Tricuspid valve disease / Infective endocarditis

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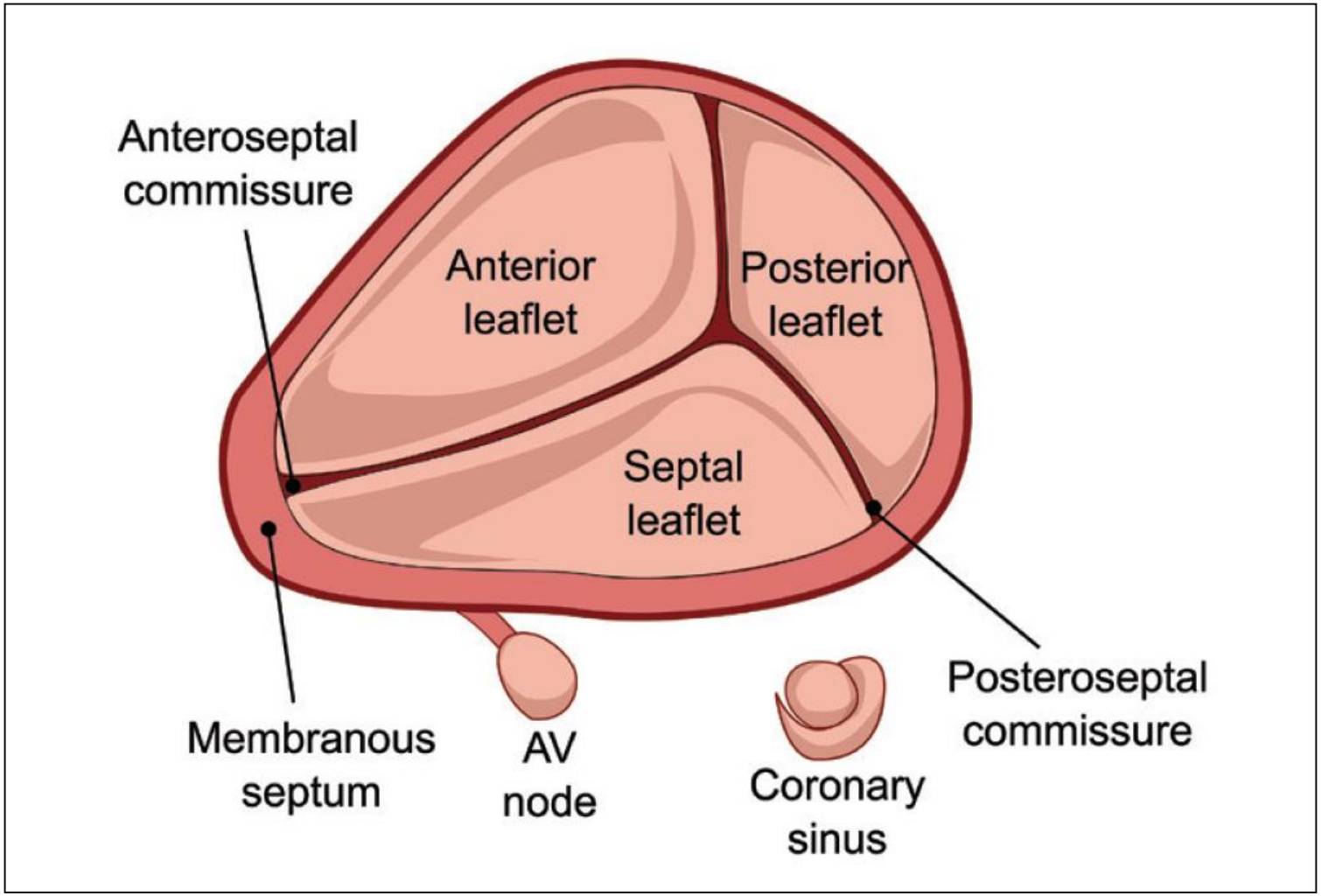
Tricuspid valve disease

Anatomy


Anteroseptal commissure
Anterior leaflet
Posterior leaflet
Septal leaflet
Membranous septum
AV node
Coronary sinus
Posteroseptal commissure

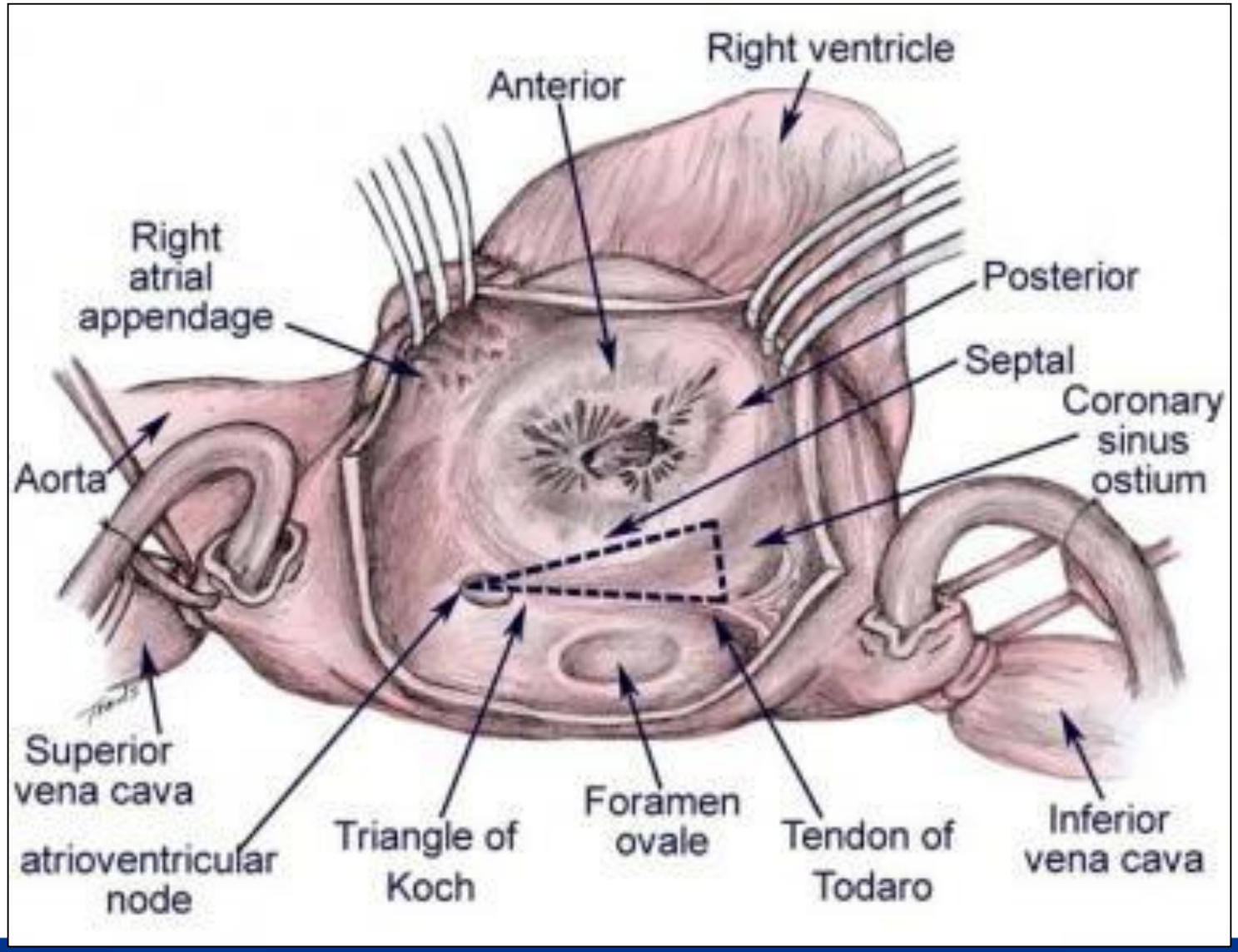
Anatomy

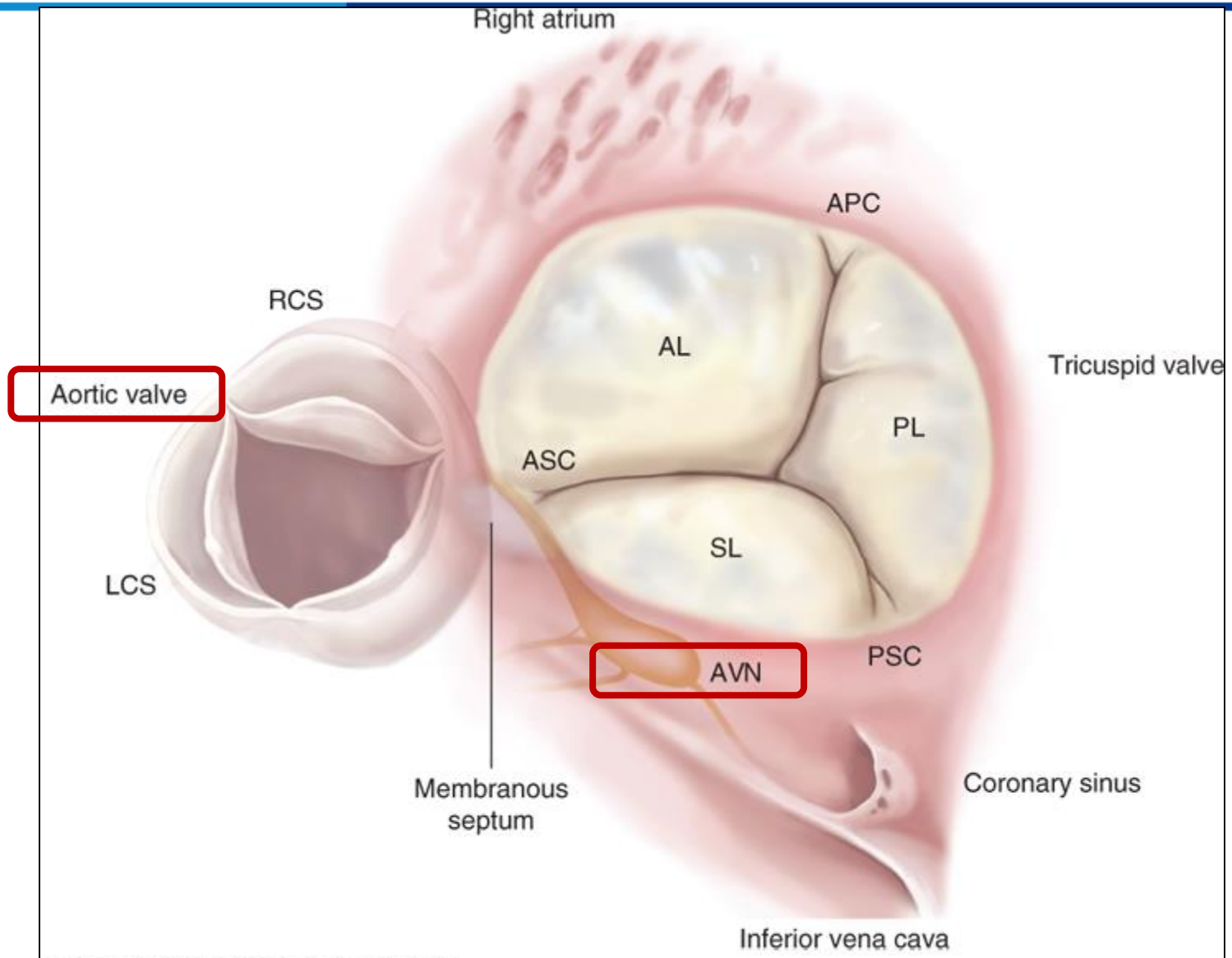
- Most apically placed
- Largest orifice among the 4 valves
- TV annulus is 20% larger than MV annulus

