



Presentation & Management of Cardiac Surgical Diseases

Objectives:

- Overview of Diseases of Heart, Where Surgery Can Play a Role.
- Surgical Indications.
- Understanding of The Basic Principles of Cardiac Surgery.

Resources:

- Davidson.
- Slides.
- Surgical recall.
- Raslan's notes.
- 435' team work.

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Color index:

Notes , Important , Extra , Davidson's

[Editing file](#)
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To see what exactly what was added [click here](#).



Cardiac Diseases

Approach to The Cardiac Diseases:

1. History
2. Physical examination
3. Chest x-ray
4. ECG
5. Investigations [non-invasive (echo) & invasive (catheterization)]

Types of Cardiac Diseases: we will discuss each of them

- Coronary Artery Disease
- Valvular Heart Diseases
- Congenital Heart Diseases
- Miscellaneous:¹
 - Aortic Diseases
 - Pericardial Disease
 - Cardiac Tumors
 - Trauma
 - Heart failure
 - Arrhythmia surgery

Modes of Presentation of Cardiac Diseases:

- Chest pain (the most common)
- Symptoms due to lung congestion: Shortness of Breath
- Symptoms due to systemic congestion → **IMP: Symptoms due to right heart failure: edema, ascites and congestive**
- Palpitations
- Symptoms due to low cardiac output: Dizziness, Syncope²
- Congestive Cardiac Failure
- Cyanosis³ and Clubbing in Congenital Defects
- Other Symptoms (fever, sweating, G.I. symptoms, pressure symptoms embolic symptoms, loss of weight)

¹ Made up of an odd bunch of things.

² Loss of consciousness, due to low cardiac output

³ Advanced heart disease



Modes of Presentation of Cardiac Diseases

Chest Pain	Differential diagnosis: <ol style="list-style-type: none"> 1. Cardiac causes 2. Non-cardiac causes 	Life threatening causes: <ol style="list-style-type: none"> 1. Myocardial infarction 2. Aortic dissection 3. Pulmonary embolism 4. Tension pneumothorax 5. Rupture of esophagus 	
Lung congestion	Congestive lung symptoms in cardiac patients occur as a result of: <ol style="list-style-type: none"> 1. Stagnation of blood behind a failing left atrium or left ventricle (left sided heart failure) 2. Left –to- Right shunts. 	In a patient with heart disease, lung congestion can present with: <ol style="list-style-type: none"> 1. Dyspnea on exertion 2. Orthopnea 3. Paroxysmal nocturnal dyspnea 4. Hemoptysis 5. Recurrent chest infection 	
Shortness of Breath (Dyspnea*)	Cardiac Causes: <ul style="list-style-type: none"> • Heart failure • Myocardial ischemia • Congenital heart disease • Arrhythmias • Pericardial diseases • Valvular heart diseases 	Respiratory Causes: <ul style="list-style-type: none"> • COPD • Pneumothorax • Infections • Pulmonary embolism • Pleural effusion • Restrictive lung disease 	Other Causes: <p style="color: red; margin-top: 10px;">Anemia, renal failure, obesity, anxiety and hyperthyroidism.</p>
Systemic Venous Congestion	Symptoms due to systemic venous congestion: <ol style="list-style-type: none"> 1. Abdominal distension 2. Swelling of lower limbs 3. Dyspepsia 4. Pain in the right hypochondrium 5. Oliguria 	Causes of systemic venous congestion: <ol style="list-style-type: none"> 1. Right atrium: tricuspid stenosis / regurge, right atrial tumor 2. Right ventricle: pressure overload, volume overload, myocardial damage. 3. Obstruction to venous inflow: pericardial effusion, constrictive pericarditis. 	
Palpitation	Awareness of the heart beats could be due to change in: Rate • Rhythm • Contractility		
Low Cardiac Output	<ul style="list-style-type: none"> • Blurring of vision • Dizzines • Headache • Oliguria • Easy fatiguability • Angina pectoris 		

*when patients present with dyspnea on exertion and orthopnea and paroxysmal (PND) we think about left heart disease due to lung congestion; either patient has myocardial ischemia with significant loss of left ventricular function or valvular heart disease like aortic regurgitation and stenosis of mitral or regurgitation or severe tachycardia impairing the filling of the heart leading to stagnation of blood in the lung or like constrictive pericarditis or pericardial effusion.

