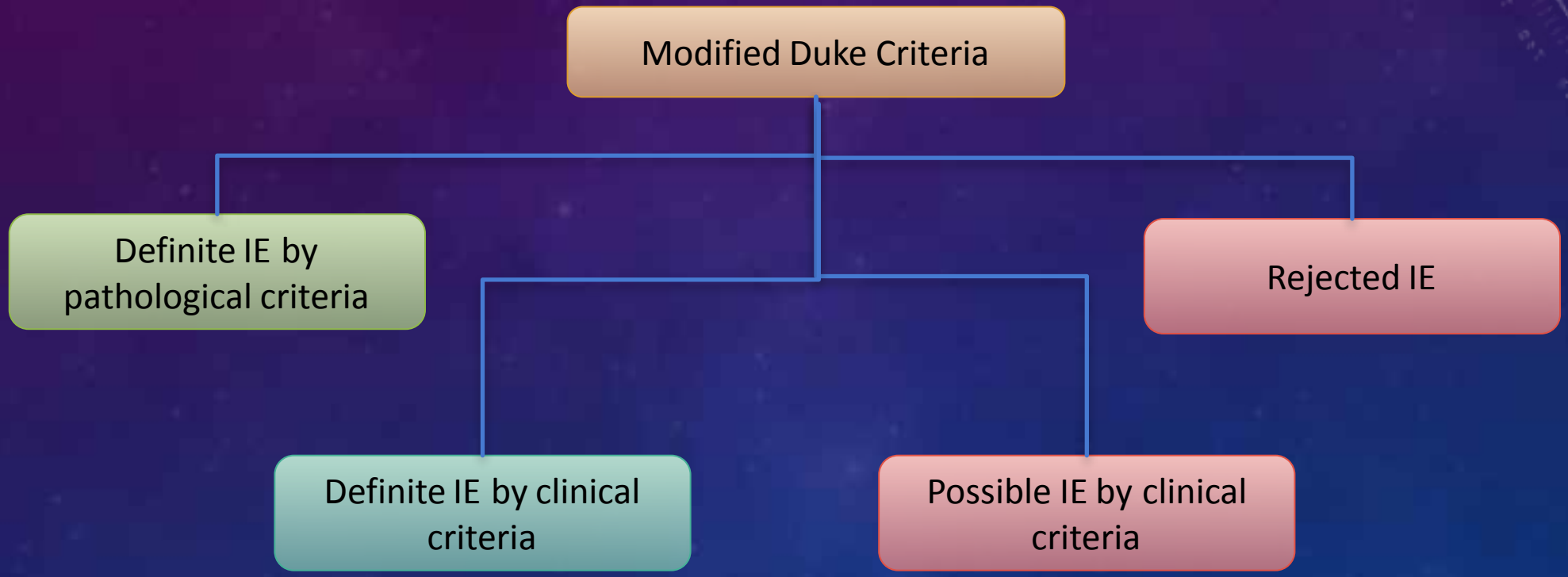
Nishimura RA, et al. JACC 2014; 63(22): e57-185