- Septal and anterior leaflets are larger than posterior leaflet

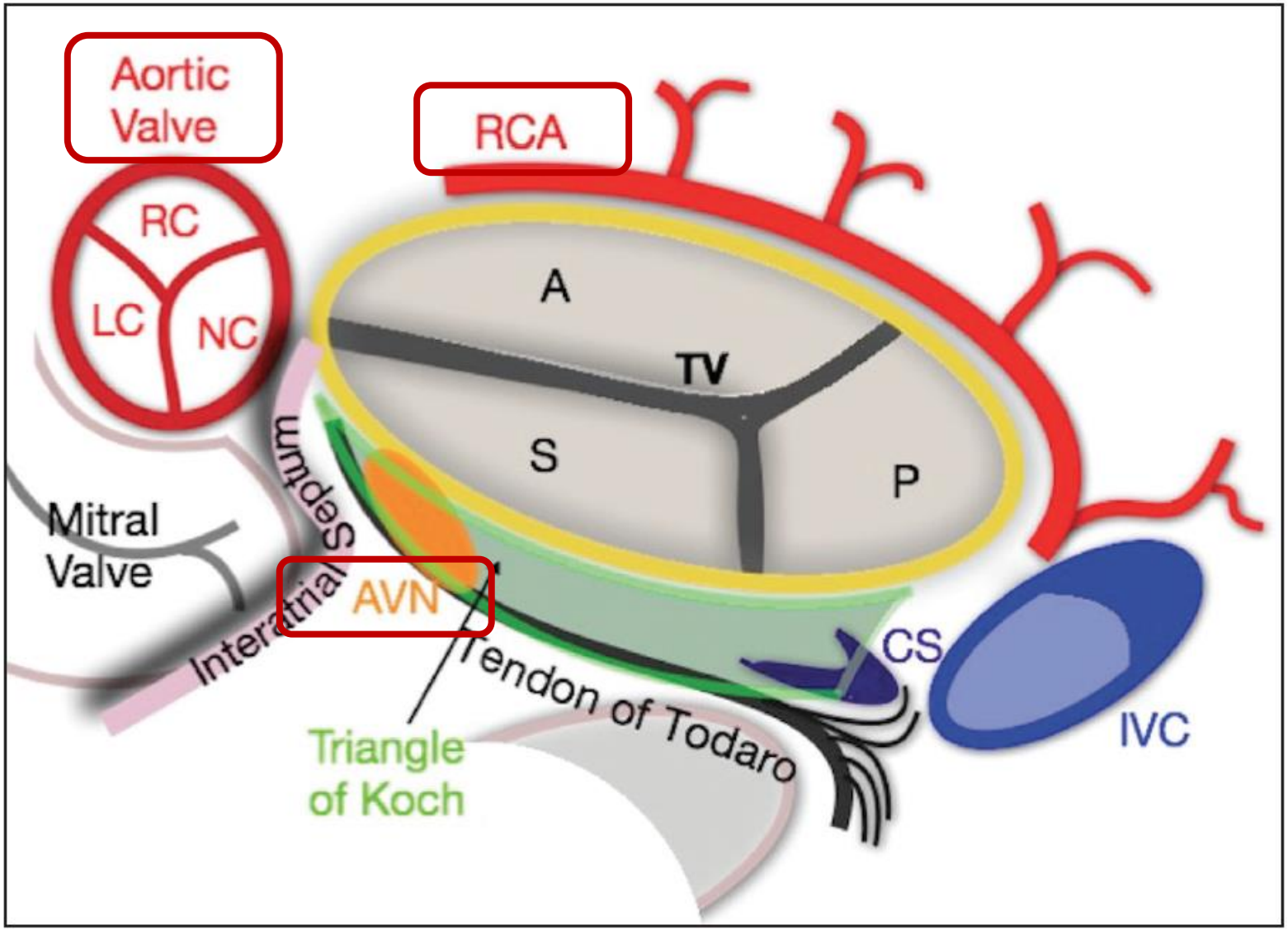
- Septal leaflet
  - Basis for spontaneous closure of the PM-VSD

Anatomy


Right ventricle
Anterior
Right atrial appendage
Posterior
Septal
Coronary sinus ostium
Aorta
Superior vena cava
atrioventricular node
Triangle of Koch
Foramen ovale
Tendon of Todaro
Inferior vena cava



Anatomy


Aortic Valve
RC
LC
NC
RCA
A
TV
S
P
Mitral Valve
Interatrial Septum
AVN
Tendon of Todaro
Triangle of Koch
CS
IVC

Tricuspid regurgitation

Pathophysiology

- ***Most TR is secondary to tricuspid annular dilatation : functional TR..!! – 80%***
  - **RV failure**
  - **Pulmonary vascular disease (mitral valve disease)**
  - **RV infarction**
  - **Congenital : pulmonary stenosis, primary pulmonary HTN, Marfan (annular dilatation)**

  → May diminish or disappear if RV decrease in size with HF treatment..!!

Pathophysiology

- Primary TR
  - Congenital disease
    - Ebstein anomaly, AV canal defect, corrected TGA
  - Rheumatic
  - Carcinoid syndrome
  - Prolapse caused by myxomatous change
  - Others
    - Tumor (ex. myxoma), PM leads, endomyocardial fibrosis, trauma, endocarditis..

Symptoms

- *TR is generally well tolerated in absence of pulmonary HTN..!!*

- Rt. Side HF with pul HTN + TR
  - Ascites, hepatomegaly, edema
- Wt.loss, cachexia, cyanosis, jaundice
- Jugular distension, venous thrill & murmur
- Pulsations of an enlarged liver

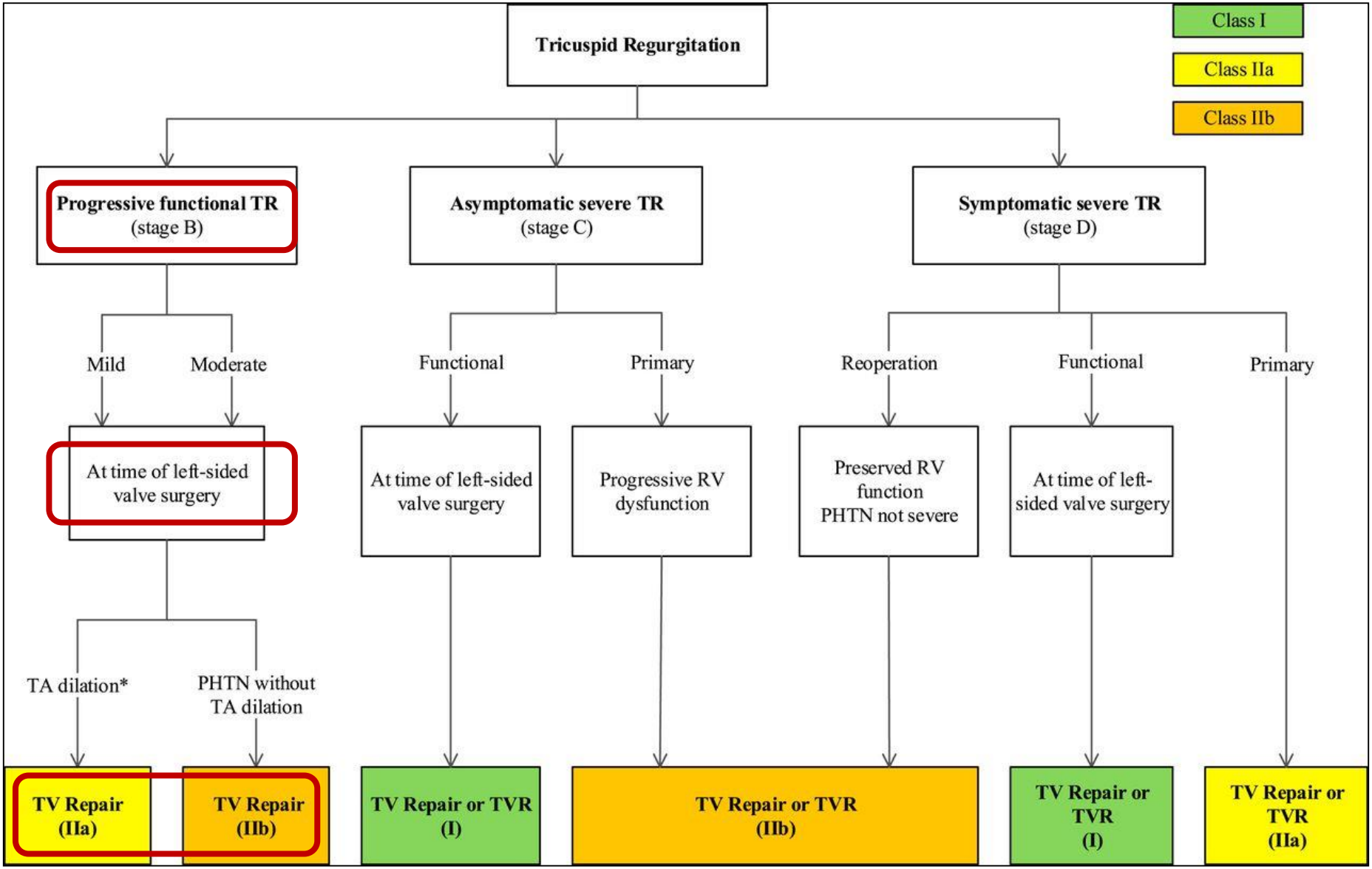
Treatment

- **Medical**
  - **Diuretics if Rt.side heart failure**
  - **Reduce PAP and PVR**