Ischemic Heart Disease⁴

15 years ago, IHD wasn't common in SA but because of the life style changings the prevalence increased, and stress is one of the main factors in my belief. Arteries can recoil after putting the balloon, so they came up with the stent (drug eluting wire) but before all of that they used to do CABG until now.

Clinical manifestations

Asymptomatic	Symptomatic	
Usually in diabetic, old age patients and female or they might present with atypical chest pain	<ul style="list-style-type: none"> • Classic symptoms of angina • Other symptoms: Dyspnea, Dizziness, Syncope, and Pulmonary edema. <p>Coronary angiography remains the gold standard for diagnosis.</p>	<ul style="list-style-type: none"> • Angina pectoris: stable - unstable • Myocardial infarction • V.S.D⁵, Ischemic mitral regurge⁶, Ventricular aneurysm, Heart failure, Conduction defects. <p>Patients with VSD and Ischemic mitral regurge we must take them to OR immediately because mortality rate without surgery is 100% and even during surgery the mortality rate is high but we must operate on them anyway</p>

Indications of surgery:

1. Failure of medical therapy or percutaneous intervention.
2. Left main disease more than 50%.
3. Left main equivalent: Proximal LAD⁷ & proximal Cx⁸ more than 70%.
4. 3-Vessel disease with left ventricular dysfunction/diabetes
5. Mechanical complications of myocardial infarction.
6. Associated valve disease.

First line of treatment for CAD is medication, if medication doesn't work we do coronary angioplasty (balloon), once we are inside the obstruction we inflate the balloon, then the artery is dilated.

What is CABG?

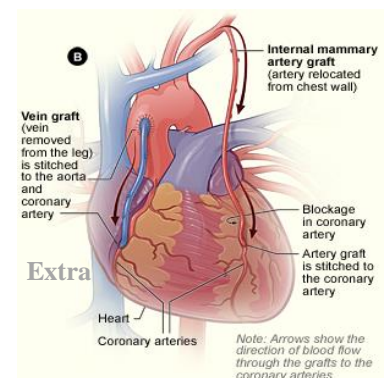


Definition: Coronary artery bypass grafting (CABG).

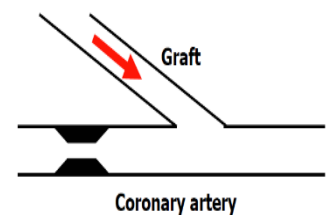
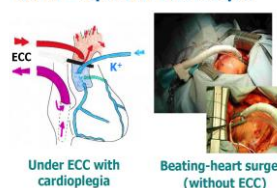
Indication: People who have severe coronary heart disease.

Mechanism: A vascular graft is sutured to the coronary artery beyond the stenosis.

Function: Improves blood flow to the heart.



CABG – Operative technique



⁴ The most common world wide

⁵ Ventricular septal defect

⁶ Due to rupture of papillary muscle

⁷ Left anterior descending most commonly affected artery in IHD

⁸ Circumflex coronary artery

Coronary conduits⁹:

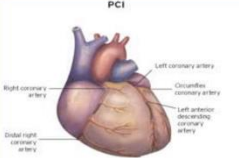
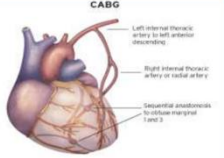
1. Arterial: **Internal thoracic artery**¹⁰.
usually left ITA used to anastomose LDC¹¹, we only anastomose one end distal to stenosis because proximal end is a branch of subclavian artery .
2. Venous: Long saphenous vein.

We take the graft of the vein then (1) Distal end we attach it distally to the stenosis and the (2) proximal end on the aorta. So we bypassed the stenosis and restored the supply. For this procedure arteries are better than veins because they tolerate high pressure of the aorta.

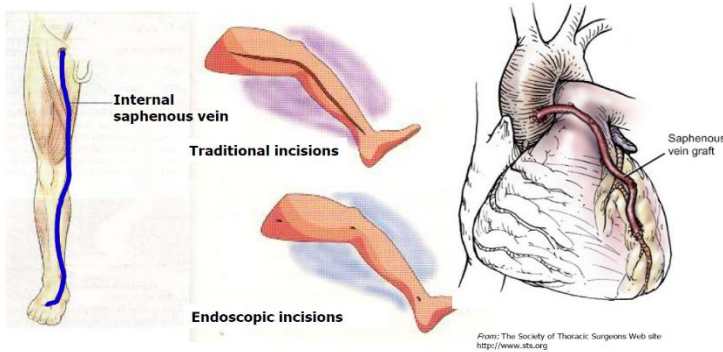
Types of surgery:

1. Conventional: using the heart lung machine and cardioplegic¹² arrest.
2. Off-pump (beating heart surgery)

Not every coronary obstruction gets medical intervention, it must be more than 50% because the native flow will overcome the new flow. Triple vessels disease, especially in diabetic patients, and double vessels disease are first indications for CABG evidences based.

