VALVULAR HEART DISEASE

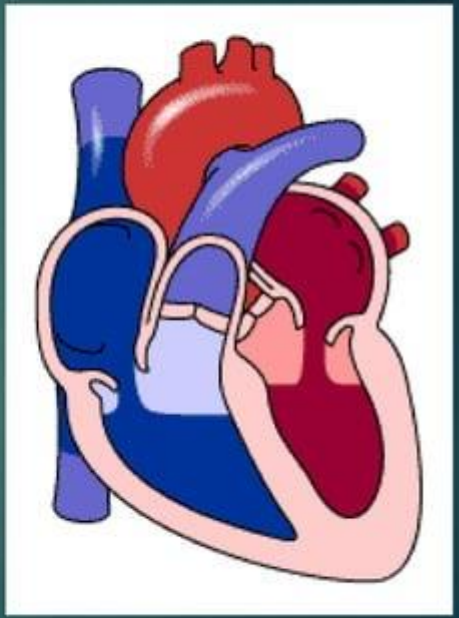
What Is Valvular Heart Disease?

- **Heart valve disease occurs when your heart's valves do not work the way they should.**

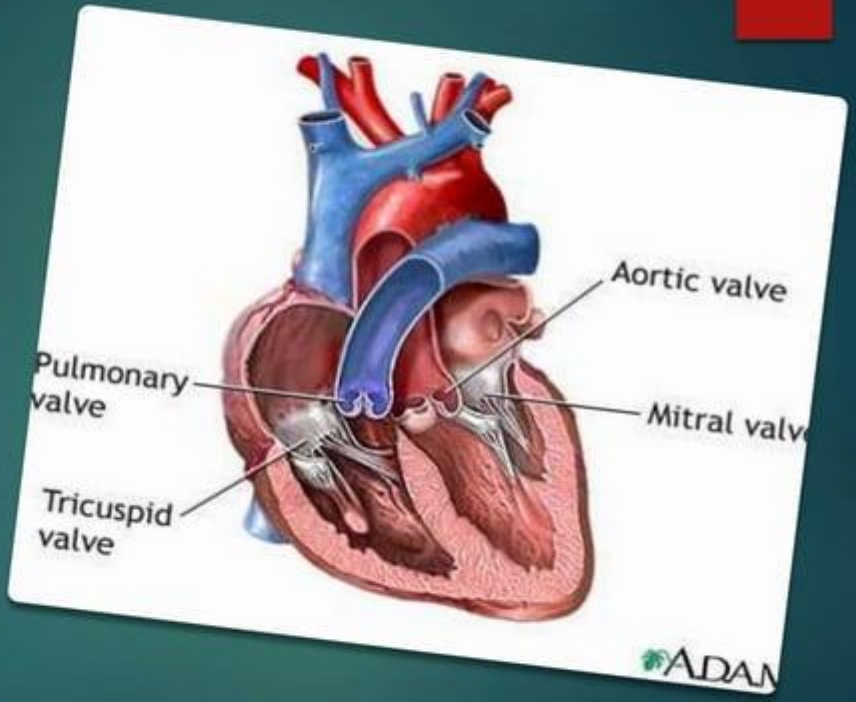
How Do Heart Valves Work?

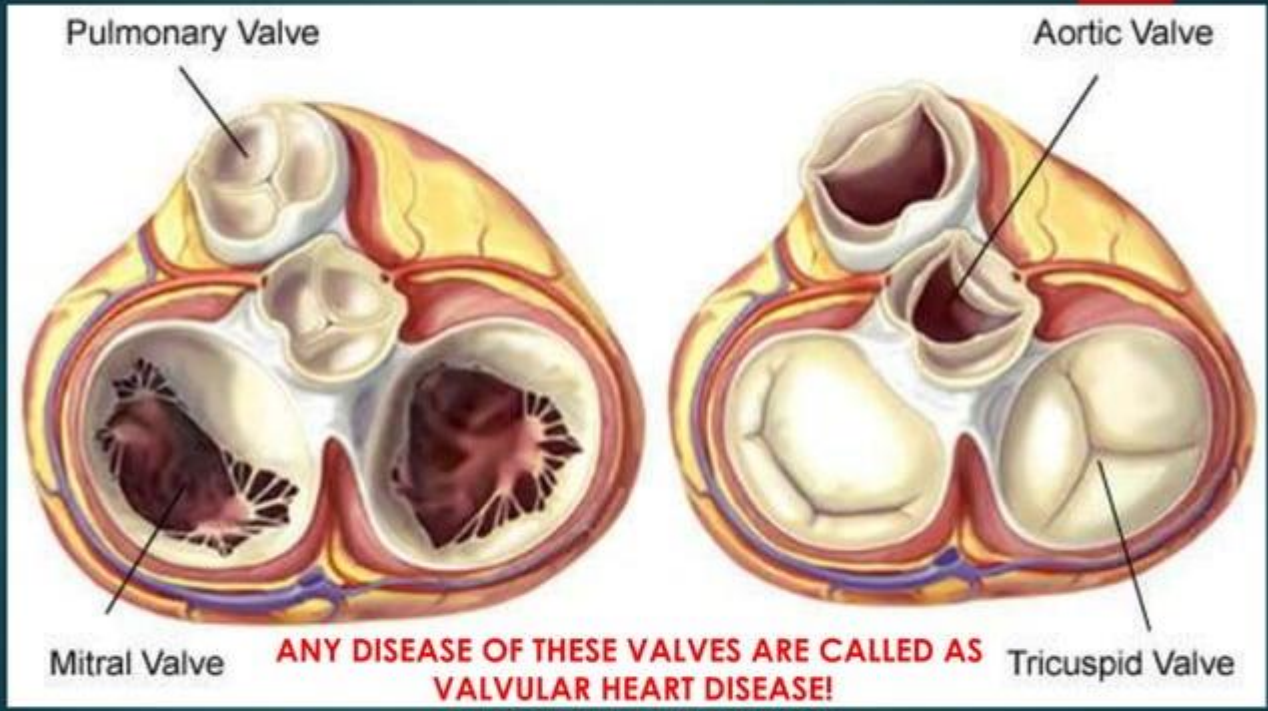
MAINTAIN ONE-WAY BLOOD FLOW THROUGH YOUR HEART

- The four heart valves make sure that blood always flows freely in a forward direction and that there is no backward leakage.