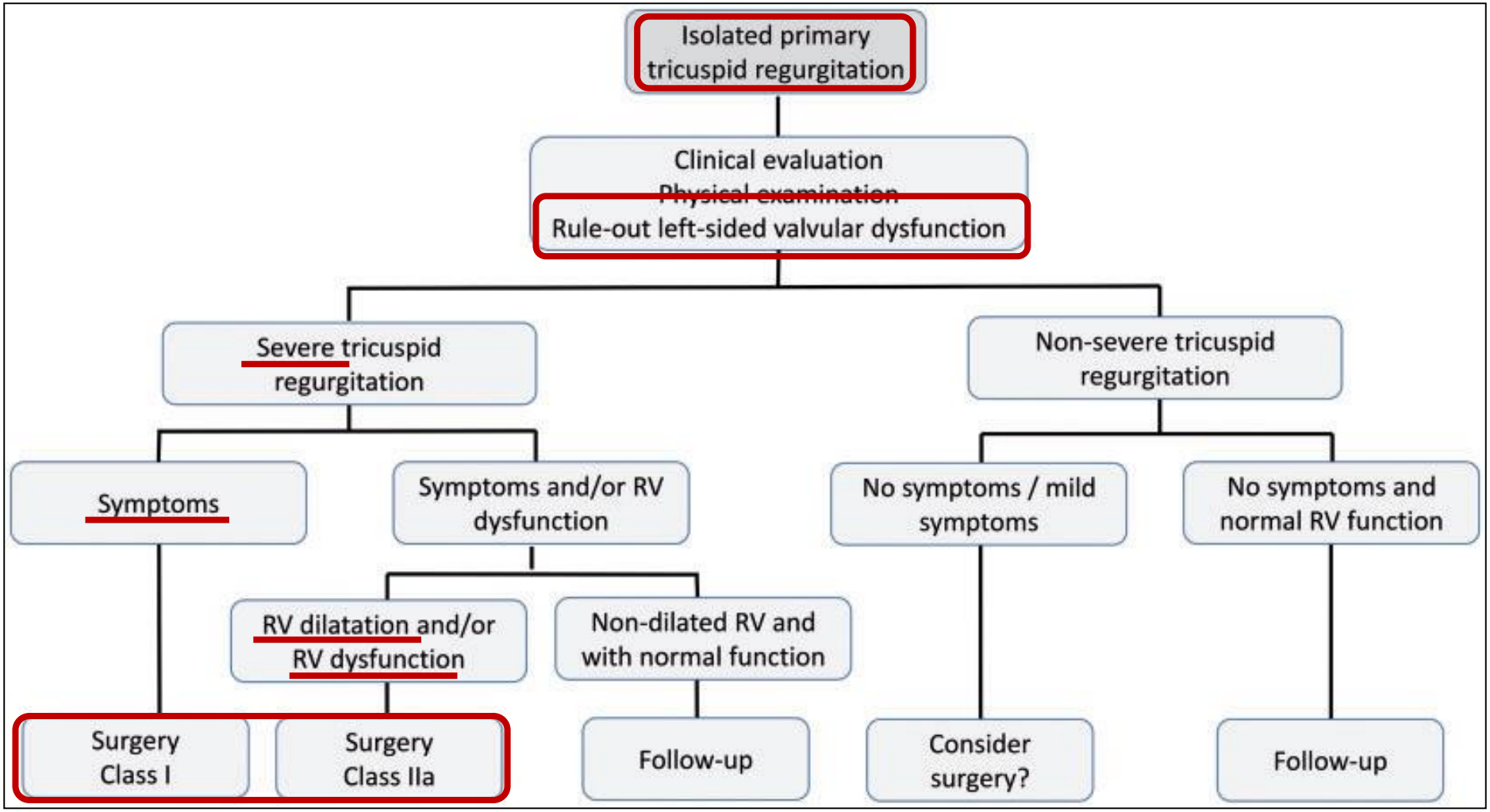
- **Surgical**
  - ***Absence of pul.HTN → no surgery!***
  - **Mostly annuloplasty**
  - **If, TVR**

    → Bioprosthesis >> Mechanical

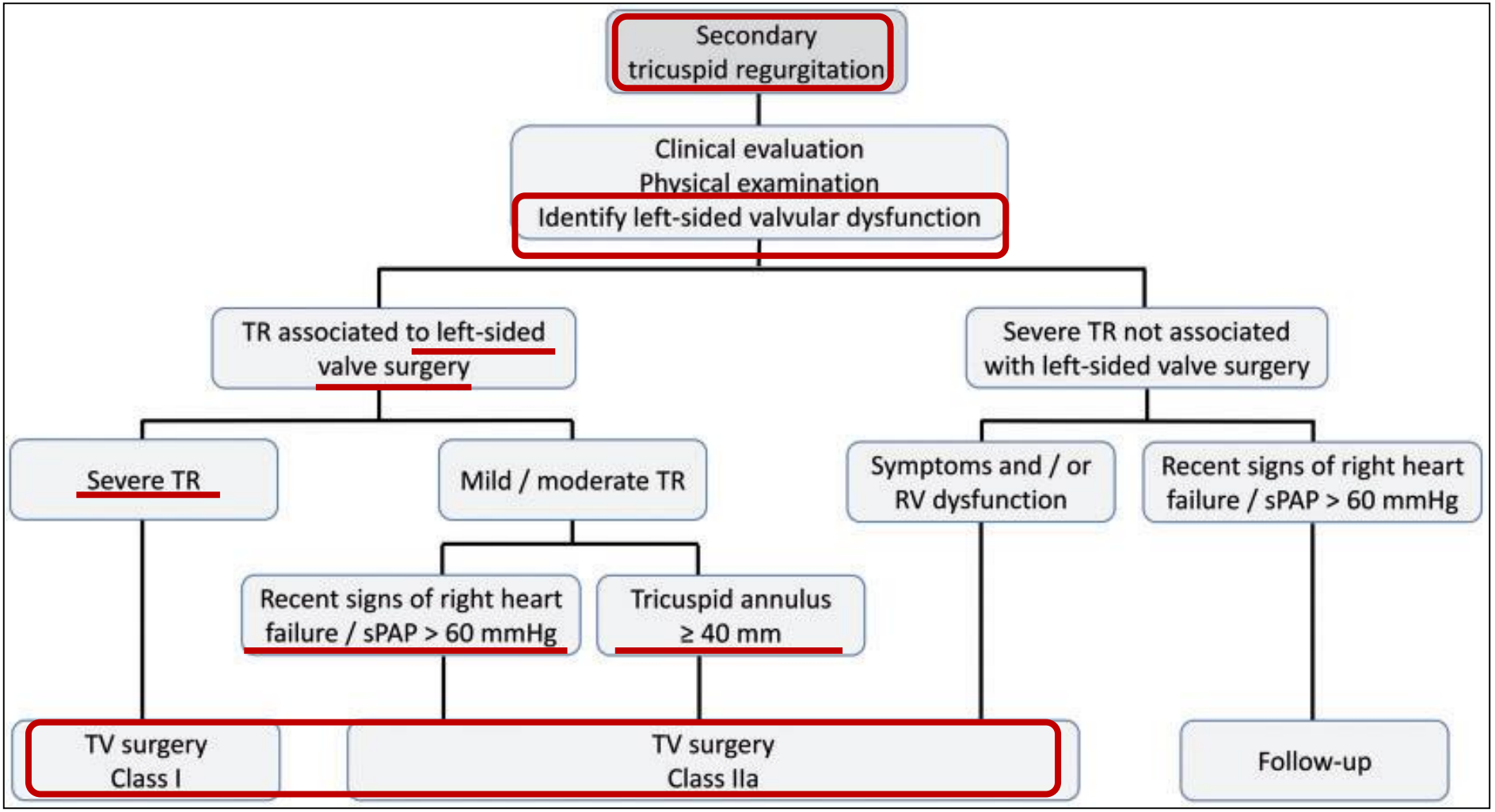
    : risk of thrombosis, d/t lower flow rate