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

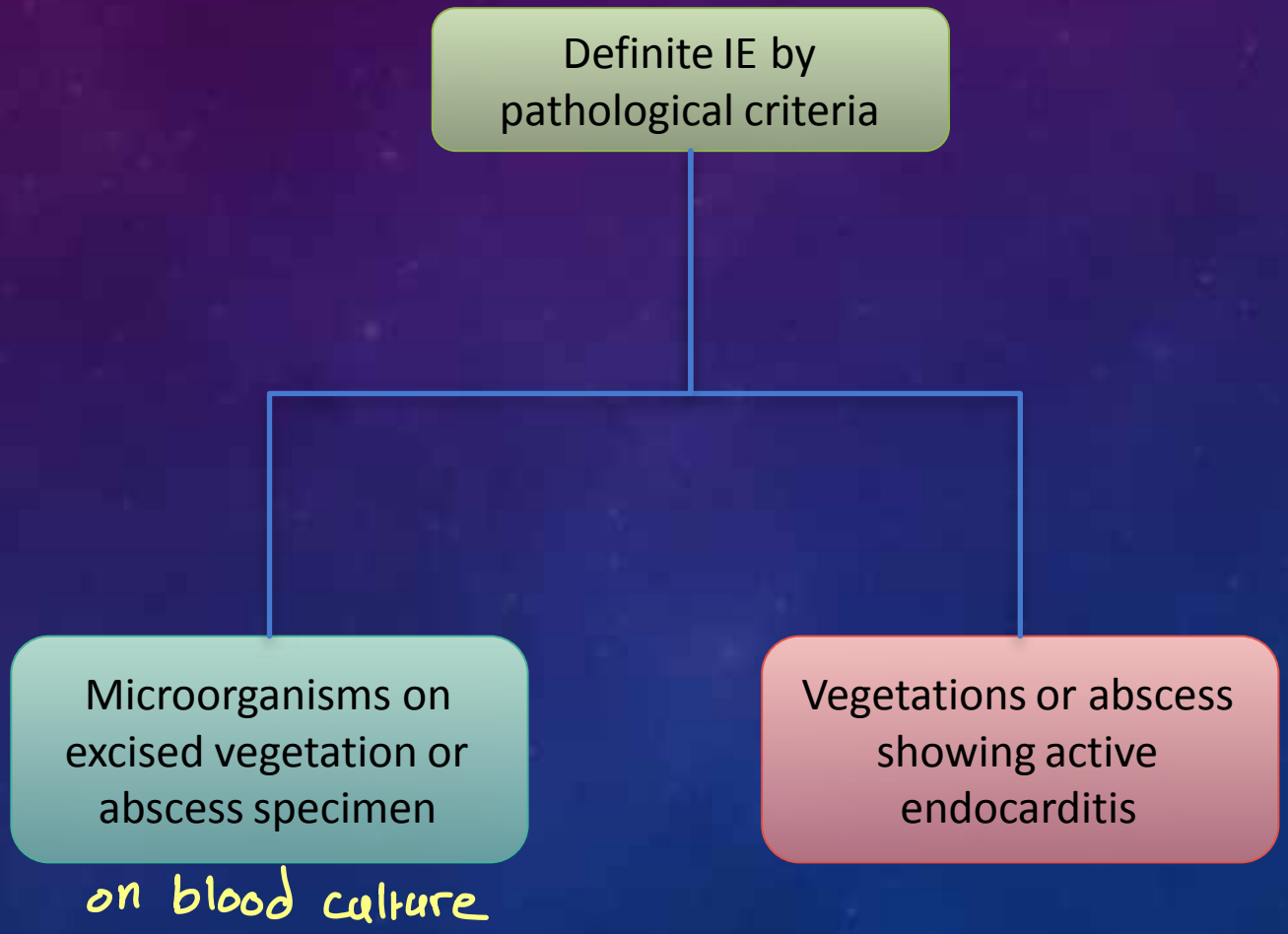
Infective Endocarditis

Diagnosis



Infective Endocarditis

Diagnosis



Infective Endocarditis

Diagnosis

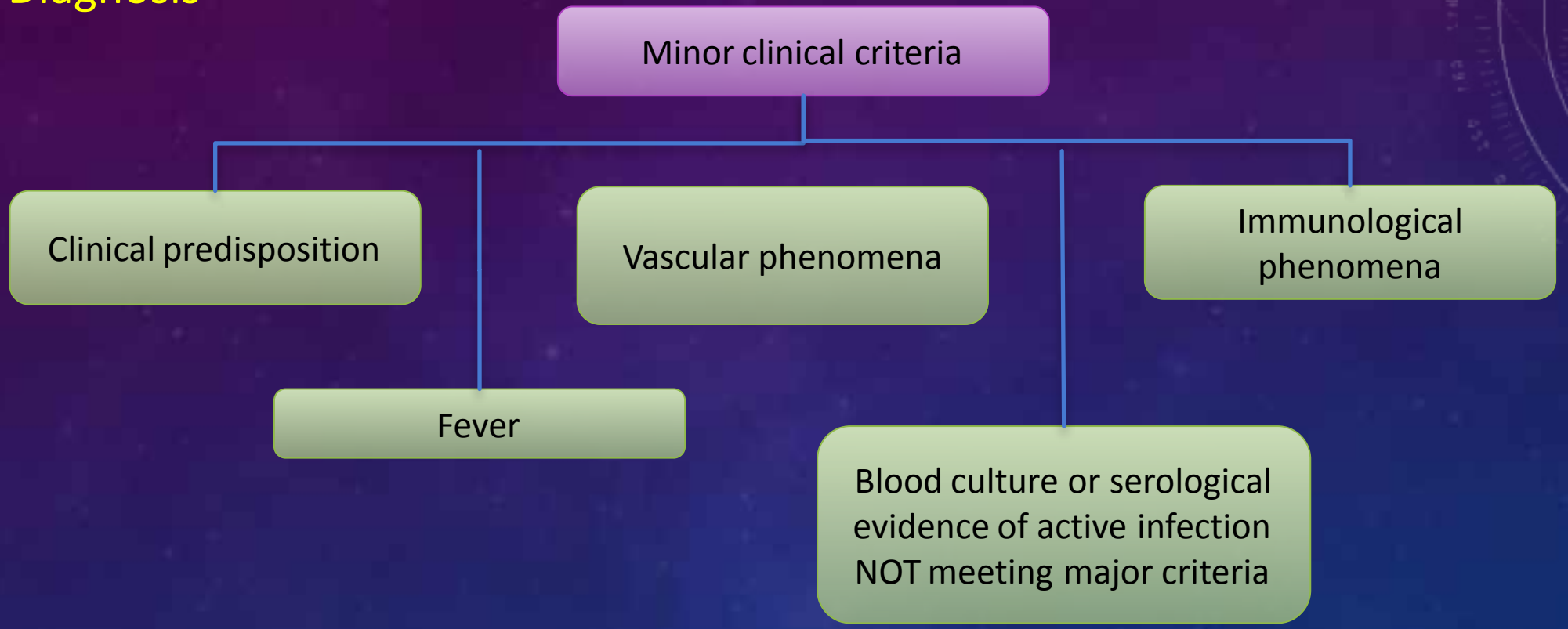
Infective Endocarditis

Diagnosis

- Major clinical criteria
  - Multiple blood cultures positive
  - Single positive culture for *Coxiella burnetti*
  - Endocardial involvement
    - Vegetation, abscess, dehiscence
    - New regurgitation