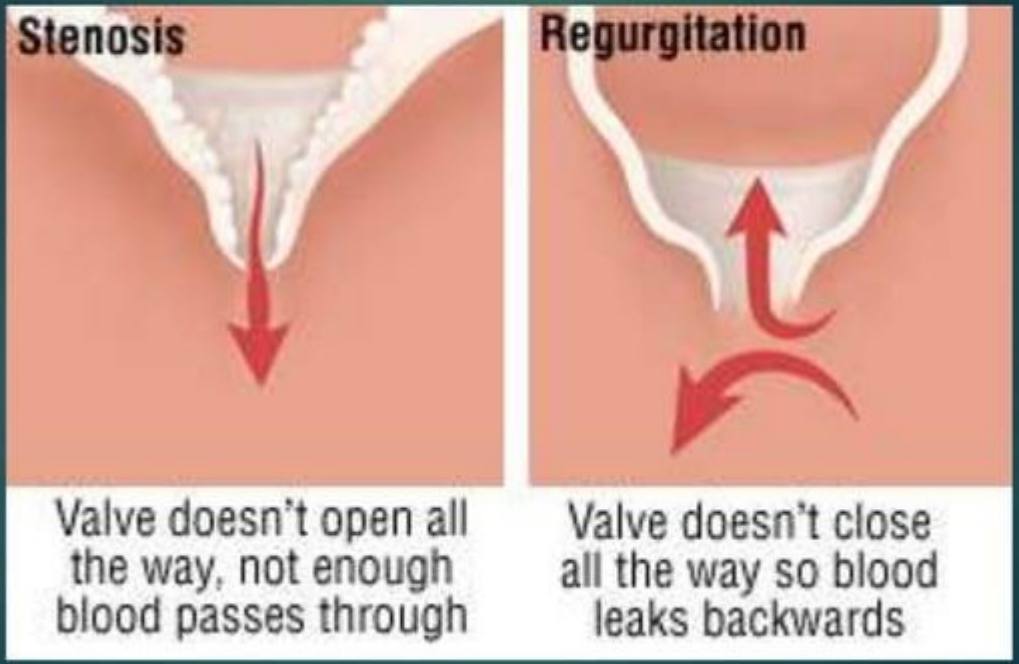


Heart Valves




Pulmonary Valve
Aortic Valve
Mitral Valve
ANY DISEASE OF THESE VALVES ARE CALLED AS VALVULAR HEART DISEASE!
Tricuspid Valve

Types of valve disease



Valvular Stenosis

THE VALVE OPENING NARROWS

- **the valve leaflets may become fused or thickened that the valve cannot open freely → obstructs the normal flow of blood**

EFFECTS:

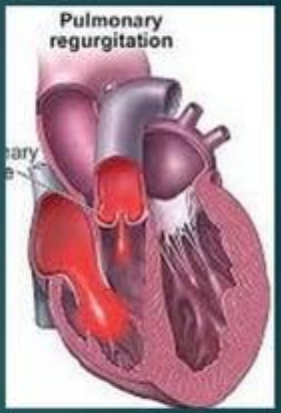
the chamber behind the stenotic valve is subject to greater stress

→ must generate more pressure (work hard) to force blood through the narrowed opening

- initially, the ❤ compensates for the additional workload by gradual hypertrophy and dilation of the myocardium
  → **heart failure**

Valvular Regurgitation

LEAKAGE OR BACKFLOW OF BLOOD RESULTS FROM INCOMPLETE CLOSURE OF THE VALVE



- due to:
  - **Scarring and retraction of valve leaflets**
    OR
  - **Weakening of supporting structures**

EFFECTS:

causes the ❤️ to pump the same blood twice

(as the blood comes back into the chamber)

- the ❤️ dilates to accommodate more blood
- ventricular dilation and hypertrophy → eventually leads to **heart failure**

Principal Causes

•Valve stenosis	•Valve regurgitation
• **Congenital** • **Rheumatic** carditis • **Senile** degeneration	• **Congenital** • **Rheumatic** carditis (acute or chronic) • **Infective** endocarditis • Valve ring dilatation (e.g. dilated cardiomyopathy) • Syphilitic aortitis • **Traumatic** valve rupture • Damage to chordae and papillary muscle (e.g. **MI**) • **Senile** degeneration

Valvular Heart Disease

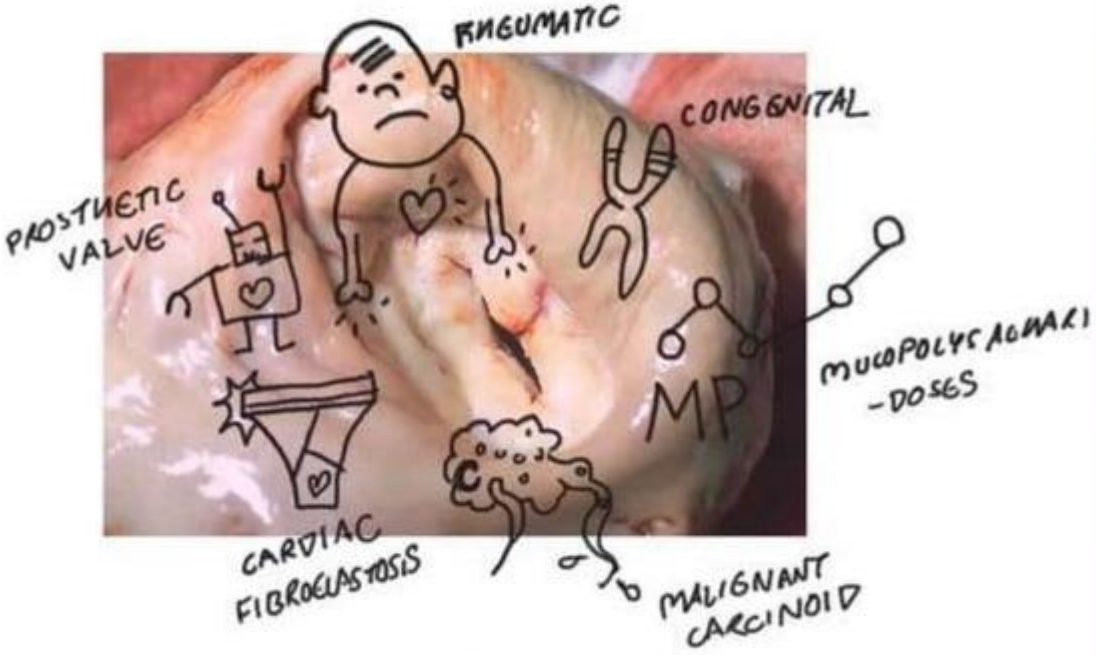
1. MITRAL STENOSIS
2. MITRAL REGURGITATION
3. AORTIC STENOSIS
4. AORTIC REGURGITATION
5. TRICUSPID STENOSIS
6. TRICUSPID REGURGITATION
7. PULMONARY STENOSIS
8. PULMONARY REGURGITATION

1. MITRAL STENOSIS

Aetiology

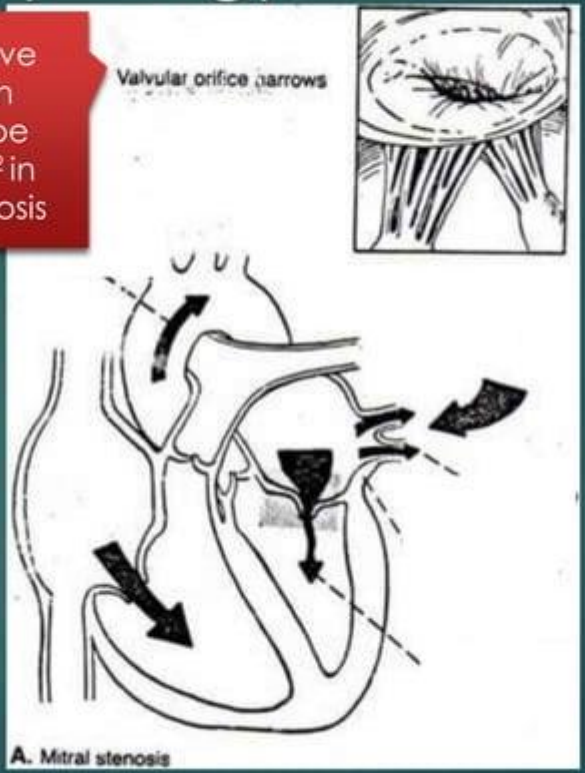
- Almost always **rheumatic** in origin
- Older people: can be caused by heavy **calcification** of mitral valve congestion
- **Congenital** (rare)