2014 ACC/AHA guideline

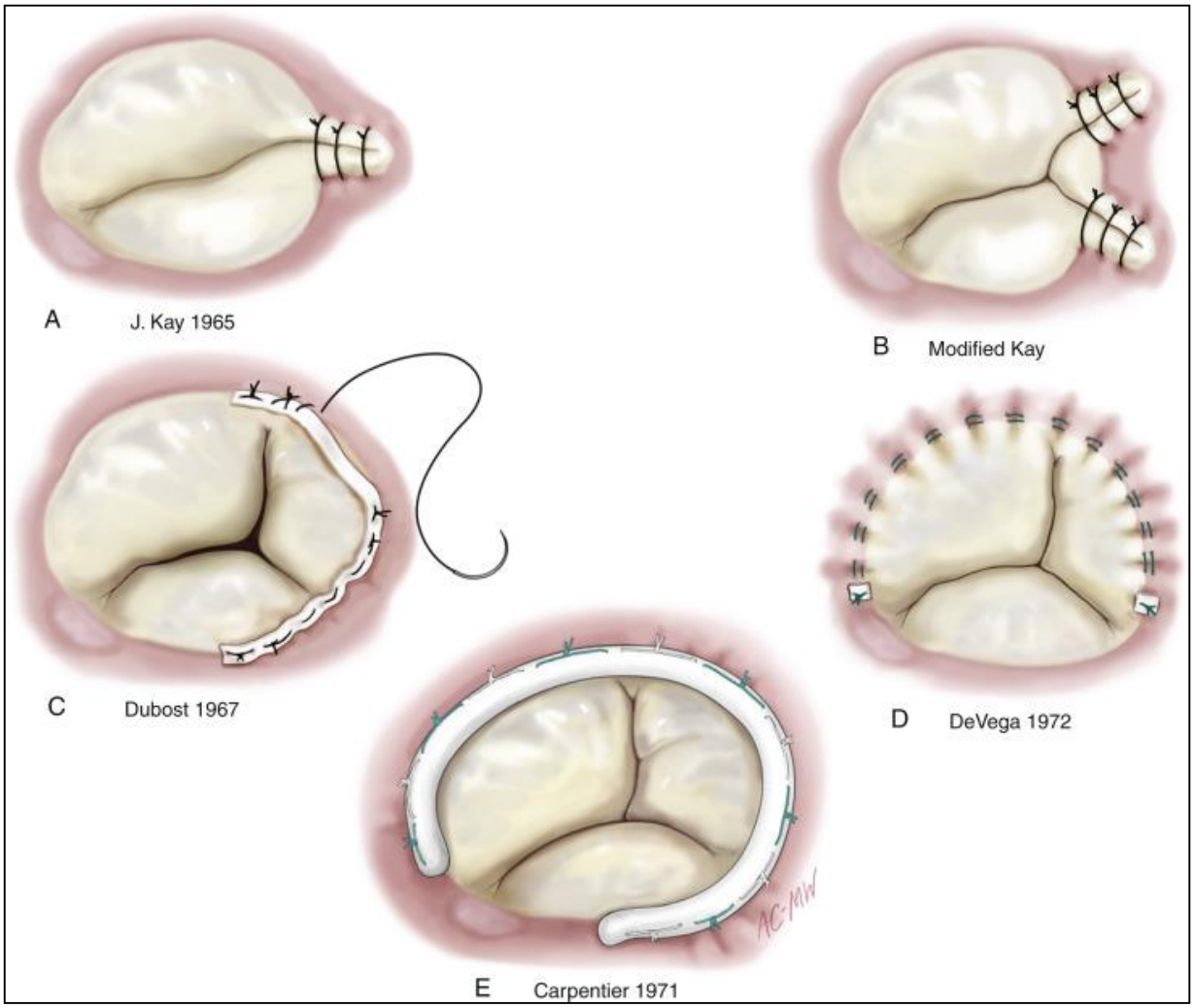


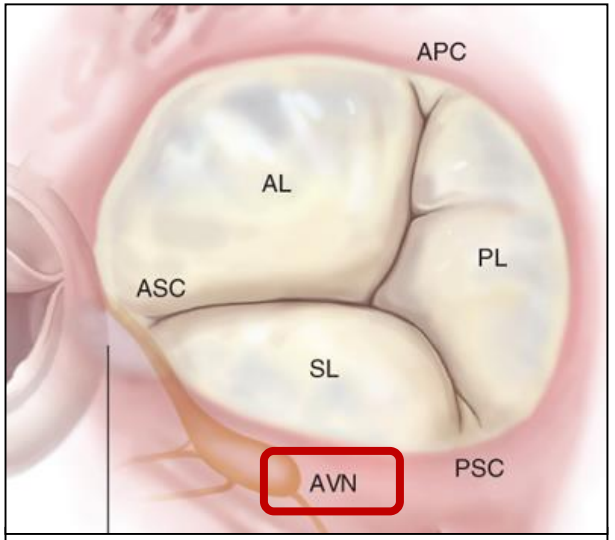
Management of primary tricuspid regurgitation
Eur J Cardiothorac Surg 2017;52:1022-30.

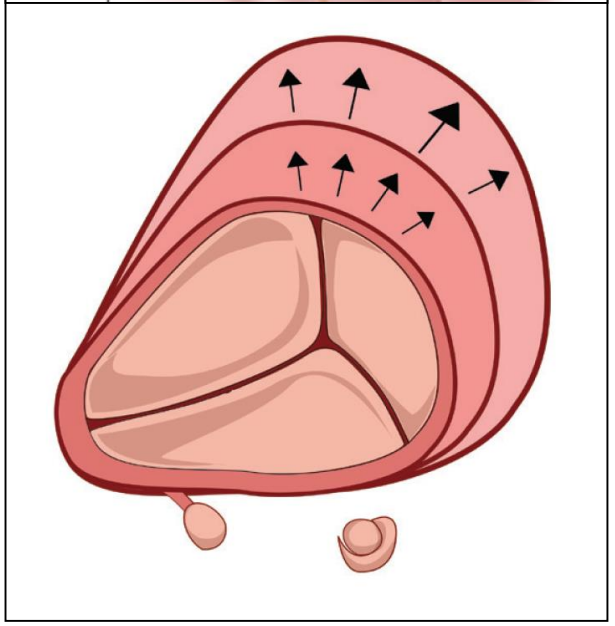


Management of secondary TR
Eur J Cardiothorac Surg 2017;52:1022-30.