Infective Endocarditis

Diagnosis



Vascular Phenomena

Janeway Lesions

Painless septic emboli

↳ from the valve vegetations

Vascular Phenomena

Conjunctival Hemorrhage

Vascular Phenomena

Splinter Hemorrhage

بتصوير على اصبع المريض
إذا بيه
↓

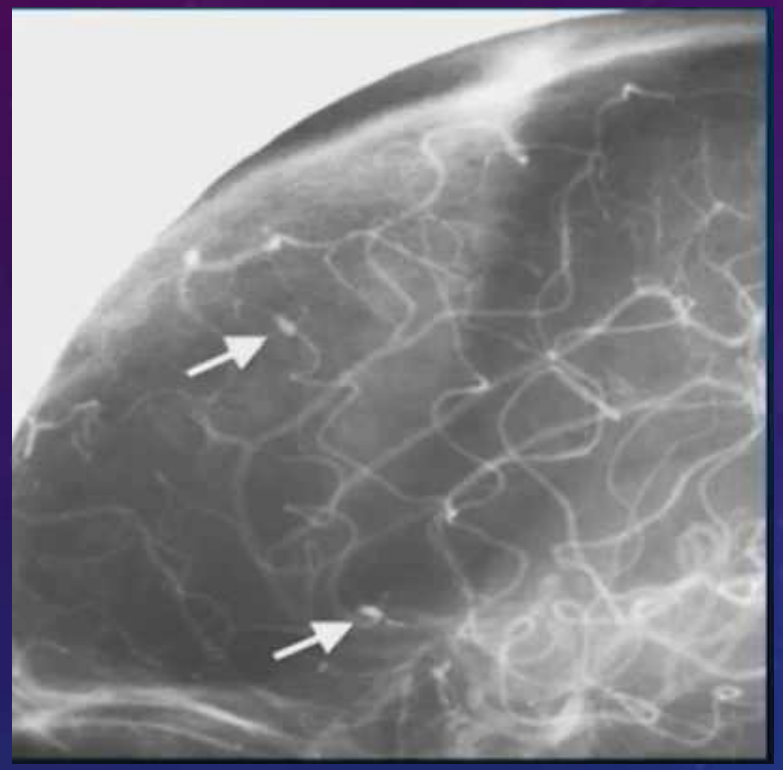
Traumatic

Embolic

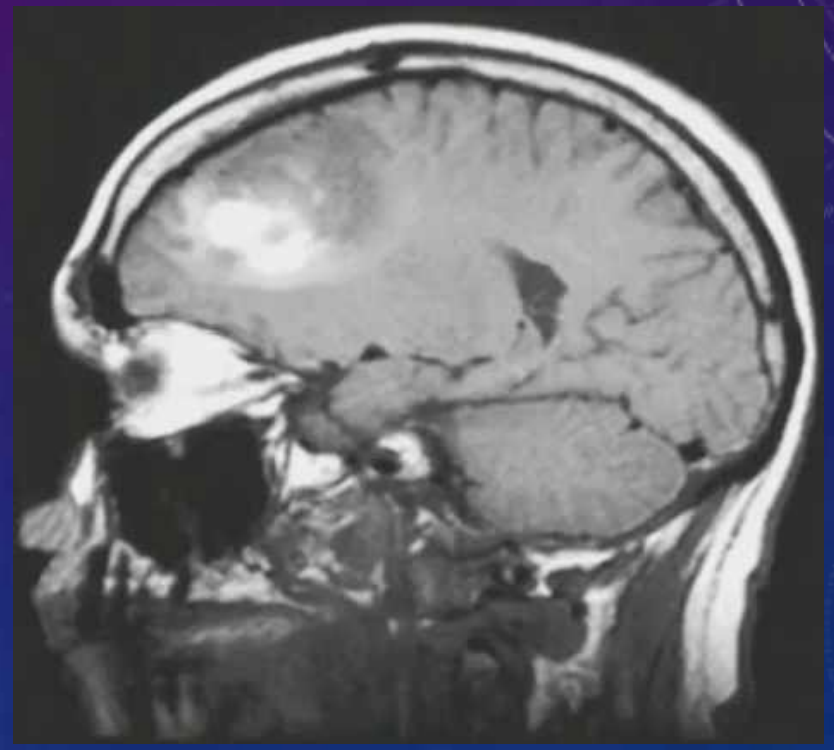
splinter hemorrhage

Vascular Phenomena

Cerebral Involvement



Mycotic Aneurysms

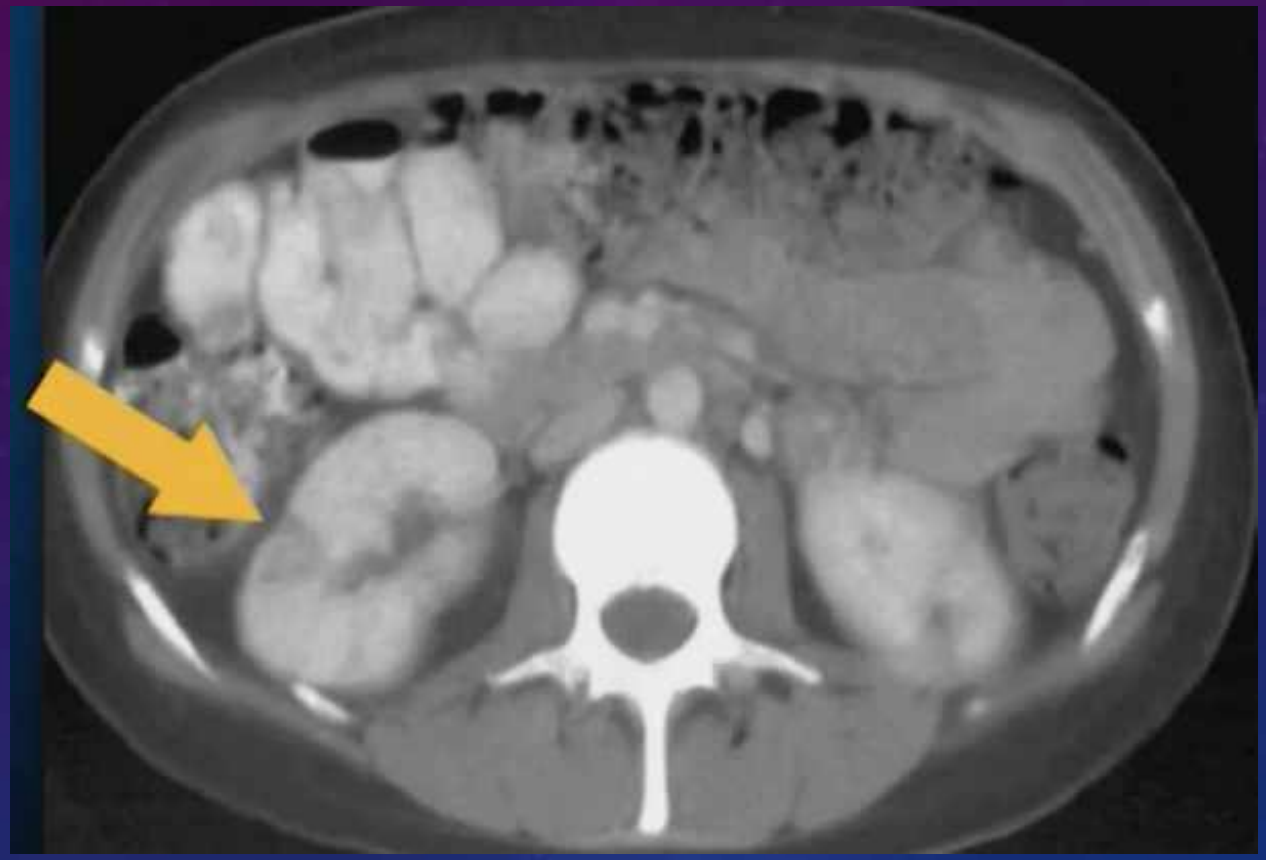


Cerebral Hemorrhage

Vascular Phenomena

Embolic Infarcts

↳ to arteries of GI → causes mesenteric ischemia



