# Cardiovascular Thoracic Surgery

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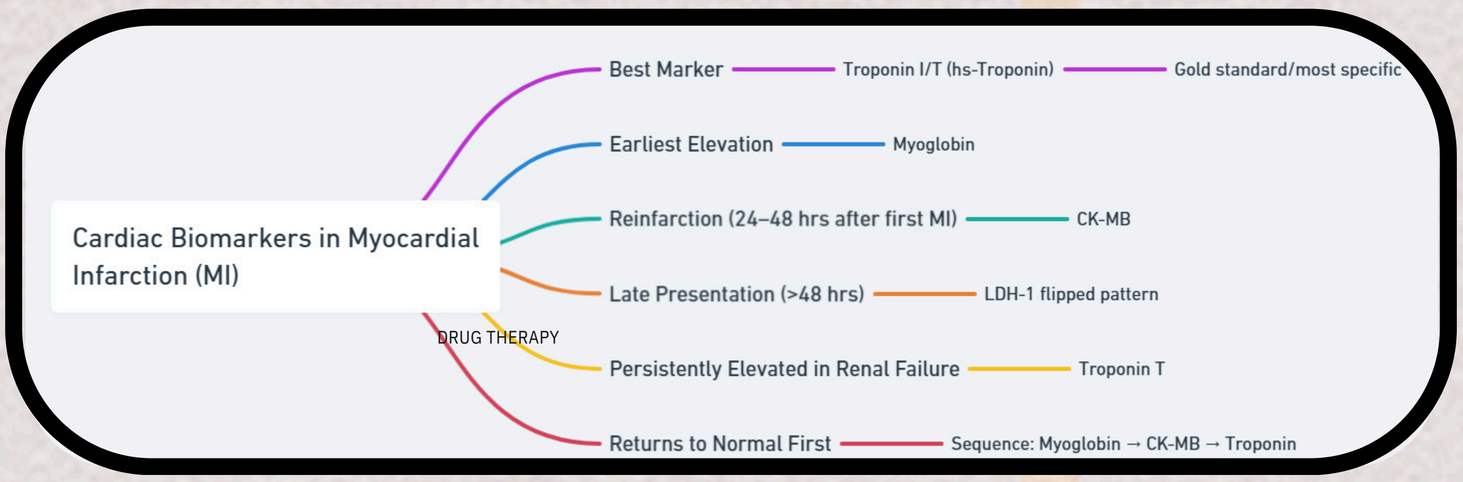



| Condition | Troponin Behavior |
|---|---|
| Chronic Kidney Disease | Mild persistent elevation, NOT diagnostic |
| Myocarditis | Elevated troponin without coronary occlusion |
| Pulmonary Embolism | Elevated but lower than MI |
| Sepsis/Critical illness | Can show elevation (“Type 2 MI”) |

## Quick Revision Points

- Troponin T > 0.1 ng/mL = diagnosticforMI
- CK-MB > 5% of total CK = significant
- In ST-elevation MI, if troponin is negative at 6 hours  MI ruled out
- Troponin elevation without ST elevation = NSTEMI

## Kawasaki

### ✅ Most Tested MCQ Points

Incomplete Kawasaki – suspect when: Fever + ≥2 features + elevated ESR/CR

Day of IVIG administration? Within 10 days of fever onset

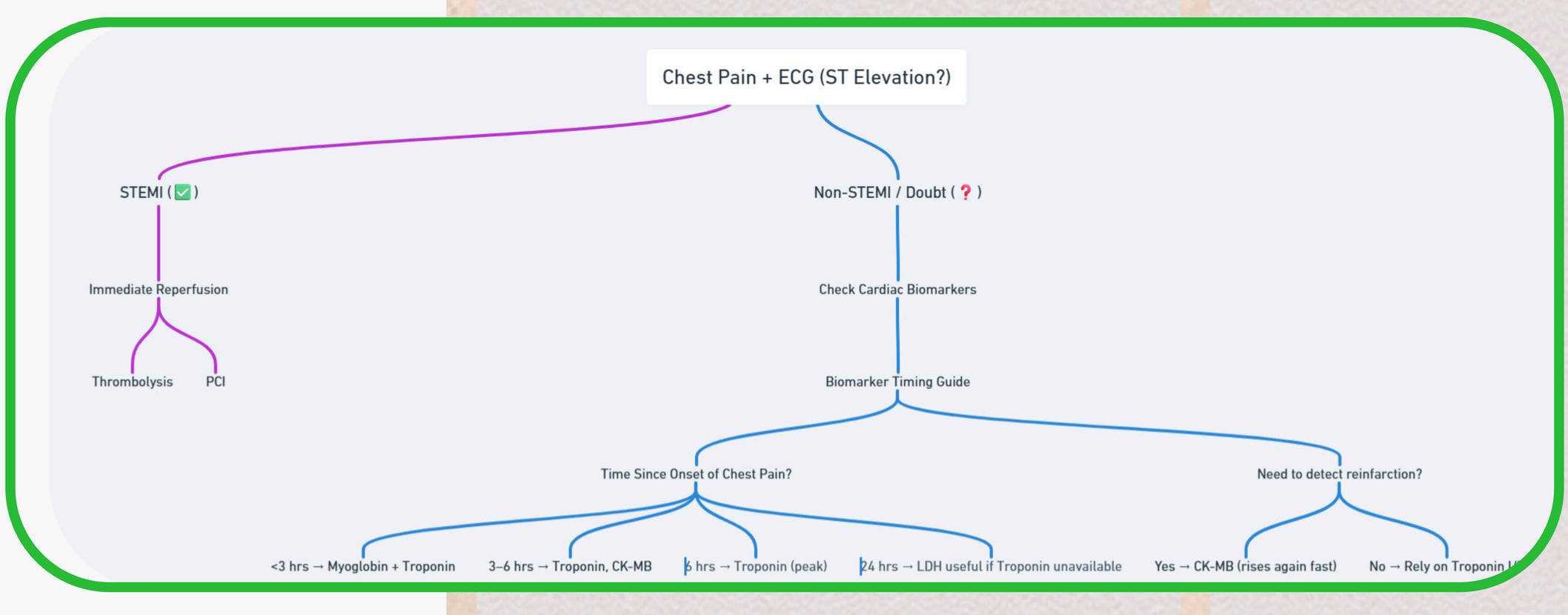
Best investigation? Echocardiography

Most dangerous complication? Coronary artery aneurysm

Thrombocytosis appears in? Subacute phase

Resistant Kawasaki treatment? Repeat IVIG or cor ticosteroids

## Chest Pain + ECG (ST Elevation?)



# Cardiovascular Thoracic Surgery

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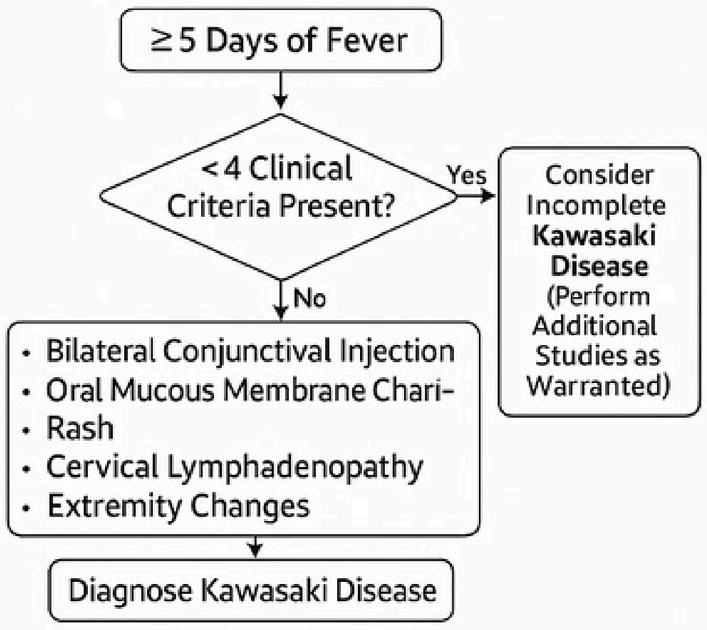
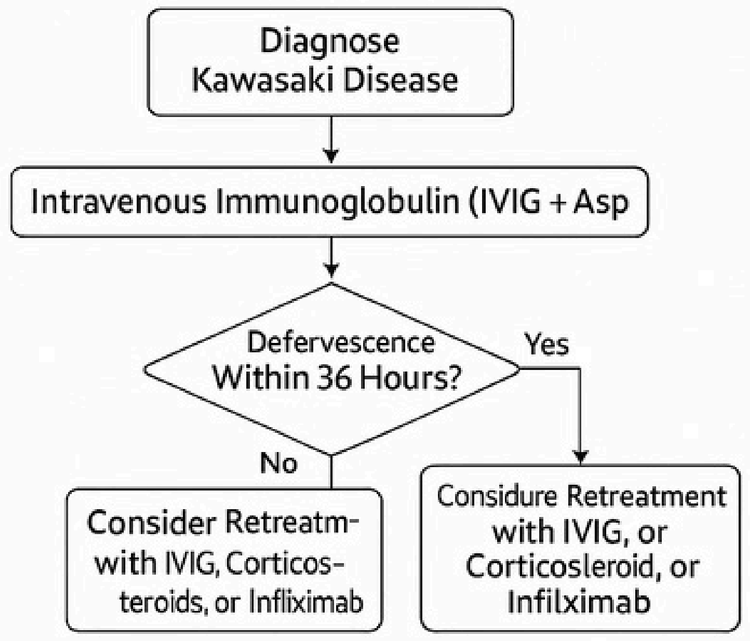
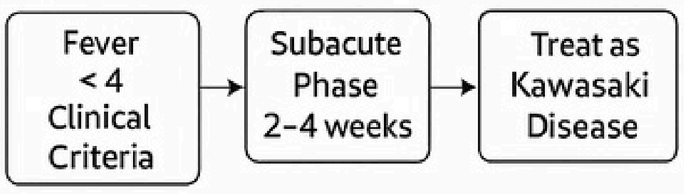
## Diagnosis of Kawasaki Disease