PCI	CABG
	
<p>FAVOURS PCI</p> <p>Clinical characteristics Presence of severe comorbidity (not adequately reflected by scores) Advanced age/frailty/reduced life expectancy Restricted mobility and conditions that affect the rehabilitation process</p> <p>Anatomical and technical aspects MVD with SYNTAX score <22 Anatomy likely resulting in incomplete revascularization with CABG due to poor quality or missing conduits Severe chest deformation or scissures Sequelae of chest radiation Porcelain aorta</p>	<p>FAVOURS CABG</p> <p>Clinical characteristics Diabetes Reduced LV function (EF <35%) Contraindication to DAPT Recurrent diffuse in-stent restenosis</p> <p>Anatomical and technical aspects MVD with SYNTAX score >23 Anatomy likely resulting in incomplete revascularization with PCI Severely calcified coronary artery lesions limiting lesion resection</p> <p>Need for concomitant interventions Ascending aortic pathology with indication for surgery Concomitant cardiac surgery</p>

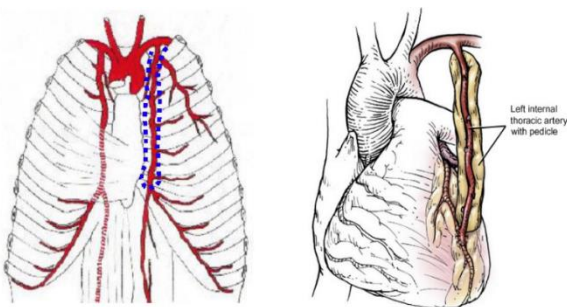
Saphenous vein graft (SVG):



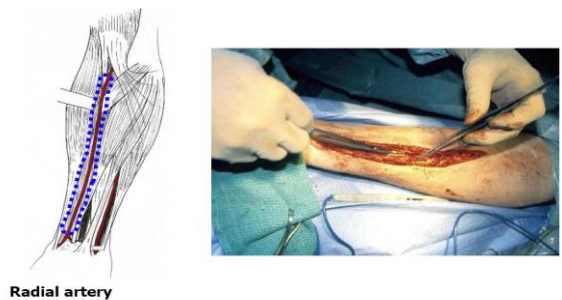
Less complications than traditional



Internal thoracic artery graft:



Other arterials grafts:



For the radial artery we need fine manipulation so it's better done with open technique and you have to make sure it isn't the dominant artery (Allen's test)

⁹ قنوات

¹⁰ Also called **internal mammary artery**. It has a very high graft patency (exceeds 95% at 5 years and 90% at 10 years)

¹¹ LDC (left descending coronary or left descending artery)

¹² Cardioplegia is intentional and temporary cessation of cardiac activity, primarily for cardiac surgery.

Valvular Heart Diseases

It's better to understand this topic from Medicine valvular heart diseases

1. Mitral stenosis:

Etiology: Rheumatic, Congenital, L.A. Myxoma

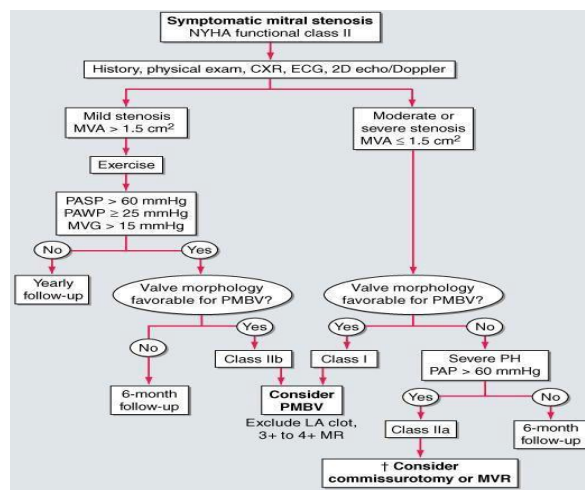
- The natural progression of MS causes the mitral valve area to reduce by 0.1 - 0.3 cm **per year**.
- The progression from the onset of rheumatic fever to onset of signs of MS **takes 10 -20 years**.
- The progression from signs of MS to mild symptoms of MS **takes 10 - 20 years**.
- The progression from mild symptoms to decompensation takes 10 - 20 years
- In patients with severe PH¹³ the mean survival is 3 years.

