



# Valvular Heart Diseases

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New Edition Of



Done by

**Medicine Team**  
**429**



## General characteristics of all valvular heart disease

- ALL cardiac valves can be involved in pathological processes.
- Right sided valvular lesions change in intensity with inspiration, while Left sided VHD change with expiration.
- Etiology of valvular heart disease:
  - 1- Congenital :
    - Bicuspid or unicuspid
    - Subvalvular or supravalvular
  - 2- Acquired :
    - Rheumatic
    - Ischemic
    - Degeneration (myxomatous – calcification)
    - Infective Endocarditis
    - Valve ring dilatation
- Types of presentation of VHD:
  - Acute:
    - E.g.: - Acute mitral regurgitation due to acute myocardial infarction or acute chordae tendineae rupture
  - Chronic:
    - E.g.: - Chronic mitral regurgitation due to Rheumatic fever or Mitral valve prolapse
    - Chronic aortic regurgitation due to Bicuspid Aortic valve.
- Hemodynamic consequences of VHD:
  - 1- Pressure-overload:
    - Aortic stenosis → Left Ventricular hypertrophy
    - Mitral stenosis → Left Atrial hypertrophy & dilatation
  - 2- Volume-overload:
    - Chronic mitral regurgitation → Left ventricle & Left atria dilation
    - Chronic aortic regurgitation → Left ventricle dilation
    - Chronic tricuspid regurgitation → dilated right ventricle & right atria
- General symptoms of some VHD:
  - 1- Exertional dyspnea/ PND (paroxysmal nocturnal dyspnea) / Orthopnea
  - 2- Palpitation
  - 3- Chest pain
  - 4- Fatigue
  - 5- Dizziness, pre-fainting, syncope
  - 6- Symptoms of congestive heart failure (edema/ascites)
  - 7- Cough – Hemoptysis
  - 8- Symptoms of thromboembolic complication
- General signs of some VHD:
 

|  |  |
|--|--|
| <ol style="list-style-type: none"> <li>1. Abnormal look (mitral facies in mitral stenosis).</li> <li>2. Abnormal pulse (Atrial fibrillation- Aortic regurgitation)</li> <li>3. Abnormal JVP</li> </ol> | <ol style="list-style-type: none"> <li>4. Apex beat abnormality</li> <li>5. Sternal or parasternal heave</li> <li>6. Thrill</li> <li>7. Abnormal heart sounds</li> <li>8. MURMURS (Systolic or Diastolic)</li> </ol> |
|--|--|

- **Specific Symptoms for some Valvar disease:**

- Dyspnea, Hemoptysis and pulmonary edema are seen in mitral stenosis (due to bronchial venules rupture)
- Chest pain is common in aortic stenosis (not common in mitral stenosis)
- Palpation is common for all especially mitral stenosis and mitral prolapse
- Dizziness and fainting is common in aortic stenosis
- Abnormal facial changes seen in mitral stenosis (are not seen these days due to early diagnosis)

- **Investigations in ALL VHD:**

- a) ECG
- b) Chest X-ray (CXR)
- c) Echocardiology (**Test of choice for diagnosis**)
  - M mode, 2D, 3D, 4D, TEE (Transesophageal echocardiography)
  - Doppler (**To assess severity**)
- d) 24 hours monitor for heart rhythm
- e) MRI
- f) Cardiac catheterization (helpful & confirmatory, needed if the patient is old suspecting IHD -look at the coronaries-)

- **Extra notes :**

To have infective endocarditis the patient should have:

1- Infected blood (septicemia)

2- Abnormal valve

Unless the bacterium is aggressive (ex.: staph. aureus infection)

## Mitral stenosis

- **Common etiology of MS:**

- Rheumatic Fever (**most common**):
  - Related to streptococcus infections, causing damage to the mitral valve and leading to mitral stenosis later in life
  - Pathophysiology : Inflammation > cusps thickening > fusing and calcification
  - Mainly affect children from 5 to 15 years. Starts as sore throat followed by joint pain
  - Mitral stenosis result in several changes of the valves:
 

|                               |   |
|-------------------------------|---|
| 1- Cusps thickening           | 3- Chordae tendinae thickening & shortening |
| 2- Commissures fused together | 4- Calcium deposition                       |
- Congenital
- Degenerative (calcification & fibrosis) in elderly
- SLE
- Rheumatoid Arthritis
- Atrial Myxoma
- Malignant Carcinoid
- Bacterial Endocarditis