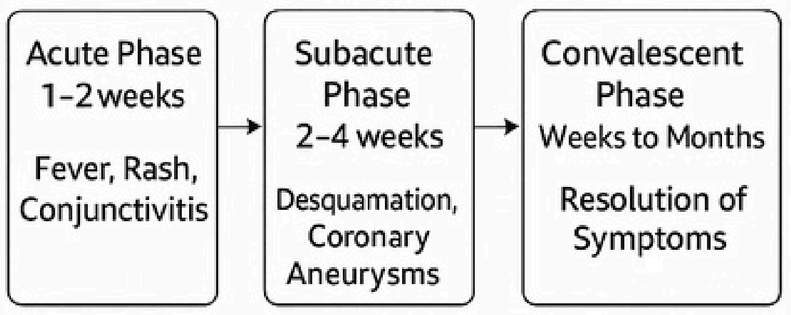

## Treatment Algorithm

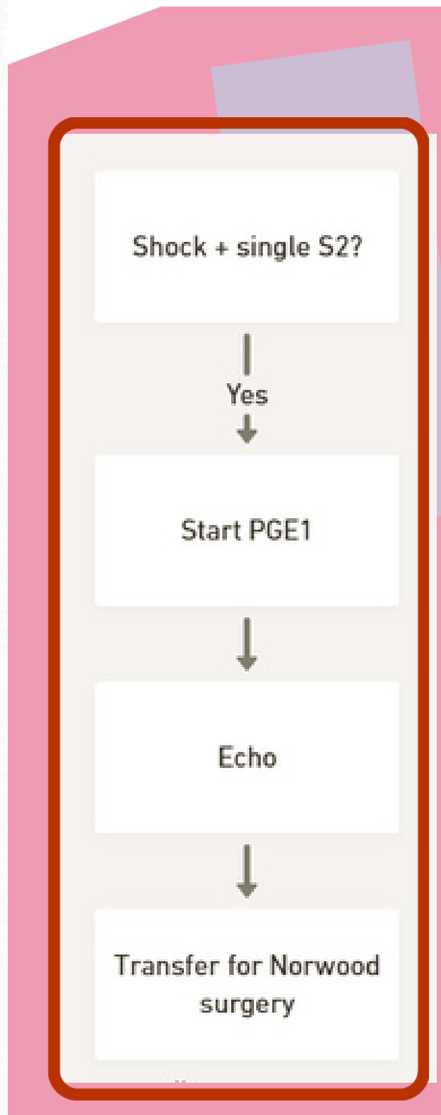



## Approach to Incomplete Kawasaki Disease



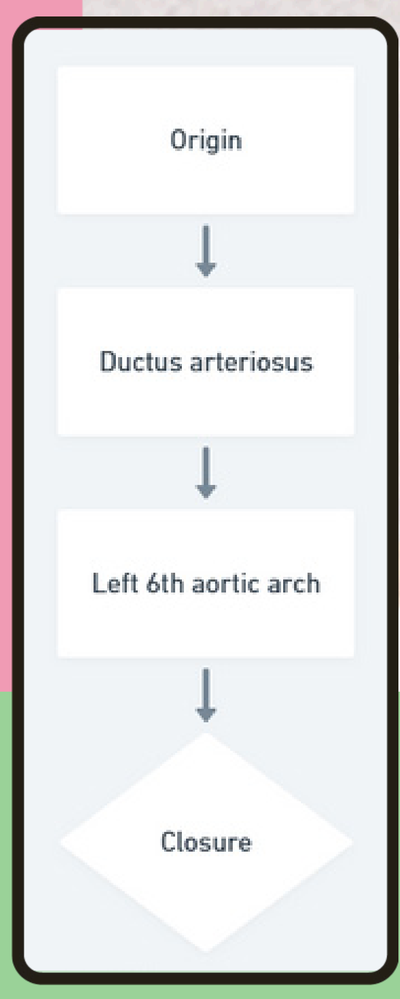

## Phases of Kawasaki Disease



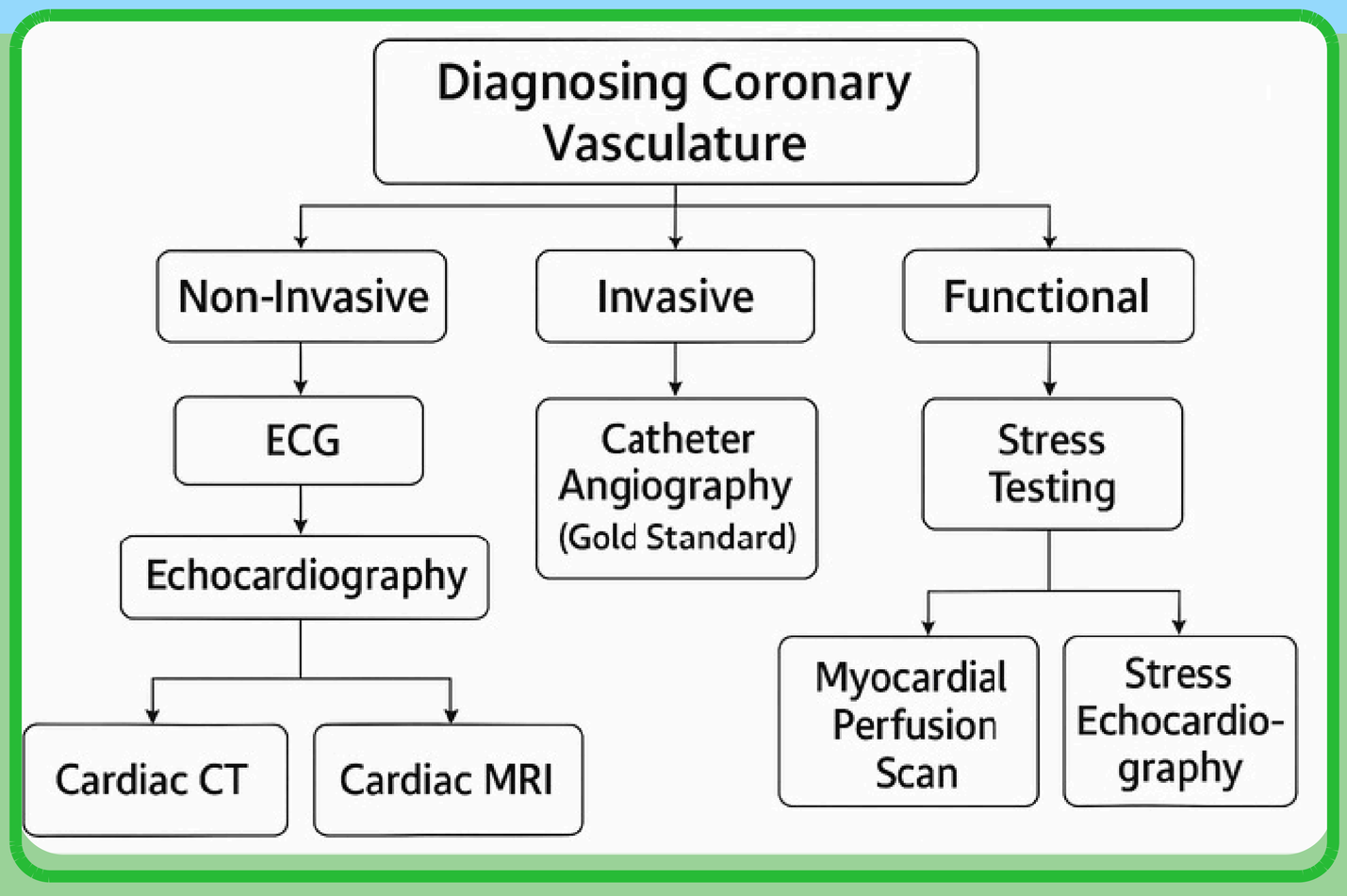

## Neonate Suspected HLHS

## Embryology

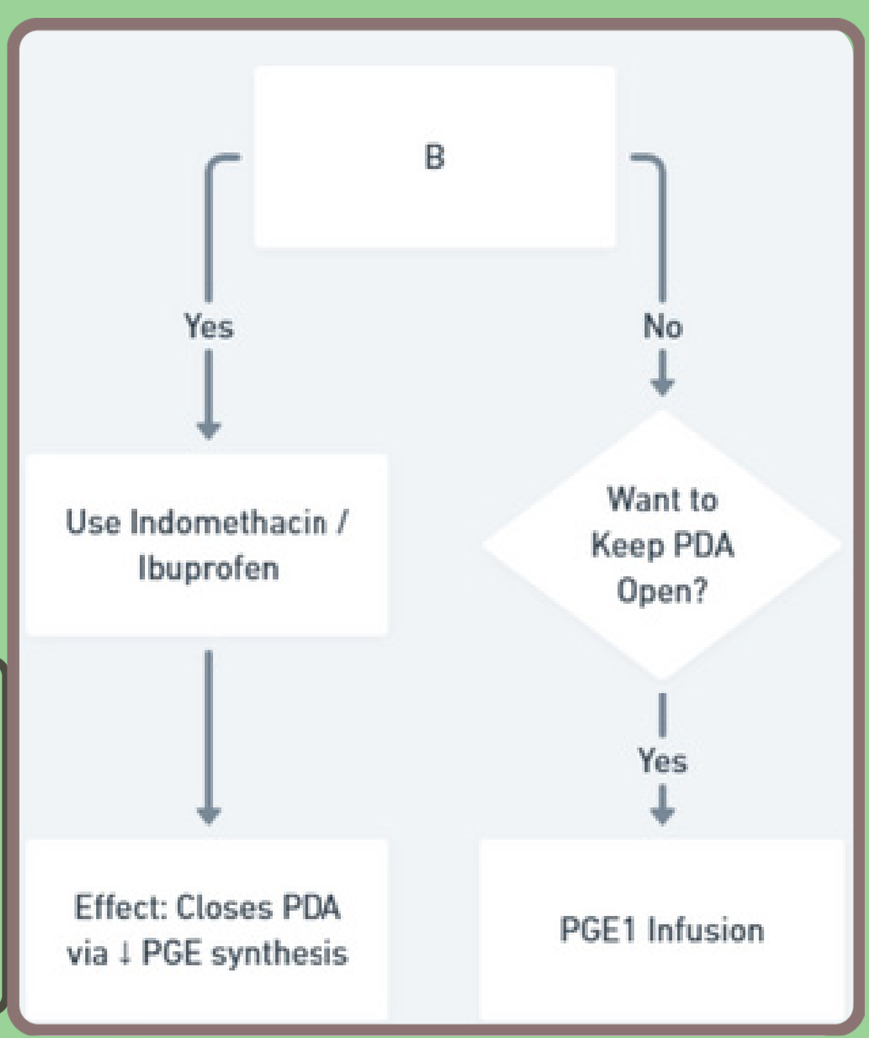



## 5. MU?T-?NO? MC? PO?NT?

- Gold Standardfor CoronaryImaging InvasiveCoronaryAngiography
- Best non-invasive test for coronary artery stenosis CTCA
- Best for myocardial viability Cardiac MRI / PET
- Best for coronary flow reserve / microvascular angina PET or Doppler flow in cath lab
- Coronary Calcium Score (Agatston Score) Done via CT to estimate future CAD risk




## DRUG THERAPY




## 5. Must-Know MCQ Points

- **Gold Standard for Coronary Imaging → Invasive Coronary Angiography**
- **Best non-invasive test for coronary artery stenosis → CTCA**
- **Best for myocardial viability → Cardiac MRI / PET**
- **Best for coronary flow reserve / microvascular angina → PET or Doppler flow in cath lab**
- **Coronary Calcium Score (Agatston Score) → Done via CT to estimate future CAD risk**

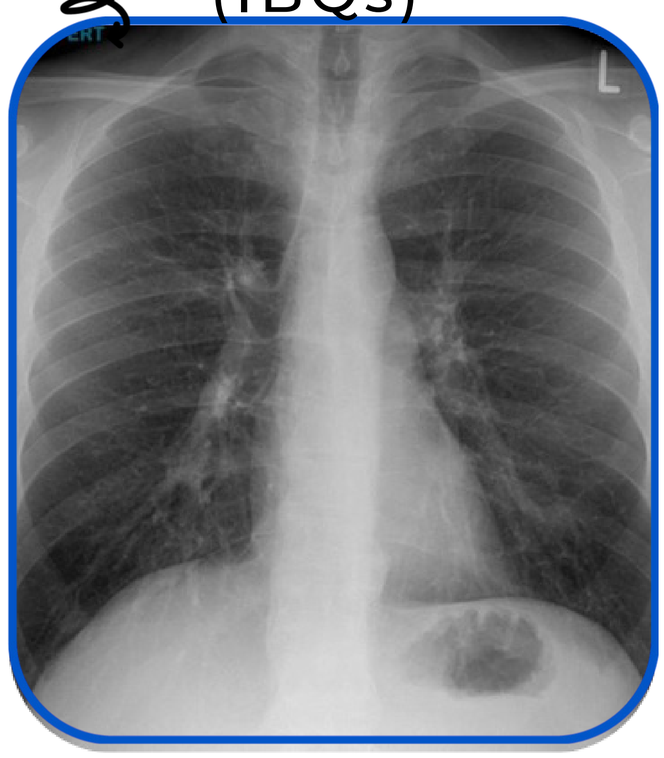
# Cardiovascular Thoracic Surgery



## When to Choose Which Test? (Clinical Decision)

| Clinical Situation | Best Investigation |
|---|---|
| Ongoing chest pain + ST Elevation | **Immediate Coronary Angiography (Cath Lab)** |
| Suspected NSTEMI | **ECG + Troponin → Early Angiography** |
| Stable Angina, low-intermediate risk | **Stress ECG or Stress Echo** |
| Stable Angina, high risk or inconclusive tests | **CT Coronary Angiography (CTCA)** |
| Known CAD + planning revascularization | **Invasive Coronary Angiography** |
| Suspected coronary anomalies in young | **Cardiac MRI / CTCA** |
| Assessment of myocardial viability before CABG | **Cardiac MRI or PET** |

Chest X-ray (IBQs)



## Comparison of Major Investigations of Coronary Arteries

| Investigation | Type | What it Detects | Limitations |
|---|---|---|---|
| **ECG (Resting)** | Non-invasive | Ischemia, infarction changes | Poor sensitivity for stable CAD |
| **Echocardiography (TTE)** | Non-invasive | Wall motion abnormalities | Cannot directly visualize coronaries |
| **Stress ECG** | Functional | Exercise-induced ischemia | Low sensitivity in women & baseline ECG abnormalities |
| **Stress Echo** | Functional | Regional wall motion under stress | Operator-dependent |
| **Myocardial Perfusion Scan (SPECT)** | Functional | Perfusion defects | Radiation exposure |
| **CT Coronary Angiography (CTCA)** | Non-invasive imaging | Coronary anatomy, calcium scoring | Not for high heart rate / calcified arteries |
| **Cardiac MRI (CMR)** | Non-invasive | Function, perfusion, viability | Limited coronary resolution |
| **Coronary Angiography (CAG)** | Invasive (Gold Standard) | Lumen stenosis & anatomy | Risky: bleeding, stroke, dissection |

**Left Recurrent Laryngeal Nerve (branch of vagus; loops around aortic arch near PDA)**

Nearest Nerve during PDA ligation (Surgery Viva Question)

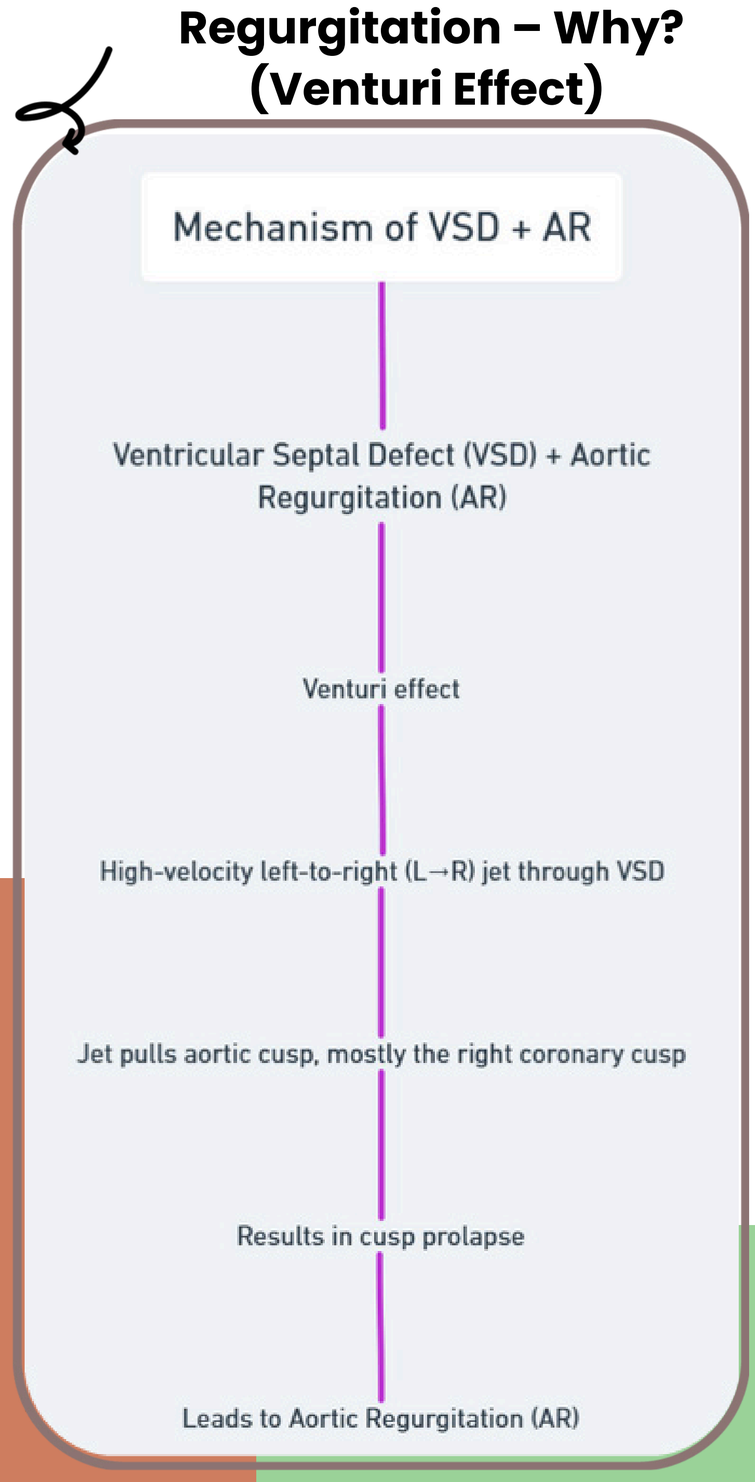
# Cardiovascular Thoracic Surgery



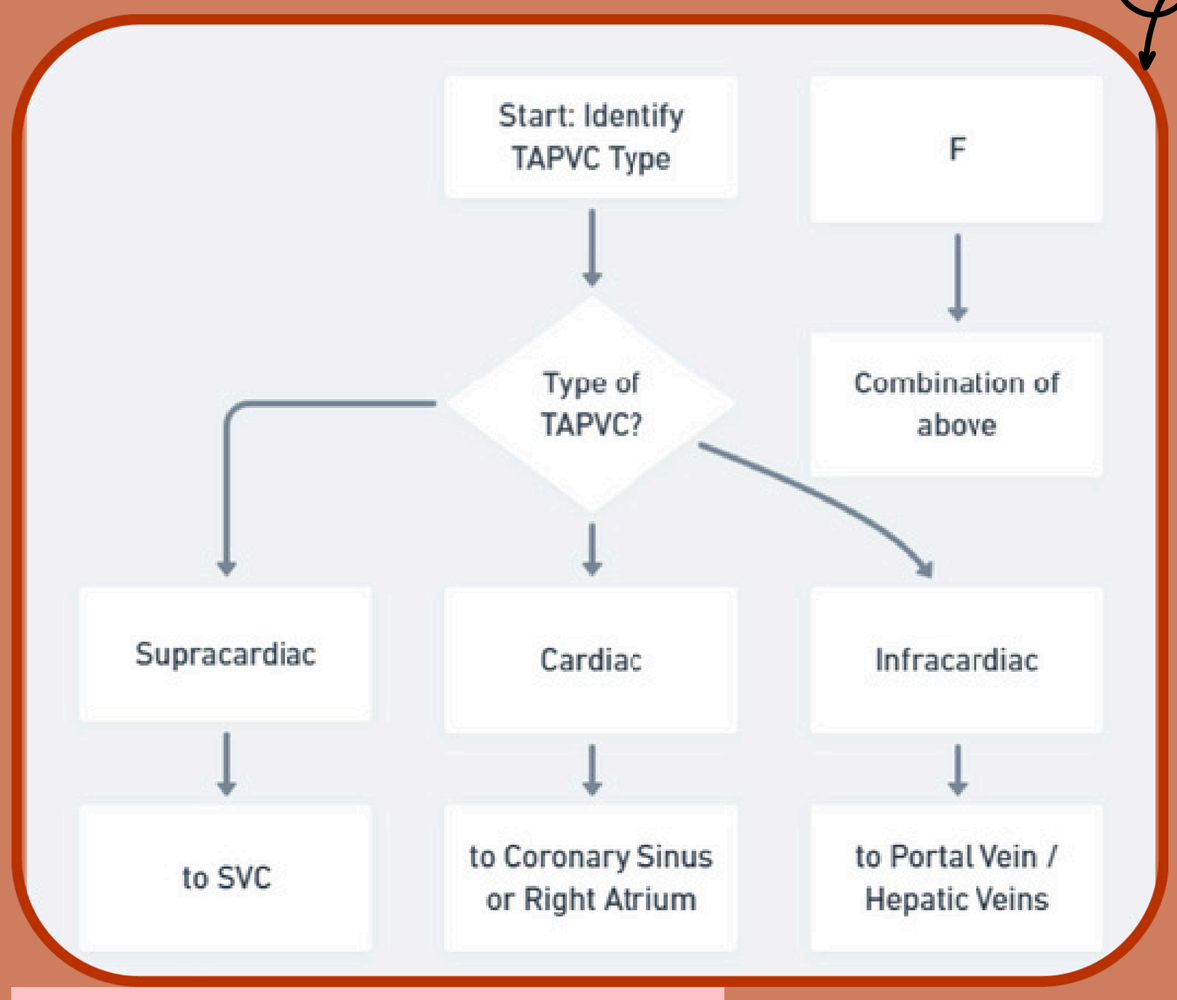
## Rastelli Operation

| Q | A |
|---|---|
| **Done for?** | **TGA with VSD and Pulmonary Stenosis** |
| **What is done?** | VSD is routed to aorta + conduit from RV → pulmonary artery |
| **Alternative?** | Arterial switch (Jatene) preferred if no PS |