Symptoms:

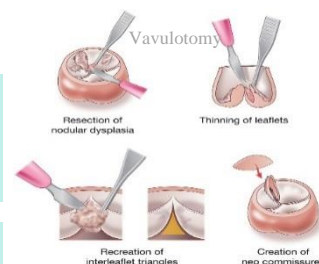
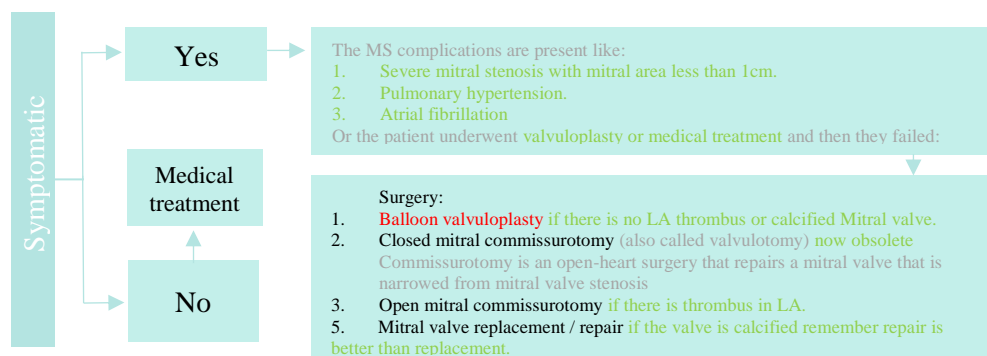
- **Asymptomatic for many years**
- Easy fatigability
- Dyspnea, Orthopnea and PND
- Palpitations
- Dysphagia *due to compression of esophagus in late stage*
- compression of left main bronchus

Signs:

- **Low volume pulse.**
- **Irregular pulse**
- **Tapping non-displaced apex beat**
in longstanding MS, RV gets enlarged so you feel the tapping of RV instead of LV which got pushed posteriorly
- **Loud S1**
- Mid-diastolic rumbling murmur
- Signs of PH: central cyanosis, Loud P2, TR¹⁴, PR¹⁵.



Treatment:



¹³ Pulmonary hypertension
¹⁴ Tricuspid regurge
¹⁵ Pulmonary regurge



Indications for surgery:

Mitral valve surgery for mitral stenosis is recommended for symptomatic severe M.S. when the valve is not favorable for Percutaneous balloon commissurotomy (presence of L.A. clot, significant mitral regurge).

2. Mitral Regurgitation:

MR is defined as retrograde flow of blood from the LV into the LA due to impaired systolic coaptation between the anterior and posterior leaflets.

Etiology: Rheumatic, Degenerative, Endocarditis, Ischemic and Traumatic.

Types:

- A. **Chronic mitral regurgitation:** Rheumatic fever, Myxomatous degeneration, ischemic cardiomyopathy and longstanding MS.
- B. **Acute mitral regurgitation:** chordal rupture¹⁶, infective endocarditis, papillary muscle rupture following MI.

Symptoms:

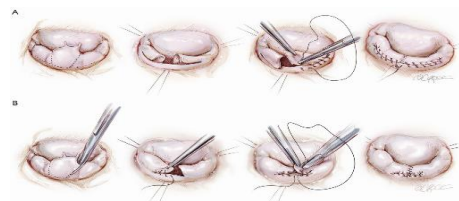
- Fatigue and weakness
 - Dyspnea, Orthopnea¹⁷, PND¹⁸
 - Pulmonary hypertension and right heart failure.
- ✓ Note that: **Asymptomatic patients** can have a long latent period before the onset of symptoms as chronic MR¹⁹ is well tolerated if LV²⁰ function is still preserved.

Signs:

- Displaced apex beat.
- Apical thrill²¹.
- Apical pan-systolic murmur.
- Signs of pulmonary hypertension.

Treatment:

1. Medical therapy. (for asymptomatic patient)
2. Valve repair / replacement



¹⁶ Several common diseases such as rheumatic heart disease and infectious diseases have been known to cause chordae rupture. Severe mitral valve prolapse had been reported to be at increased risk for chordal rupture.

¹⁷ Shortness of breath (dyspnea) that occurs when lying flat.

¹⁸ Paroxysmal nocturnal dyspnea.