Mitral Stenosis Causes

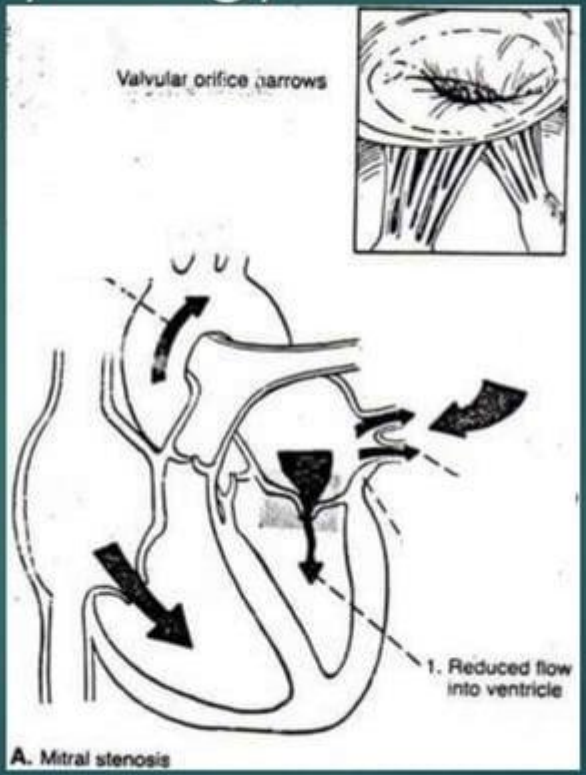


Pathophysiology

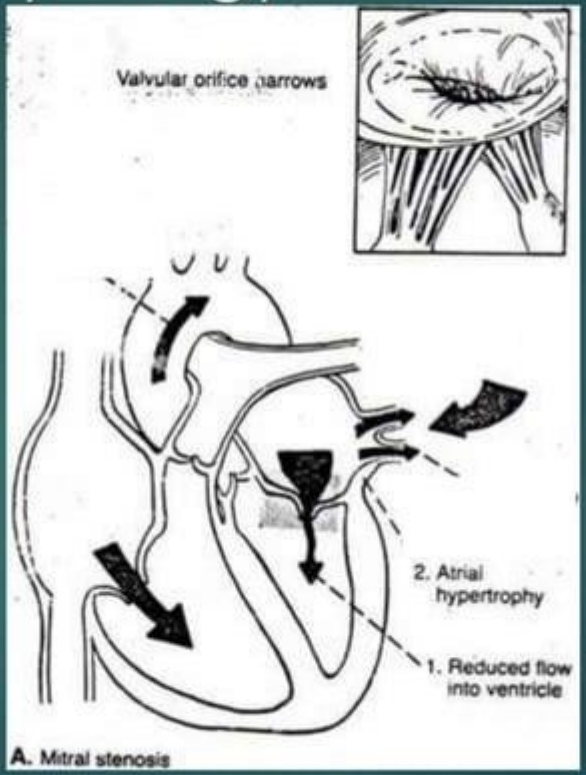
Normal mitral valve orifice is 5cm^2 in diastole & may be reduced to 1cm^2 in severe mitral stenosis



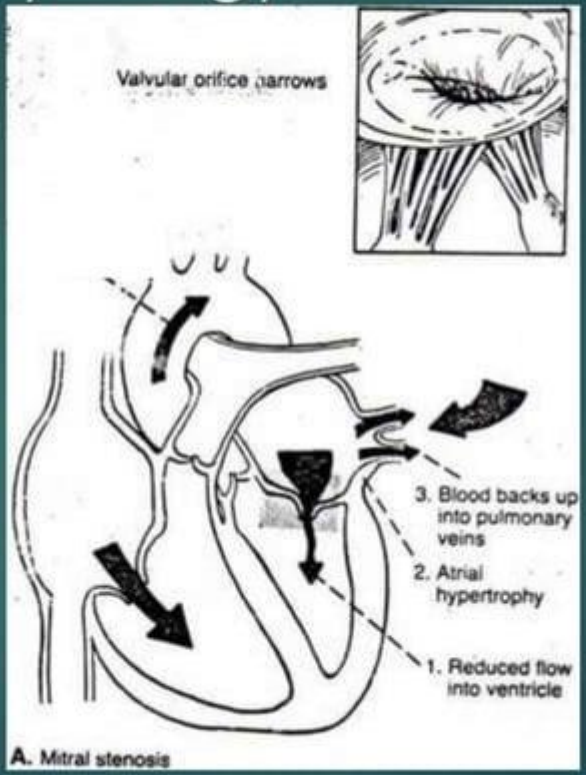
Pathophysiology



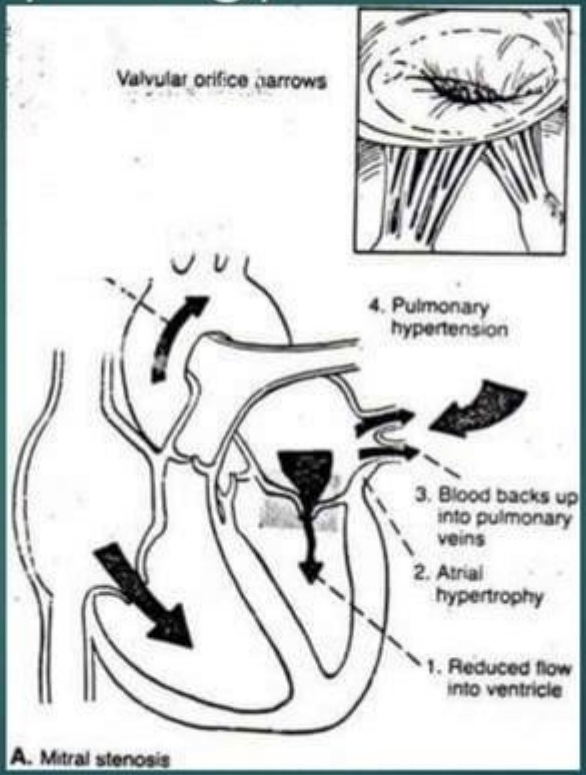
Pathophysiology



Pathophysiology



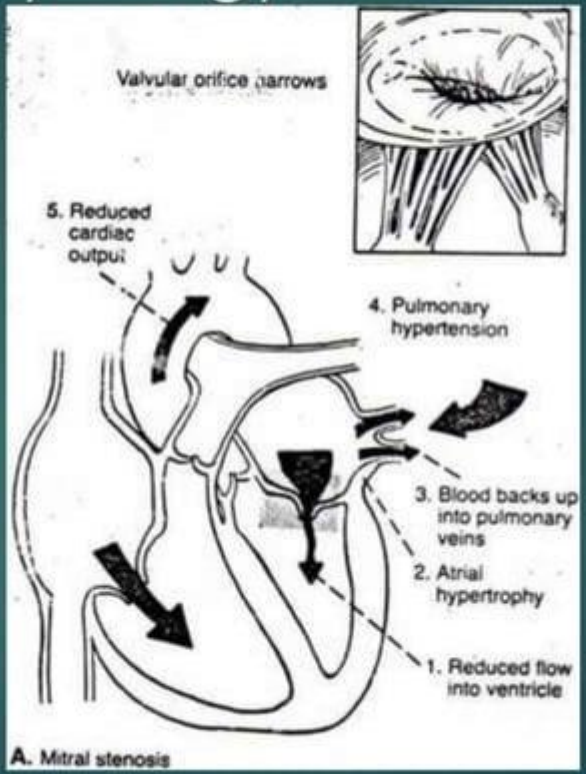
Pathophysiology



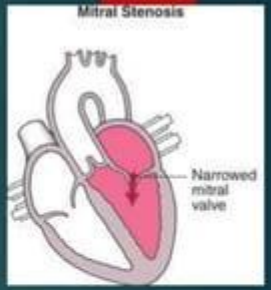
Pathophysiology

Atrial fibrillation due to **progressive dilatation** of the LA is very common.
Its onset often precipitates pulmonary oedema