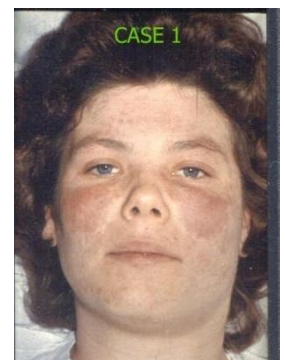
- **Pathophysiology of MS:**

- **Valvular orifice:**

- Normal adults the mitral valve orifice is 4-6cm<sup>2</sup>.
    - When the orifice is reduced to approximately 2cm<sup>2</sup> (mild mitral stenosis) → blood can flow from the left atrium to the left ventricle only if propelled by an abnormal pressure gradient (the hemodynamic hallmark of MS).
    - When the mitral valve opening is reduced to 1 cm<sup>2</sup> (critical mitral stenosis) → a left atrioventricular pressure gradient of approximately 20mmHg is required to maintain normal cardiac output at rest.

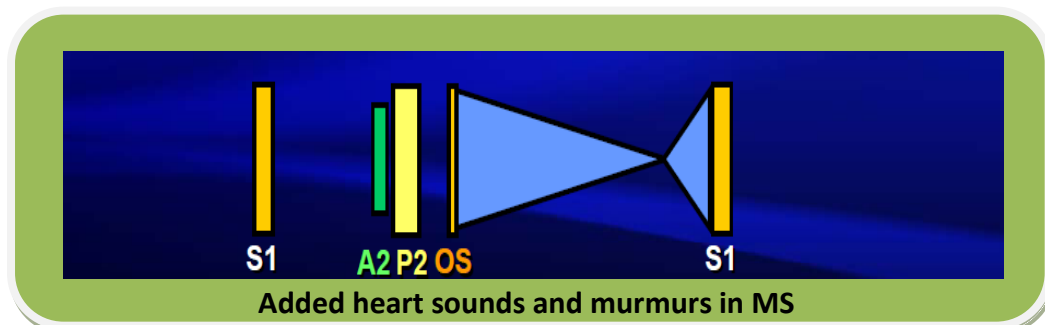
- **Symptoms of MS:**

1. Dyspnea on exertion (**hallmark signs of the beginning of MS**)
  - The first bouts of dyspnea in patients with mitral stenosis are usually precipitated by exercise, emotional stress, infection, or atrial fibrillation, all of which increase HR & the rate of blood flow across the mitral orifice → result in further elevation of Left atrial pressure & consequent pulmonary edema & congestion
2. Paroxysmal nocturnal dyspnea (PND)
3. Orthopnea
4. Fatigue
5. Palpitations (due to atrial fibrillation)
6. Cough & Hemoptysis (due to rupture of thin dilated bronchial veins)
7. Peripheral edema & symptoms of Right heart failure