## VSD Causing Aortic Regurgitation – Why? (Venturi Effect)



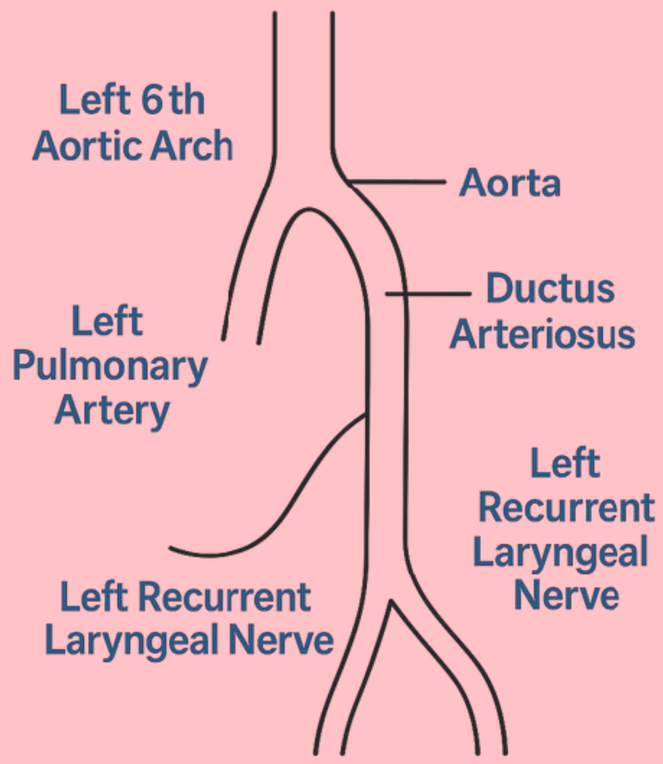

This flowchart shows the classification of Total Anomalous Pulmonary Venous Connection (TAPVC):




## Ebstein's Anomaly

| Feature | Detail |
|---|---|
| **Most common valve affected** | Tricuspid valve (displaced inferiorly) |
| **Leads to** | Atrialized RV + TR + RA enlargement |
| **Association** | WPW syndrome (accessory pathwa |

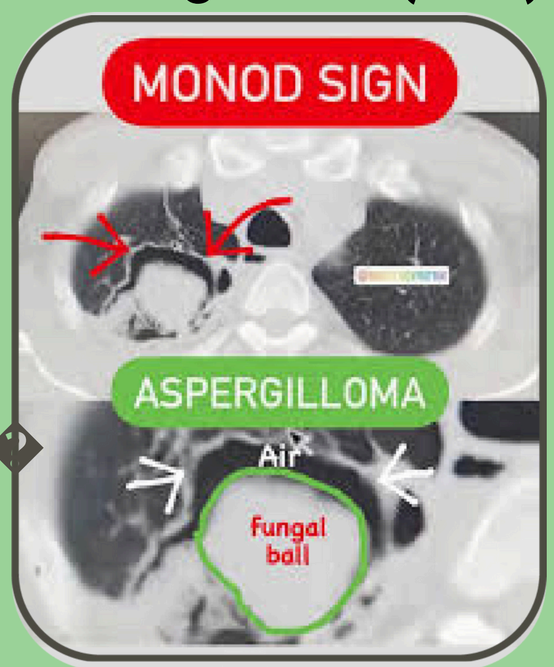
## PDA – Embryology




**Sign**

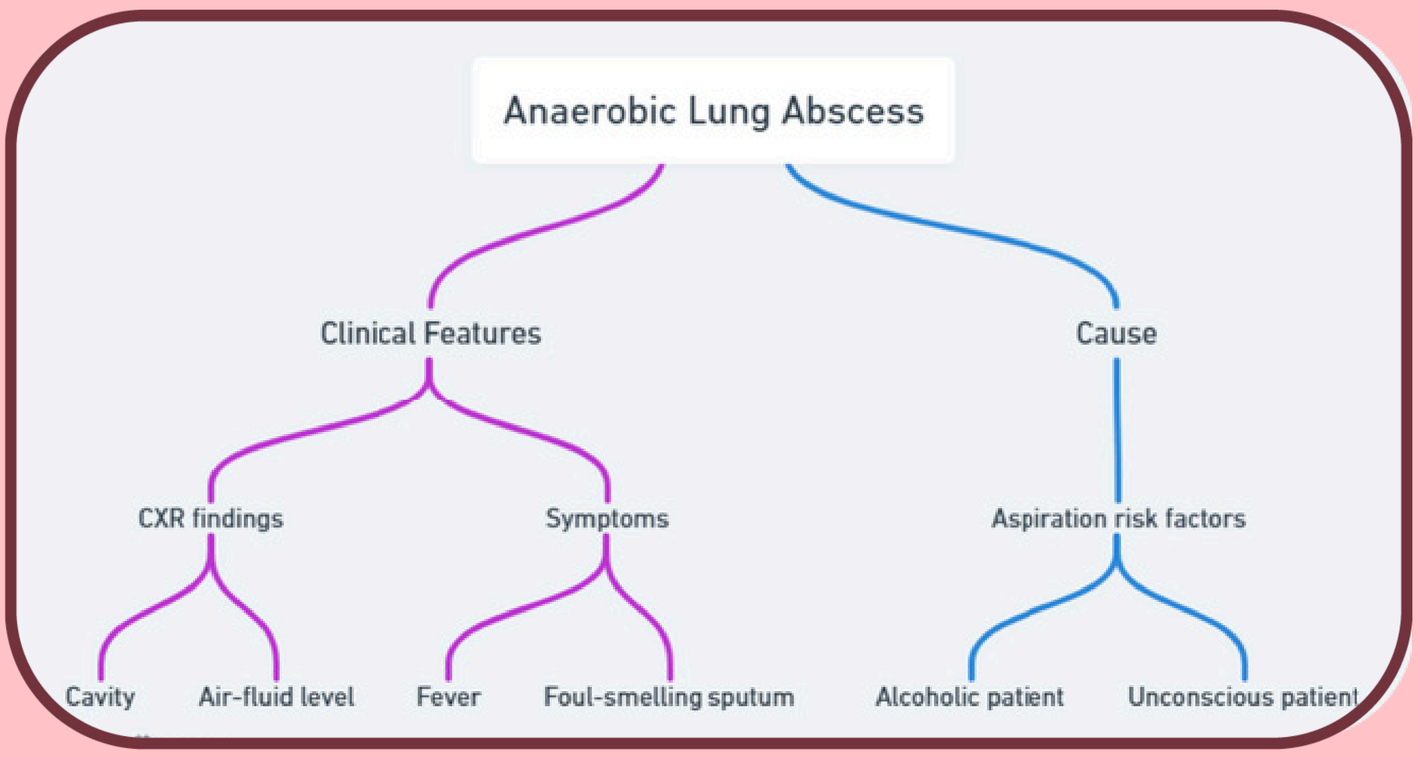
Mo□es wi□h po□tu□e Mo□il□ fu□gu□ ba□l wi□hi□ pr□-e□is□□ng ca□it□ (o□d TB ca□it□)

## Cyanotic Spell Management (TOF)

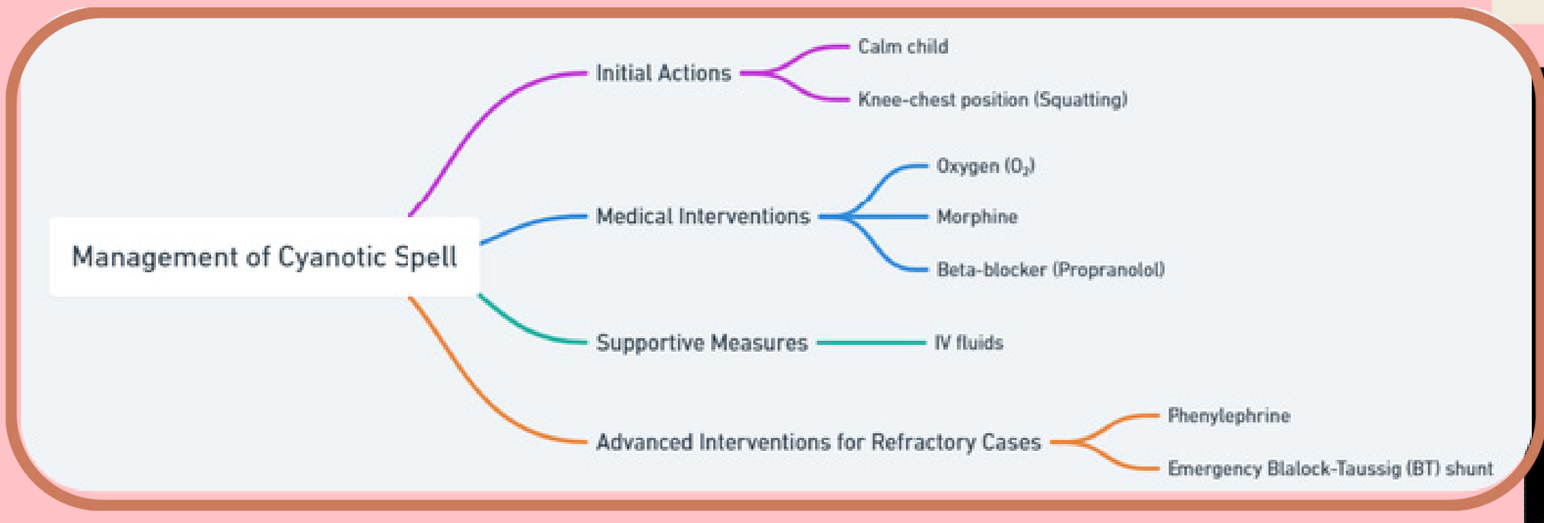


# Cardiovascular Thoracic Surgery





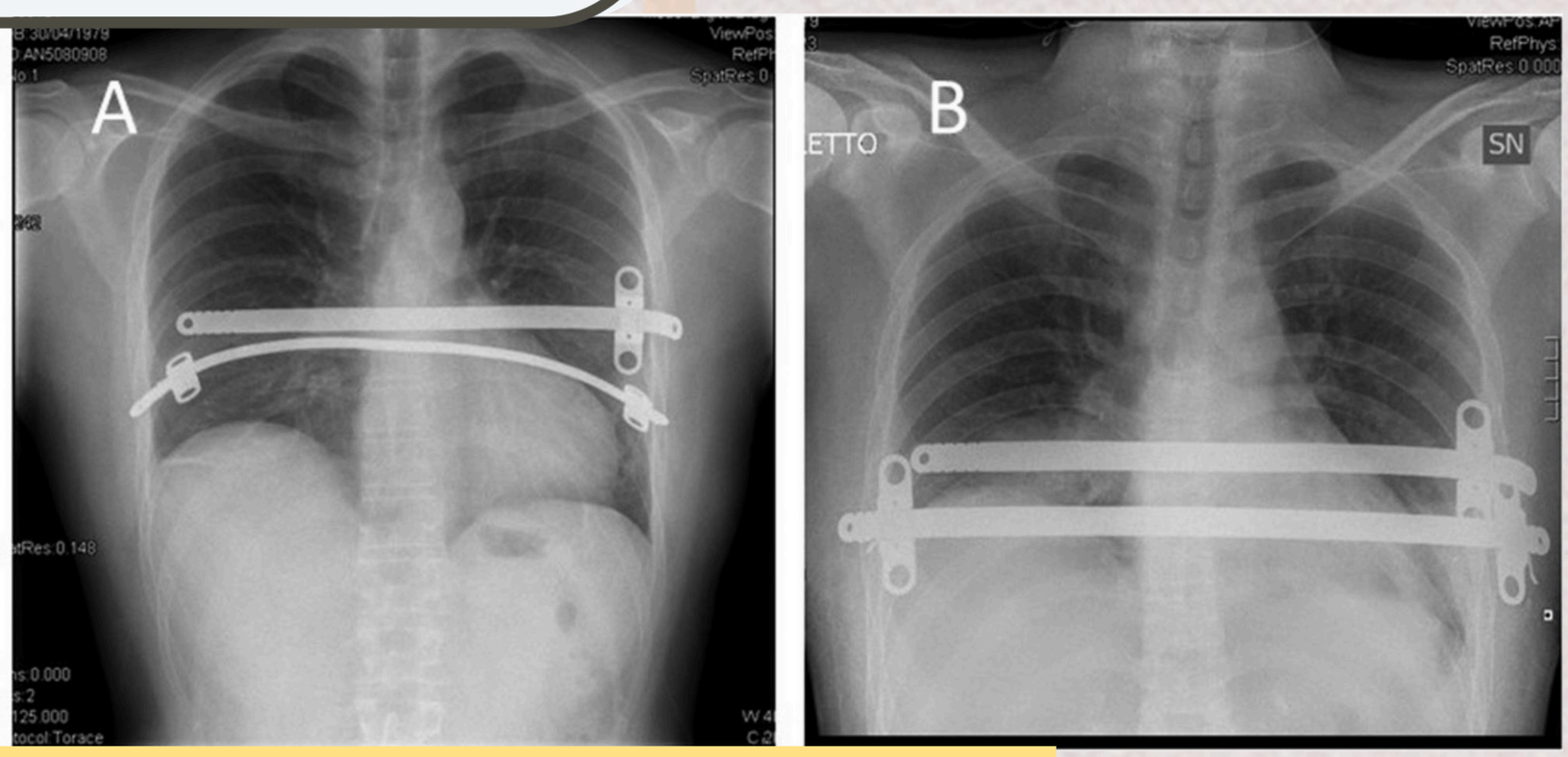

| Feature | Detail |
|---|---|
| Triad | 1. Clubbing 2. Periostitis of long bones 3. Arthralgia |
| Seen in | Lung adenocarcinoma (most common)<br>Periosteal new bone formation (on long bones) |
| X-ray | |



