

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ



السلام عليكم ورحمة الله وبركاته

رحمة الله



Valvular Heart Diseases

By

Dr. Walid Elgendy

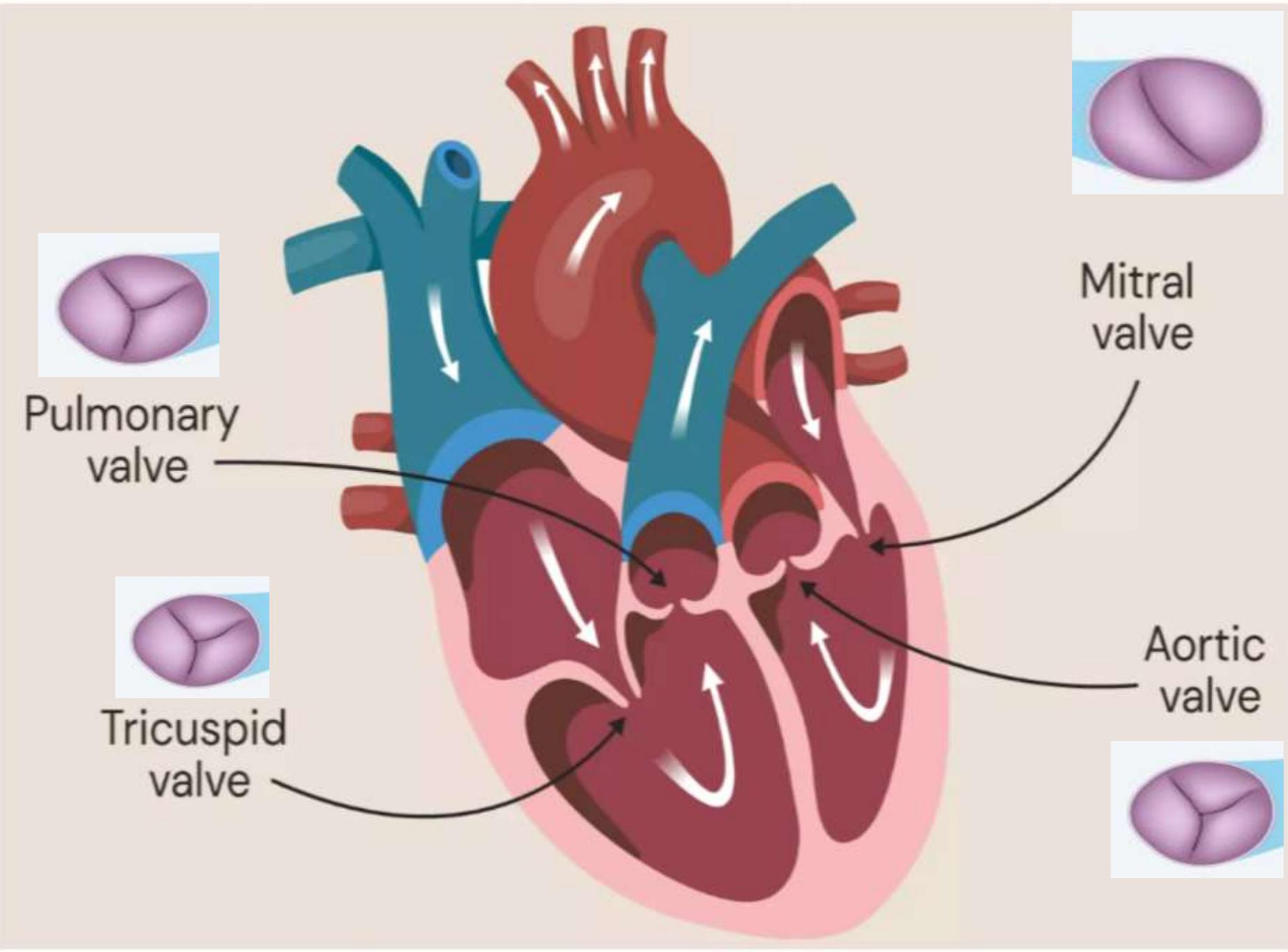


Diseases of the heart valves

☺ The heart valves **allow forward flow** of blood through the cardiac chambers when they are open and **prevent backward flow** when they are closed.

☺ A diseased valve may lead to:

1. Narrow when opened → Obstruction of flow → **Stenosis**
2. Leaky when closed → backward flow → **Regurgitation** or incompetence.
3. Both → **Stenosis and Regurgitation.**



Pulmonary valve

Mitral valve

Tricuspid valve

Aortic valve

Scheme for left sided valvular heart diseases

Aetiology of VHD

MS	AS	MR	AR
<ol style="list-style-type: none"> 1. Rheumatic (The most common) 2. Congenital. 3. Collagen diseases : SLE, RA. 4. Relative (functional) 			
		<ol style="list-style-type: none"> 5. Infective endocarditis. 6. Surgical. 	
<ol style="list-style-type: none"> 5-Carey Coomb murmur 6 -Austin Flint murmur. 	<ol style="list-style-type: none"> 5- Calcification. 6- IHSS. 	<ol style="list-style-type: none"> 7- Mitra valve prolapse. 8- Papillary muscle Dysfunction (MI). 	<ol style="list-style-type: none"> 7. Syphilis. 8. Dissecting aorta. 9. Marfan syndrome. 10. Severe hypertension.

Scheme for left sided valvular heart diseases

Hemodynamics of VHD

1. Cardiac chambers pressure or volume overload
2. Heart Failure: Right Sided or Left Sided.
3. Cardiac output.
4. PCWP, Pulmonary congestion, Pulmonary hypertension.

- ✓ In general, any stenosis leads to **pressure overload** on the upstream cardiac chamber
- ✓ Whereas regurgitant lesions cause **volume overload**.

Scheme for left sided valvular heart diseases

Clinical Picture of VHD

Clinical picture of hemodynamics PLUS:

- ✓ AS → Syncope.
- ✓ AR → Peripheral signs of AR (9 signs)
 - Angina.
 - Palpitation , general throbbing.

Scheme for left sided valvular heart diseases

Cardiac examination in VHD

Inspection & palpation:

Apex:

- o MS → Slapping apex (weak impulse (due to ↓ LV filling) with palpable S1 .
- o AS → Sustained apex (forcible, sustained).
- o AR, MR → hyperdynamic apex (forcible, non-sustained).

Pulsation in the 2nd left intercostal space in pulmonary HTN.

Signs of ventricular enlargement

Percussion :

Dullness in the 2nd left intercostal space in pulmonary HTN.

Scheme for left sided valvular heart diseases

Auscultation:

Heart sounds:

- o S1 : ↑ in MS, ↓ in MR.
- o S2 : ↑ Pulmonary component accentuated in pulmonary HTN

Additional sounds :

- ① Ejection click (due to Pulmonary HTN)
- ① Gallop (due to heart failure)
- ① Opening snap: in MS due to sudden opening of rigid cusps.

Murmur :

- o Ejection Systolic → AS
- o Pan systolic → MR
- o Early diastolic → AR
- o Mid diastolic → MS

Scheme for left sided valvular heart diseases

Complications in VHD

1. Calcification.
2. Rheumatic activity.
3. Infective endocarditis.
4. Arrhythmia e.g. AF in a case of MS , heart block in calcified AS.
5. Thromboembolism: stroke.
6. LA enlargement → compression on :
 - Lung → dyspnea & cough.
 - Esophagus → dysphagia.
 - Left recurrent laryngeal nerve → hoarseness of voice.

Scheme for left sided valvular heart diseases

7. Pulmonary congestion → Hemoptysis.
8. Pulmonary infection (recurrent).
9. Pulmonary embolism (secondary to DVT)

10. RSHF.
11. LSHF except in MS.

12. Complications of surgery (artificial valves) :
 - Mechanical dysfunction.
 - Infective endocarditis.
 - Thromboembolism.
 - Hemolytic anemia.

Scheme for left sided valvular heart diseases

Investigations For VHD

X ray:

- ① Chamber enlargement.
- ① Pulmonary congestion.
- ① Pulmonary hypertension

ECG:

- Ⓜ Chamber enlargement e.g. LA → P mitrale (m shaped P wave)
- Ⓜ Pulmonary hypertension → P pulmonale (Peaked P wave)
- Ⓜ Arrhythmias