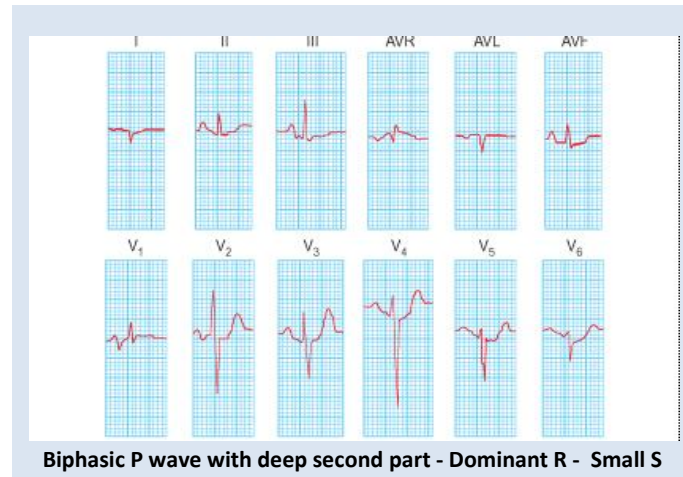
- **Signs of MS:**

1. Mitral facies (Abnormal facial look-Flush cheeks)
2. Apex beat: localized & tapping
3. Left parasternal heave (due to Right ventricular hypertrophy) & diastolic apical thrill (in Left lateral position)
4. Heart sounds: Loud S1 (due to abrupt leaflet closure) & Loud P2 (due to pulmonary hypertension).. **No Third heart sound**
5. Added sounds:
6. Opening snap (sound in early diastole after second heart sound due to sudden opening of the valve): more closer to the second heart sound indicates more severe mitral stenosis
7. Murmurs: Diastolic Apical Rumble (due to turbulent blood flow across the stenotic valve)



- **Investigations (as discussed previously):**

- ECG will show: atrial fibrillation – Left atrial enlargement (LAE) – Right atrial enlargement (RAE) – Right ventricular hypertrophy (RVH).
- Echo will show: LA dilation & valvular stenosis.
- Chest Radiograph
- Doppler Study
- Transesophageal Echocardiography



Calcium in mitral valve ring



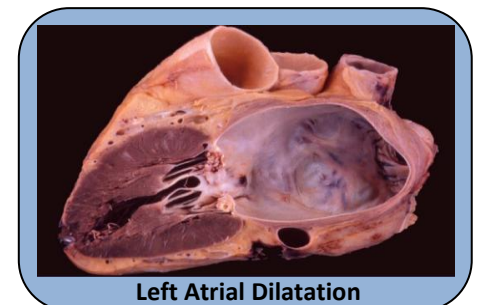
Hypertrophy and Left atrial border appendage (not straight)



Barium swallow: esophagus pushed by left atrium

- **Complications of MS:**

1. Atrial fibrillation (due to atrial dilatation)
2. Pulmonary edema
3. Blood clots with systemic embolization:
4. Left atrial dilatation > loss sinus rhythm > atrial fibrillation > thrombus formation (can reach brain)
5. Pulmonary hypertension may lead to Right heart failure
6. Infective endocarditis.



- **Treatment of symptomatic MS:**

- ✓ **Medical Therapy (treats the symptoms not the cause):**

- 1- Diuretics – for congestion.
- 2- Digoxin (digitalis) : to treat the fibrillation by blocking the conduction through AV node (doesn't work as inotropes)
- 3- Beta and Ca Channel Blockers (anti-arrhythmics) – for atrial fibrillation rate control.
- 4- Anticoagulation (to prevent thrombus formation)
- 5- Antibiotics : In case of rheumatic fever and before procedures that may develop infection (E.g. endocarditis)

- ✓ **Surgical Therapy (treats the cause):**

- 1) Percutaneous transvenous mitral commissurotomy (PTMC) "Percutaneous Balloon Valvuloplasty" → for a Non-calcified, pliable valve.
- 2) Surgical commissurotomy.
- 3) Mitral valve replacement:
  - Mechanical valve : for young patients – stay for years but need anticoagulation through life
  - Tissue valve : work 10 to 15 years (given to old patients)

## Mitral Regurgitation (MR)

- **Common etiology:**

- 1- **Alterations of the Leaflets, Commissures, Annulus of the valve:**

- Rheumatic heart disease
      - Mitral valve prolapse (MVP)
      - Infective endocarditis
- } (Common causes)

- 2- **Alterations of LV or LA size and Function (functional MR):**

- IHD
    - Hypertensive heart disease
    - Myocarditis
    - Cardiomyopathy (dilated - hypertrophic)

- 3- **Other:**

- Connective tissue disorders (SLE)
    - Collagen abnormalities (Marfan's syndrome)