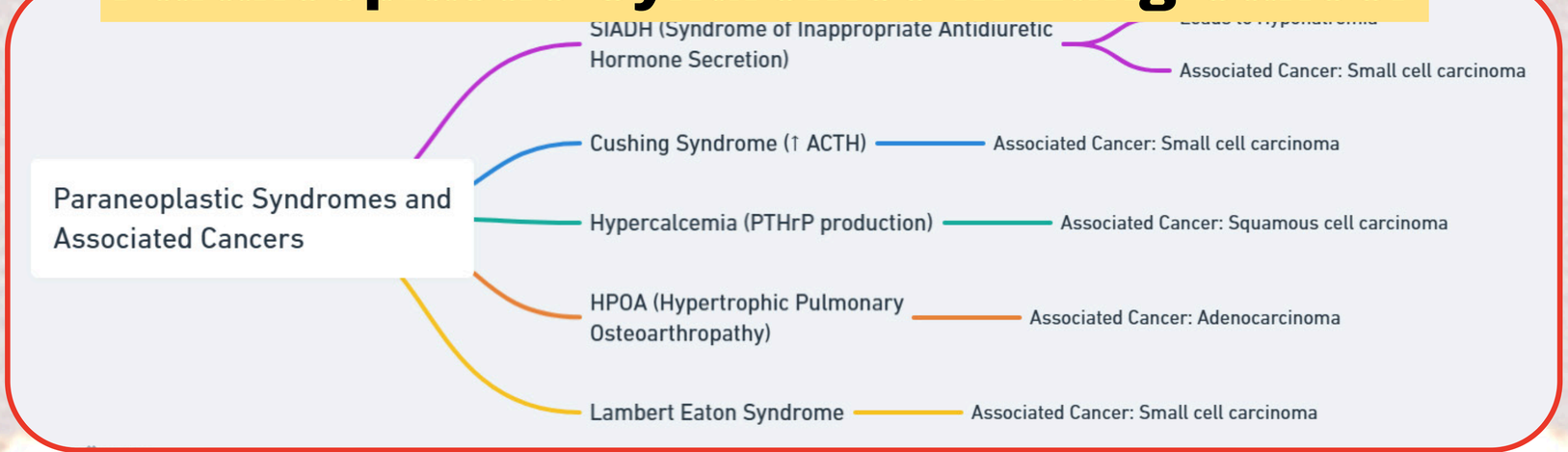

## Post-Pneumonectomy – Normal Sequelae (X-ray)


**NussProcedure –**

Done For Pectus Excavatum (funnel chest)




## Paraneoplastic Syndromes in Lung Cancer



# Cardiovascular Thoracic Surgery

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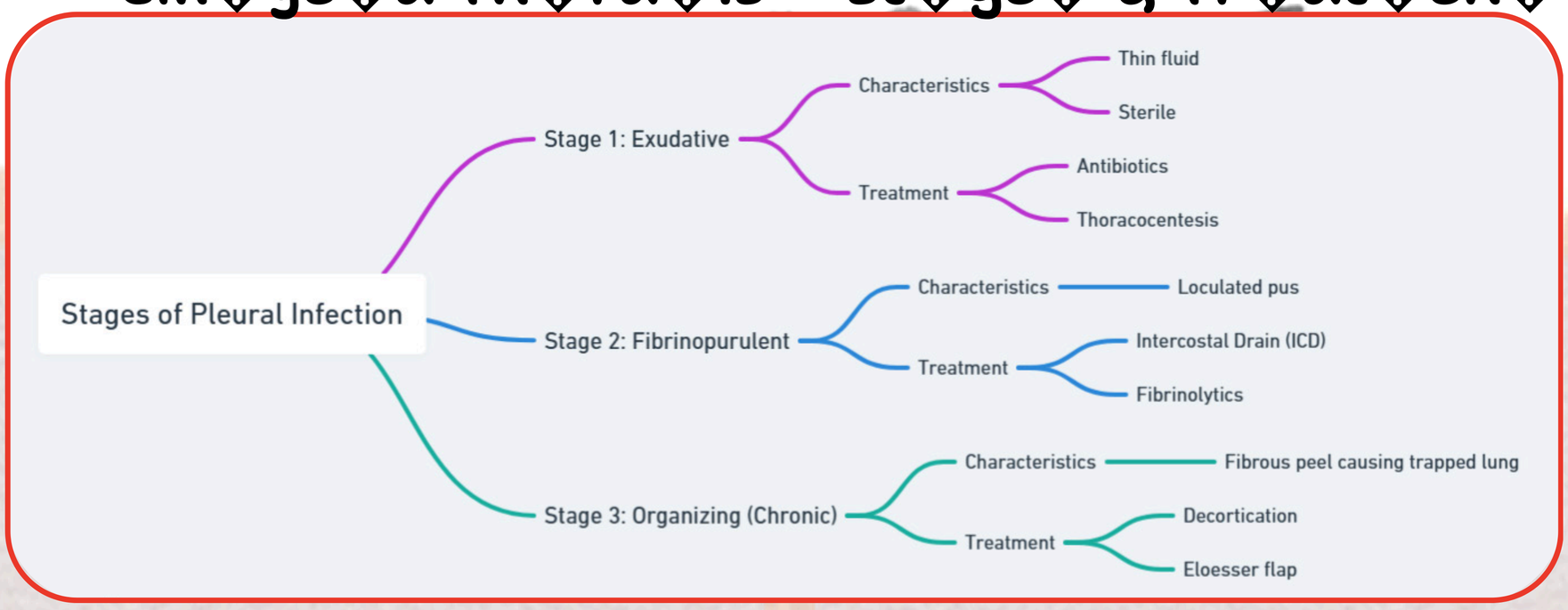
## Em?ye?a Th?ra?is – St?ge? & Tr?at?en?

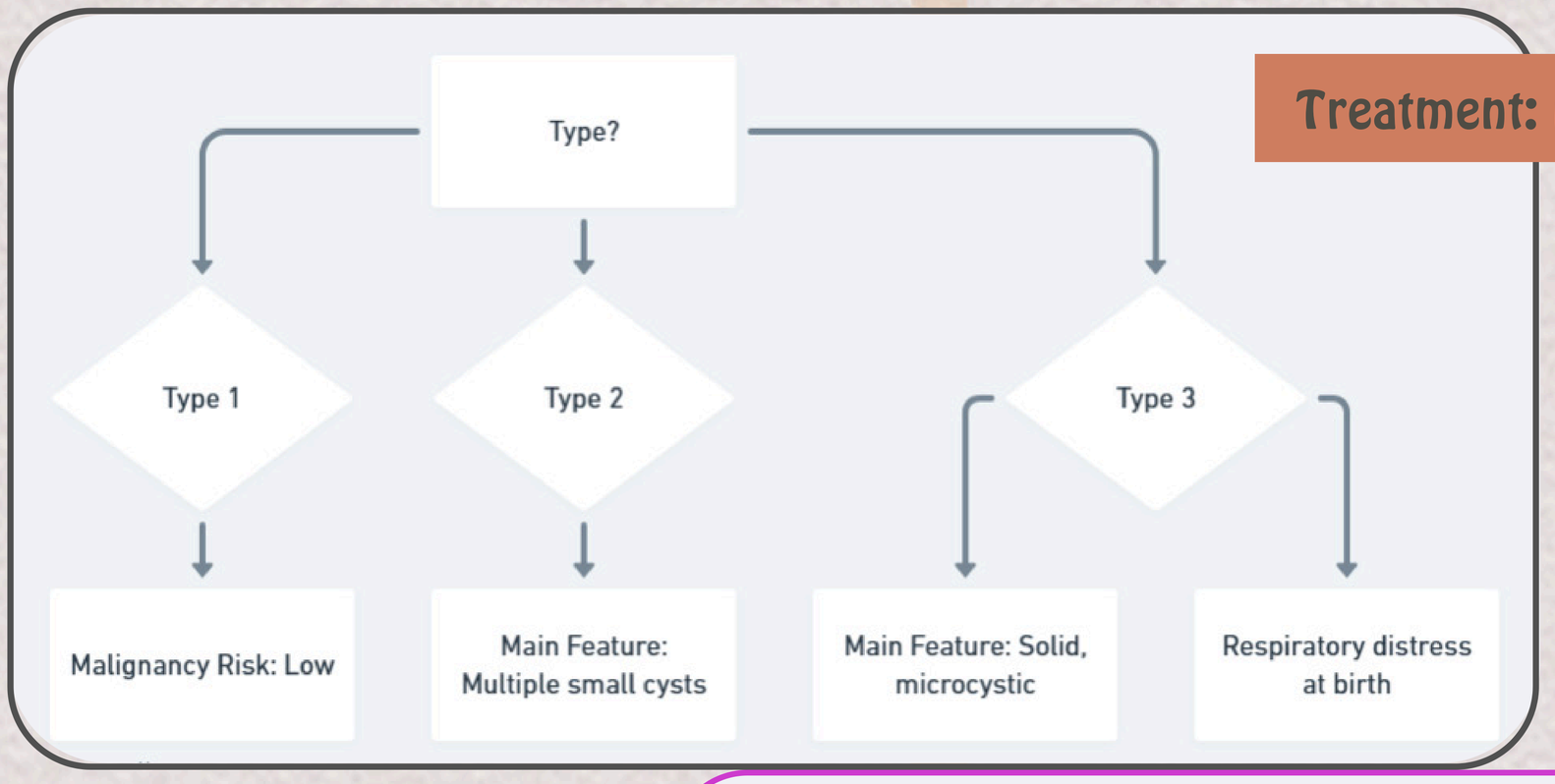



## Lung Abscess vs Aspergilloma

- **Lung Abscess
  - Cause: Aspiration (anaerobes
  - Chest X-Ray (CXR): Air-fluid level
  - Sputum: Foul-smelling

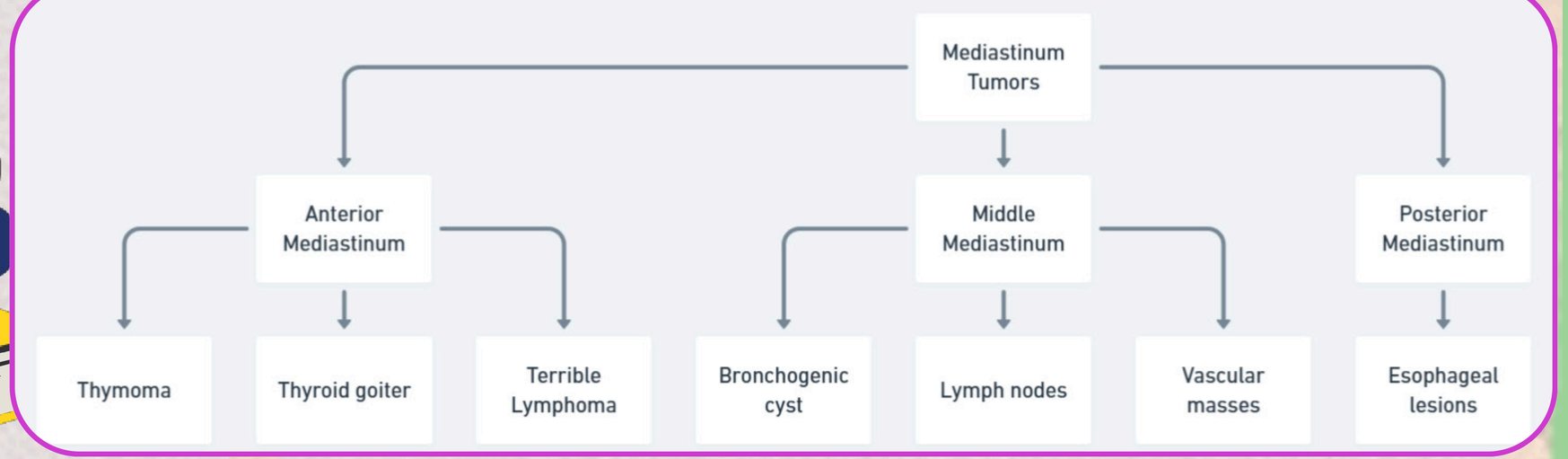
- **Aspergilloma
  - Cause: Fungal ball in old TB cavity
  - Chest X-Ray (CXR): Monod/air-crescent sign
  - Sputum: Hemoptysis possible

## CCAM – Congenital Cystic Adenomatoid Malformation

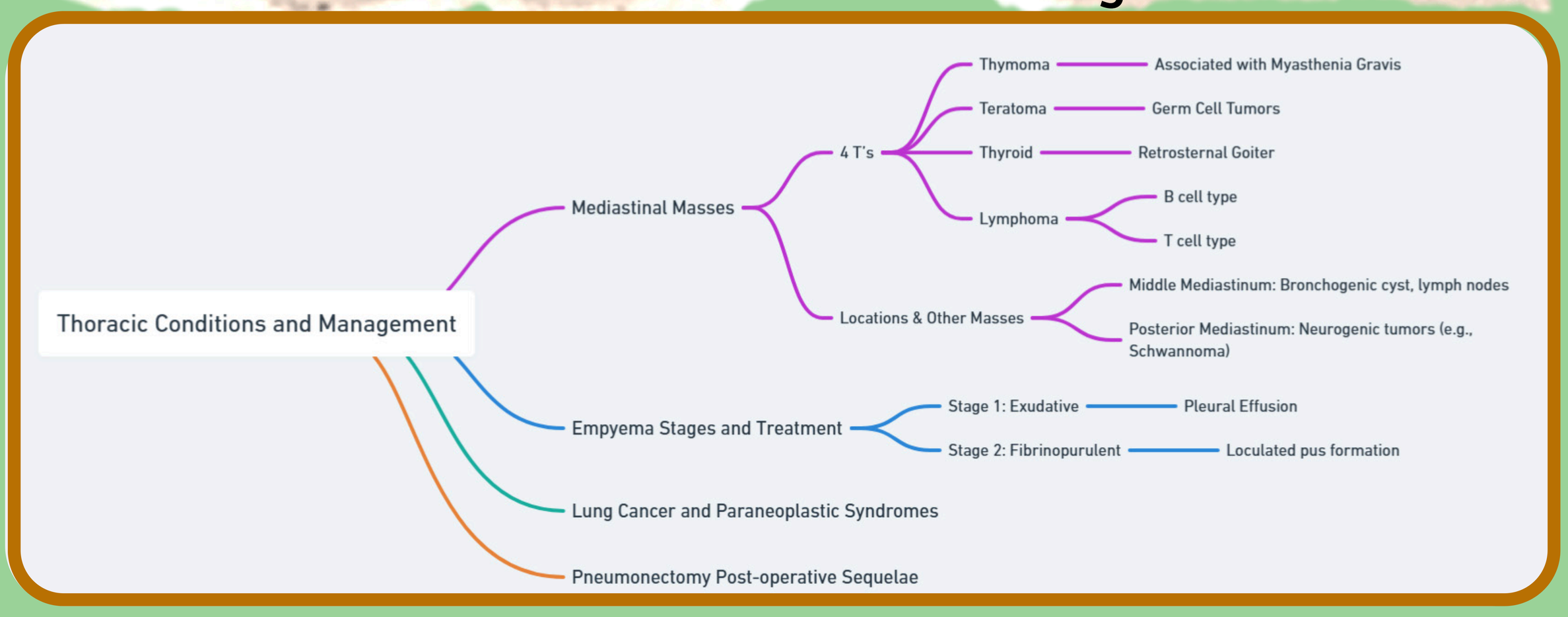



**Treatment: Lobectomy**

- **Future MCQ:** "Thymoma is the most common anterior mediastinal tumor in adults"
- **Association:** Thymoma + Myasthenia gravis (autoimmune)