In contrast, a more **gradual rise** in left atrial pressure tends to cause an increase in pulmonary vascular resistance → pulmo. HTN → RVH, TR RHF



Pathophysiology



Narrowing of mitral valve

↑ left atrial pressure

Hypertrophy left atrium

↓ blood flow to left ventricle

↑ pulmonary pressure

↓ CO

pulmonary congestion

Left ventricular atrophy

Fatigue

↓O2/CO2 exchange (fatigue, dyspnea, orthopnea)

Right-sided ❤ failure

Clinical features

Symptoms

- Breathlessness, cough (pulmonary congestion)
- Chest pain (pulmonary hypertension)
- Hemoptysis (pulmonary congestion or hypertension)
- Fatigue (low cardiac output)
- Oedema, ascites (right heart failure)
- Palpitation (atrial fibrillation)
- Thromboembolic complications

Clinical features

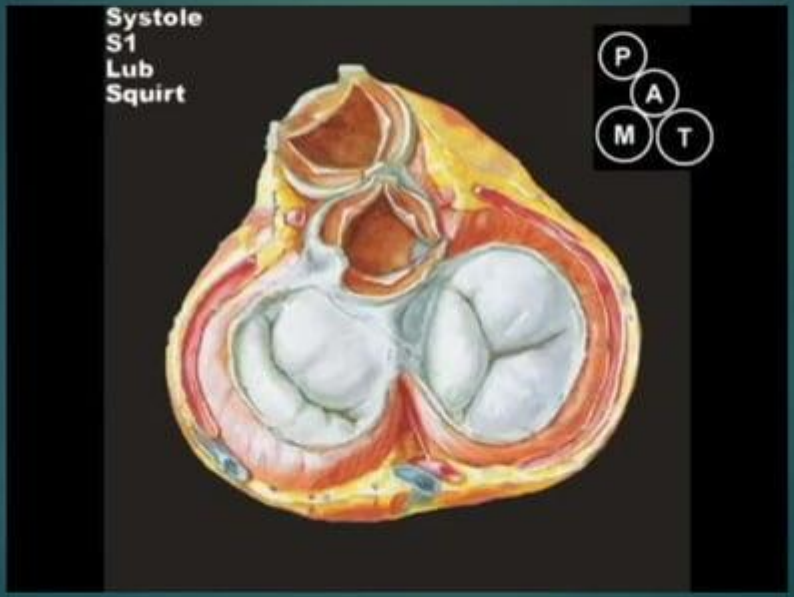
Signs

- Atrial fibrillation
- Mitral facies (abnormal flushing of the cheeks that occurs from cutaneous vasodilation in the setting of severe mitral valve stenosis)
- Auscultation - Loud first heart sound, opening snap

  (created by forceful opening of mitral valve)

  - Mid-diastolic murmur **(apex)**
- Crepitations, pulmonary edema, effusions (raised pulmonary capillary pressure)
- RV heave, loud P_2 (pulmonary hypertension)

Mitral stenosis



...Lub Hoot...

Investigations

- ECG: - right ventricular hypertrophy → tall R waves
- Chest x-ray: - enlarged LA & appendage
  - signs of pulmonary venous congestion
- ECHO: - thickened immobile cusps
  - reduced valve area
  - enlarged LA
  - reduced rate of diastolic filling of LV
- Doppler: - pressure gradient across mitral valve
- Cardiac catheterization: - coronary artery disease
  - pulmonary artery pressure
  - mitral stenosis and regurgitation

Management

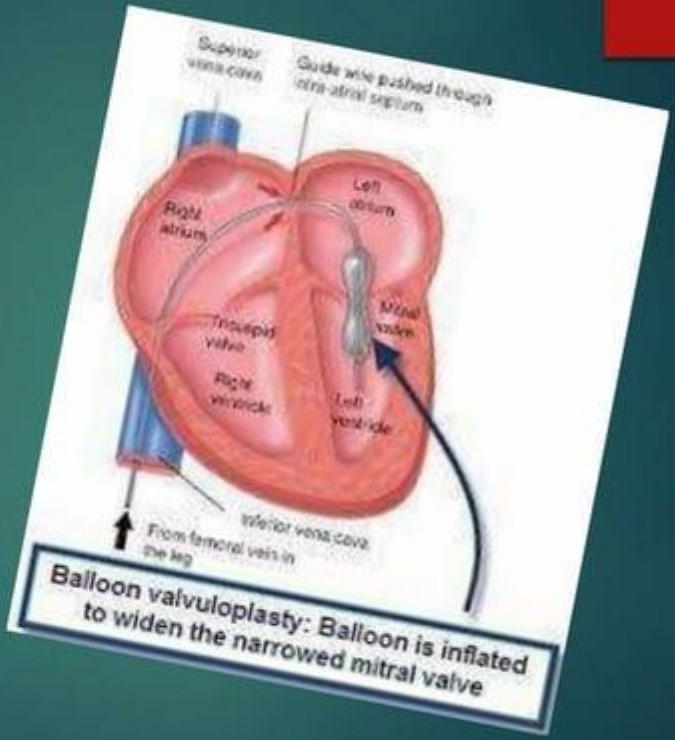
Medically

- Anticoagulant
  - To reduce the risk of systemic embolism
- Digoxin, beta blockers, or rate limiting calcium antagonists
  - To control ventricular rate in atrial fibrillation
- Diuretic
  - To control pulmonary congestion