Annuloplasty







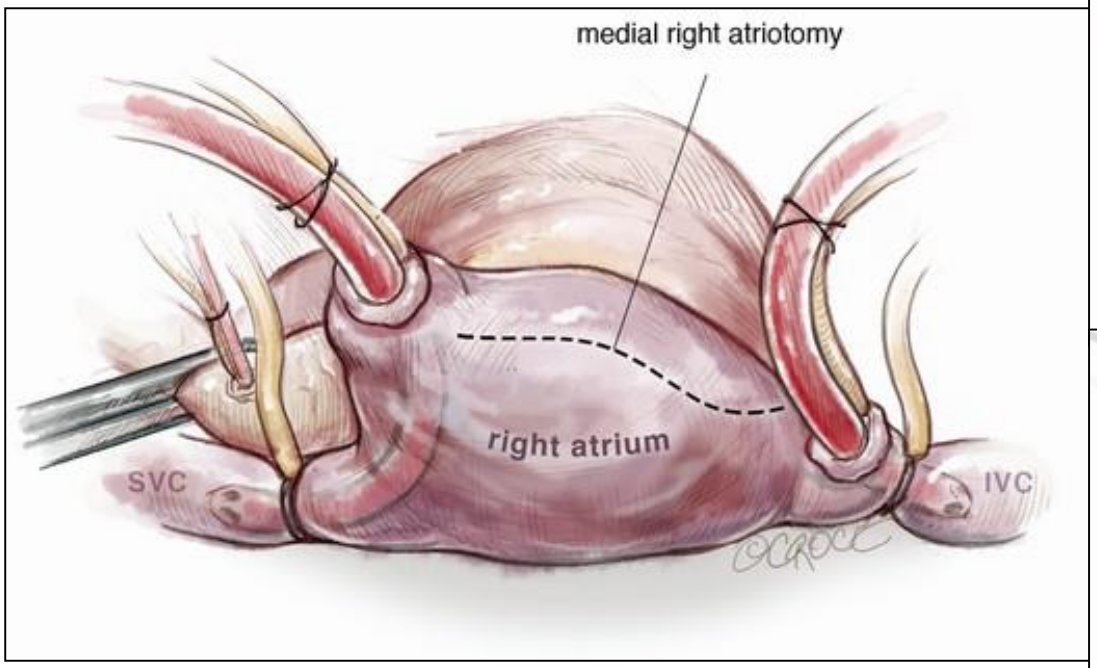
Tricuspid stenosis

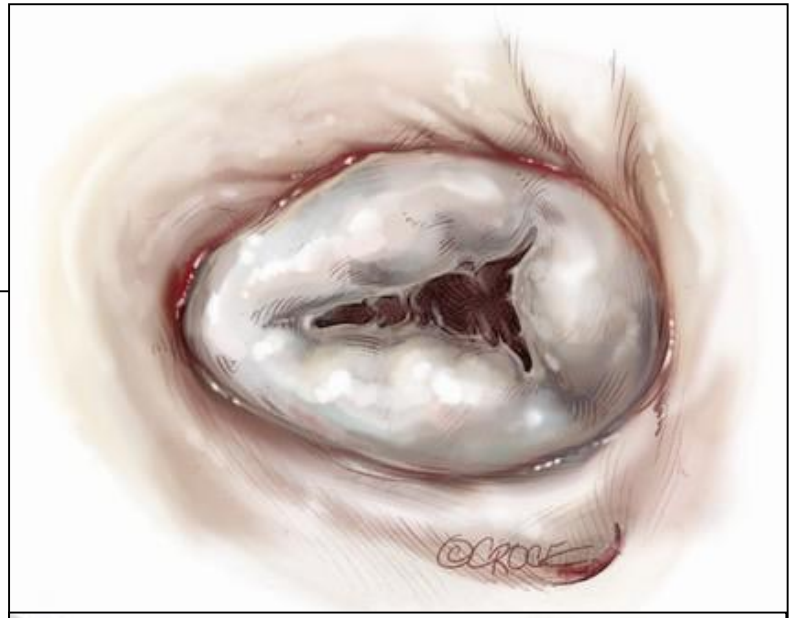
Pathophysiology & symptoms

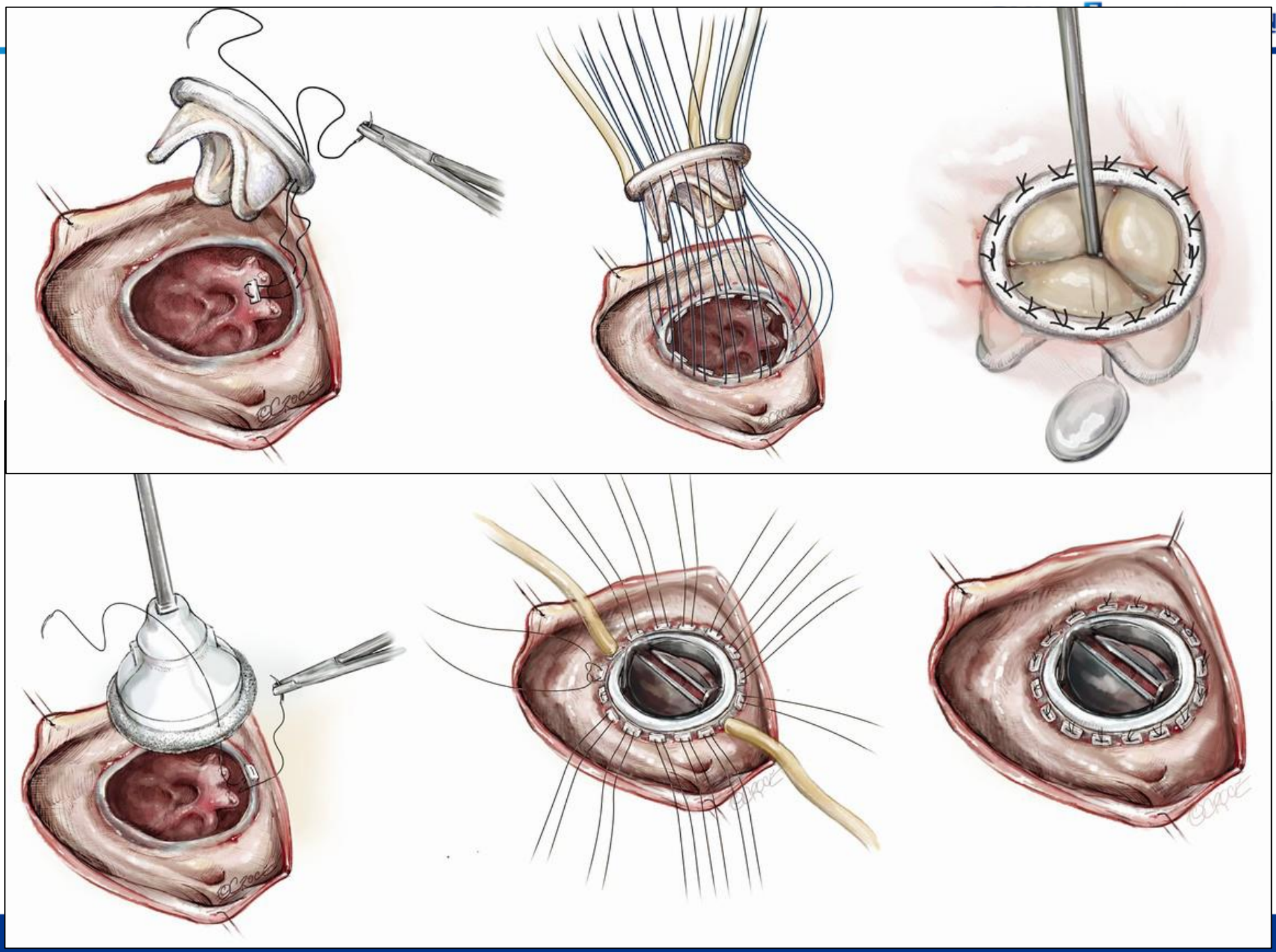
- Mostly rheumatic, rare isolated TS

- Symptoms : similar to TR
  - Fatigue
  - Distension of neck veins
  - Hepatomegaly, ascites, peripheral edema

Tricuspid valve replacement







Infective endocarditis

Definition

- Infection of the endocardial surface of the heart, which may include one or more heart valves, the mural endocardium, or a septal defect

Epidemiology

- IE is rare in healthy individuals despite common bacteremia (ex. dental procedures)
- Increasing incidence of nosocomial endocarditis - both native and prosthetic valve

- Increasing risk
  - Injecting drug user
  - long-term HD
  - Patients with IV cath
  - Diabetes
  - HIV-infected patients

Native valve endocarditis (NVE)

- **Rheumatic valvular disease**
  - Usually mitral valve followed by the aortic valve
- Congenital heart disease
  - PDA, VSD, ToF, *any native or surgical high-flow lesion*
- Mitral valve prolapse
- Degenerative heart disease
  - Aortic stenosis in elderly ,bicuspid valve, Marfan syndrome, rarely syphilitic disease
  - Mitral regurgitation

Prosthetic valve endocarditis (PVE)

- Early PVE
  - within 1 year (60 days)
  - usually aggressive nosocomial infection of se wing material
- Late PVE
  - 1 year after surgery / implantation

Organisms

- Dental procedures, poor dental hygiene : viridans streptococci, nutritionally variant streptococci, HACEK (Haemophilus, Actinobacillus, Cardiobacterium, Eikenella, Kingella)

- Prosthetic valves
  - Early: coagulase negative staphylococci, S. aureus
  - Late: coagulase negative staphylococci, viridans streptococci
- Gastrointestinal or genitourinary procedures : enterococci or S. bovis (colon carcinoma)

Organisms

- **Nosocomial : S. aureus (including MRSA), Gram negatives, Candida species**
- **HIV : S. aureus**

- **Animal or farm exposure: Coxiella, Chlamydia, Brucella**
- **History of homelessness, alcoholism (body lice): Bartonella**

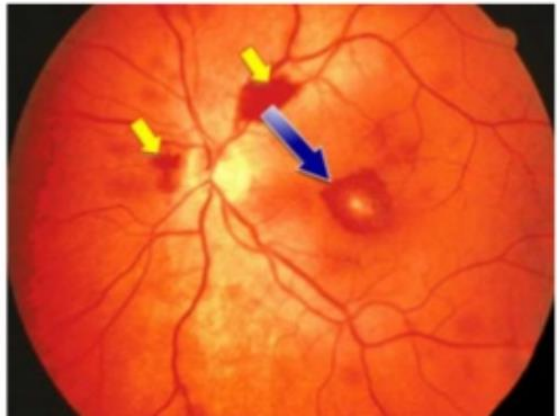
Clinical presentation

- **Fever (95%),** signs of systemic disease (nausea, weight loss….)
- Heart murmur (85%)
- Septic embolization (20-50%)
  - brain, kidneys, spleen
  - pulmonary
- Peripheral microembolization less common

Clinical presentation

Splinter hemorrhage

Osler node



Roth's spot

Janeway lesion

Diagnosis

- Blood cultures
  - 3 sets (aero + anaerobe)
  - At different times + from diff. sites
  - 85-90% - streptococci, staphylococci, enterococci
  - 10% culture negative
    - usually due to previous antibiotics Tx.
    - less commonly HACEK
    - Fungi – Candida, Aspergillus
    - Intracellular pathogens: Coxiella, Bartonella, Chlamydia, Mycoplasma, Legionella, Trephonema

Echocardiogrpahy

- TTE - low sensitivity (40-60%)
- TEE – high sensitivity (90-100%)

- Definite finding
  - Vegetations
  - Abscess
  - new prosthetic valve dehiscence

Duke criteria

Major Criteria

- Positive echocardiography
- Positive blood culture

Minor Criteria

- Predisposing conditions
- Fever > 37^0 C
- Vascular phenomenon
- Immunologic phenomenon
- Suggestive echocardiogram
- Ambiguous blood culture

Diagnosis of infective endocarditis requires two major, or one major and three minor or five minor criteria.

Modified Duke criteria

Definite IE

- Pathologic criteria
  1. Microorganisms demonstrated by culture or histologic examination of a vegetation, a vegetation that has embolized, or an intracardiac abscess specimen; or
  2. Pathologic lesions; vegetation or intracardiac abscess confirmed by histologic examination showing active endocarditis
- Clinical criteria (see Table 34.3)
  1. Two major criteria
  2. One major criterion and three minor criteria
  3. Five minor criteria

Possible IE (see Table 34.3)

1. One major criterion and one minor criterion
2. Three minor criteria

Rejected

1. Firm alternate diagnosis explaining evidence of IE
2. Resolution of infection endocarditis syndrome with antibiotic therapy for ≤4 days
3. No pathologic evidence of IE at surgery or autopsy, with antibiotic therapy for ≤4 days
4. Does not meet criteria for possible IE, as described previously