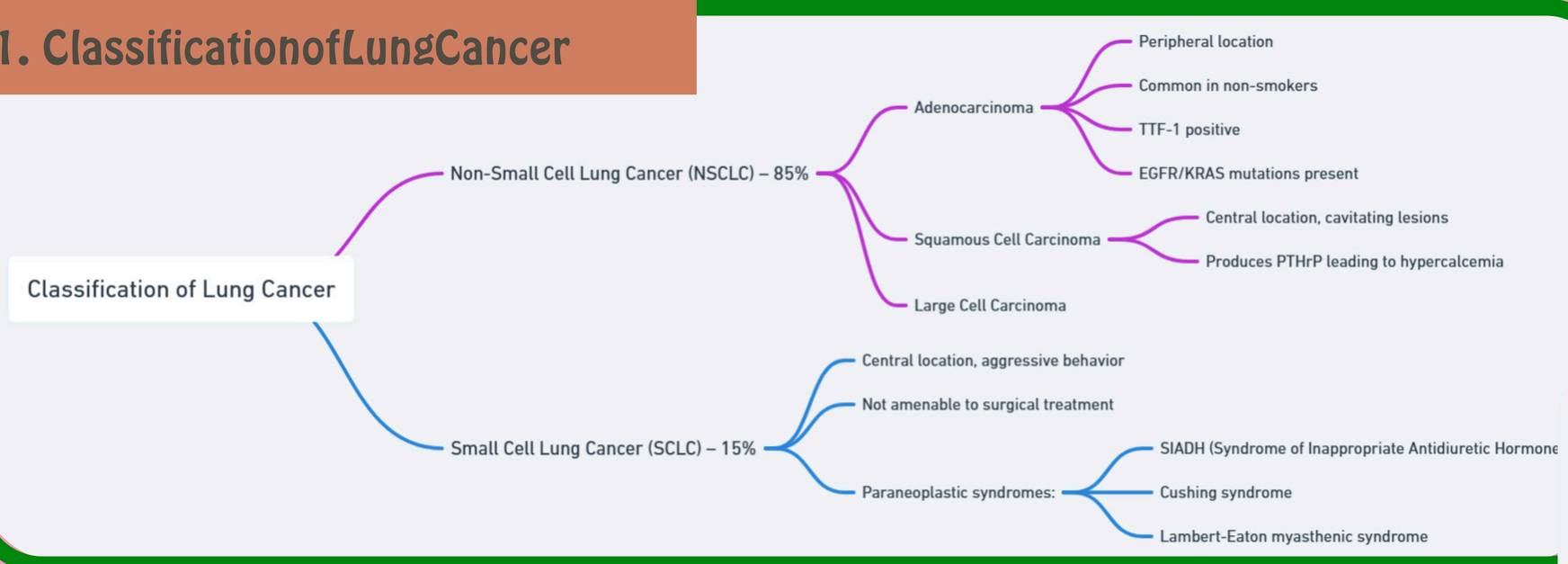



## Thoracic Conditions and Management

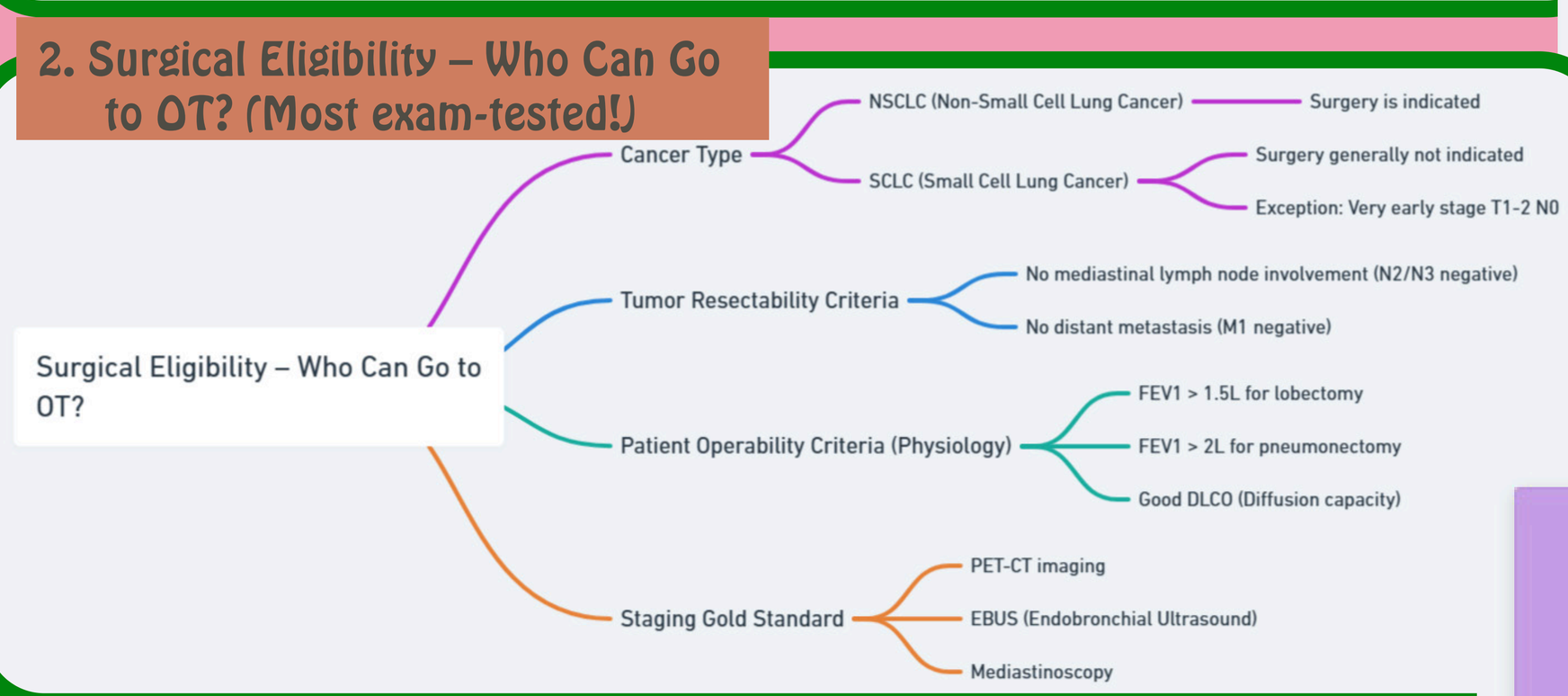


# Lung Cancer – Staging & Surgery (NEET-SS Focus)

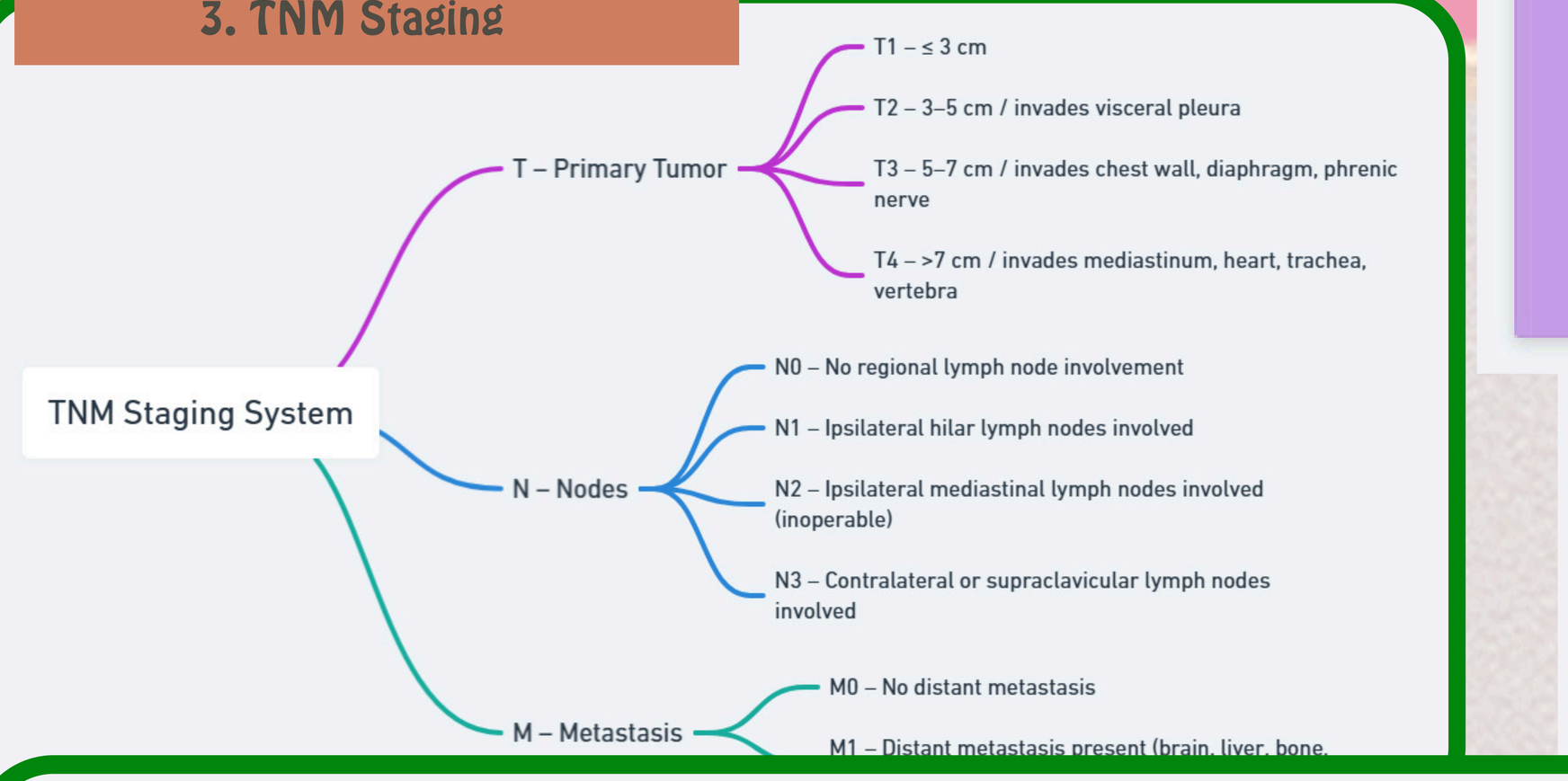
## 1. ClassificationofLungCancer



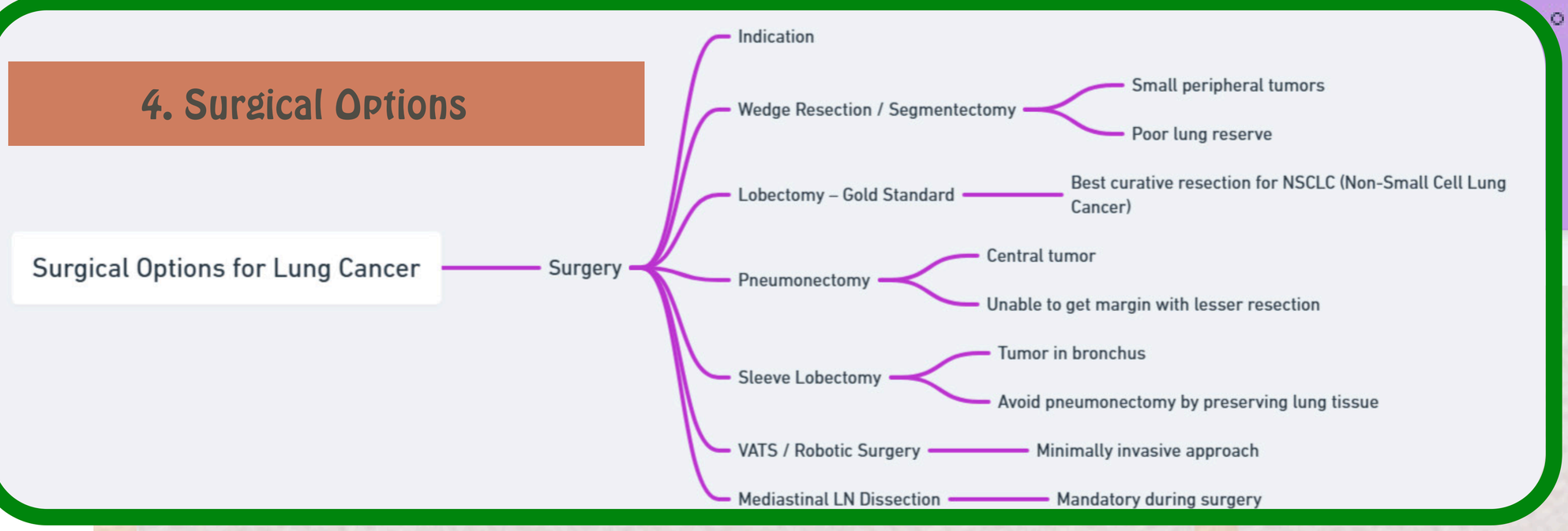

## 2. Surgical Eligibility – Who Can Go to OT? (Most exam-tested!)




## 3. TNM Staging




## 4. Surgical Options

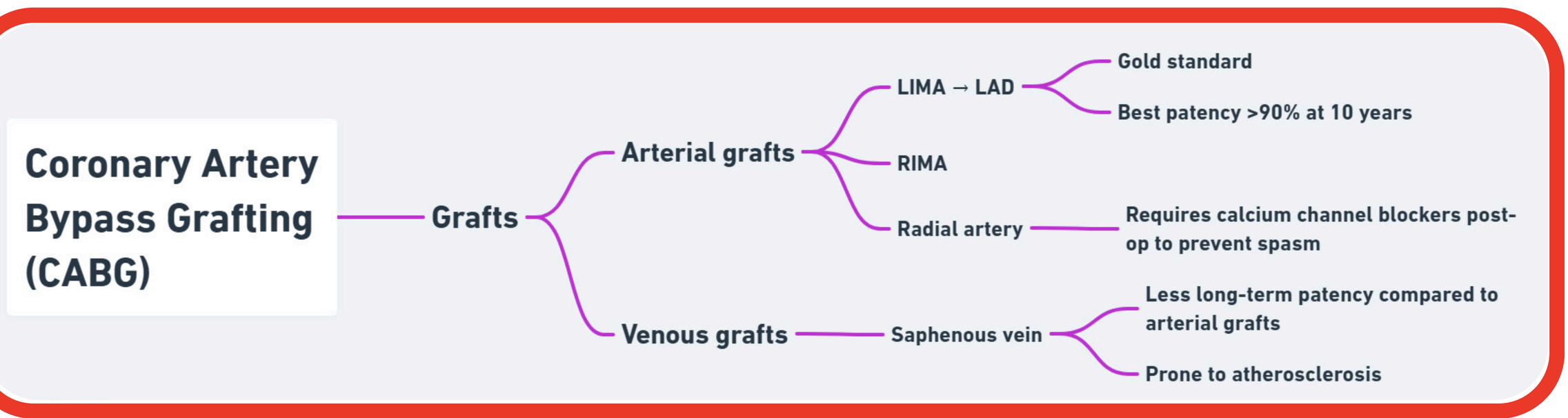



- Post-Surgical Complications
  - Late complications
    - Post-pneumonectomy syndrome (tracheal shift
    - Empyema thoracis
  - Immediate complications
    - Bleeding
    - Air leak
    - Arrhythmia
  - Early complications
    - Atelectasis
    - Pneumonia
    - Bronchopleural fistula


## 7. Future Exam Predictions (New Trends)

- Immunotherapy-based staging incorporating biomarkers such as PD-L1, ALK, and EGFR
- Shift in Small Cell Lung Cancer (SCLC) staging from Limited/ Extensive classification to TNM system
- Use of Stereotactic Body Radiation Therapy (SBRT) for Stage I lung cancer patients who are unfit for surgery
- Adoption of Robotic Lobectomy as the newer surgical gold standard for lung cancer resection
- Implementation of adjuvant Osimertinib therapy after resection in EGFR-positive Non-Small Cell Lung Cancer (NSCLC) based on ADAURA trial results
- Integration of molecular testing to guide targeted therapies in lung cancer treatment plans
- Enhanced imaging techniques improving accuracy in lung cancer staging and treatment planning
- Emphasis on multidisciplinary team approaches combining surgery, radiation, systemic therapy, and immunotherapy
- Development of novel immune checkpoint inhibitors expanding treatment options beyond PD-L1 targeting
- Personalized medicine approaches tailoring treatments based on genetic mutations and tumor microenvironment profiling