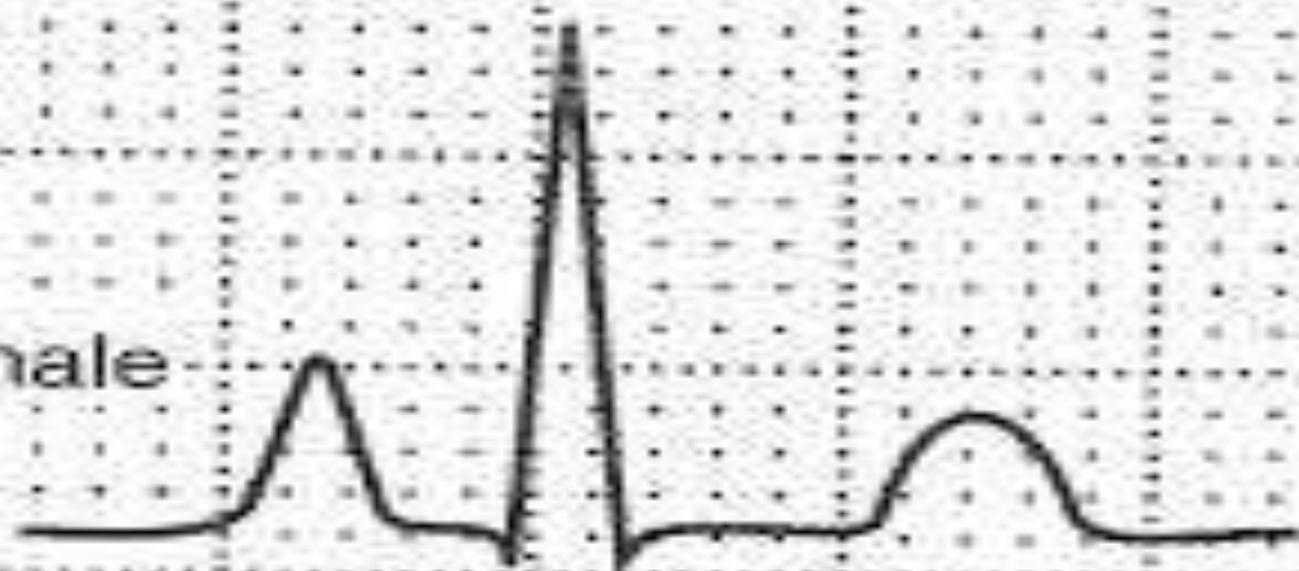
Echo & Doppler echo : (The most important)

- Chamber enlargement.
- Detect the severity of the valve lesion.

Catheterization & angiography :

- Detect the severity.
- Chamber enlargement.

P-Pulmonale



P-Mitrale



Scheme for left sided valvular heart diseases

Treatment of VHD

Medical

- 1- Prophylaxis against Infective Endocarditis & rheumatic activity.
- 2- Treatment of complications e.g. HF, AF, infections ...

Curative

- 1- Balloon dilatation for stenosis especially pure MS.
- 2- Valvotomy: Commissurotomy for stenosis.
- 3- Valve replacement : Tissue or synthetic valves.

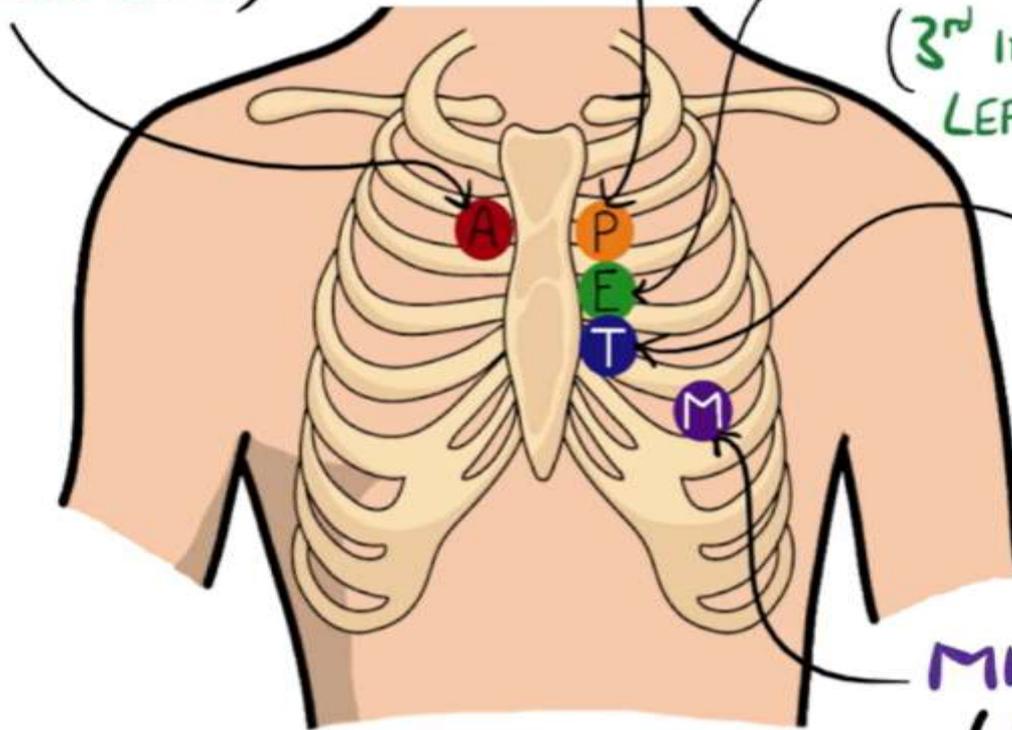
AORTIC AREA
(2nd INTERCOSTAL SPACE
RIGHT STERNAL EDGE)

PULMONIC AREA
(2nd INTERCOSTAL SPACE
LEFT STERNAL EDGE)

ERB'S POINT
(3rd INTERCOSTAL SPACE
LEFT STERNAL EDGE)

**TRICUSPID
AREA**
(4th INTERCOSTAL
SPACE LEFT
STERNAL EDGE)

**MITRAL AREA
(APEX)**



Mitral stenosis

Anatomy of Mitral valve

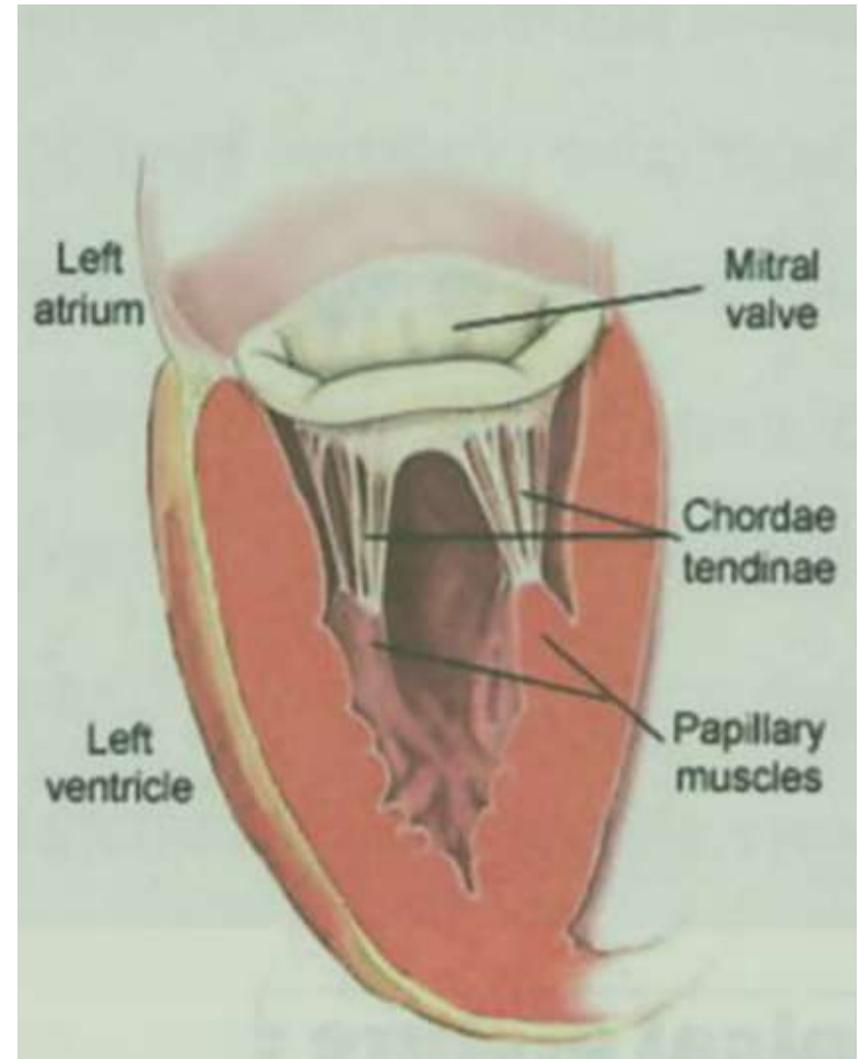
Site: between the LA & LV.

Surface area : 4 - 5 cm²

MS if mitral valve orifice < 2.5 cm²
if < 1 cm ~ tight MS.

Components:

- ✓ **Fibrous ring.**
- ✓ **2 Cusps (anteromedial & posterolateral)**
- ✓ **2 Papillary muscles : arise from the ventricle, to control the cusps movement.**
- ✓ **Chordae tendinae : arise from papillary muscles to both cusps.**



Mitral stenosis

Etiology

❑ Rheumatic heart disease :

- ① The commonest cause (99%).
- ① Occurs years after the original attack
- ① Usually associated with multi valvular lesions.

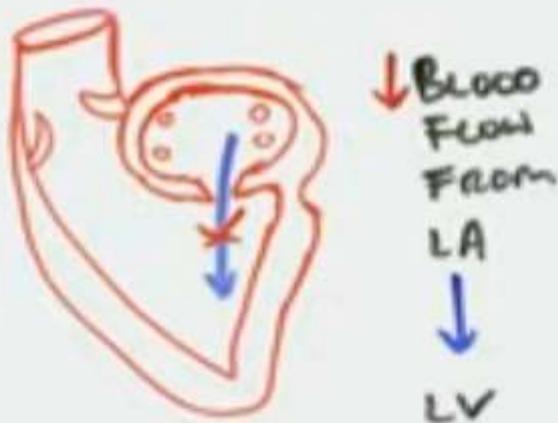
❑ Relative :

- **Carrey coomb's murmur:** in acute stage of rheumatic fever due to edema of the cusps → transient narrowing of the mitral valve.
- **Austin-Flint murmur:** murmur of MS in sever AR (The regurged blood during diastole interferes with opening of mitral valve).
- ↑ **blood flow** through the mitral valve : MR, VSD, PDA.