Renal Infarct

Immunological Phenomena

Osler's Nodes

Oush → painful

Immune complex deposition ? Necrotizing vasculitis

inflammation in lesions

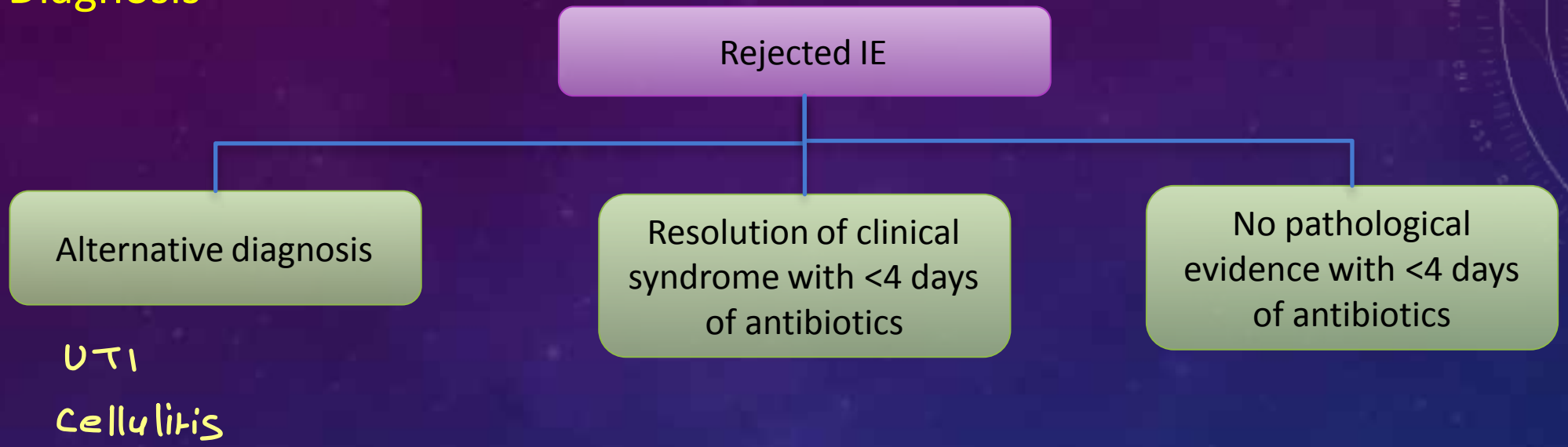
Immunological Phenomena

Roth Spots

Exudative retinal lesions with pale center
Immune-mediated vasculitis

Infective Endocarditis

Diagnosis



UTI

Cellulitis

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?

Minor

Major

1. Definitive infective endocarditis
2. Possible infective endocarditis
3. Unlikely infective endocarditis
4. Rejected infective endocarditis