## Adult Heart Disease



## KEY QUESTIONS ASKED PREVIOUSLY

1.Best graft? → LIMAto LAD
2.First graft to occlude? → Saphenous vein
3.Radial artery special precaution? → Give CCB

**MIDCAB (Minimally Invasive Direct CABG)**

- Definition
  - Minimally invasive coronary artery bypass grafting
  - LIMA to LAD grafting through left mini-thoracotomy
- Surgical Approach
  - Left mini-thoracotomy incision
  - No sternotomy required
- Procedure Characteristics
  - Off-pump surgery (no cardiopulmonary bypass)
  - Direct visualization and access to LAD artery
- Indications and Limitations
  - Limited to single-vessel LAD disease
- Advantages
  - Reduced surgical trauma and recovery time
  - Avoidance of cardiopulmonary bypass complications

**Coarctation of Aorta (Stent-based Treatment)**

- Stent Placement
  - Access site: Femoral artery
  - Location: Just distal to left subclavian artery
- Radiographic Signs (CXR)
  - "3 Sign"
  - Rib notching (late sign)
- Complications
  - Aortic rupture
  - Aneurysm formation
  - Spinal cord ischemia

**Paroxysmal Nocturnal Dyspnea (PND)**

- Definition
  - Occurs at night
  - Patient wakes up gasping for breath
- Cause
  - Left Ventricular (LV) failure
    - Leads to pulmonary venous congestion
- Associated Conditions
  - Mitral stenosis
  - Left ventricular dysfunction
  - Ischemic heart disease
- Relief Measures
  - Sitting up (orthopnea position)

## LA Myxoma (Echo-based IBQ)

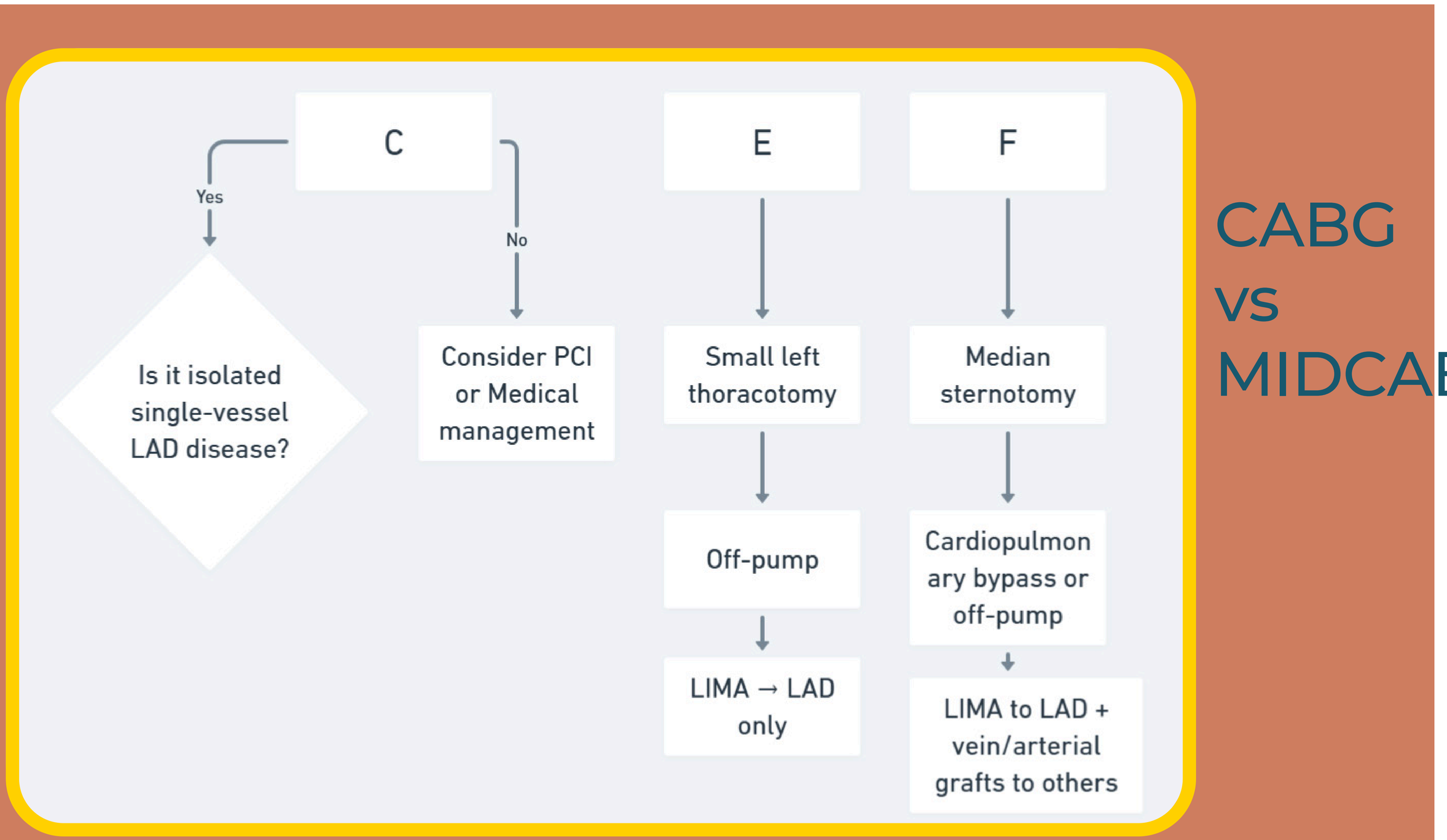
- Overview
  - Most common primary cardiac tumor
- Site
  - Left atrium
  - Attached to fossa ovalis of interatrial septum
- Echo Findings
  - Mobile pedunculated mass
  - Prolapsing into mitral valve
- Symptoms
  - "Tumor plop" sound
  - Syncope
  - Embolic stroke
  - Fever and high IL-6 (mimics infective endocarditis)

## Pulsus Paradoxus

- Definition
  - Drop in systolic BP >10 mmHg during inspiration
- Seen In
  - Cardiac tamponade (most common)
  - Massive asthma
  - COPD (Chronic Obstructive Pulmonary Disease)
  - Tension pneumothorax
- Mechanism
  - Right ventricle overfilling during inspiration
    - Leads to interventricular septal shift toward left ventricle
    - Results in decreased left ventricular stroke volume

## Biventricular Pacemaker (Cardiac Resynchronization Therapy – CRT)

- Purpose
  - Resynchronizes contraction of right ventricle (RV) and left ventricle (LV)
  - Used in heart failure patients
- Lead Placement
  - Right atrium
  - Right ventricle
  - Coronary sinus → to left ventricle
- Indications
  - Left ventricular ejection fraction (LVEF) <35%
  - QRS duration >150 ms (Left Bundle Branch Block pattern)
  - Symptomatic heart failure (NYHA class III/IV)




## Te?tb?ok Fa?ts to In?lu?e:

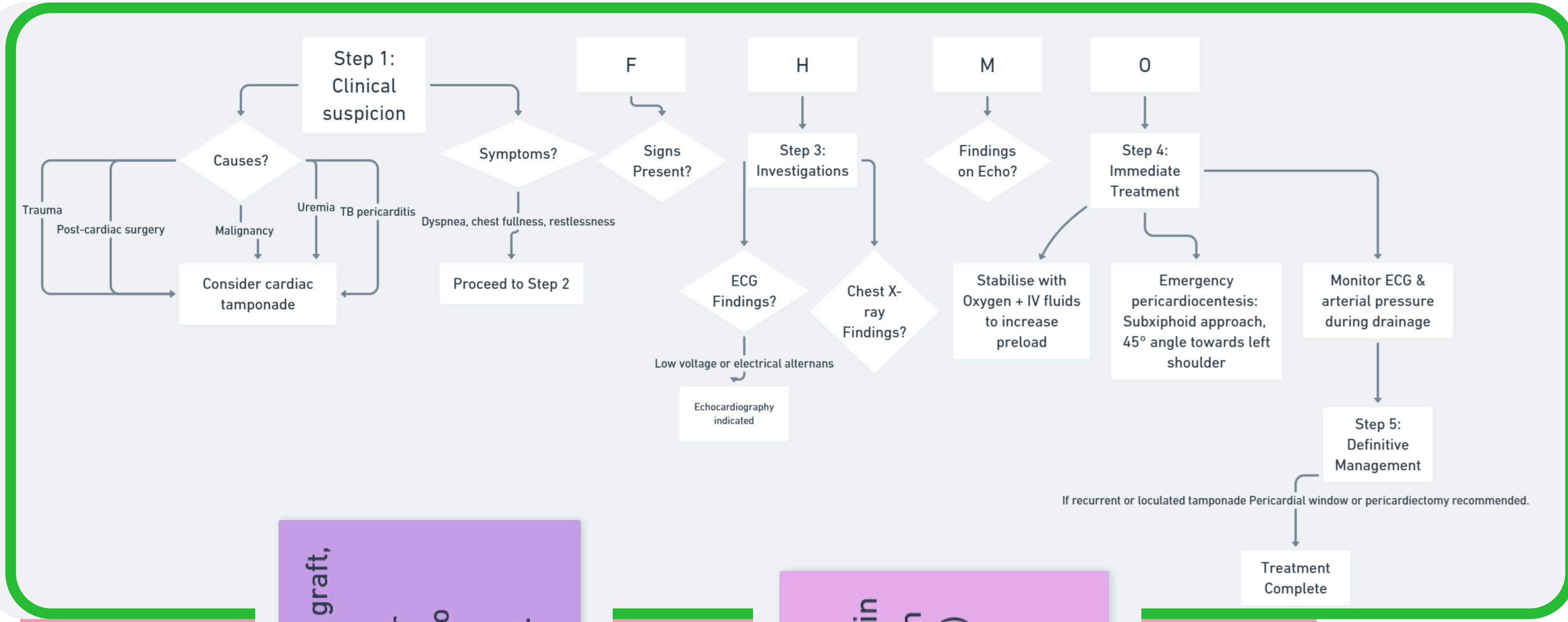
- LI?A → LA? = Go?d St?nd?rd gr?ft (h?gh?st 10?15 yr pa?en?y)?
- ✓ CA?G pr?fe?re? ov?r PC? in di?be?ic?, LV?F <4?? tr?pl?-v?ss?l di?ea?? or le?t ma?n di?ea?? (B?il? Lo?e)?
- ✓ MI?CA? on?y fo? is?la?ed pr?xi?al LA? st?no?is

Maintain strict glycemic control in diabetic patients to improve wound healing and reduce infection risk.

Employ meticulous surgical technique to minimize trauma and ensure optimal graft patency.

Consider smoking cessation preoperatively to enhance vascular health and healing outcomes.

# Ca?di?c Ta?po?ad? – Di?gn?si? & Ma?ag?me?t




After radial graft, prescribe diltiazem or verapamil to prevent vasospasm.

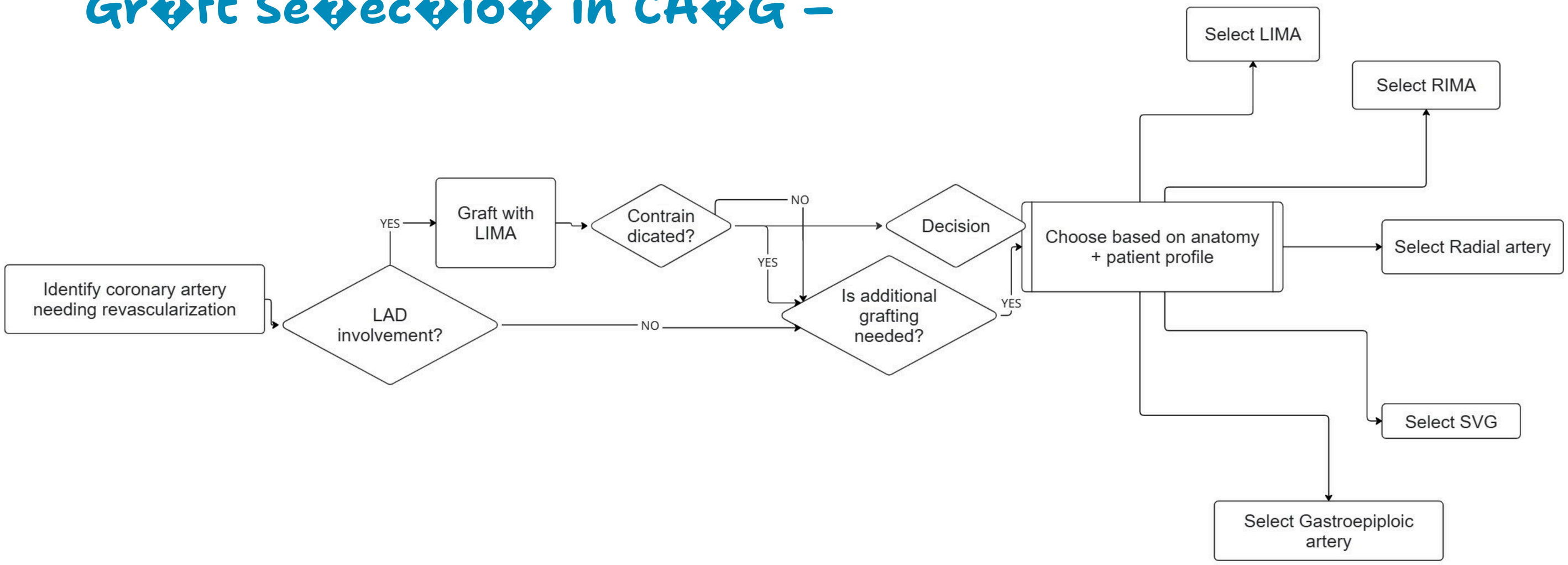
Use Transit Time Flow Measurement (TTFM) intraoperatively to assess graft flow.

Avoid bilateral internal mammary artery (IMA) grafts in diabetics, obese, or COPD patients due to risk of sternal ischemia.

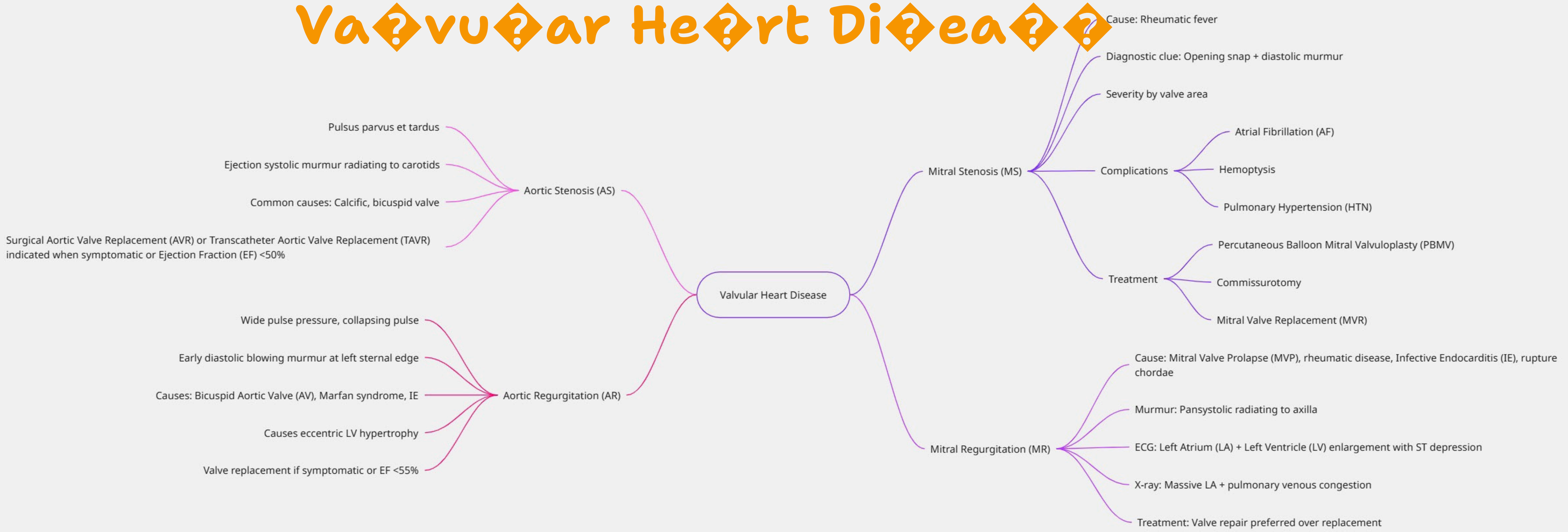
Early post-operative therapy includes Aspirin and Statin; add calcium channel blockers (CCB) if a radial artery graft was used.