Surgically

- Mitral balloon valvuloplasty***
- Mitral valvotomy
- Valve replacement

Balloon mitral valvuloplasty



2. MITRAL REGURGITATION

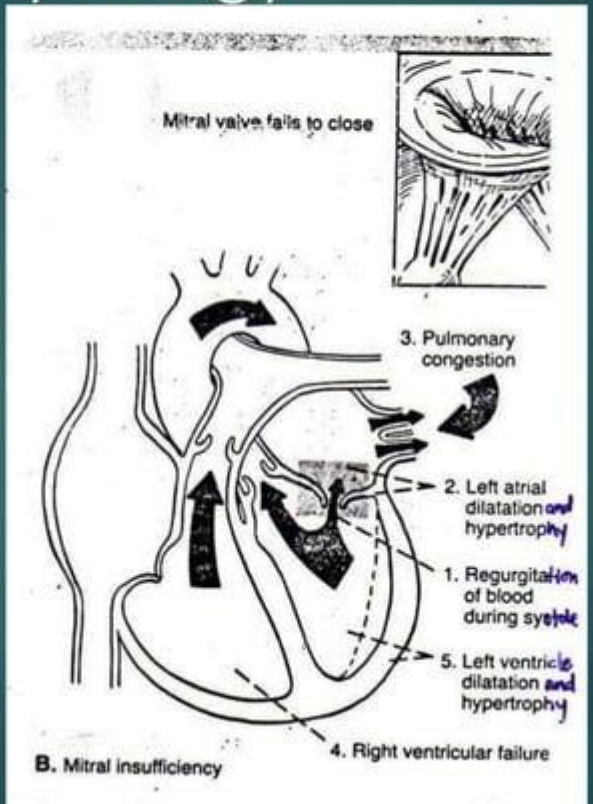
Mitral regurgitation

Incomplete closure of mitral valve

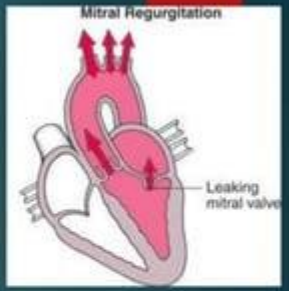
Aetiology

- **Rheumatic disease is the principal cause** (in countries where disease is common)
- **Mitral valve prolapse**
- **Dilatation of the LV and mitral valve ring** (e.g. coronary artery disease, cardiomyopathy)
- **Damage to valve cusps and chordae** (e.g. rheumatic heart disease, endocarditis)
- **Ischaemia or infarction of papillary muscle (MI)**

Pathophysiology



Pathophysiology



Incomplete closure of mitral valve

↓

Backflow of blood to the left atrium

↓ vol. of blood ejected by left ventricle

↓

↓ CO

↑ Left atrial pressure

↓

Left atrial hypertrophy

↓

↑ Pulmonary pressure

↓

↑ Right ventricular pressure

←

Right-sided heart failure

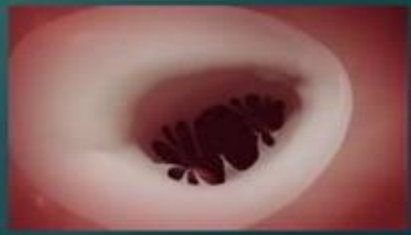
Mitral regurgitation
mitral valve prolapse

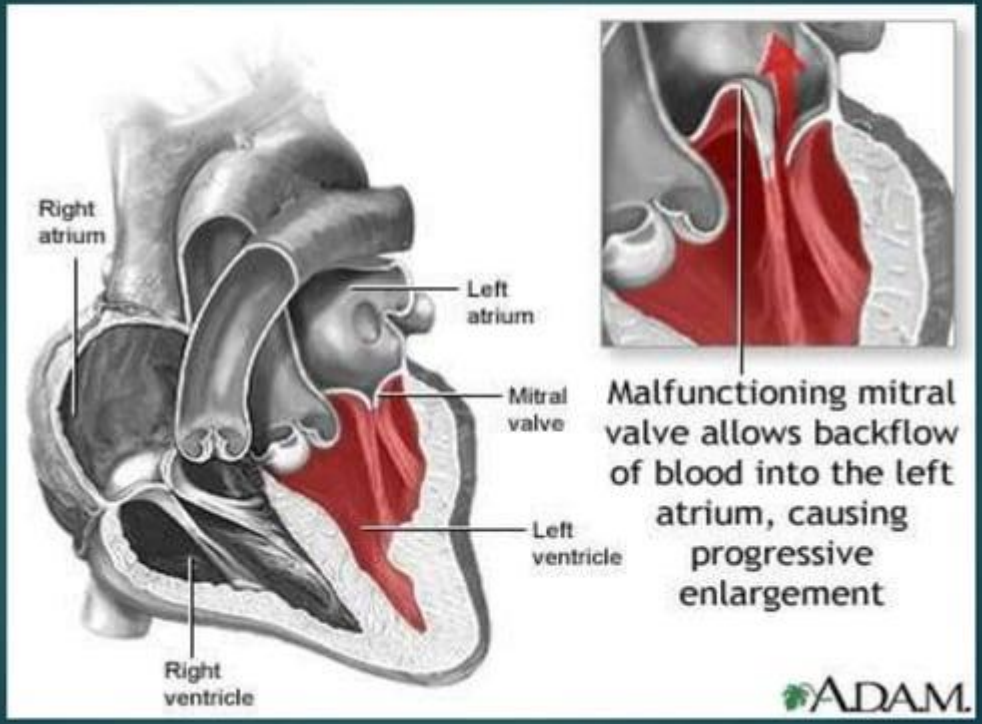
- A.k.a **'floppy' mitral valve**
- One of the most common cause of mild mitral regurgitation
- Caused by
  - **congenital anomalies**
  - **degenerative myxomatous changes**
  - feature of connective tissue disorders like **Marfan's syndrome**

Mitral regurgitation

mitral valve prolapse

- **Mildest form:**
  - Valve remains competent but bulges back into atrium during systole → mid-systolic click but no murmur
- **In the presence of regurgitant valve:**
  - Click is followed by a late systolic murmur, which lengthens as the regurgitation becomes more severe
- **Severe form:**
  - Progressive elongation of chordae tendinae→ increasing regurgitation→ Chordal rupture→ severe regurgitation




Right atrium
Left atrium
Mitral valve
Left ventricle
Right ventricle
Malfunctioning mitral valve allows backflow of blood into the left atrium, causing progressive enlargement
A.D.A.M.

Clinical Manifestations

SYMPTOMS

- Fatigue & weakness – due to ↓ CO – predominant complaint
- Exertional dyspnea & cough – pulmonary congestion
- Palpitations – due to atrial fibrillation (occur in 75% of pts.)
- Edema, ascites – Right-sided heart failure

Clinical Manifestations

SIGNS

- Atrial fibrillation
- Cardiomegally
- Apical pansystolic murmur +/- thrill
- Soft S1, apical S3
- Signs of pulmonary venous congestion (crepitations, pulmonary edema, effusions)
- Signs of pulmonary hypertension & right heart failure

Mitral regurgitation

…Hoot Dub…

Investigations

- ECG: - left atrial hypertrophy
  - left ventricular hypertrophy
- Chest x-ray: - enlarged LA,LV
  - pulmonary venous congestion
  - pulmonary oedema
- ECHO: - dilated LA,LV
  - structural abnormalities of mitral valve (e.g. prolapse)
- Doppler: - detects and quantifies regurgitation
- Cardiac catheterization: - dilated LA,LV
  - mitral regurgitation
  - pulmonary hypertension
  - coexisting coronary artery disease

Management

Medically

- Vasodilators (e.g. ACE inhibitors)
- Diuretics
- If atrial fibrillation presents,
  - Anticoagulant
  - Digoxin