Infective Endocarditis

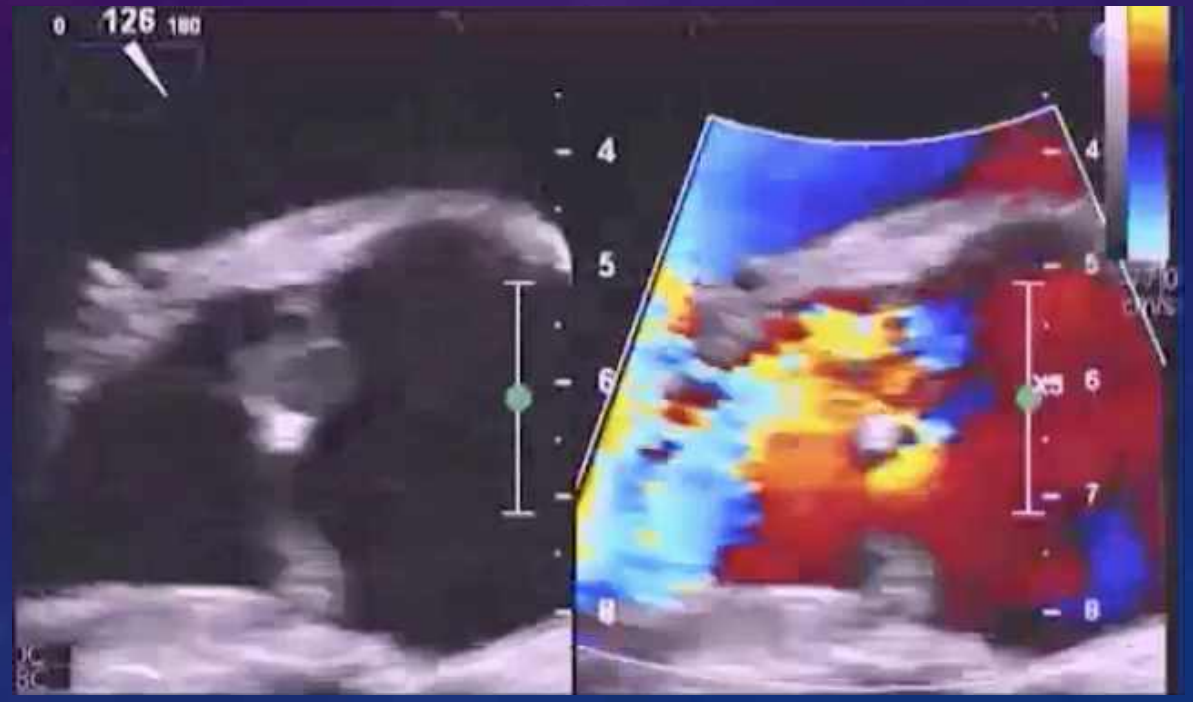
Complications

1. Local
2. Systemic
3. Immunological

Infective Endocarditis

Complications

Valvular destruction, HF



Infective Endocarditis

Complications

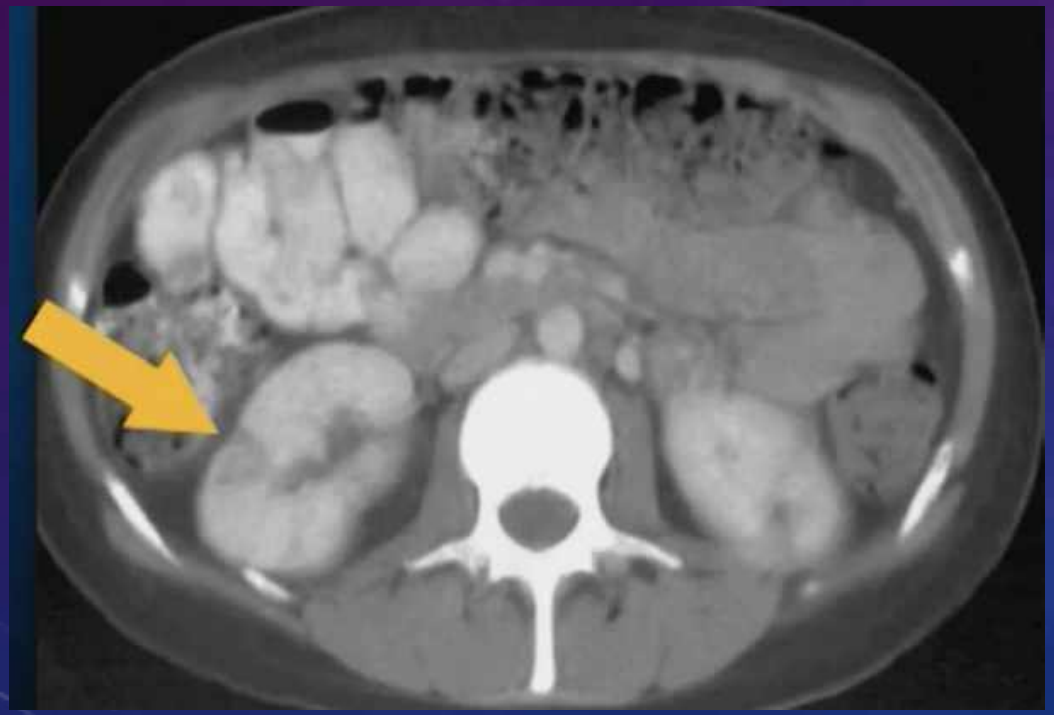
Perivalvular Extension

on annulus → abcess

Infective Endocarditis

Complications

Embolism/metastasis

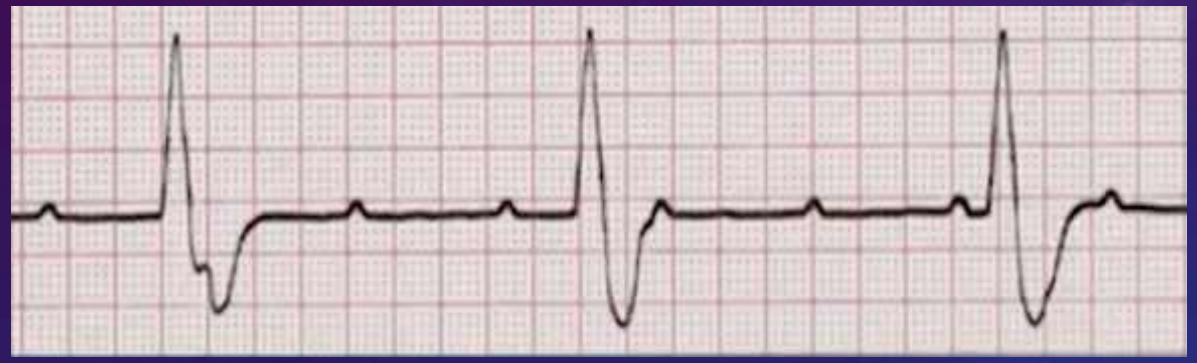


osteomyelitis

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

Medical therapy

- Therapy should be:
  - Prolonged
  - Parenteral IV
  - Bactericidal not bacteriostatic