Monitor for signs of graft occlusion or failure postoperatively using imaging modalities as needed.

# Gr?ft Se?ec?io? in CA?G –



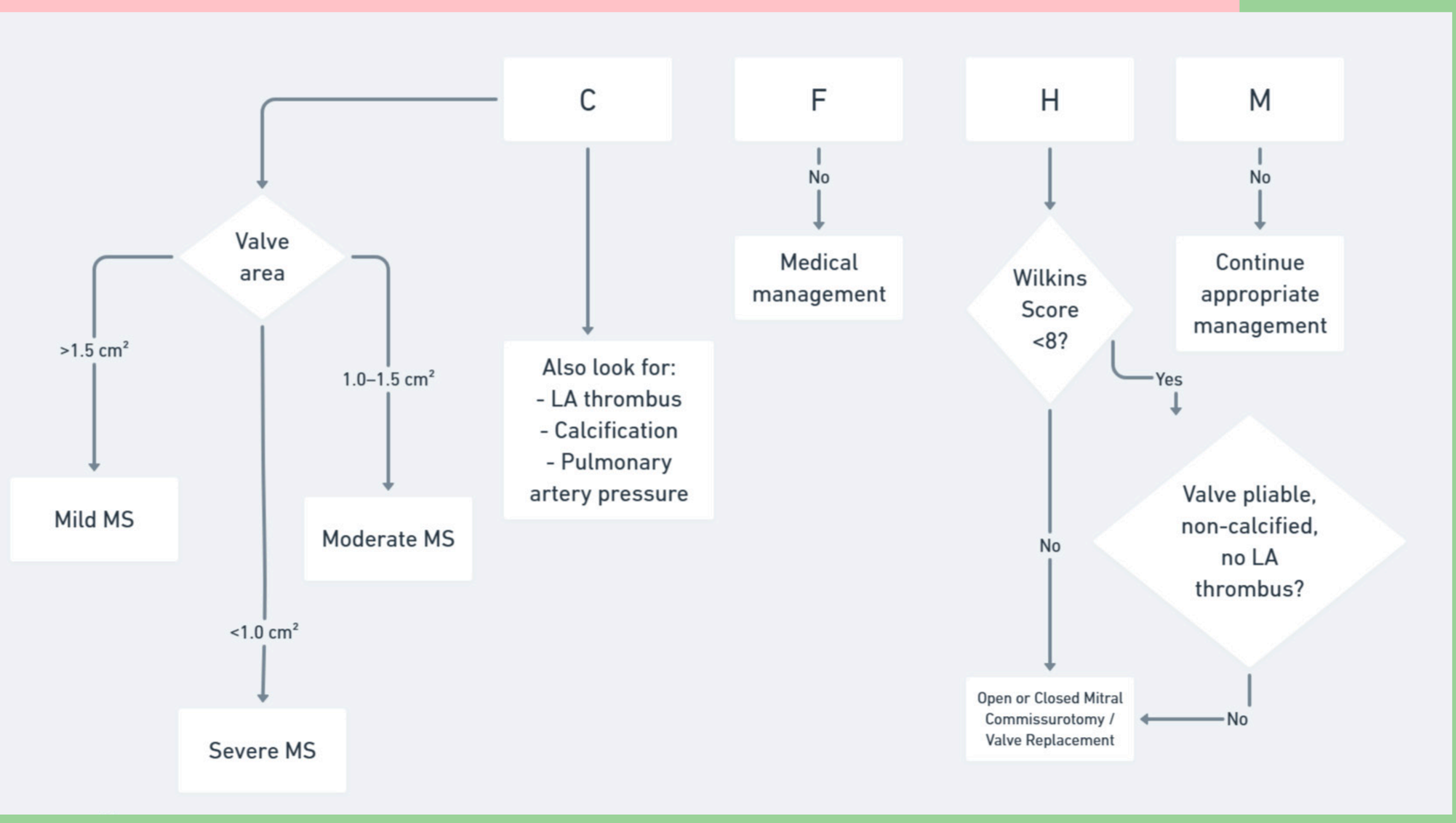

# Va?vu?ar He?rt Di?ea??



## Mitral Stenosis (MS) vs Mitral Regurgitation (MR)

| Feature | Mitral Stenosis (MS) | Mitral Regurgitation (MR) |
|---|---|---|
| Valve Area | Normal: 4–6 $cm^2$ → Severe <1.0 $cm^2$ | No narrowing; valve leaks backward |
| Murmur | Mid-diastolic rumble + Opening Snap | Pansystolic murmur radiating to axilla |
| Heart Sounds | Loud S1 | Soft S1, wide split S2 |
| Apex Beat | Tapping | Hyperdynamic, displaced |
| ECG | P mitrale (LA enlargement), RVH | LA enlargement + LVH + ST depression |
| X-ray | Left atrial straightening, double shadow | Massive LA + LV enlargement |
| Echo | Hockey stick mitral valve | Regurgitant jet on color Doppler |
| Treatment | PBMV → commissurotomy → replacement | Repair (ring annuloplasty) preferred; replace if severe |
| Complication | AF, pulmonary HTN, hemoptysis | LV failure, AF, pulmonary edema |

## Mitral Stenosis (MS) Workup & Management



## MITRACLIP – Used For?

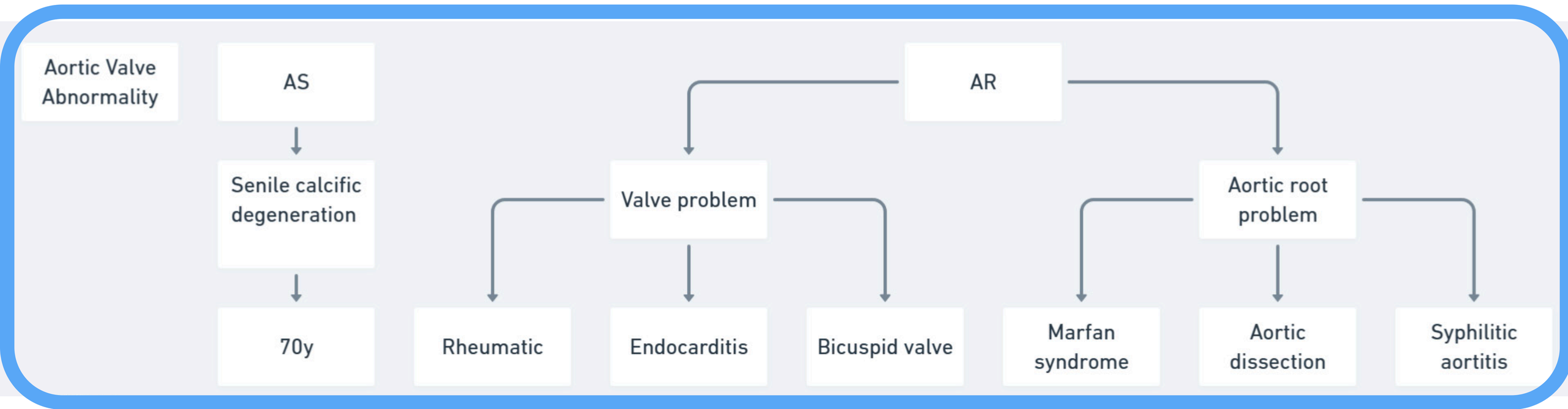
**Percutaneous Edge-to-Edge Repair of Mitral Regurgitation (MR)**

- **Feature** — Clips anterior & posterior mitral leaflets to reduce regurgitation
- **Detail**
  - Mechanism: Clips anterior & posterior mitral leaflets to reduce regurgitation
  - Indication: Severe degenerative or functional MR in high-risk surgical patients
  - Approach: Trans-septal via femoral vein
  - Device inspiration: Surgical Alfieri stitch (A2-P2 leaflet clipping)
- **Purpose** — To repair Mitral Regurgitation percutaneously in patients unsuitable for surgery

## Aortic Stenosis (AS) vs Aortic Regurgitation (AR)

| Feature | Aortic Stenosis | Aortic Regurgitation |
|---|---|---|
| Pulse | Slow rising (anacrotic) | Bounding / water hammer |
| Murmur | Ejection systolic, radiates to carotid | Early diastolic, high-pitched at LSE |
| LV Effect | Concentric LVH | Eccentric LVH |
| CXR | Post-stenotic aortic dilation | Enlarged LV + aortic root |
| ECG | LVH with strain | LVH |
| Definitive treatment | Valve replacement (SAVR/TAVR) | Valve replacement if symptomatic or EF <50% |

## Aortic Valve



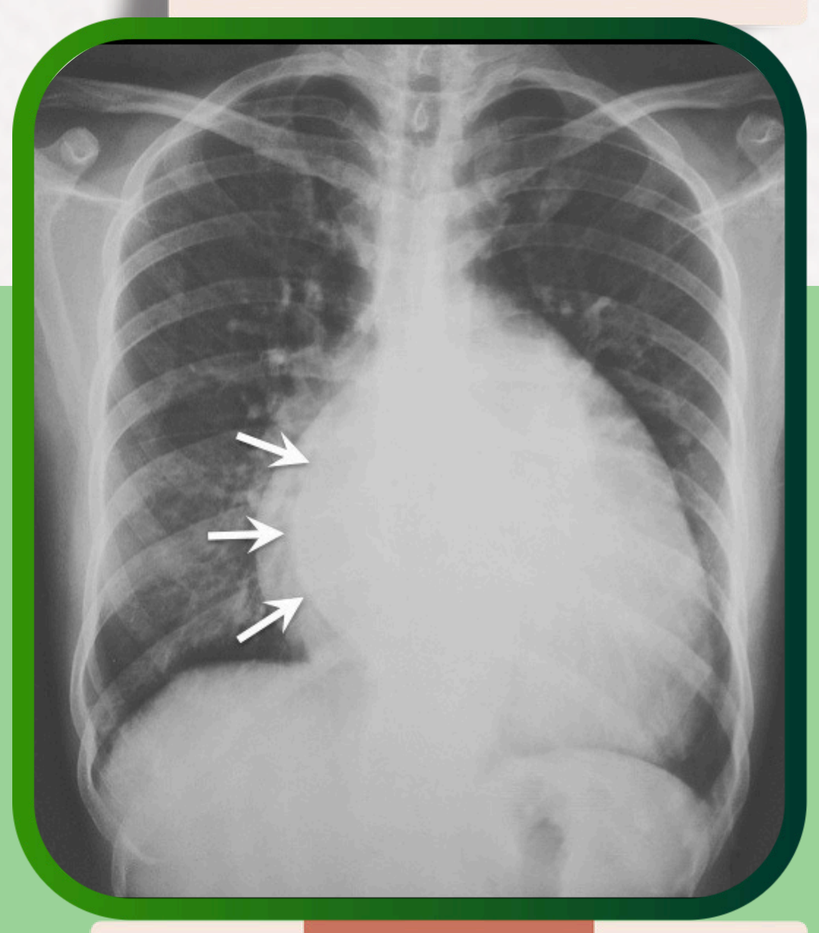
# Mitral Restenosis

Patient: Previoussurgical commissurotomyor balloon mitral valvotomy (BMV)
Now presents with:
Dyspnea, recurrent PND, palpitations
Restenosis suspected if valve area <1.5 cm2 on echo
Causes:
Incomplete commissurotomy
Calcification + fibrosis
Thrombus formation


Straightening of Left Heart Border + Pulmonary Congestion = X-ray Finding of MS

## “LA Enlargement + LVH + ST Depression”

| Feature | Significance |
|---|---|
| Broad P wave (P-mitrale) | LA enlargement |
| LVH voltage criteria | ↑ LV volume overload |
| ST depression, T wave inversion | LV strain due to chronic MR |

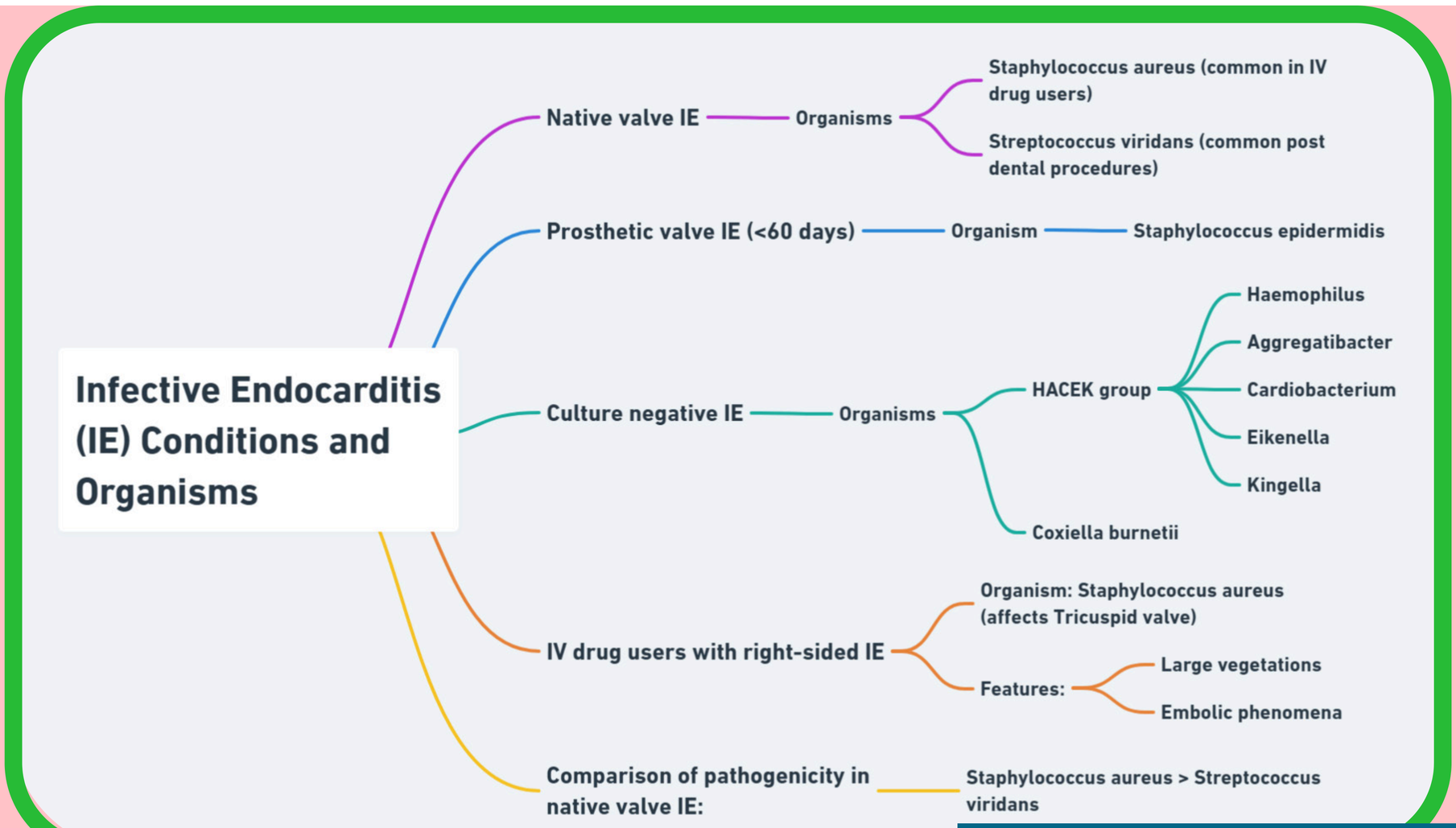


## Etiological Organism for Prosthetic Heart Valve Infection

**Prosthetic Valve Endocarditis (PVE) Organisms by Time After Surgery**

- Early PVE (<60 days)
  - Staphylococcus epidermidis (most common)
  - Staphylococcus aureus
  - Gram-negative bacilli
- Late PVE (>60 days)
  - Streptococcus viridans
  - Staphylococcus aureus
  - Enterococcus
- Fungal PVE
  - Candida
  - Aspergillus (high mortality)

Massive LA on X-ray is seen in? Mitral Regurgitation (MR)




## Te?ra?og? of Fa?lo? (T?F)

TO? = PR?V
P – Pu?mo?ar? st?no?is (R?OT ob?tr?ct?d
R – Ri?ht ve?tr?cu?ar hy?er?ro?hy
O – Ov?rr?di?g ao?ta
V – VS? (l?rg?, no?-r?st?ic??ve?