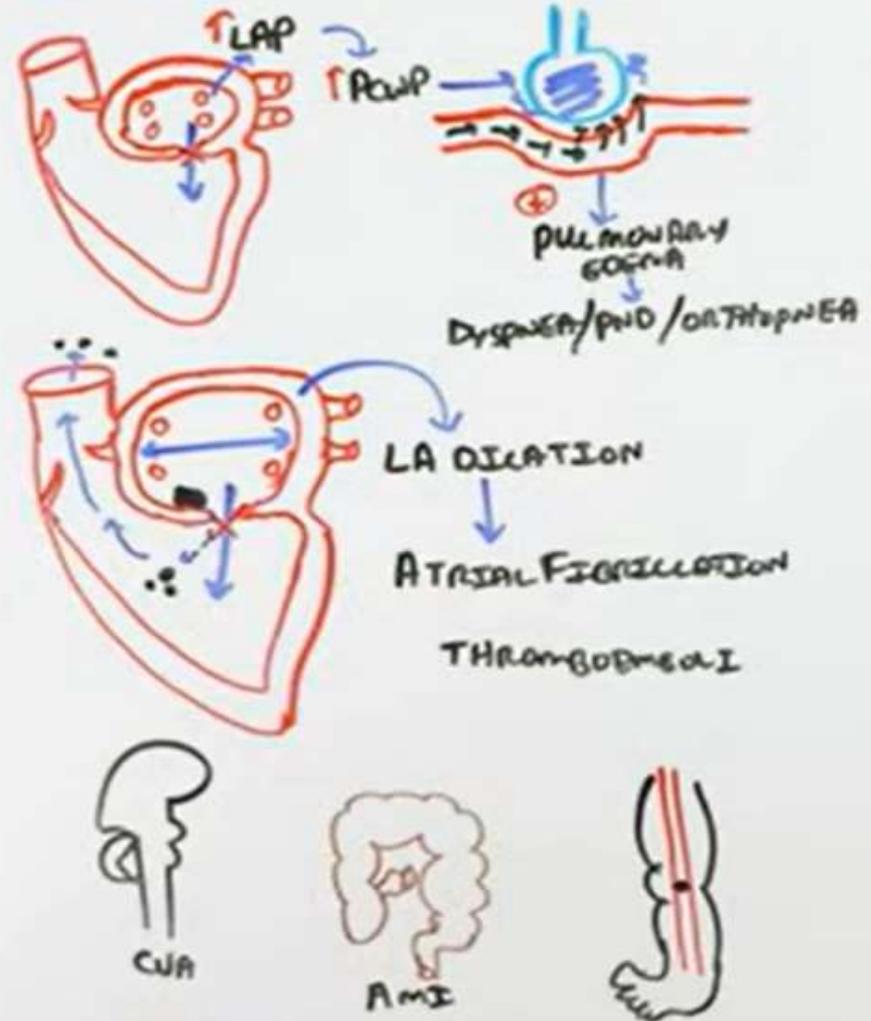
Mitral stenosis Hemodynamics

During diastole: ↓ blood flow through the mitral valve ↑ pressure load on LA → LA dilatation → AF and Pulmonary congestion.

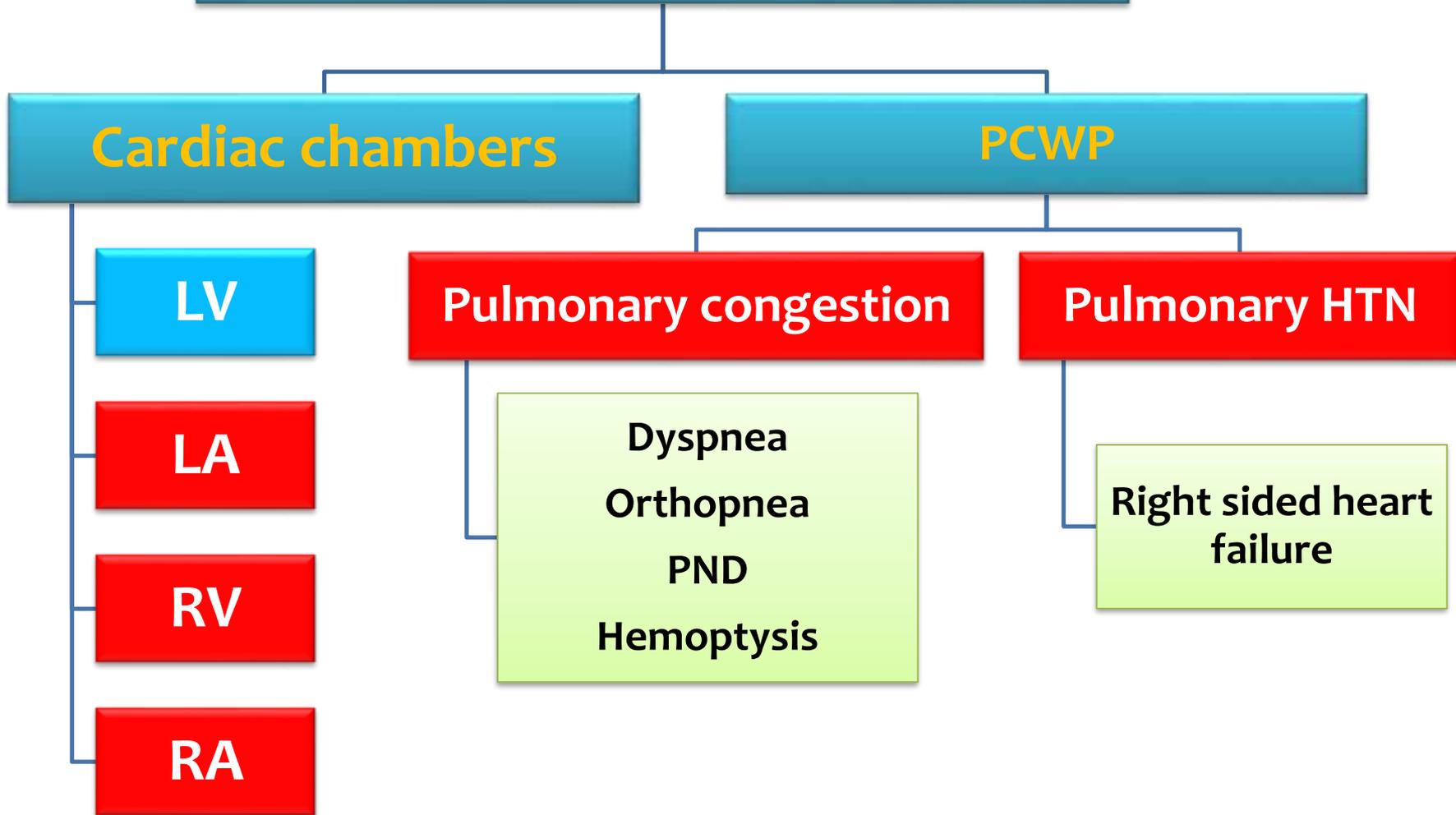
MITRAL STENOSIS



MITRAL STENOSIS



Mitral stenosis Hemodynamics



Mitral stenosis

4 stages

1- ↑ LA Pressure with dilatation



2- Back pressure on pulmonary vein
(pulmonary congestion)



3- Pulmonary hypertension

- Passive
- Constrictive → reflex VC of pulmonary arterioles
- Obstructive → PE



4- RSHF

Mitral stenosis

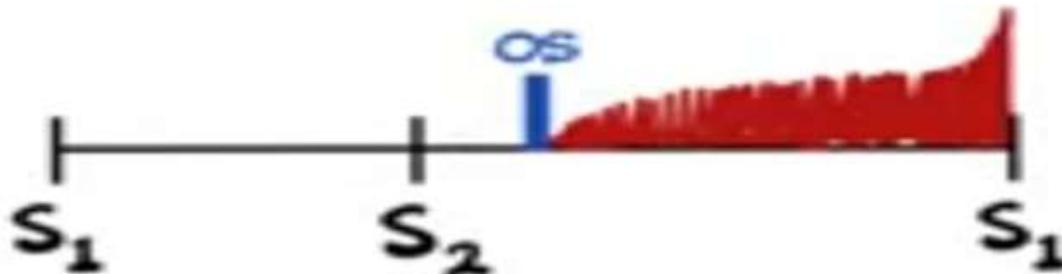
Clinical picture :

- ▶ **Stage I :** asymptomatic (just ↑ of LA pressure)
- ▶ **Stage II :** manifestations of pulmonary congestion
- ▶ **Stage III :** manifestations of pulmonary hypertension : LCOP ,
Malar flush,
- ▶ **Stage IV:** manifestations of RSHF : LCOP, systemic congestion.