- **Pathophysiology of MR:**

- **Chronic MR (volume overload):**

- Blood regurgitate to LA → LA dilation
    - ↓ CO
    - ↑ Total stroke volume → volume overload → LV dilation.
    - Mild ↑ in LA pressure → may progress to ↑ pulmonary venous pressure → pulmonary edema & congestion

- **In acute MR:**

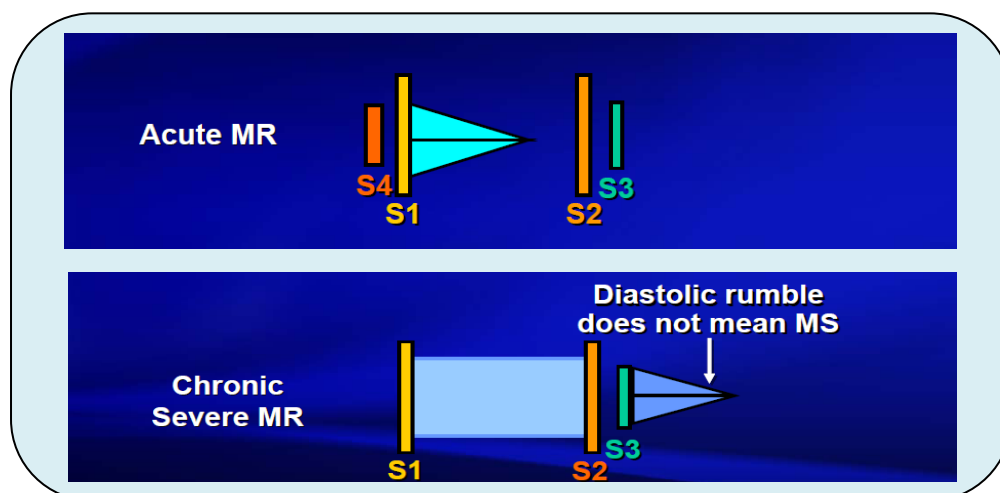
- LA is not dilated, which result in high LA pressure, high pulmonary venous pressure, severe pulmonary edema and congestion

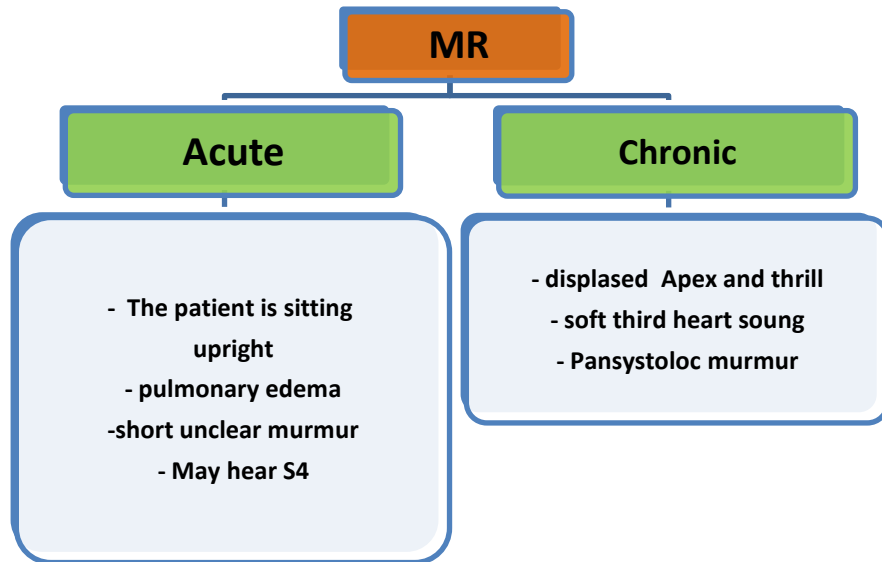
- **Symptoms of MR:**

- Same as MS except hemoptysis and systemic embolization are less common
  - Complication of infective endocarditis is more common