Surgically

- Mitral valve repair → To treat mitral valve prolapse

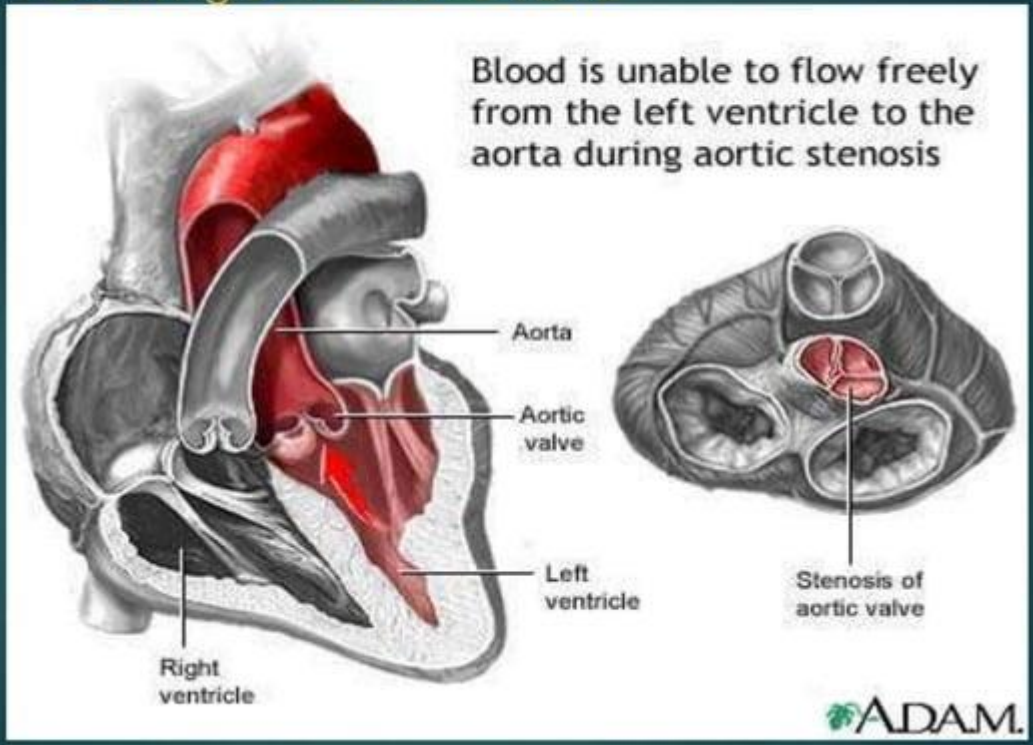
OR

- Mitral valve replacement

3. AORTIC STENOSIS

Aortic Stenosis

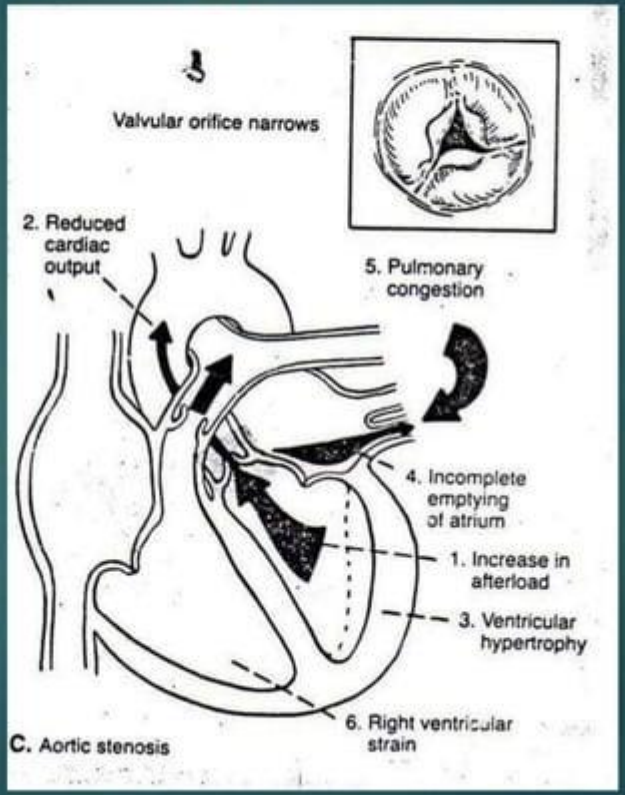
Narrowing of the aortic valve



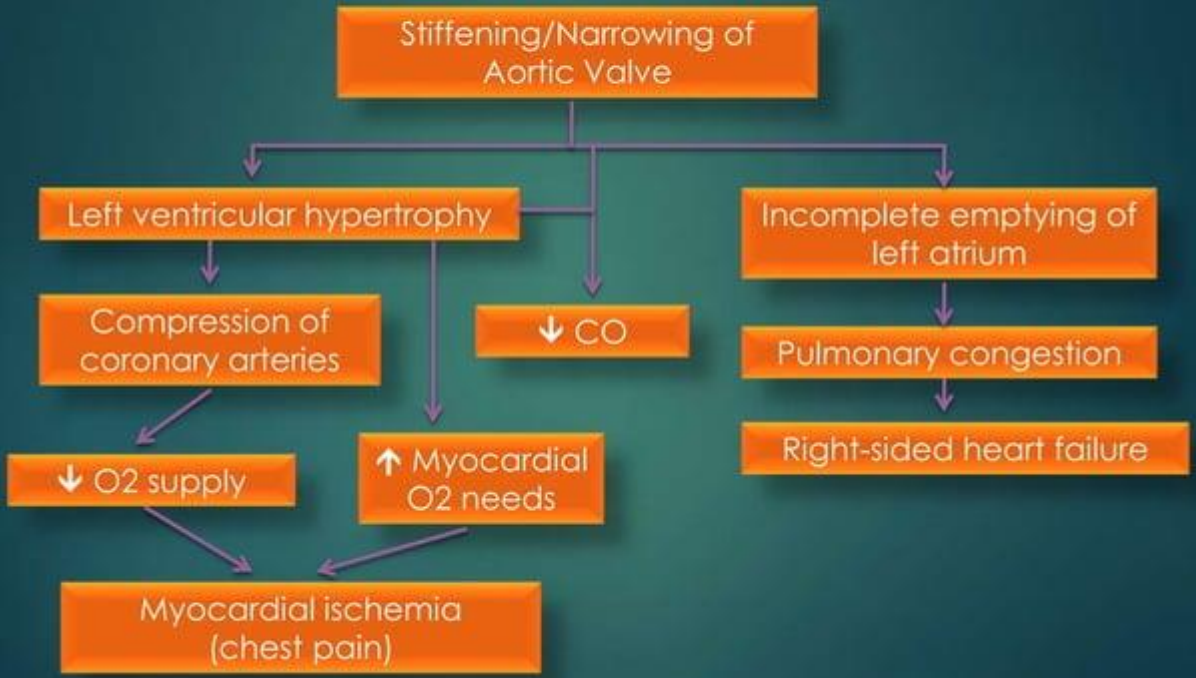
Aetiology

- **INFANTS, CHILDREN, ADOLESCENTS**
  - Congenital aortic stenosis
  - Congenital subvalvular aortic stenosis
  - Congenital subvalvular aortic stenosis
- **YOUNG ADULTS TO MIDDLE-AGED**
  - Calcification and fibrosis of congenitally bicuspid aortic valve
  - Rheumatic aortic stenosis
- **MIDDLE-AGED TO ELDERLY**
  - Senile degenerative aortic stenosis
  - Calcification of bicuspid valve
  - Rheumatic aortic stenosis

Pathophysiology



Pathophysiology



Clinical features

Symptoms

- Mild or moderate stenosis: **usually asymptomatic**
- Exertional **dyspnea**
- **Angina** (due to ↑ demands of hypertrophied LV)
- Exertional **syncope**
- Sudden death
- Episodes o acute pulmonary oedema