Wh?t NE?T-?S Sp?cifica?ly As?s Ab?ut TO?

### Frequently Asked

- Hy?er?ya?ot?c (T?t) sp?ll?
- Sq?at?in? re?ie?es cy?no?is
- BT Sh?nt
- Co?pl?te Re?ai?
- Bo?t-?ha?ed he?rt on X-?ay
- Wh?n to re?ai??

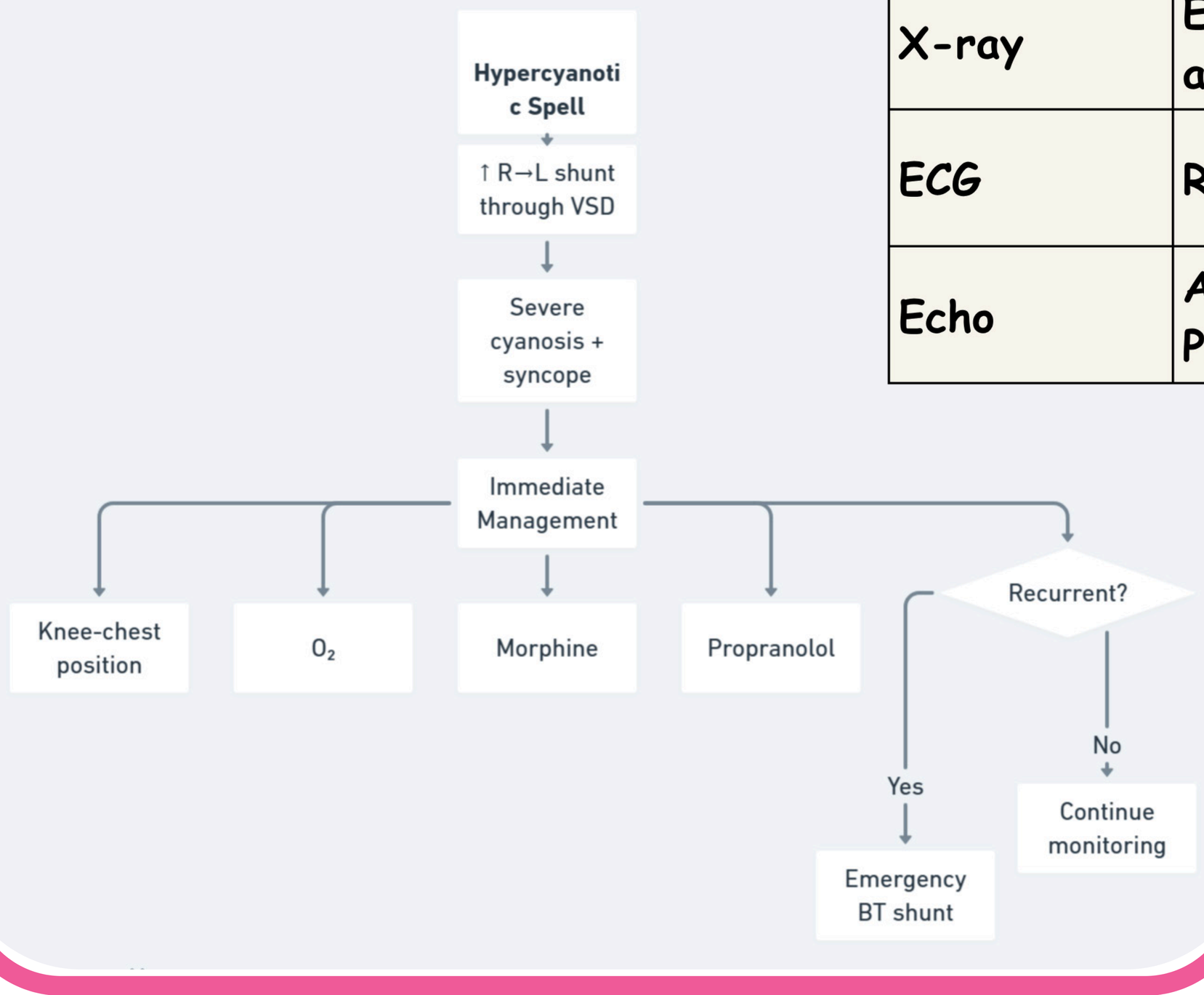
### What to Know

- Me?ha?is?: ↓ SV? → ↑R→L sh?nt → hy?ox?a
- ↑SV? → ↓R→L sh?nt
- Su?cl?vi?n ar?er? → Pu?mo?ar? a r?e r? +
- VS? cl?su?e RV?T wi?en?ng
- RV? li?ts ap?x
- <6 mo?th? (e??l?t ise?ai? pr?fe?re?)

## Surgical Management of TOF

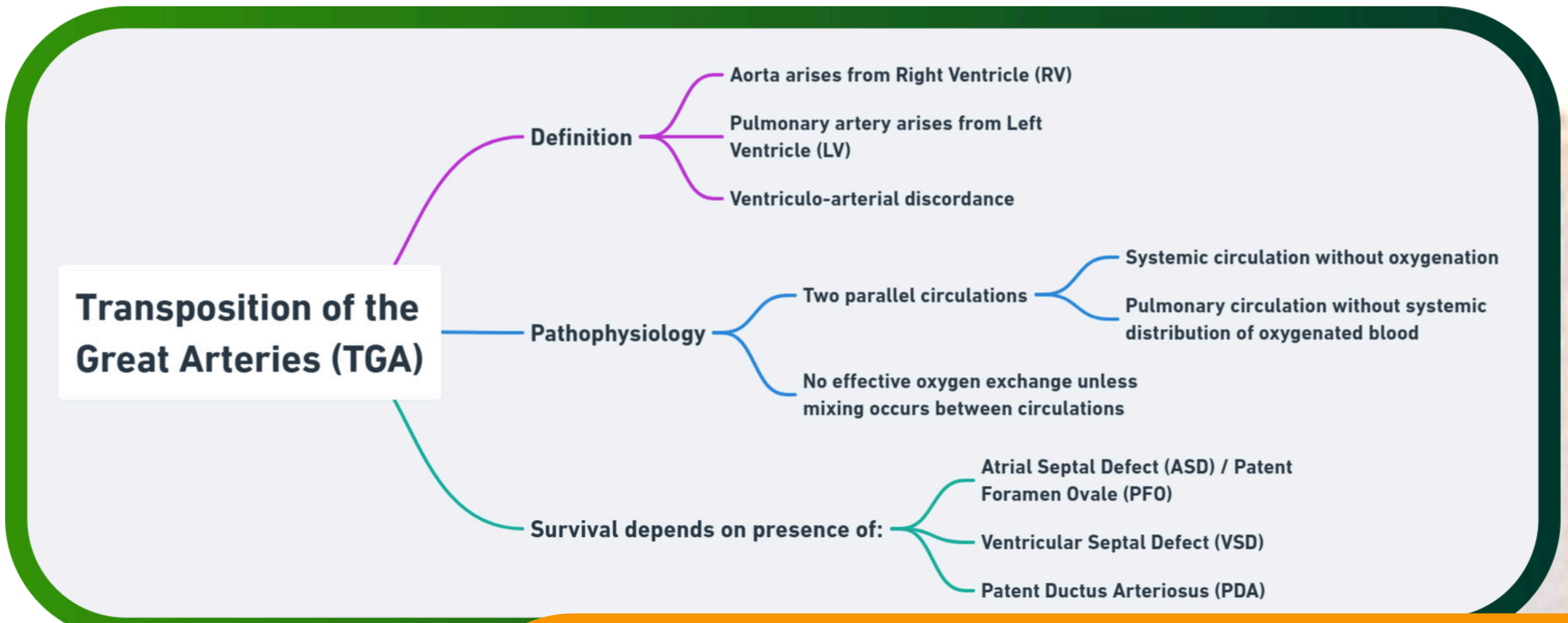
| Surgery | When? | Details |
|---|---|---|
| Modified Blalock-Taussig (BT) shunt | Cyanotic neonate not fit for repair | Gore-Tex tube from subclavian artery to PA |
| Complete Repair (Preferred) | 4–6 months | VSD closure + RVOT patch |
| Contraindication to repair | Severe hypoplastic pulmonary arteries | Will require staged or Fontan-type |

| Feature | Description |
|---|---|
| Cyanosis | Within hours of birth, unresponsive to oxygen |
| X-ray | Egg-on-a-string appearance (narrow |
| ECG | RVH |
| Echo | Aorta anterior & right of Pulmonary artery |

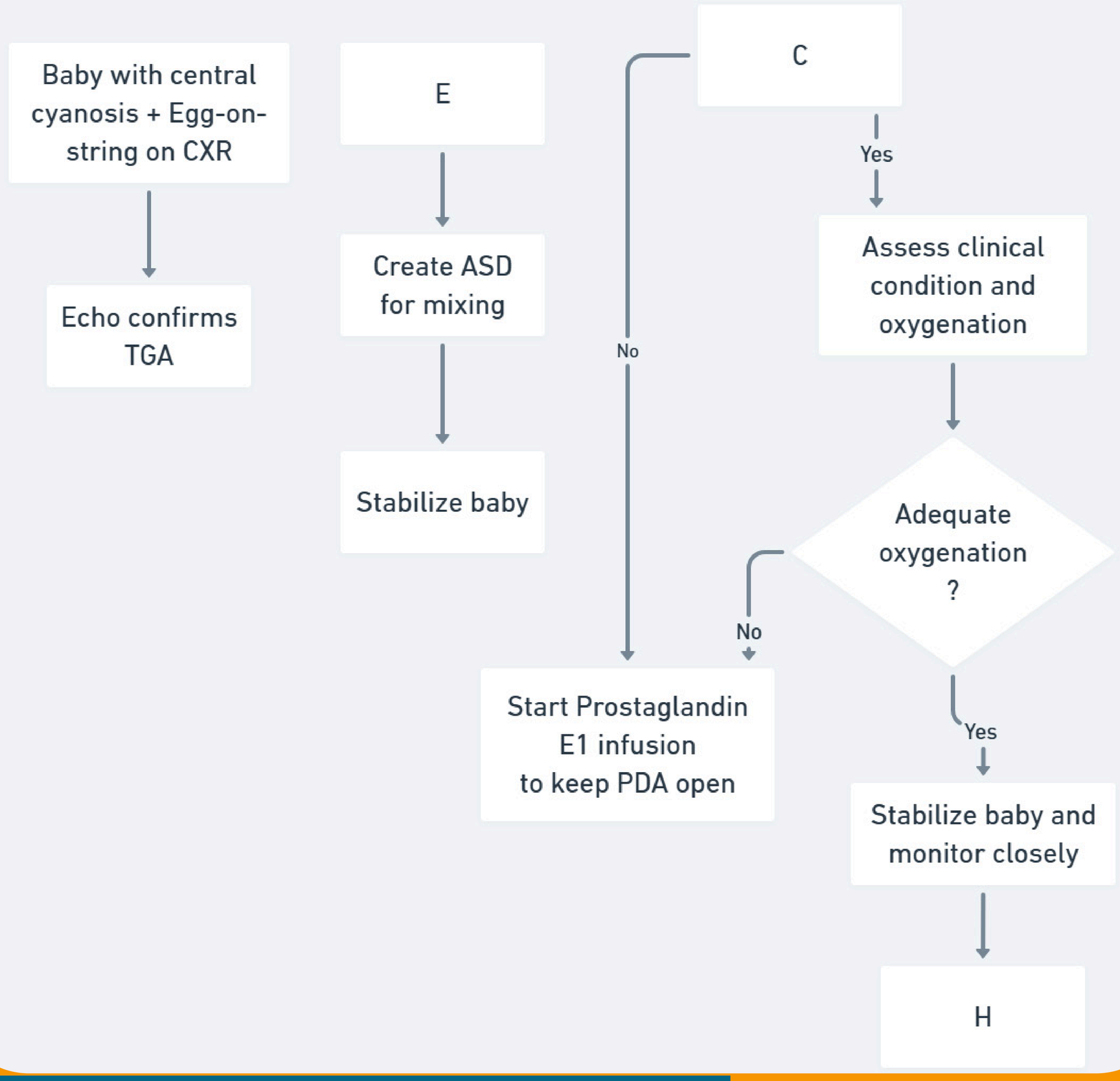


# Cardiovascular Thoracic Surgery

## Transposition of Great Arteries (TGA)




## Management




## Im?or?an? Po?nt? NE?T-?S Lo?es to As?

| Question | Answer |
|---|---|
| • Jatene ArterialSwitch surgery? | Mostphysiological repair? |
| • What is doneinRashkind? | Balloon atrial septostomy |
| • What's doneinMustard? | Pericardial patch baffleinatria |
| • Main riskinJateneprocedure? | Coronary artery transfer |
| • TGA + VSD+PS | Rastelli procedure |

# Surgical Procedures

| Surgery | Age | Concept | Notes |
|---|---|---|---|
| Rashkind Septostomy | Day 1–7 | Balloon creates ASD | Temporary palliation |
| Jatene Arterial Switch (Gold Standard) | <2 weeks | Switch aorta & PA, reimplant coronaries | Best long-term outcome |
| Senning / Mustard (Atrial Switch) | 3–6 months (historical) | Redirect pulmonary & systemic venous blood at atrial level | Late complications: arrhythmia, RV failure |
| When VSD present | May delay surgery | TGA + VSD + PS → may need Rastelli procedure | |

## Why Time Matters in TGA Surgery?

- LV begins to deconditionafter birthasit pumps to low-pressure pulmonary circulation
- After 2–3 weeks, LV can't handle systemic circulation  Jatene becomes risky
- Hence surgery should be done within 2 weeks of life

## Future NEET-SS Question Predictions

| Possible Question | Expected Answer |
|---|---|
| •Why is Prostaglandin E1 used in TGA? | •Keeps PDA open for mixing |
| •What are Senning & Mustard? | •Atrial switch procedures |
| •Which surgery requires coronary reimplantation? | •Jatene arterial switch |
| •What is parallel circulation? | •TGA physiology |

**This is just a sample**
**for more information, contact us**
**on this number – 7990676247**