Infective Endocarditis

Antimicrobial therapy

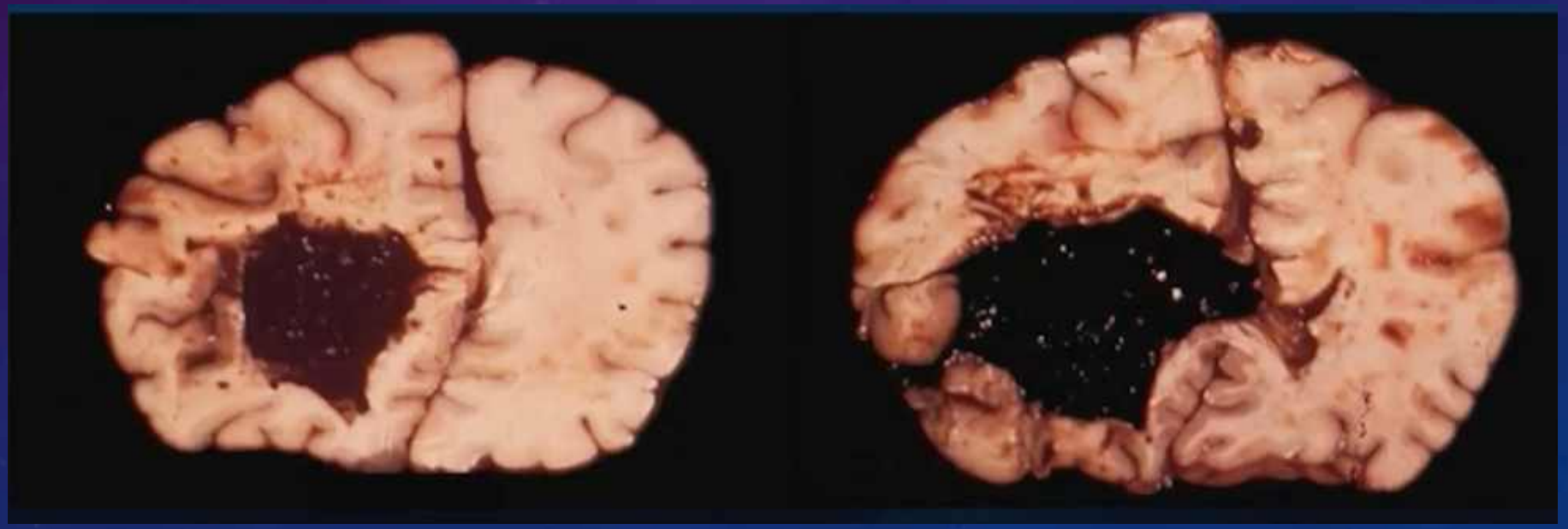
	Viridans group streptococci		*Staphylococcus*	*Enterococcus*
	Penicillin susceptible	Penicillin resistant		
Native valve	4 weeks Penicillin OR Ceftriaxone 2 weeks Above + Gentamicin	4 weeks Penicillin OR Ceftriaxone AND 2 weeks Gentamicin	6 weeks Naficillin OR Cefazolin OR Vancomycin	4-6 weeks Pen / Amp + Gentamicin 6 weeks Amp + Ceftriaxone
Prosthetic valve	6 weeks Penicillin OR Ceftriaxone ± 2 weeks Gentamicin	6 weeks Penicillin OR Ceftriaxone AND Gentamicin	6 weeks Above + Rifampin AND 2 weeks Gentamicin	6 weeks Pen / Amp + Gentamicin 6 weeks Amp + Ceftriaxone

Infective Endocarditis

Anticoagulation → mechanical valve

Neurological complications in infective endocarditis

Septic embolism → Ischemia (بالدماغ) → Hemorrhagic transformation (damage) → Stroke



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

إذا ما راح عالدماغ كادي ما بتوقفه

A 50yo lady 3 years s/p mechanical MVR presents with fever and malaise. She is hospitalized after blood cultures x2 grow viridans group streptococci. TEE shows a small vegetation on the mechanical MV. She receives appropriate antibiotics. On the 3rd hospital day, she develops transient left-sided visual loss that resolves after 7 minutes. MRI shows a small focus of occipital ischemia. She is on warfarin. INR is 2.9. How do you manage her anticoagulation?

TVL

1. Continue warfarin uninterrupted
2. Stop warfarin, start aspirin 81mg daily
3. Stop warfarin, bridge with IV unfractionated heparin.
4. Stop warfarin, start rivaroxaban
5. Stop warfarin.