CARDINAL SYMPTOMS

CO fails to rise to meet demand

Clinical features

Signs

- Ejection systolic murmur
- Slow-rising carotid pulse
- Thrusting apex beat (LV pressure overload)
- Narrow pulse pressure
- Signs of pulmonary venous congestion (e.g. crepititions)

Investigations

- ECG: - left ventricular hypertrophy
  - left bundle branch block
- Chest x-ray: - may be normal
  - enlarged LV & dilated ascending aorta (PA view)
  - calcified valve on lateral view
- ECHO: - calcified valve with restricted opening, hypertrophied LV
- Doppler: - measurement of severity of stenosis
  - detection of associated aortic regurgitation
- Cardiac catheterization: - to identify asst. coronary artery disease
  - may be used to measure gradient between LV and aorta

Management

- Asymptomatic aortic stenosis → **kept under review**
  (as the development of angina, syncope, symptoms of low CO or heart failure has a poor prognosis and is an indication for prompt surgery)
- Moderate/severe stenosis → evaluated every 1-2 years with **Doppler echocardiography** (to detect progression in severity)
- Symptomatic severe aortic stenosis → **valve replacement**
- Congenital aortic stenosis → **aortic balloon valvuloplasty**
- Atrial fibrillation or post valve replacement with a mechanical prosthesis → **anticoagulant**

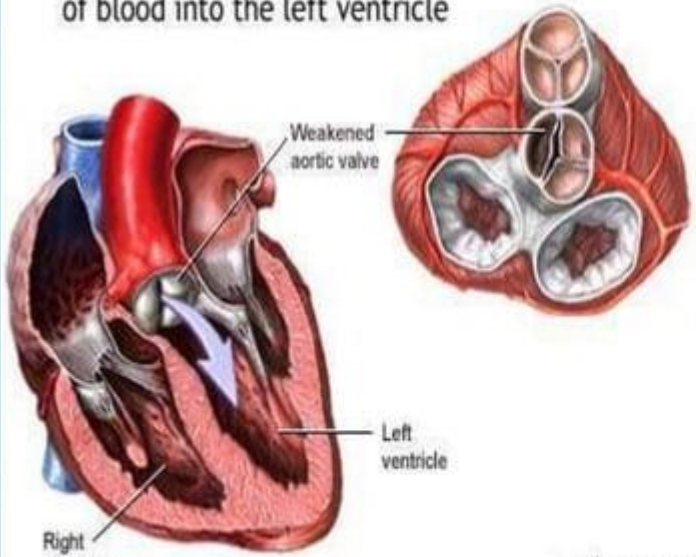
4. AORTIC REGURGITATION

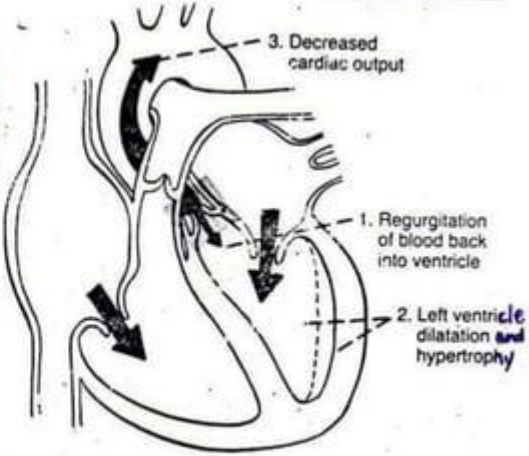
Causes

- Congenital:
  - Bicuspid valve or disproportionate cusps
- Acquired:
  - Rheumatic disease
  - Infective endocarditis
  - Trauma
  - Aortic dilatation (marfan's syndrome, aneurysm, dissection, syphilis)

Pathophysiology

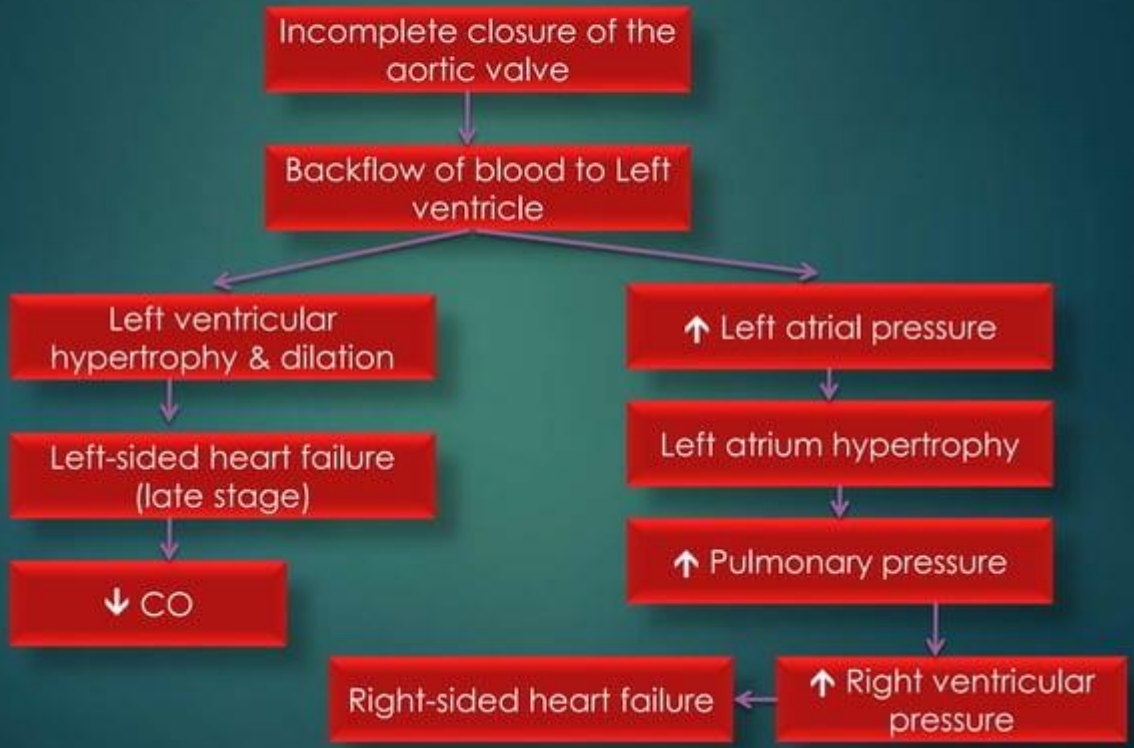
Failure of the aortic valve to close tightly causes back flow of blood into the left ventricle





ADAM. D. Aortic insufficiency

Pathophysiology



Clinical features

Symptoms

- Mild or moderate aortic regurgitation:
  - **Usually asymptomatic** (because compensatory ventricular dilatation&hypertrophy occur)
  - **Awareness of heartbeat, 'palpitations'** particularly when lying on the left side, which results from increased in stroke volume
- Severe aortic regurgitation:
  - **Breathlessness**
  - **Angina**