Mitral stenosis

Murmur:

- ▶ **Site:** best heard at the apex.
- ▶ **Propagation :** No propagation (localized)
- ▶ **Timing:** Mid diastolic with pre systolic accentuation due to atrial contraction .
- ▶ **Character:** rumbling, low pitched murmur.
- ▶ **Relation to respiration & position:** ↑ with expiration & ↓ in left lateral position.
 - Left sided heart murmurs are ↑ on expiration .
 - Right sided heart murmurs are ↑ on inspiration .



Mitral stenosis

Complications: as

Investigations: as

Treatment: as

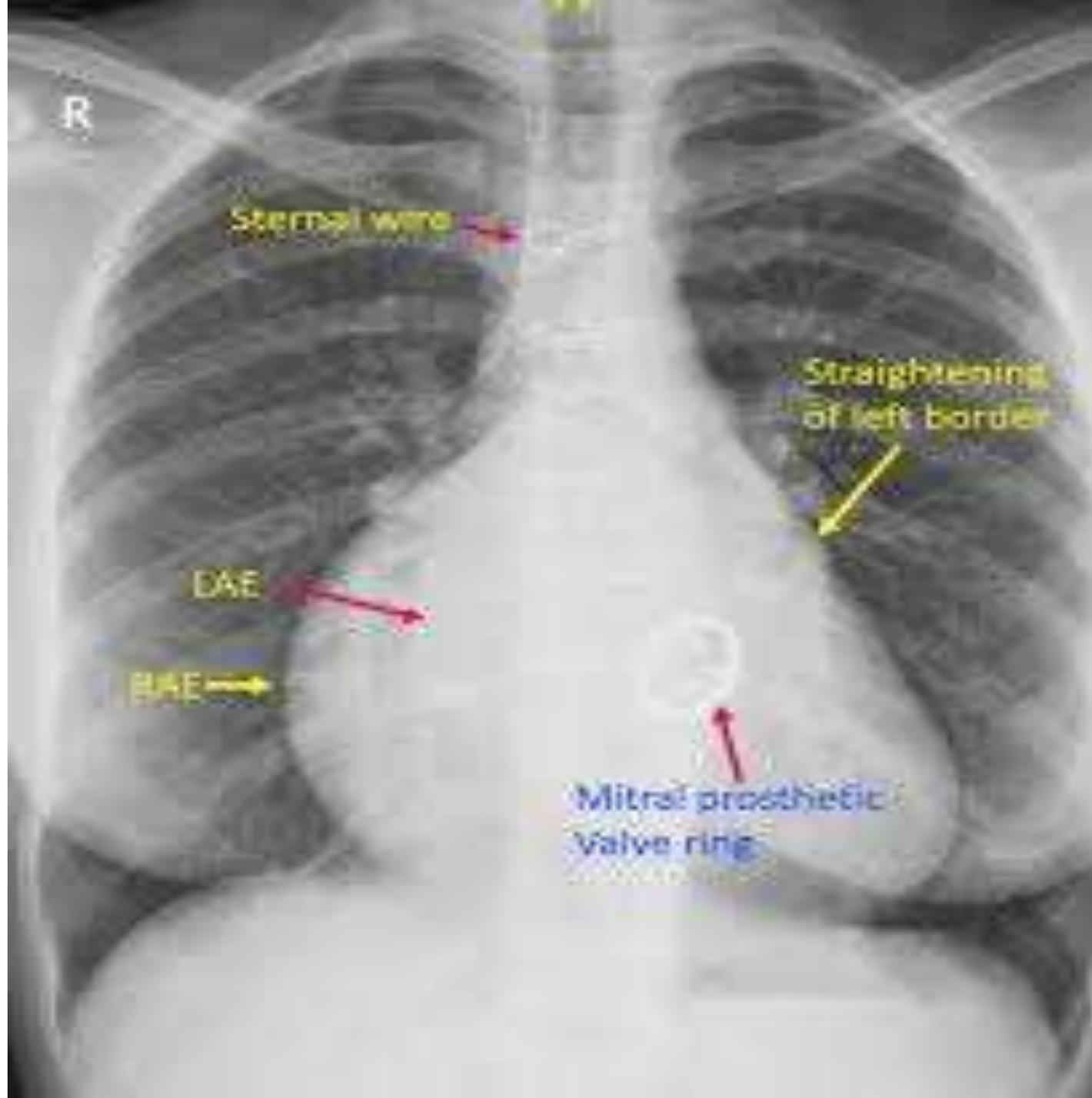
Indications of valve replacement :

1. Calcification
2. Associated MR
3. Tight MS (surface area $< 1 \text{ cm}^2$ or severe manifestations)
4. Recurrent stenosis after balloon dilatation or valvotomy .



PA L





R

Sternal wire

Straightening
of left border

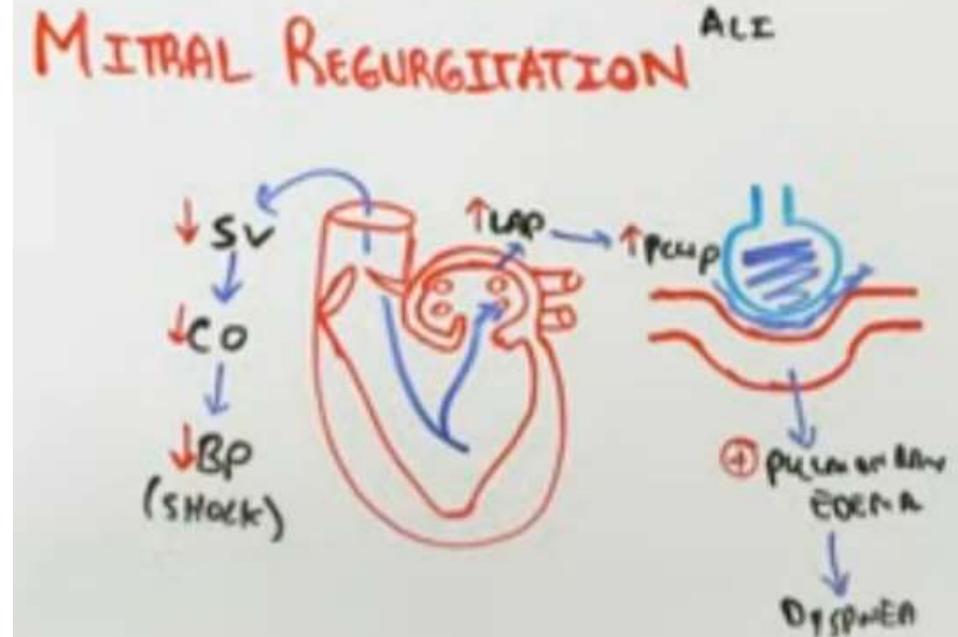
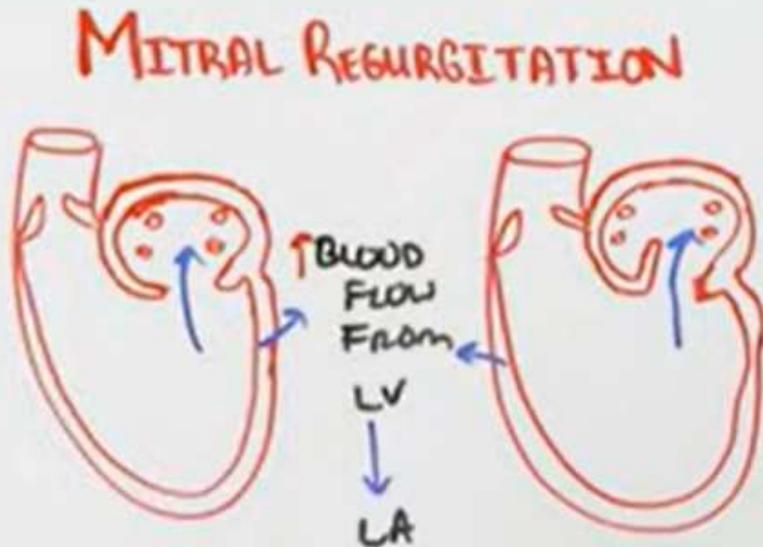
DAE