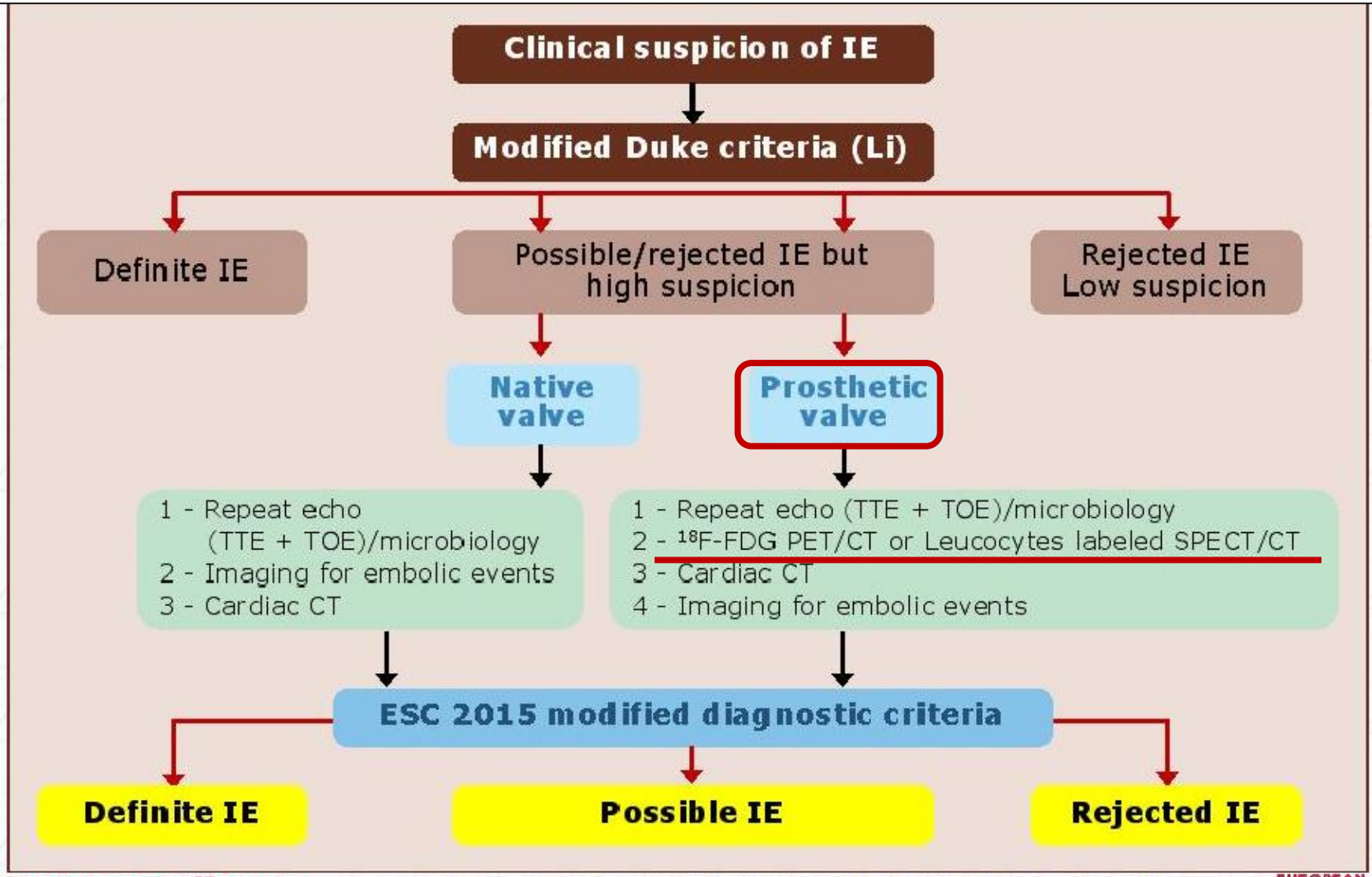
Major Criteria

- Blood culture positive for IE
  - Typical microorganisms consistent with IE from two separate blood cultures
    - Viridans streptococci; *Streptococcus bovis*, HACEK group, *Staphylococcus aureus*; or
    - Community-acquired enterococci, in the absence of a primary focus
  - Microorganisms consistent with IE from persistently positive blood cultures, defined as follows:
    - At least two positive blood cultures of blood samples drawn >12 h apart; or
    - All of three or a majority of ≥4 separate cultures of blood (with first and last sample drawn at least 1 h apart)
  - Single positive blood culture for *Coxiella burnetii* or antiphase I IgG antibody titer >1:800
- Evidence of endocardial involvement
- Echocardiogram positive for IE (TEE recommended in patients with prosthetic valves, rated at least "possible IE" by clinical criteria, or complicated IE [paravalvular abscess]; TTE as first test in other patients), defined as follows:
  - Oscillating intracardiac mass on valve or supporting structures, in the path of regurgitant jets, or on implanted material in the absence of an alternative anatomic explanation; or
  - Abscess; or
  - New partial dehiscence of prosthetic valve
- New valvular regurgitation (worsening or changing or preexisting murmur not sufficient)

Minor Criteria

- Predisposition, predisposing heart condition or injection drug use
- Fever, temperature >38°C
- Vascular phenomena, major arterial emboli, septic pulmonary infarcts, mycotic aneurysm, intracranial hemorrhage, conjunctival hemorrhages, and Janeway lesions
- Immunologic phenomena: Glomerulonephritis, Osler nodes, Roth's spots, and rheumatoid factor
- Microbiological evidence: Positive blood culture but does not meet a major criterion as noted previously (excluding single positive cultures for coagulase-negative staphylococci and organisms that do not cause endocarditis) or serologic evidence of active infection with organisms consistent with IE
- Echocardiographic minor criteria eliminated

2015 ESC guideline



European Heart Journal (2015);36:3075-3123 - doi:10.1093/eurheartj/ehv319

ESC 2015 modified criteria for diagnosis of IE:

Major criteria

1. Blood cultures positive for IE

a. Typical microorganisms consistent with IE from 2 separate blood cultures:
- *Viridans streptococci, Streptococcus gallolyticus (Streptococcus bovis), HACEK group, Staphylococcus aureus*; or
- Community-acquired enterococci, in the absence of a primary focus; or

b. Microorganisms consistent with IE from persistently positive blood cultures:
- ≥2 positive blood cultures of blood samples drawn >12 h apart; or
- All of 3 or a majority of ≥4 separate cultures of blood (with first and last samples drawn ≥1 h apart); or

c. Single positive blood culture for *Coxiella burnetii* or phase I IgG antibody titre >1:800

2. Imaging positive for IE

a. Echocardiogram positive for IE:
- Vegetation
- Abscess, pseudoaneurysm, intracardiac fistula
- Valvular perforation or aneurysm
- New partial dehiscence of prosthetic valve

b. Abnormal activity around the site of prosthetic valve implantation detected by ^{18}F-FDG PET/CT (only if the prosthesis was implanted for >3 months) or radiolabelled leukocytes SPECT/CT.

c. Definite paravalvular lesions by cardiac CT.

European Heart Journal (2015);36:3075-3123 - doi:10.1093/eurheartj/ehv319

ESC 2015 modified criteria for diagnosis of IE:

Minor criteria
1. Predisposition such as predisposing heart condition, or injection drug use.
2. Fever defined as temperature >38°C.
3. Vascular phenomena **(including those detected only by imaging)**: major arterial emboli, septic pulmonary infarcts, infectious (mycotic) aneurysm, intracranial haemorrhage, conjunctival haemorrhages, and Janeway's lesions.
4. Immunological phenomena: glomerulonephritis, Osler's nodes, Roth's spots, and rheumatoid factor.
5. Microbiological evidence: positive blood culture but does not meet a major criterion as noted above or serological evidence of active infection with organism consistent with IE.

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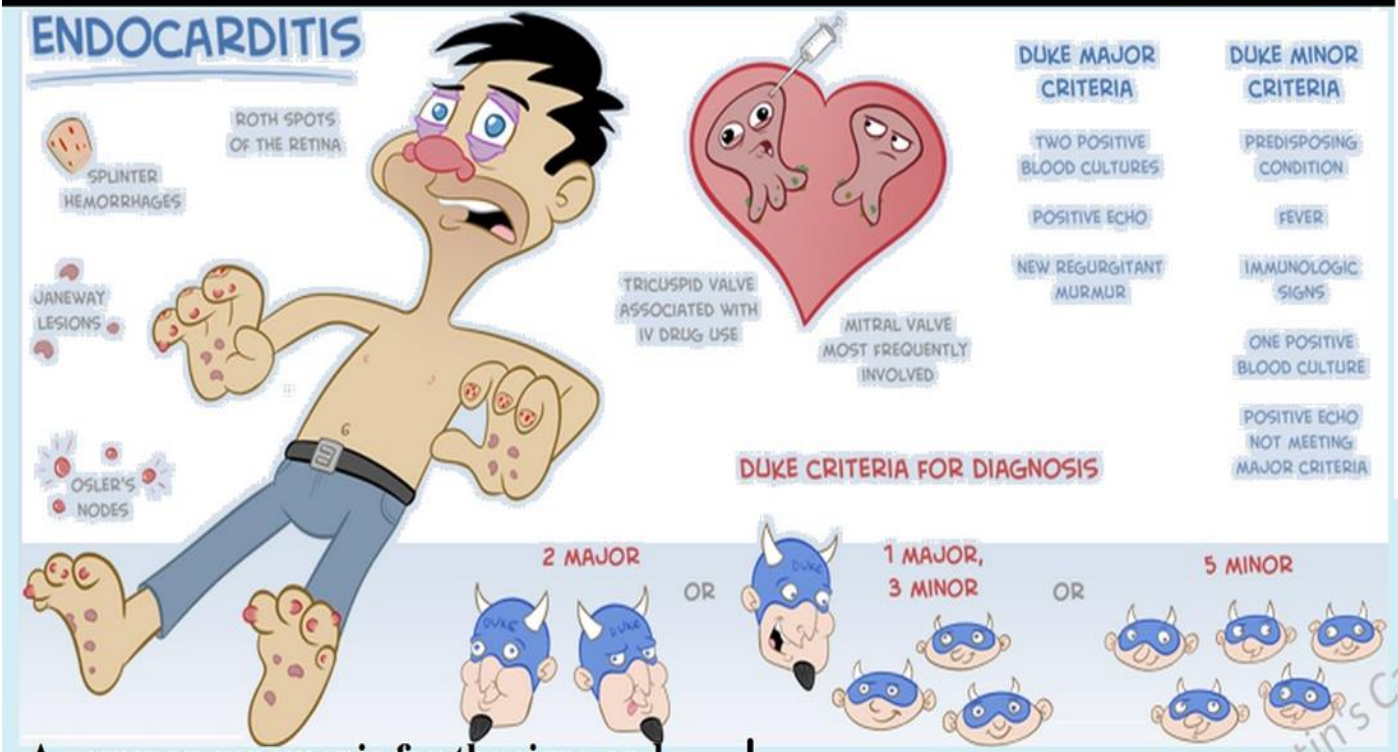
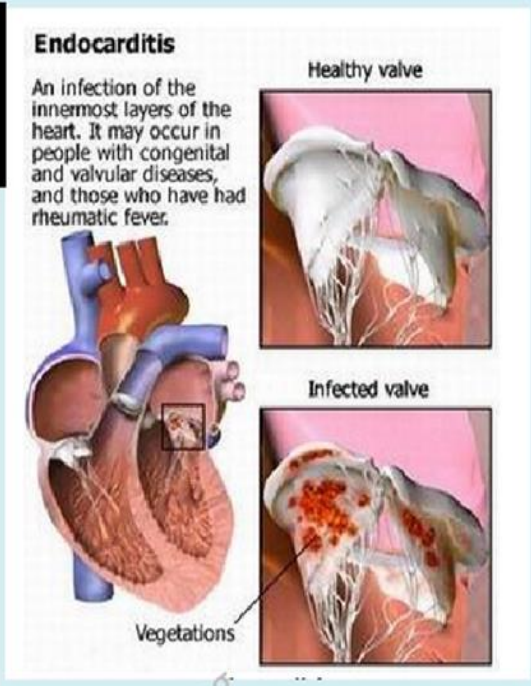
Infective Endocarditis

How to Remember Dukes Criteria

www.afghanheart.wordpress.com

Dr.Nabil Paktin's Cardiology Blog





A common mnemonic for the signs and symptoms of endocarditis is FROM JANE:

Fever
Roth's spots
Osler's nodes
Murmur
Janeway lesions
Anemia
Nail hemorrhage (splinter hemorrhages)
Emboli

DUKES CRITERIA

BE FEVEER

(*BE - Bacterial Endocarditis)

Major:

B = blood culture +ve >2 times 12 hr part
E = Endocardial involvement from Echo

Minor:

F = Fever
E = Echo findings (not fulfilling a major)
V = Vascular findings
EE = Evidences from microbiological/immunology (2 evidences)
R = Risk - factors/prediposing factors -drug abuse , valvular disease

Treatment

- **Antibiotic therapy**

- **Surgery - performed in high-risk patients**
  - Age/comorbidities/PVE/DM
  - Complicated IE (heart failure, shock…)
  - High-risk agents (S.aureus, fungi…), ATB failure
  - TTE/TEE high-risk morphology parameters – risk of embolisation

Antibiotics

- beta-lactam (penicillin, cefalosporin)
- Glykopeptide (vancomycin)
- Aminoglykosides (gentamicin)
- Rifampicin in PVE