Clinical features

Signs

- **Pulses:**
  - Large volume or 'collapsing' pulse
  - Low diastolic and increased pulse pressure
  - Bounding peripheral pulse
  - Capillary pulsation in nail beds: Quincke's sign
  - Femoral bruit('pistol shot'): Duroziez's sign
  - Head nodding with pulse: de Musset's sign
- **Murmurs:**
  - Early diastolic murmur
  - Systolic murmur (increased stroke volume)
  - Austin Flint murmur (soft mid-diastolic)
- **Other signs:**
  - Displaced, heaving apex beat (volume overload)
  - Pre-systolic impulse
  - 4th heart sound
  - Crepitations (pulmonary venous congestion)

characteristic murmur is best heard to the left sternum during held expiration

Investigations

- ECG: initially normal,
  later left ventricular hypertrophy & T-wave inversion
- Chest x-ray: - cardiac dilatation, maybe aortic dilatation
  - features of left heart failure
- ECHO: - dilated LV
  - hyperdynamic LV
  - fluttering anterior mitral leaflet
- Doppler: - detects reflux
- Cardiac catheterization: - dilated LV
  - aortic regurgitation
  - dilated aortic root

Management

- Treatment may be required for underlying conditions, such as endocarditis or syphilis
- Aortic regurgitation with symptoms→ aortic valve replacement (may be combined with aortic root replacement and coronary bypass surgery)
- Asymptomatic patients → annually follow up with echocardiography for evidence of increasing ventricular size
- Systolic BP should be controlled with vasodilating drugs, such as nifedipine or ACE inhibitors

5. TRICUSPID STENOSIS

Tricuspid Stenosis

- usually occurs together with aortic or mitral stenosis
- may be due to rheumatic heart disease (<5%)
- ↓ blood flow from right atrium to right ventricle
  - ↳ ↓ right ventricular output
    - ↳ ↓ left ventricular filling → ↓ co
- ↑ systemic pressure

Tricuspid Stenosis

Symptoms

- symptoms of right-sided heart failure
  - hepatomegaly
  - ascites
  - peripheral edema
  - neck vein engorgement
- ↓ co – fatigue, hypotension

Signs

- Raised JVP
- Mid-diastolic murmur (best heard at lower left or right sternal edge)

Tricuspid Stenosis

Management

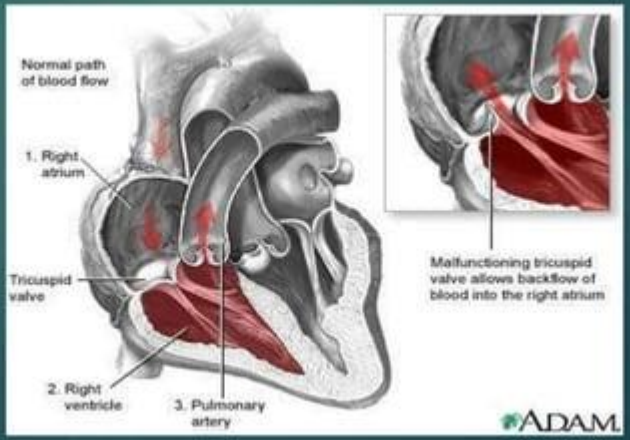
- Valve replacement
- Valvotomy
- Balloon valvuloplasty

6. TRICUSPID REGURGITATION

Tricuspid Regurgitation

- common, and is most frequently 'functional' as a result of enlargement of right ventricle

- an insufficient tricuspid valve allows blood to flow back into the right atrium → venous congestion & ↓ right ventricular output → ↓ blood flow towards the lungs



Tricuspid Regurgitation

causes

primary

- Rheumatic heart disease
- Endocarditis, particularly in injection drug-users
- Ebstein's congenital anomaly

secondary

- Right ventricular dilatation due to chronic left heart failure ('functional tricuspid regurgitation')
- Right ventricular infarction
- Pulmonary hypertension (e.g. cor pulmonale)

Tricuspid Regurgitation

Symptoms

- Usually non-specific
- Tiredness (reduced forward flow)
- Oedema
- Hepatic enlargement (venous congestion)

Signs

- Raised JVP
- Pansystolic murmur (left sternal edge)
- Pulsatile liver

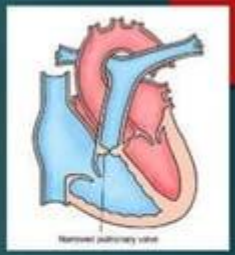
Tricuspid Regurgitation

Management

- Correction of the cause of right ventricular overload (if TR is due to right ventricular dilatation)
  - Use of diuretic and vasodilator treatment of CCF
- Valve repair
- Valve replacement

7. PULMONARY STENOSIS

Pulmonary Stenosis



Symptoms

- Fatigue, dyspnea on exertion, cyanosis
- Poor weight gain or failure to thrive in infants
- Hepatomegaly, ascites, edema

Signs

- Ejection systolic murmur (loudest at the left upper sternum & radiating towards the left shoulder)
- Murmur often preceded by an ejection sound (click)
- May be wide splitting of second heart sound (delay in ventricular ejection
- May be a thrill (best felt when patient leans forward and breathes out)

Investigations

- ECG: - right ventricular hypertrophy
- Chest x-ray: - post-stenotic dilatation in the pulmonary artery
- Doppler echocardiography is the definitive investigation

Management

- Mild to modearate isolated pulmonary stenosis is relatively common and does not usually progress or require treatment

- Severe pulmonary stenosis → **percutaneous pulmonary balloon valvuloplasty**

  OR

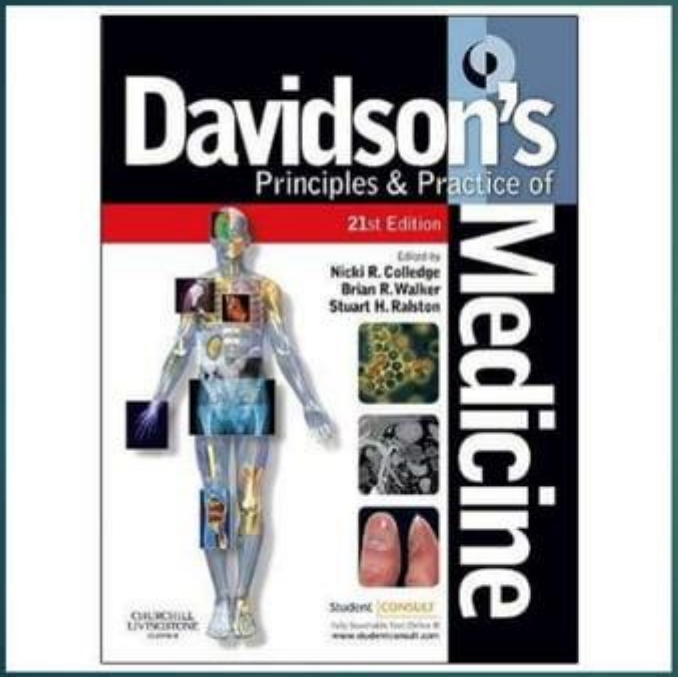
  surgical valvotomy

8. PULMONARY REGURGITATION

Pulmonary Regurgitation

- A rare condition
- Usually associated with **pulmonary hypertension** which may be
  - Secondary of the disease of left side of the heart
  - Primary pulmonary vascular disease
  - Eisenmenger's syndrome
- Blood flows back into right ventricle → right ventricle and atrium hypertrophy → symptoms of right-sided heart failure
- Trivial PR is a frequent finding in normal individuals and has no clinical significance

Reference



- For videos of heart murmurs:

https://www.youtube.com/playlist?list=PLB7F86984222A1F7C

THANK YOU