BAE

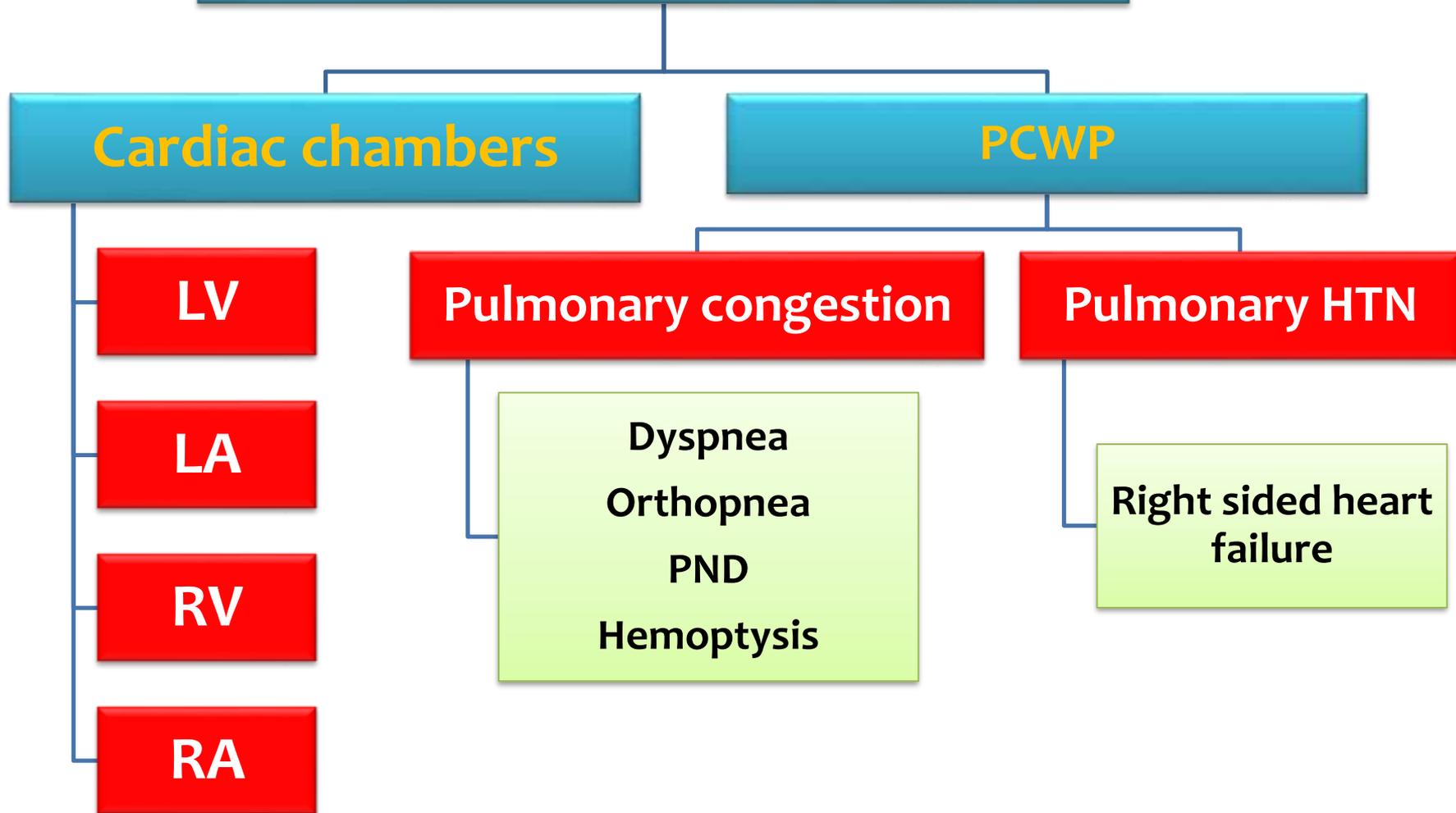
Mitral prosthetic
Valve ring

Mitral Regurge Hemodynamics

- ▶ **During systole:** A part of blood regurgitates from LV to LA → LA dilatation and pulmonary congestion.
- ▶ **During diastole:** ↑ blood flow through the mitral valve → volume overload on LV → LV enlargement then failure.



Mitral Regurgitation Hemodynamics



Mitral Regurge

Murmur:

- ▶ **Site:** best heard at the apex.
- ▶ **Propagation :** to axilla
- ▶ **Timing:** Pansystolic murmur. (plateau).
- ▶ **Character:** blowing, high pitched.
- ▶ **Relation to respiration & position:** ↑ with expiration & ↓ in left lateral position.





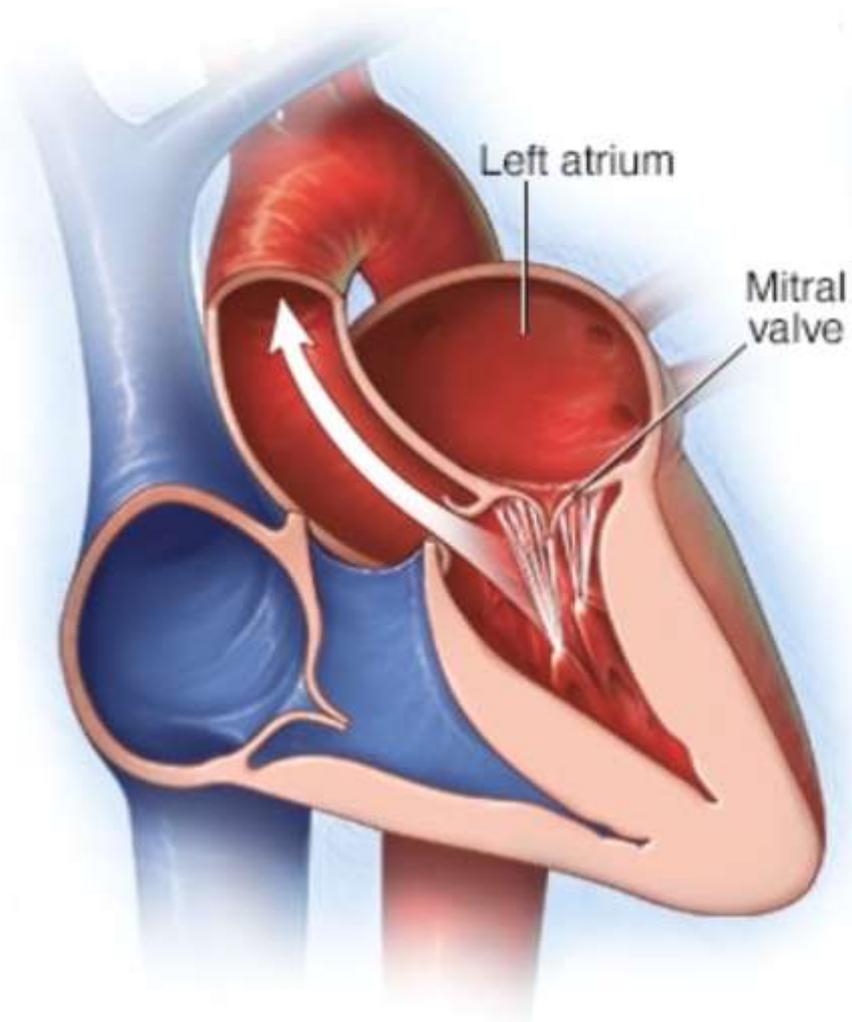


Mitral Valve Prolapse

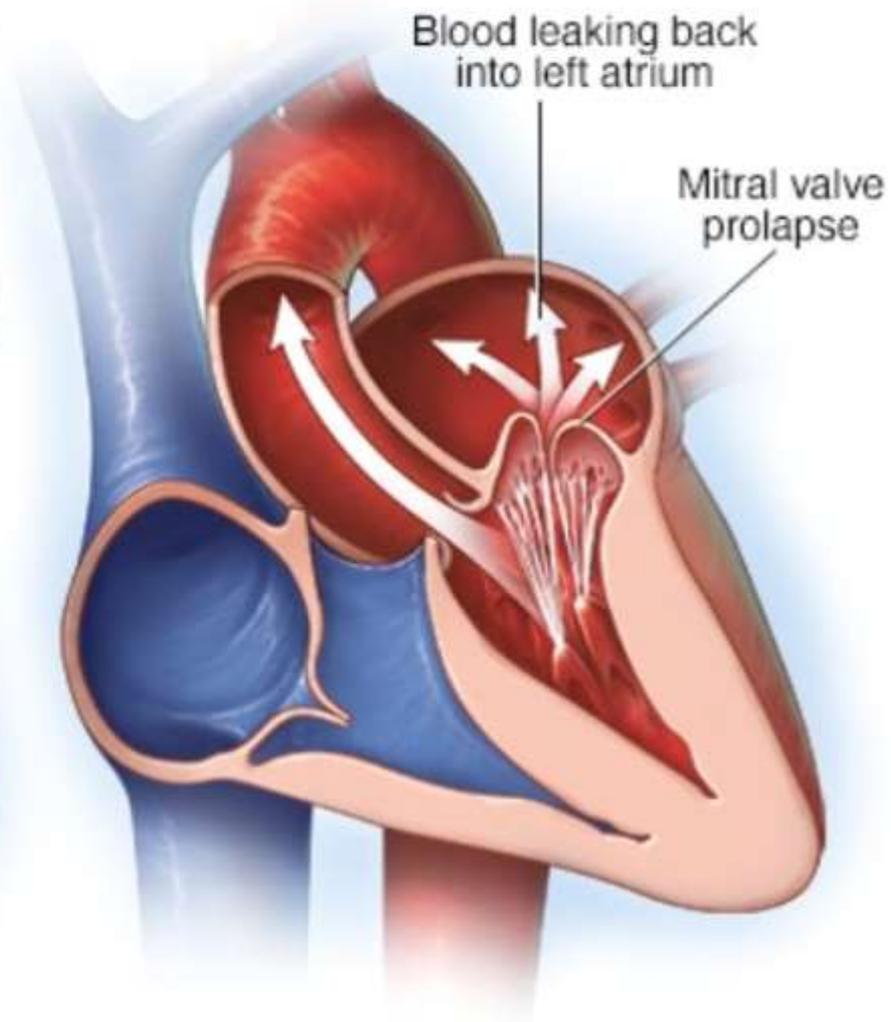
Definition: Prolapse of one or both cusps of mitral valve into LA during systole.