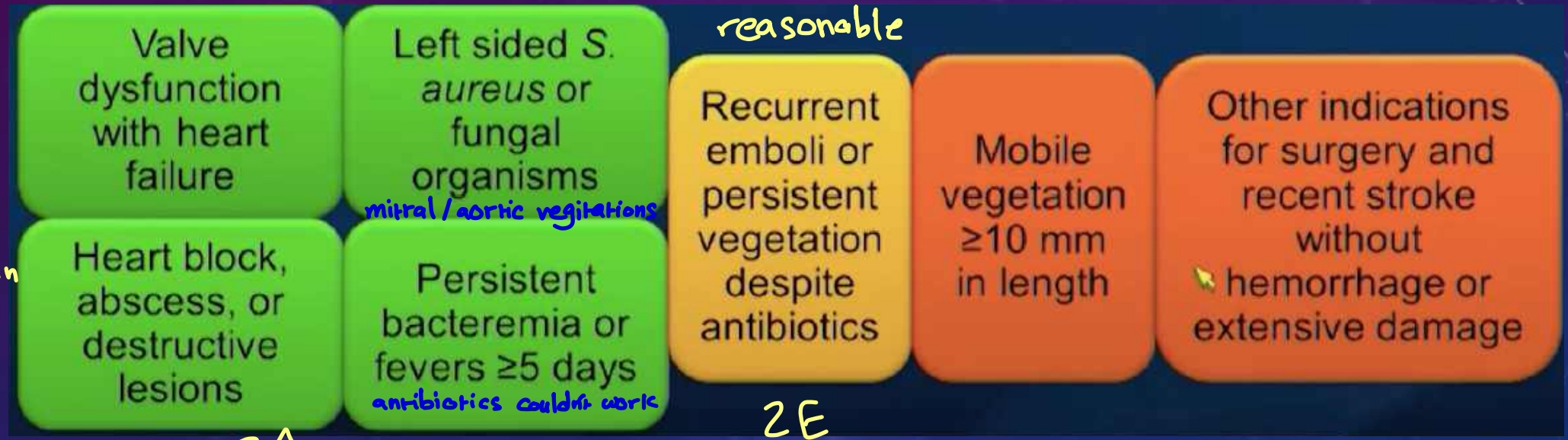
for 2 weeks

Infective Endocarditis

Surgical Management

Which patients need surgical intervention?

A must



invasion of soft tissue

2A

2E

Operate during initial hospitalization before completion of antibiotics

Nishimura RA, et al. JACC 2014; 63(22): e57-185
Nishimura RA, et al. JACC 2017; 70(2): 252-89

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

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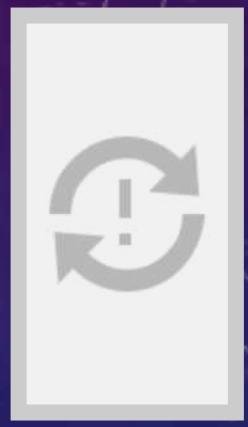
Infective Endocarditis

Management

1. Medical
   - Prolonged, parenteral targeted antibiotics
   - Withhold anticoagulation with CNS events

2. Surgical
   - Operate early if complications
   - Remove any intra-cardiac devices

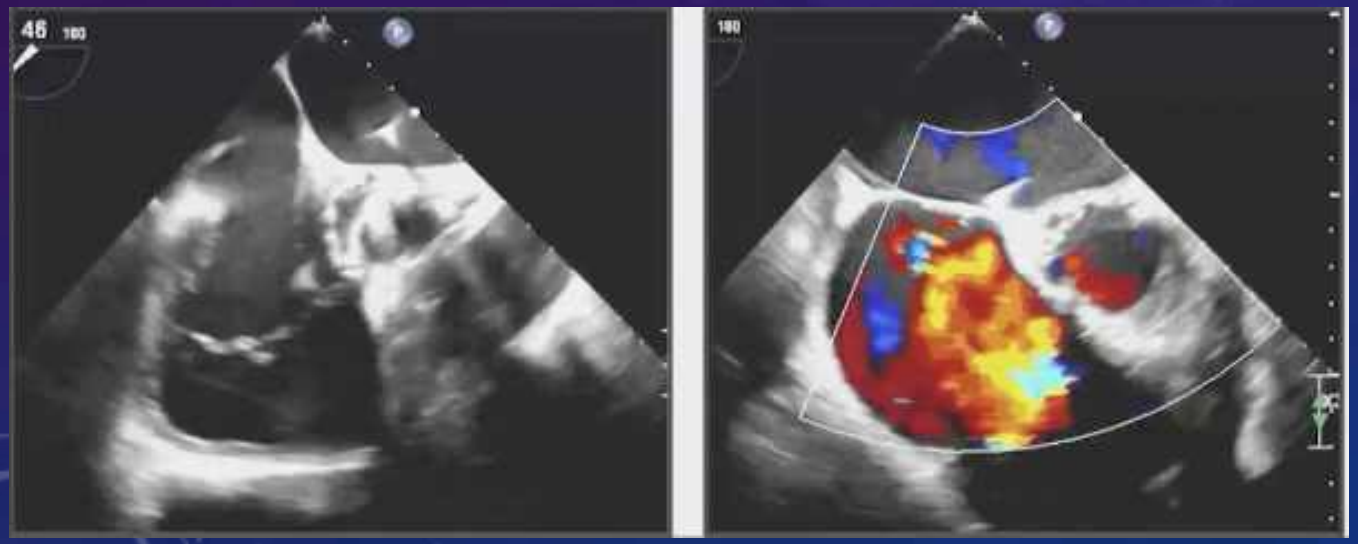


Infective Endocarditis

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



Baddour LM, et al. Circulation 2015; 123(15): 1435-86

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

Baddour LM, et al. Circulation 2010: 121(3): 458-77
Le KY, et al. Heart Rhythm 2011; 8(11): 1678-85

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

Baddour LM, et al. Circulation 2010: 121(3): 458-77

Infective Endocarditis

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

Later on

Baddour LM, et al. Circulation 2010: 121(3): 458-77

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

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?

We have to remove it device & leads

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.

Thank You