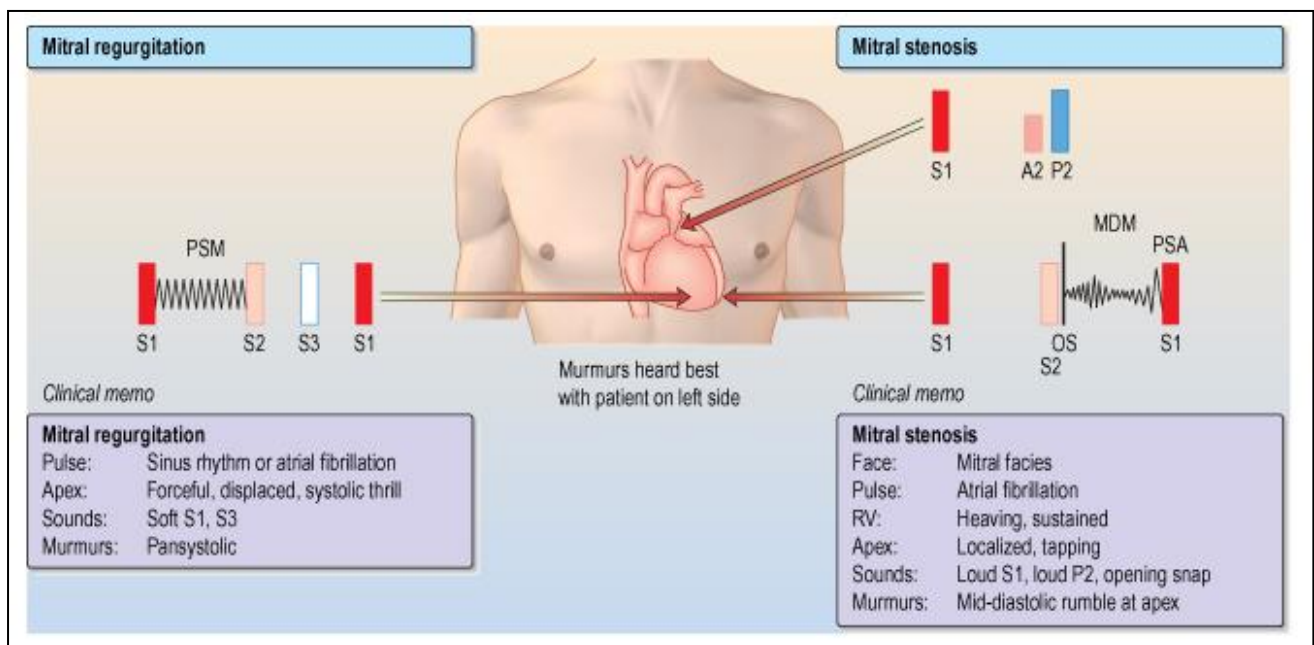
- **Signs of MR:**

- 1) Apex beat: laterally displaced & diffuse forceful - because the ventricle is dilated (in chronic cases)
- 2) Systolic apical thrill (usually radiating to axilla)
- 3) Heart sounds: Soft S1 (due to incomplete leaflet closure), Split S2 (but is obscured by the murmur)
- 4) Prominent third heart sound followed by diastolic rumble
- 5) Pansystolic murmur (whole systolic)





- **Investigations (as discussed previously):**
  - ECG will show: left atrial enlargement (LAE) – left ventricular dilatation
- **Treatment:**
  - ✓ **Medical Therapy (treats the symptoms not the cause):**
    1. Diuretics – for congestion
    2. Vasodilators (ACE inhibitors) – to ↓ afterload
    3. Anticoagulation – for atrial fibrillation and LA clots
    4. SBE Prophylaxis – prevent endocarditis
  - ✓ **Surgical Therapy (treats the cause):**
    1. Mitral valve repair
    2. Mitral valve replacement





## Mitral valve prolapse (MVP)

It is the prolapse of one or more of mitral valve leaflets back into the LA during systole