Etiology

1. **Idiopathic:** in most cases, more common in young female.
2. **Connective tissue diseases :**
 - ① Marfan syndrome.
 - ① SLE.
 - ① Polyarthrititis nodosa.
3. **Muscle disorders:** Duchenne myopathy, Myotonia dystrophy.
4. **Congenital heart diseases:** e.g. ASD
5. **Acquired heart diseases :** MI, post mitral valve surgery.



Typical heart



Mitral valve prolapse with regurgitation

Mitral Valve Prolapse

Clinical Picture

- **Asymptomatic** in most cases
- **Atypical chest pain:**
 - The most common symptom.
 - Usually it is left inframammary & stabbing.
 - Sometimes it is severe substernal aching pain.
- **Palpitation** : due to arrhythmias.
- **Dizziness or Fainting** .
- **Fatigue**
- **Shortness of breath**

Mitral Valve Prolapse

Cardiac examination :

- The most common sign is a **mid-systolic click**, which is produced by the sudden prolapse of the valve & the tension of the chordate tendineae.
- This may be followed by a **late systolic murmur** due to some regurgitation.
- With more regurgitation, the murmur becomes Pansystolic.



Mitral Valve Prolapse

Investigations : Echo is diagnostic

Treatment:

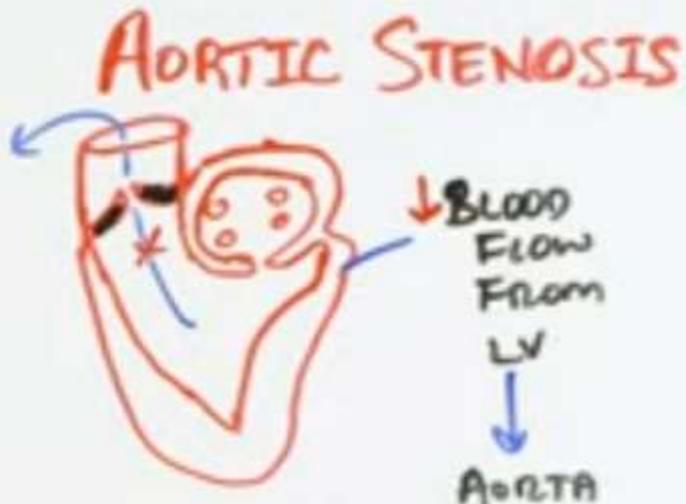
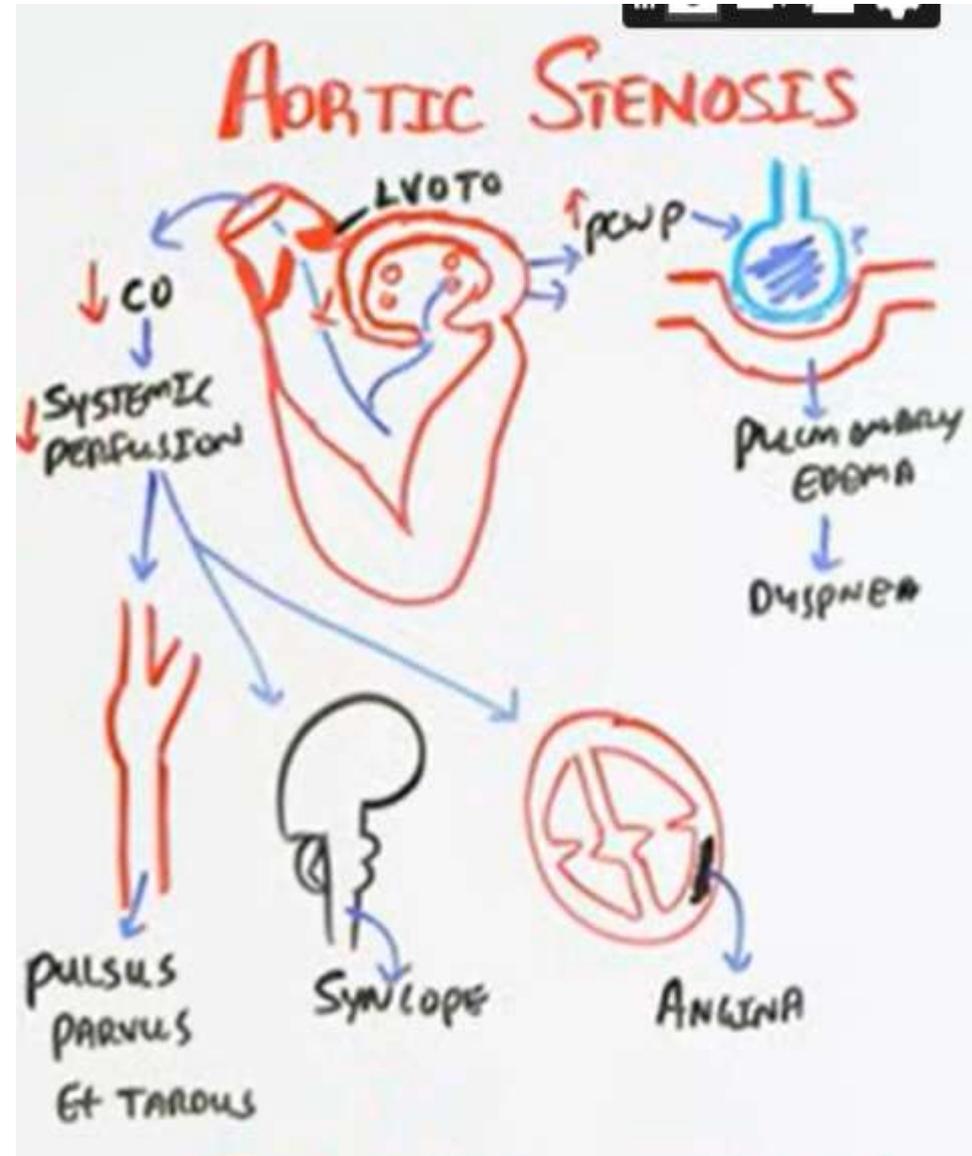
- o Reassurance.
- o B-blocker e.g. propranolol.
- o Valve replacement in severe cases

Aortic stenosis Hemodynamics

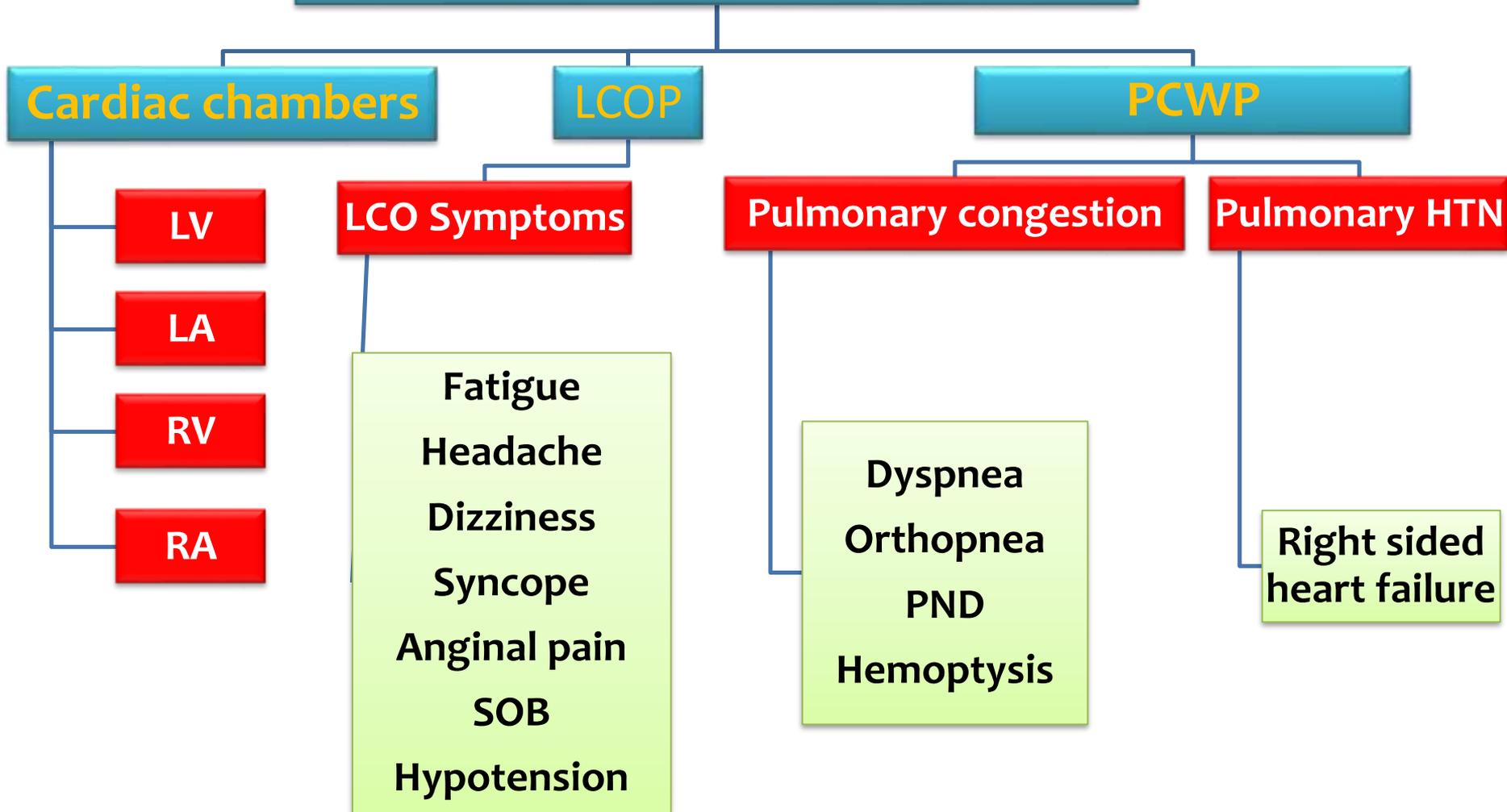
During systole:

There is obstruction of LV outflow
results in:

- o LCOP.
- o Pressure overload on LV



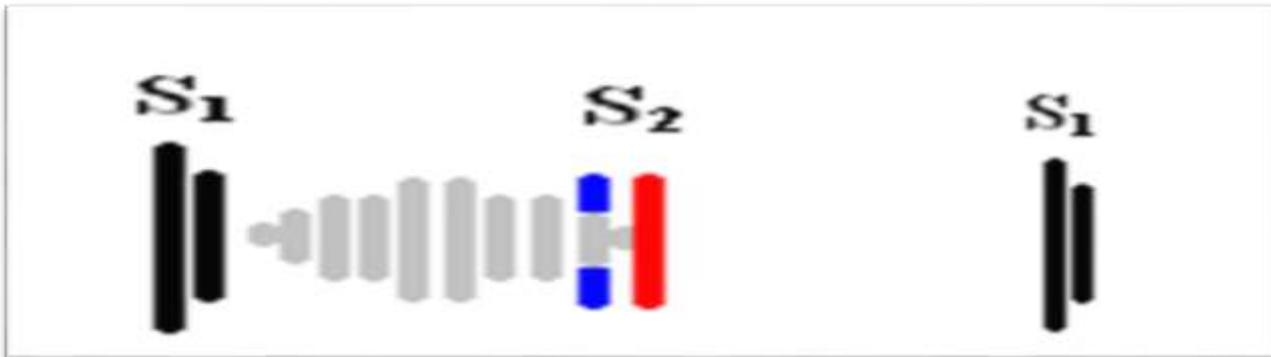
Aortic stenosis Hemodynamics



Aortic Stenosis

Murmur:

- ▶ **Site:** maximum over A1 area (2nd right intercostal space).
- ▶ **Propagation :** neck (carotid arteries) & apex.
- ▶ **Timing:** Ejection (mid) systolic murmur (diamond-shaped, crescendo decrescendo).
- ▶ **Character:** Harsh.
- ▶ **Relation to respiration & position:** ↑ with expiration & ↓ in left lateral position.
 - Left sided heart murmurs are ↑ on expiration .
 - Right sided heart murmurs are ↑ on inspiration .



Aortic stenosis

Treatment: as

Indications of valve replacement :

1. Valve area $< 0.8 \text{ cm}^2$
 2. Systolic pressure gradient across the aortic valve $> 50 \text{ mm Hg}$.
 3. Severe symptoms.
- ▶ Balloon dilatation & aortic Valvotomy (associated with a high early restenosis rate)

Aortic Regurge Hemodynamics

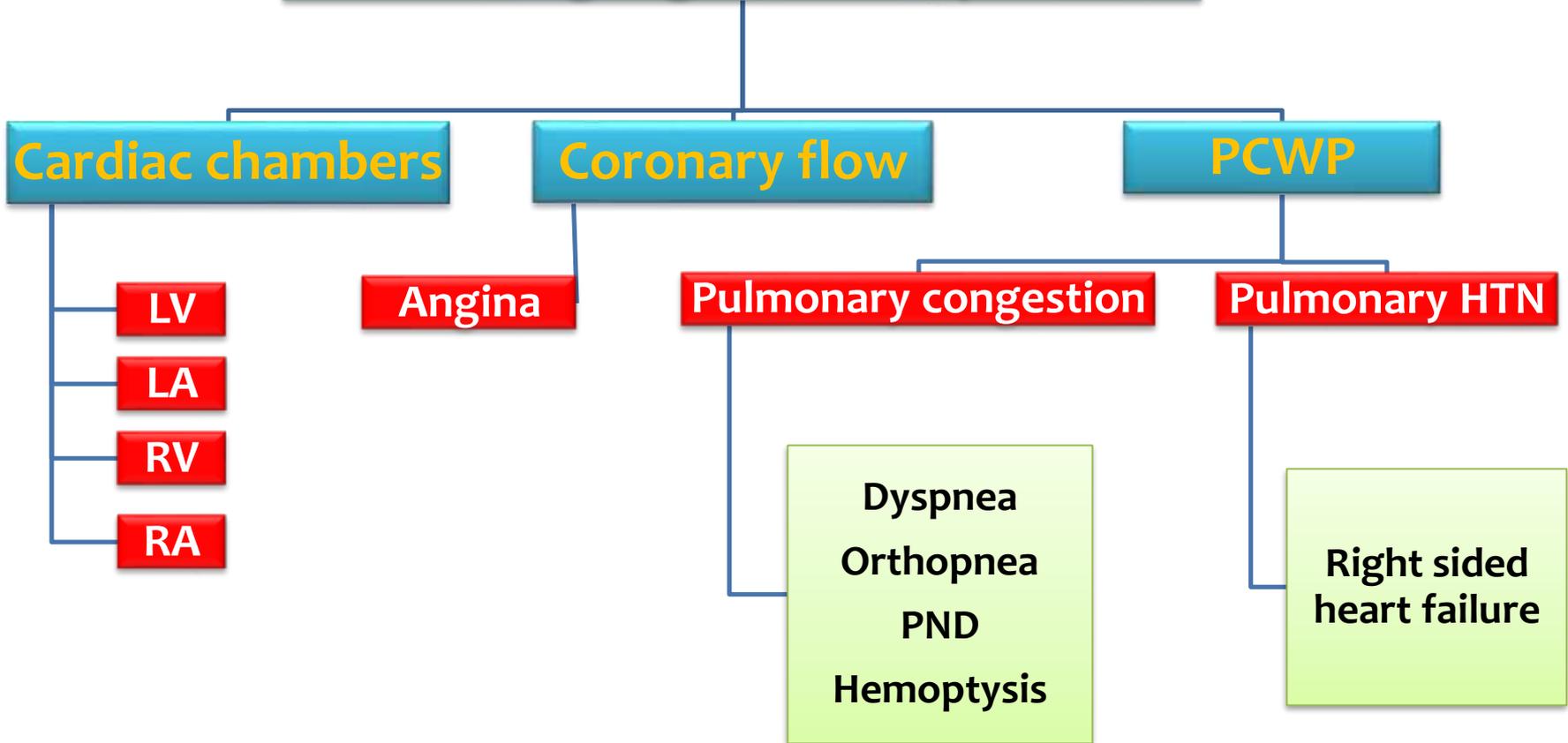
During diastol:

There is regurgitation of blood from the aorta to the LV leading to:

- ▶ Volume overload on the LV.
- ▶ ↓ Coronary blood flow → Angina.
- ▶ ↑ LV stroke volume ↑ Systolic BP which is compensated by peripheral VD

- ▶ ↓ Diastolic BP : due to peripheral VD & regurgitation of blood during diastole.

Aortic Regurge Hemodynamics



Aortic Regurge

Clinical picture

1. General throbbing : due to transmitted arterial pulsation.
2. Angina due to :
 - Diastolic BP ↓ coronary blood flow.
 - LV hypertrophy ↑ O₂ demand.
3. Manifestations of LSHF: Pulmonary congestion & LCOP.

Aortic Regurge

Peripheral signs of AR : (due to big pulse volume)

- De Musset sign : nodding of the head.
- Corrigan's sign : Marked visible carotid pulsation.
- Systolic thrill over the carotid artery.

- Pulse : Water hammer pulse.
- Capillary pulsations : pressing on the nail tip → moving red line.