- Streptococci: PEN/CEF + GENTA, (VANCO)
- Enterococci: like streptococci, PEN resist. common
- Staphylococci: MET/OXA + GENTA

- *Empirical therapy - should focus on S. aureus*

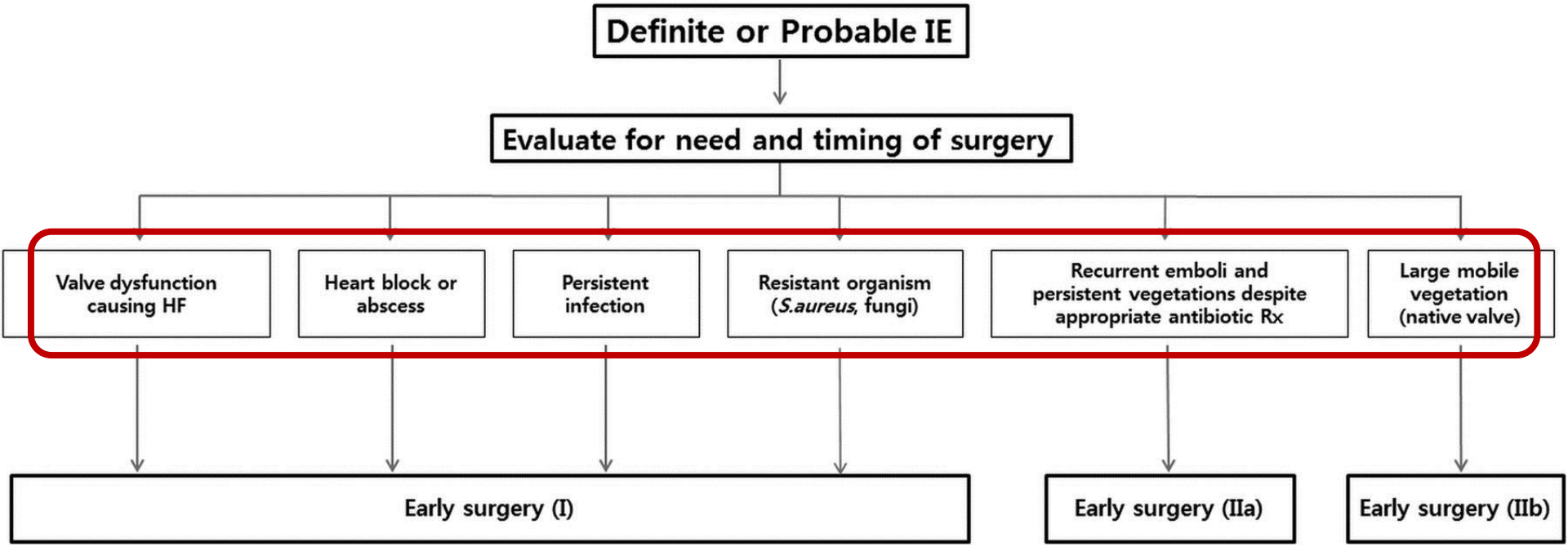
Surgery

- Indications
  - Progressive heart failure
  - Significant heart failure: fail to improve
  - Major embolism, large vegetation
  - Persistent bacteremia despite antibiotics Tx.
  - Fungal endocarditis
  - Patients with intravascular devices
  - Heart block
  - Prosthetic valve dehiscence or obstruction
  - Relapse

Indications and timing of surgery

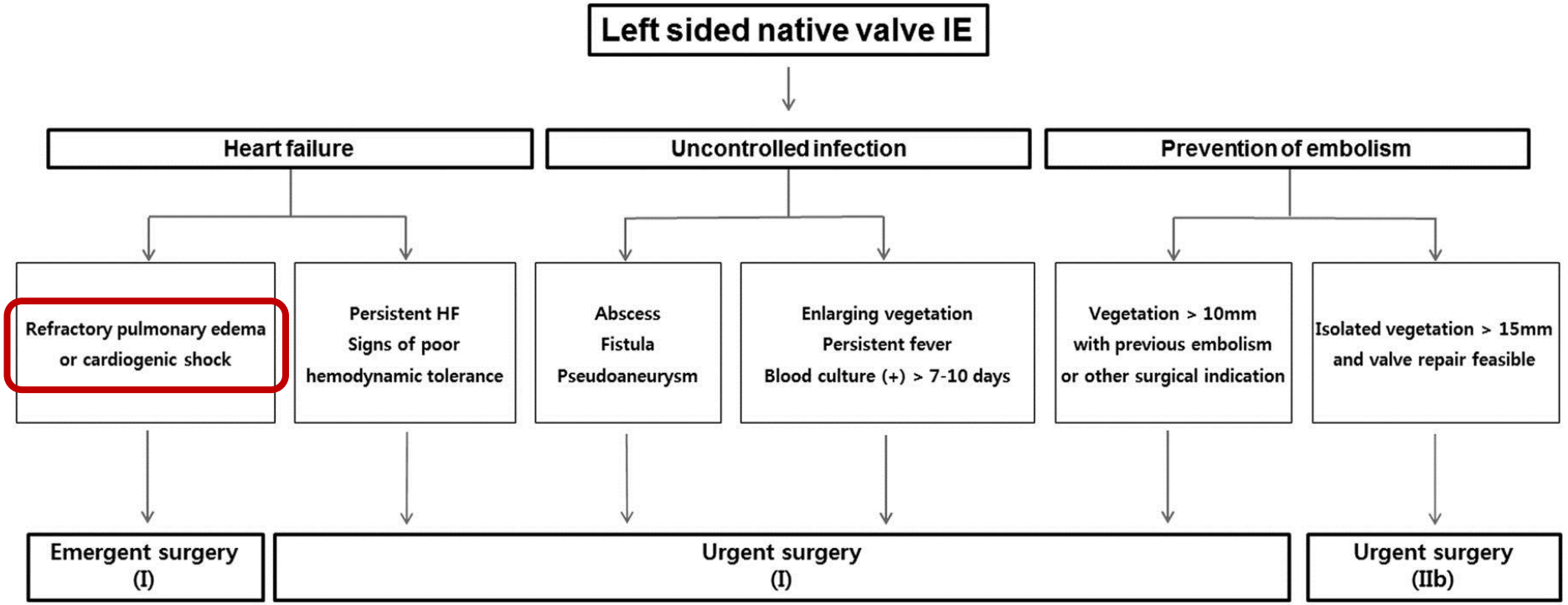
Indications for surgery	Timing	Class	Level
1. Heart Failure			
Aortic or mitral NVE or PVE with severe acute regurgitation, obstruction or fistula causing refractory pulmonary oedema or cardiogenic shock.	Emergency	I	B
Aortic or mitral NVE or PVE with severe regurgitation or obstruction causing symptoms of HF or echocardiographic signs of poor haemodynamic tolerance.	Urgent	I	B
2. Uncontrolled infection			
Locally uncontrolled infection (abscess, false aneurysm, fistula, enlarging vegetation).	Urgent	I	B
Infection caused by fungi or multiresistant organisms.	Urgent/elective	I	C
Persisting positive blood cultures despite appropriate antibiotic therapy and adequate control of septic metastatic foci.	Urgent	IIa	B
PVE caused by staphylococci or non-HACEK Gram negative bacteria.	Urgent/elective	IIa	C
3. Prevention of embolism			
Aortic or mitral NVE or PVE with persistent vegetations >10 mm after one or more embolic episode despite appropriate antibiotic therapy.	Urgent	I	B
Aortic or mitral NVE with vegetations >10 mm, associated with severe valve stenosis or regurgitation, and low operative risk.	Urgent	IIa	B
Aortic or mitral NVE or PVE with isolated very large vegetations (>30 mm).	Urgent	IIa	B
Aortic or mitral NVE or PVE with isolated large vegetations (>15 mm) and no other indication for surgery.	Urgent	IIb	C

Indication for early surgery



2014 AHA/ACC guidelines.

Indications for early surgery



2009 ESC guidelines

Right-sided infective endocarditis

Recommendations	Class	Level
Surgical treatment should be considered in the following scenarios: • Microorganisms difficult to eradicate (e.g. persistent *fungi*) or bacteraemia for >7 days (e.g. *Staphylococcus aureus, P. aeruginosa*) despite adequate antimicrobial therapy or • Persistent tricuspid valve vegetations >20 mm after recurrent pulmonary emboli with or without concomitant right heart failure or • Right HF secondary to severe tricuspid regurgitation with poor response to diuretic therapy.	**IIa**	**C**