- **Pathology of MVP:**
  - Large mitral valve leaflets, an enlarged mitral annulus, abnormally long chordae, or disordered papillary muscle contraction
  - Demonstrate myxomatous degeneration of the mitral valve leaflets
  - Associated with Marfan's syndrome, thyrotoxicosis, rheumatic or ischemic heart disease
- **Symptoms of MVP:**
  1. Atypical chest pain (**most common symptom**)
  2. Palpitations (because of the abnormal ventricular contraction or because of the atrial and ventricular arrhythmias)
  3. Sudden cardiac death (due to fatal ventricular arrhythmias) – very rare but recognized complication
- **Signs of MVP:**
  1. Mid-systolic click (**most common sign**) – produced by the sudden prolapse of the valve and the tensing of the chordae tendineae that occurs during systole
  2. A late systolic murmur (owing to some regurgitation)
- **Complications of MVP:**
  - Infective endocarditis
  - Progressive MR (acute – chronic)
  - Thromboembolism
  - Atrial-ventricular arrhythmias
- **Treatment of MVP:**
  1. Beta-blocker → effective for the treatment of the atypical chest pain and palpitations
  2. In mitral valve prolapse associated with significant mitral regurgitation and atrial fibrillation, anticoagulation is advised to prevent thromboembolism
  3. In mitral valve prolapse associated with severe mitral regurgitation which has a risk of sudden cardiac death, surgery is advised

## Aortic stenosis (AS)

- **Common etiology of AS:**
  1. Rheumatic heart disease (30-60 yrs)
  2. Congenital (bicuspid) aortic valve (60 years and less)
  3. Degenerative (>70 yrs) (**which is the most common cause**)
- **Pathophysiology of AS:**
  1. Obstruction of LV flow → ↑↑ LV end-diastolic pressure
  2. LV Concentric Hypertrophy
- **Symptoms of AS:**
  - Long asymptomatic phase



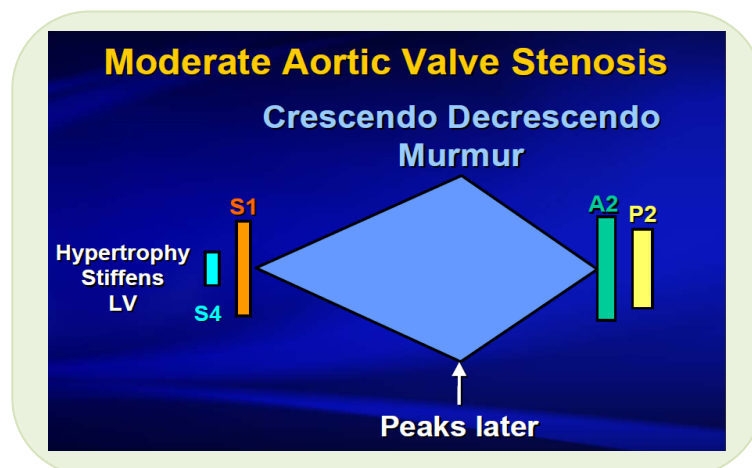
| Symptoms | Prognosis with Symptomatic Aortic Stenosis |                 |
|----------|--|-----------------|
|          | Clinical Symptoms                          | Median Survival |
|          | Angina                                     | 5 years         |
|          | Syncope                                    | 3 years         |
|          | CHF  | 2 years         |

|   |
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| <ul style="list-style-type: none"> <li>1- Angina (because of ischemia) :Ventricle hypertrophy &gt; ischemia ( cause chest pain) &gt; arrhythmia</li> <li>2- Dyspnea (because of the thick ventricle and the heart is not getting blood so high left atrium pressure)</li> <li>3- Syncope ( due to arrhythmia</li> <li>4- Chronic Heart failure</li> </ul> |
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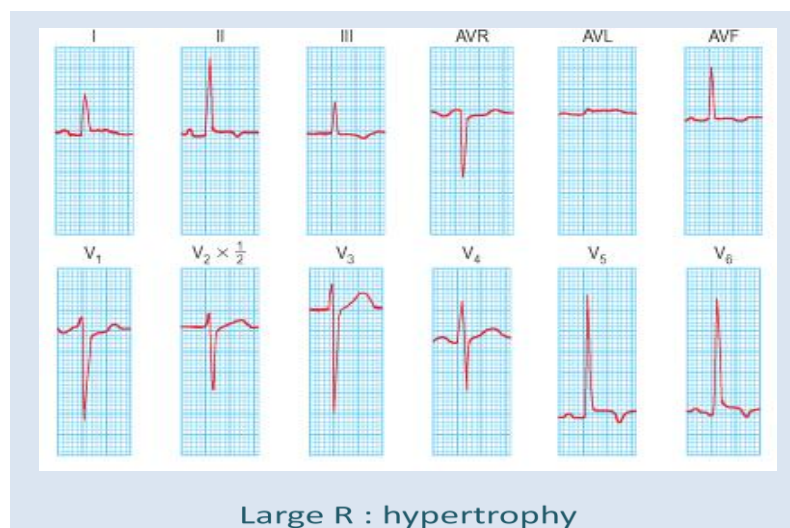
• **Signs of AS:**