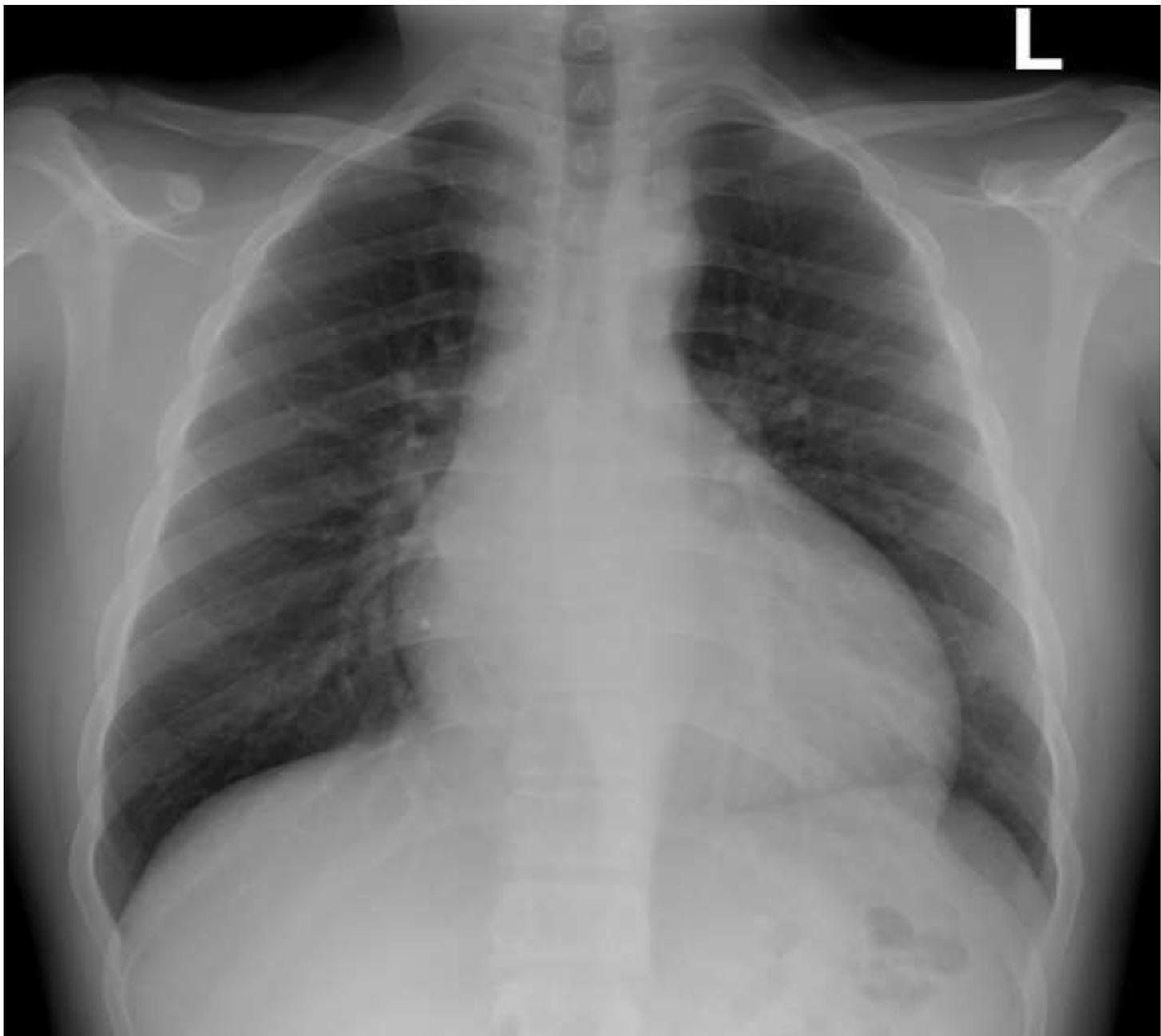
- Pistol shots : systolic femoral sound due to sudden distension of collapsed artery.
- Hill's sign : The difference between systolic BP in LL & UL > 50 mmHg. (Normally SBP in LL > UL by 10 - 20 mmHg)

Aortic Regurge

Murmur:

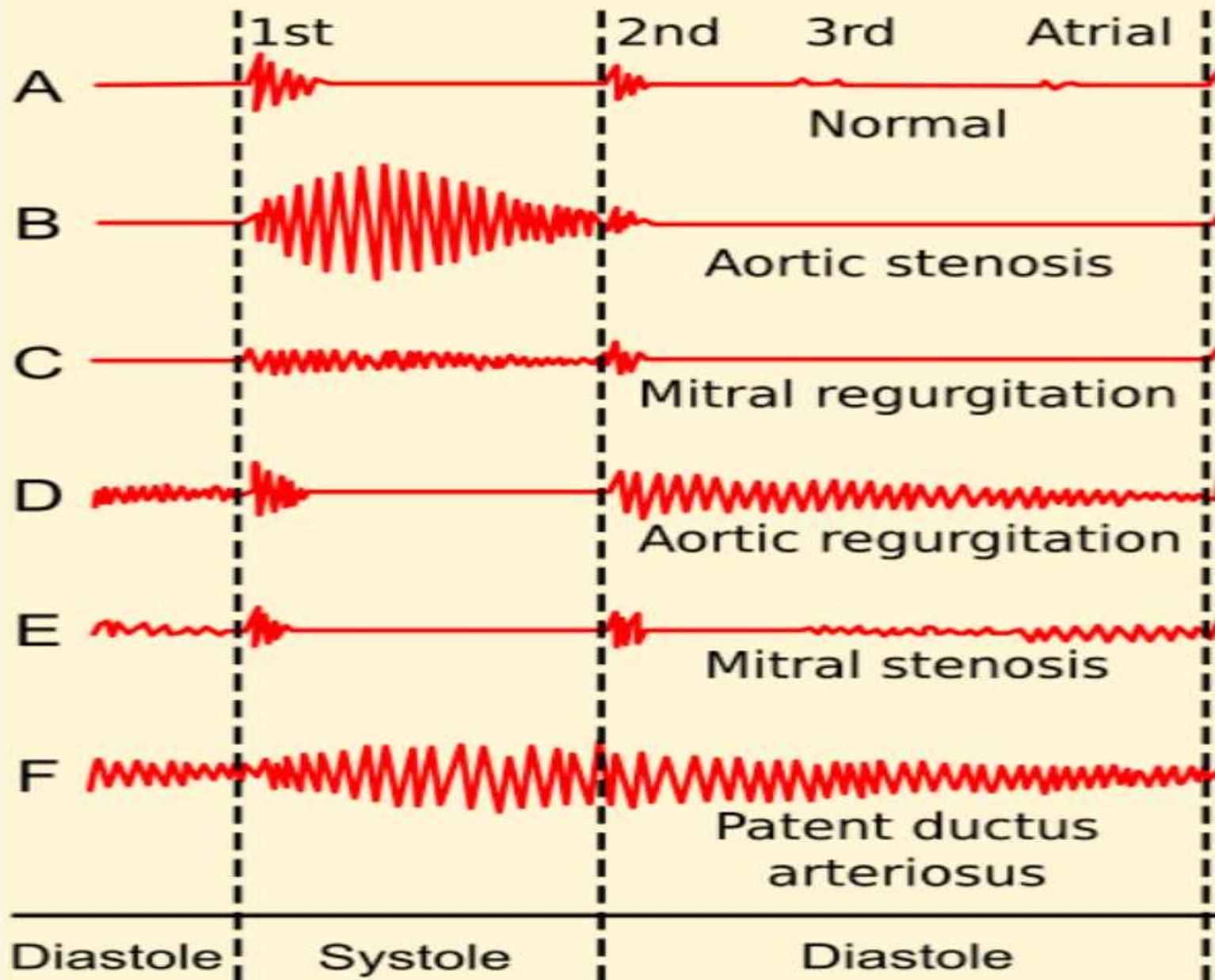
- ▶ **Site:** Best heard over the left lower sternal border, around the 3rd (A2 area).
- ▶ **Propagation :** To apex
- ▶ **Timing:** Early diastolic.
- ▶ **Character:** Soft blowing, decrescendo.
- ▶ **Relation to respiration & position:** ↑ with expiration & with leaning forward.





Chest radiographs demonstrate enlargement of the left ventricle with an aortic configuration, reflects adaptive dilatation seen in aortic regurgitation

Heart murmur



Tricuspid Stenosis

Etiology :

- ▶ It's usually rheumatic in origin & usually associated with mitral or aortic valve diseases.

Hemodynamics : obstruction of tricuspid valve leading to :

- ▶ ↑ RA pressure → RA enlargement & systemic congestion.
- ▶ ↓ RV filling → ↓ COP.

Tricuspid Stenosis

Clinical picture:

- ▶ Symptoms of LCOP and systemic congestion.
- ▶ Signs of LCOP:
 - ✓ Cold hands with weak pulse
 - ✓ ↓ Systolic BP
 - ✓ Peripheral cyanosis.
- ▶ Signs of systemic congestion:
 - ✓ Congested pulsating neck vein with systolic expansion and giant A wave.
 - ✓ Enlarged tender pulsating liver with mild jaundice.
 - ✓ Ascites and LL edema.
- ▶ Mid diastolic presystolic murmur at lower left sternal border, increases by inspiration.

Tricuspid Regurge

Etiology :

- ▶ TR is usually functional resulting from RVE → dilatation of tricuspid ring.

Hemodynamics :

During systole, part of blood regurgitates from RV to RA causing:

- ▶ ↑RA pressure → RA enlargement & systemic congestion.
- ▶ Volume overload on RV → RV enlargement then failure.

Tricuspid Regurge

Clinical picture:

- ▶ Symptoms and signs of LCOP and systemic congestion.
- ▶ Pansystolic murmur over tricuspid area & propagated to the apex, and increases by inspiration.

Pulmonary Stenosis

Etiology :

▶ Anatomy :

- Valvular : the most common type (80 %) .
- Subvalvular (Infundibular)
- Supravalvular: rare.

Hemodynamics :

During systole: ↓ blood flow through the pulmonary valve → ↑

Pressure overload on RV leading to :

- ▶ LCOP.
- ▶ RV enlargement then failure. & systemic congestion.
- ▶ ↓ Right CO to the lung → lung oligemia → predispose to TB.

Pulmonary Stenosis

Clinical picture:

- ▶ Systolic thrill over pulmonary area.
- ▶ Weak pulmonary component of S₂ with wide splitting.
- ▶ Murmur : ejection systolic murmur on pulmonary area.

Systolic Murmurs

DD of Systolic Murmurs

1. AS
2. PS
3. MR
4. TR.
5. VSD
6. PDA
7. Coarctation of aorta