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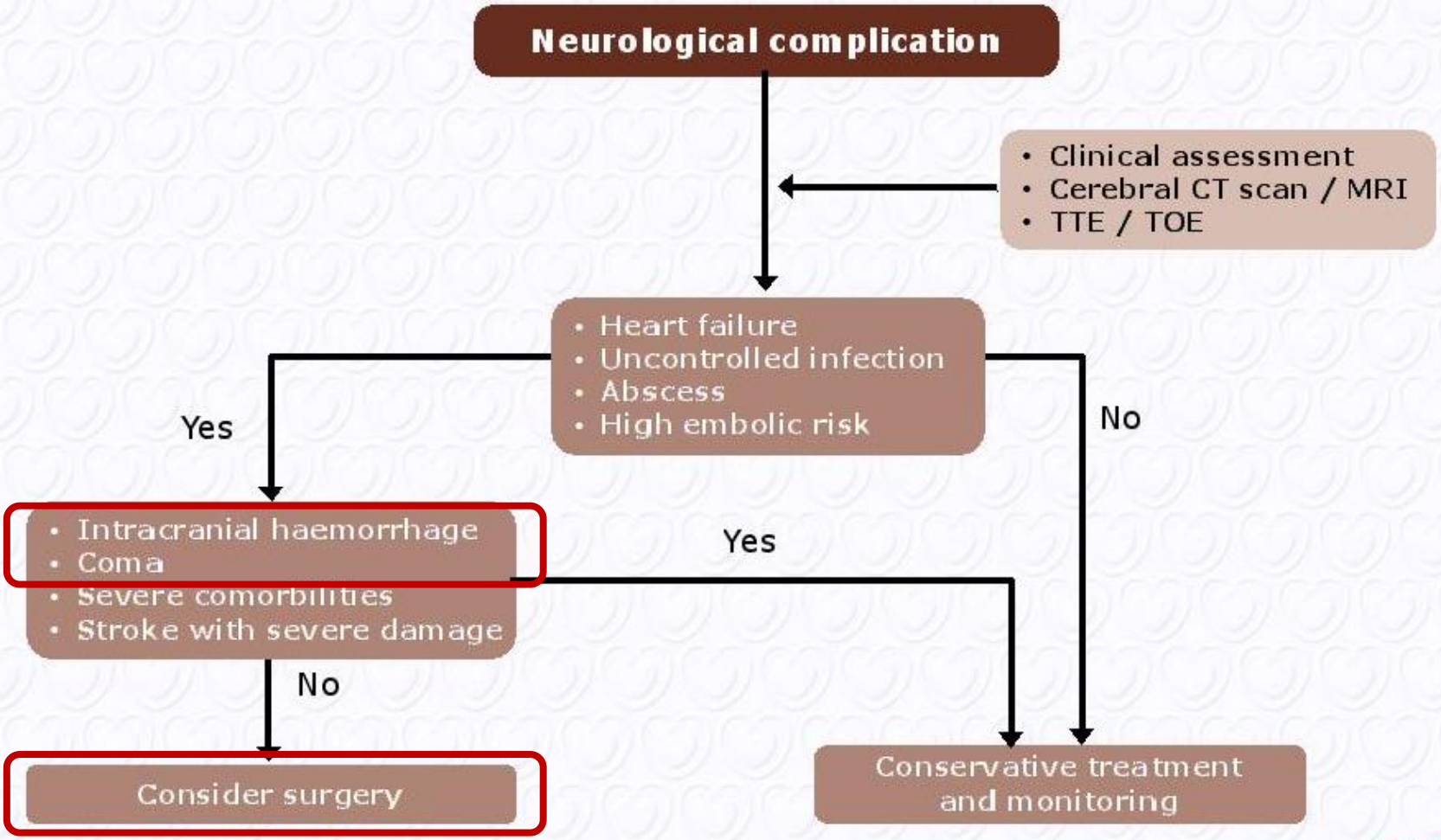
Management of neurological complications



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Management of neurological complications

Recommendations	Class	Level
After a silent embolism or transient ischaemic attack, cardiac surgery, if indicated, is recommended without delay.	I	B
Neurosurgery or endovascular therapy is indicated for very large, enlarging or ruptured intracranial infectious aneurysms.	I	C
Following intracranial haemorrhage, surgery should generally be postponed for ≥1 month.	IIa	B
After a stroke, surgery indicated for HF, uncontrolled infection, abscess, or persistent high embolic risk should be considered without any delay as long as coma is absent and the presence of cerebral haemorrhage has been excluded by cranial CT or MRI.	IIa	B
Intracranial infectious aneurysms should be looked for in patients with IE and neurological symptoms. CT or MR angiography should be considered for diagnosis. If non-invasive techniques are negative and the suspicion of intracranial aneurysm remains, conventional angiography should be considered.	IIa	B

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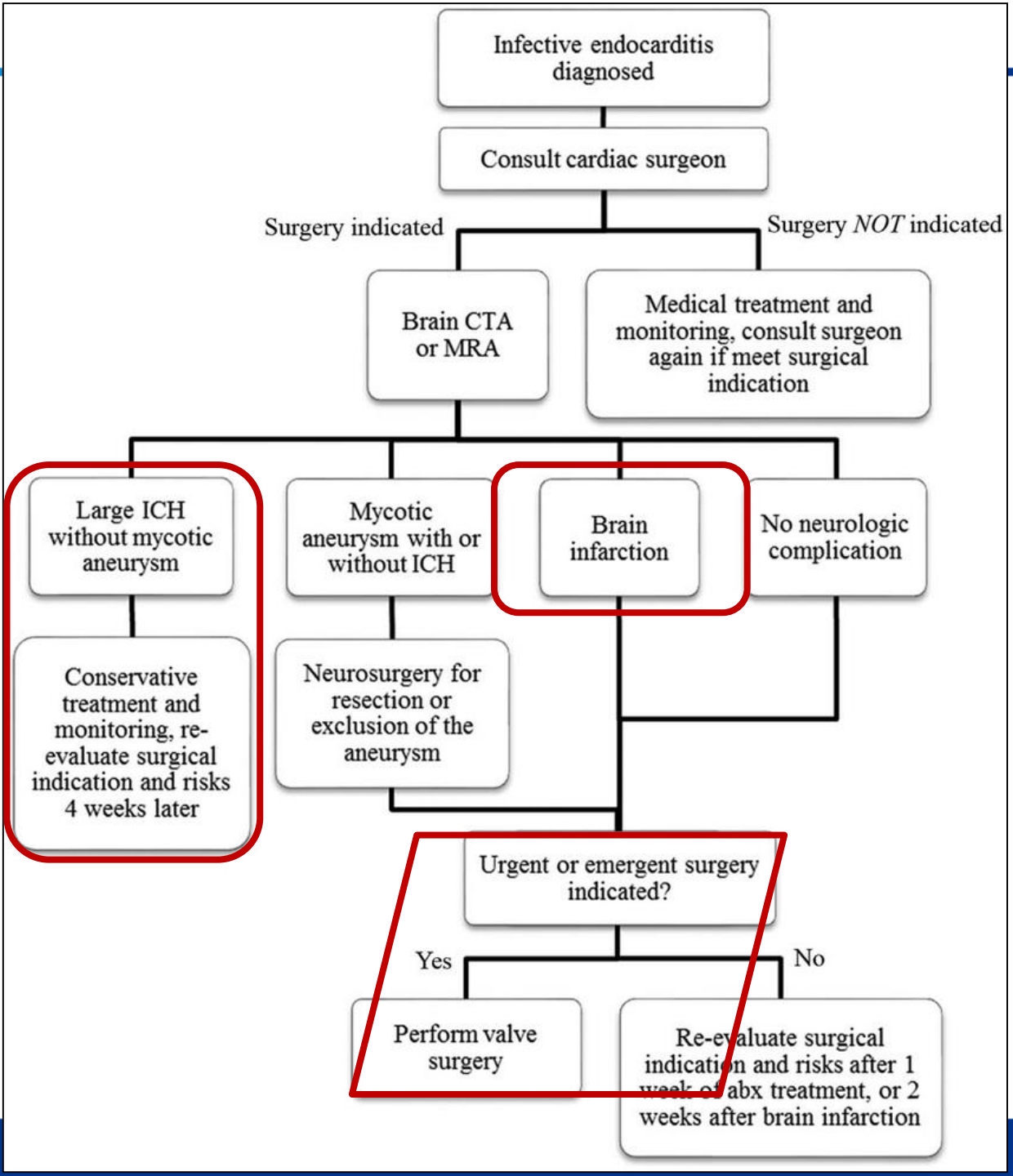

Lee H-A, et al. Surgical interventions of isolated active mitral valve endocarditis. *Medicine*. 2018;97:11.

Prevention

Recommendations	Class	Level
Antibiotic prophylaxis should only be considered for patients at highest risk of IE: 1. Patients with any prosthetic valve, including a transcatheter valve, or those in whom any prosthetic material was used for cardiac valve repair. 2. Patients with previous IE. 3. Patients with congenital heart disease. a. Any cyanotic congenital heart disease. b. Any type of congenital heart disease repaired with a prosthetic material whether placed surgically or by percutaneous techniques, up to 6 months after the procedure or lifelong if residual shunt or valvular regurgitation remains.	IIa	C
Antibiotic prophylaxis is not recommended in other forms of valvular or congenital heart disease.	III	C

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Procedures at highest-risk of IE

Recommendations	Class	Level
A. Dental procedures • Antibiotic prophylaxis should only be considered for dental procedures requiring manipulation of the gingival or periapical region of the teeth or perforation of the oral mucosa.	IIa	C
• Antibiotic prophylaxis is not recommended for local anaesthetic injections in non-infected tissues, treatment of superficial caries, removal of sutures, dental X-rays, placement or adjustment of removable prosthodontic or orthodontic appliances or braces, or following the shedding of deciduous teeth or trauma to the lips and oral mucosa.	III	C
B. Respiratory tract procedures • Antibiotic prophylaxis is not recommended for respiratory tract procedures, including bronchoscopy or laryngoscopy, transnasal or endotracheal intubation.	III	C
C. Gastrointestinal or urogenital procedures or TOE • Antibiotic prophylaxis is not recommended for gastroscopy, colonoscopy, cystoscopy, vaginal or caesarean delivery or TOE.	III	C
D. Skin and soft tissues procedures • Antibiotic prophylaxis is not recommended for any procedure.	III	C

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Prophylaxis for dental procedures at risk

Situation	Antibiotic	Single-dose 30–60 minutes before procedure	
		Adults	Children
No allergy to penicillin or ampicillin	Amoxicillin or Ampicillin[a]	2 g orally or i.v.	50 mg/kg orally or i.v.
Allergy to penicillin or ampicillin	Clindamycin	600 mg orally or i.v.	20 mg/kg orally or i.v.

[a]Alternatively, cephalexin 2 g i.v. for adults or 50 mg/kg i.v. for children, cefazolin or ceftriaxone 1 g i.v. for adults or 50 mg/kg i.v. for children.

"Cephalosporins should not be used in patients with anaphylaxis, angio-oedema, or urticaria after intake of penicillin or ampicillin due to cross-sensitivity".

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Take home message (1)
- Tricuspid valve disease -

- **Tricuspid regurgitation**
  - ***Most TR is secondary to tricuspid annular dilatation : functional TR..!!***

  →May diminish or disappear if RV decrease in size with HF treatment..!!

- **TAP or TVR 시 주의해야하는 구조물**
  - ***AV node*, aortic valve, RCA**

Take home message (2)
- Infective endocarditis -

- Diagnosis
  - Modified Duke criteria

- Indication of early surgery
  - Valve dysfunction causing HF
  - Heart block or abscess
  - Persistent infection
  - Resistant organism
  - recurrent emboli and persistent vegetation
  - Large mobile vegetation

Take home message (3)
- Infective endocarditis -

- Neurologic Cx 동반된 환자의 수술 시기
  - Hemorrhage
    - 4주 경과 후 수술 혹은 재평가
  - Infarct
    - Urgent or emergent op 가 필요한 경우에는 지체 없이 진행 (not coma, not hemorrhage)

Thank you for your attention~!

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