1. Crescendo Decrescendo murmur: Longer murmur indicates more stenosed valve)\
2. Pulse: Pulsus Parvus et Tardus (Carotid Impulse){parvus= **low volume**- tardus= **late**}
3. Apex beat: Sustained and not displaced
4. Systolic thrill in aortic area (usually radiating to carotid)
5. Added sounds: S4 gallop (from LVH)



• **Investigations (as discussed previously):**

- ECG will show: Left atrial enlargement (LAE) – Left ventricular hypertrophy (LVH)



- **Treatment of AS:** (Follow up and clinical assessment if asymptomatic - Valve replacement if symptomatic)
  - ✓ **Medical Therapy** (treats the symptoms).
  - ✓ **Surgical Therapy** → aortic valve replacement (Bioprosthetic or Mechanical)
    - In patients with aortic stenosis, symptoms are a good index of severity and all symptomatic patients should have aortic valve replacement.
    - Asymptomatic patients should be under regular review for assessment of symptoms and echocardiography.

## Aortic regurgitation

- **Common etiology of AR:**
  - **Valvar:**
    - **Chronic:** Rheumatic heart disease, Bicuspid valve, Marfan syndrome, degenerative, Syphilis Arthritides (Reiter's syndrome- Ankylosing spondylitis)
    - **Acute:** Endocarditis, Acute rheumatic fever, Failure of prosthetic heart valve
  - **Aortic root (Dilation of the aortic annulus) :**
    - **Chronic:** Hypertention, Aortic Aneurysm, Marfan syndrome, Osteogenesis Imperfecta, Syphilis Arthritides (Reiter's syndrome- Ankylosing spondylitis), Aortitis
    - **Acute:** Dissection, Ruptured sinus of Valsalva aneurysm
- **Pathophysiology of AR:** Volume overload with LV dilation.
- **Symptoms of AR:**
  - **Pulmonary venous congestion :**
    - ✓ Dyspnea on exertion.
  - **Inadequate cardiac output :**
    - ✓ Fatigue.
    - ✓ Diminished exercise tolerance.
- **Signs of AR:**
  1. Bounding (collapsing) Pulses.
  2. Bisferiens pulse (Biphasic pulse)
  3. Wide pulse pressure ( abnormal pulses in chronic cases)
  4. Apex beat: Hyperdynamic {shifted apex}.
  5. Added sounds: S4, S3 Gallop (in advanced AR).
  6. Murmurs:
    - Early-Diastolic (Decrescendo) Blowing murmur at left sternal edge.
    - Mid-Diastolic Apical Rumble – “**Austin Flint Murmur**” (due to the vibration of the anterior leaflet of the mitral valve as it is buffeted simultaneously by the blood jets from the left atrium and the aorta).

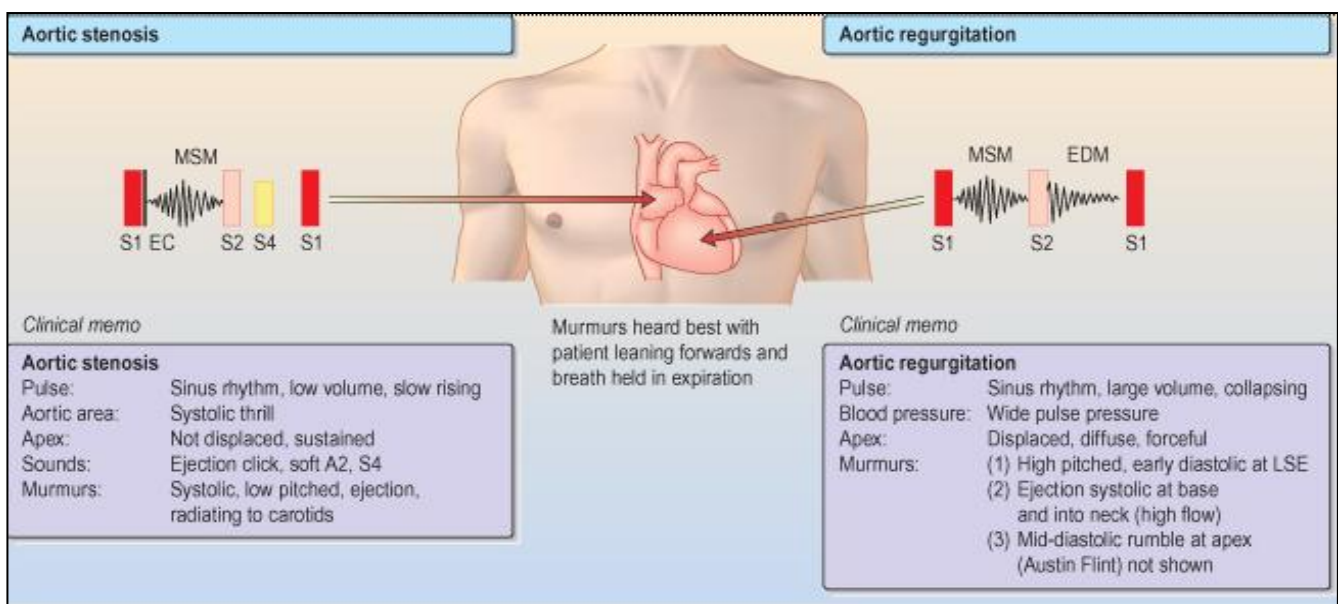


- **Investigations of AR (as discussed previously):**

- ECG will show: Left atrial enlargement (LAE) – Left ventricular hypertrophy (LVH).

- **Treatment of AR:**

- ✓ **Surgical Therapy (if symptomatic):** Aortic Valve Replacement.
  - Because symptoms do not develop until the myocardium fails and because the myocardium does not recover fully after surgery, operation is performed before significant symptoms occur.
  - The timing of the operation is best determined according to hemodynamic, echocardiographic or angiographic criteria.
- ✓ **Medical Therapy (if there is NO significant symptoms):**
  - 1- Serial Checkups with Echos (evaluate EF, Severity AR).
  - 2- Diuretics – for congestion.
  - 3- Vasodilators (Nifedipine – ACE inhibitors) – to ↓ afterload.
  - 4- Subacute Bacterial Endocarditis (SBE) Prophylaxis – prevent endocarditis.



## Pulmonary & Tricuspid valvular disease

- **Tricuspid Valve: (stenosis and regurgitation)**
  - 1- Uncommon and usually due to rheumatic fever (especially Tricuspid stenosis)
  - 2- Tricuspid Regurgitation is more common, Benign, May be secondary to Pulmonary HTN.
  - 3- Tricuspid Stenosis is a part of rheumatic heart disease
  - 4- High pressure may lead to tricuspid regurgitation
  - **Causes:**
    - Endocarditis (esp. in – IV drug abusers or input with IVs).
    - Carcinoid Heart Disease (classically TS).
- **Pulmonary Valve: (Usually a congenital problem seen in young patients)**
  - Patient have murmur and will go to vulvoplasty
  - **Causes:**
    - In Pediatrics – Pulmonary Stenosis
    - Rheumatic HD – Pulmonary Regurgitation (Graham Steel Murmur)

Done