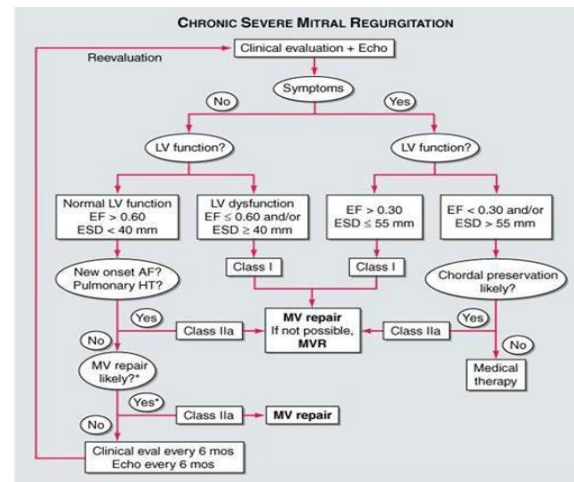
¹⁹ Mitral Regurgitation.

²⁰ Left ventricular.

²¹ Murmurs may be so loud as to be palpable as thrills.

Indications for surgery:

1. Prompt mitral valve surgery is indicated for the symptomatic patient with acute severe primary MR.
2. In chronic mitral regurgitation, surgery is done for symptomatic or asymptomatic patients with evidence of LV dysfunction, new onset A.F., or pulmonary hypertension.
3. Asymptomatic patients with chronic severe MR and preserved LV (EF > 60% and ESD < 40 mm) in experienced centres with likelihood of repair > 90%.



3. Aortic stenosis:

Etiology: Rheumatic, Congenital, Degenerative.

Symptoms:

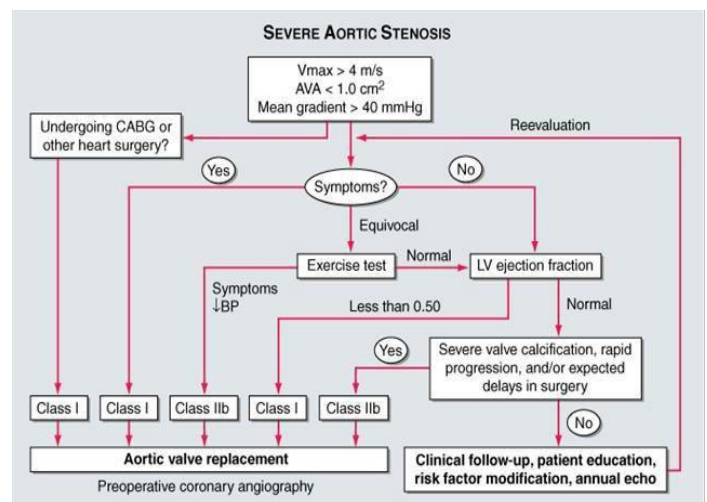
- Asymptomatic
- Chest pain
- Syncopal attacks
- Dyspnea and CHF²²

Once patient developed symptoms he is indicated for surgery

The interval from onset of symptoms to death tends to be 2 years for CHF, 3 years for syncope, and 5 years for angina.

Signs:

- Slow-rising pulse
- Small amplitude pulse
- Sustained apical pulse
- Harsh ejection systolic murmur



For old or high risk patient, you go for percutaneous valve replacement through femoral artery or trans epical

Surgical indications for AVR include:

1. Patients with severe symptomatic AS
2. Asymptomatic patients with moderate or severe AS undergoing cardiac surgery for coronary or other valve disease.
3. Asymptomatic patients with severe AS and reduced EF.

Surgical treatment:

1. Surgical AVR
2. Transcatheter AVR (TAVR)
3. Percutaneous balloon valvuloplasty

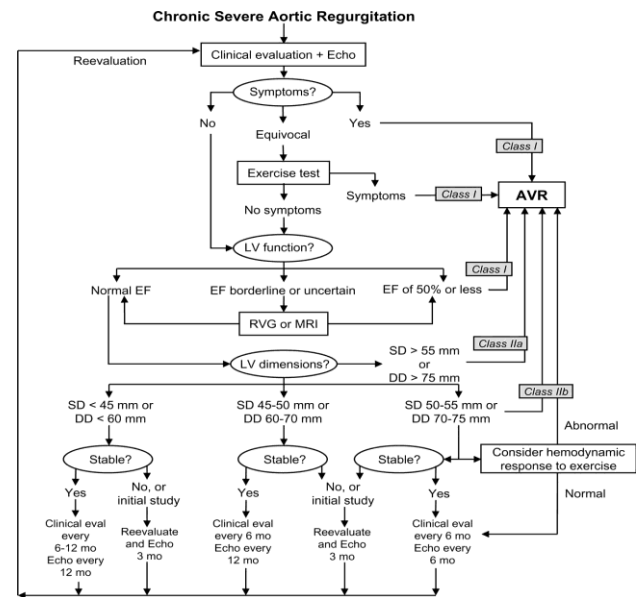
4. Aortic regurgitation:

AR is the diastolic reflux of blood from the aorta into the LV due to failure of coaptation of the valve leaflets at the onset of diastole.

Etiology: Rheumatic, Endocarditis, Connective tissue disorders, Aortic dissection or aneurysm. AR can be acute or chronic.

Management of acute aortic regurge is by early surgery.

Current recommendations for management of chronic AI depend on the presence of symptoms, LV function, and LV dimensions



Valvular Prostheses

Prosthetic Heart Valve

Biologic "Tissue"	Mechanical
<ul style="list-style-type: none"> • Lasts 8 – 10 years • No anticoagulation • No click 	<ul style="list-style-type: none"> • Lasts > 20 years²³ • Lifelong anticoagulation • Click 

Overview of AVR Options

Prosthesis	Description	Advantages	Disadvantages	Lifespan
Mechanical	Bileaflet	Best durability	Anticoagulation	Lifetime
Stented Bioprostheses	Porcine/ Bovine(cows) pericardial	No anticoagulation	Durability	10 – 15 years
Homografts/ Autografts	Human aortic valves	No anticoagulation, excellent dynamics	Technical complexity	

Complications of prosthetic valves:

1. Thrombosis
2. Bleeding complications
3. Infective endocarditis
4. Paravalvular leak
5. Degeneration of biological valves

We use biological valve for old age and contraindication for anticoagulant like in female childbearing age. But if a young patient says he doesn't want to take drugs for the rest of his life we can use biologic valve. In the end it's the patient's choice.

²³ Unless there is contraindication to anticoagulation, mechanical valves are commonly used in a younger age group.



Endocarditis

Modified Duke criteria: Major criteria:

1. Microbiologic evidence:

- a. Typical microorganisms consistent with IE from 2 separate blood cultures.
- b. persistently positive blood cultures with other organisms:
 - i. At least 2 +ve cultures drawn >12 hours apart
 - ii. All 3 or majority of 4 separate cultures with the first and last at least 1 hour apart.
 - iii. Single +ve culture for *Coxiella burnetti*

2. Evidence of endocardial involvement:

- a. Oscillating intracardiac mass
- b. Abscess
- c. New partial dehiscence of prosthetic valve
- d. New valvular regurgitation.

A definitive clinical diagnosis can be made on the following:

2 major criteria, 1 major and 3 minor, or 5 minor criteria.

Indication	Timing of Surgery†
Heart failure	
Aortic or mitral-valve infective endocarditis with severe acute regurgitation or obstruction causing refractory pulmonary edema or cardiogenic shock	Emergency
Aortic or mitral-valve infective endocarditis with fistula into a cardiac chamber or pericardium causing refractory pulmonary edema or cardiogenic shock	Emergency
Aortic or mitral-valve infective endocarditis with severe acute regurgitation or obstruction and persistent heart failure or signs of poor hemodynamic tolerance (early mitral-valve closure or pulmonary hypertension)	Urgent
Aortic or mitral-valve infective endocarditis with severe regurgitation and heart failure easily controlled with medical treatment	Elective
Uncontrolled infection	
Locally uncontrolled infection (abscess, false aneurysm, fistula, enlarging vegetation, or dehiscence of prosthetic valve)	Urgent
Persistent fever and positive blood cultures for >5–7 days	Urgent
Infection caused by fungi or multidrug-resistant organisms, such as <i>Pseudomonas aeruginosa</i> and other gram-negative bacilli	Elective
Prevention of embolism	
Aortic or mitral-valve infective endocarditis with large vegetations (>10 mm in length) after one or more embolic episodes, despite appropriate antibiotic therapy, especially during the first 2 weeks of therapy	Urgent
Aortic or mitral-valve infective endocarditis with large vegetations (>10 mm) and other predictors of complicated course (heart failure, persistent infection, or abscess)	Urgent
Isolated, very large vegetations (>15 mm); surgery may be preferred if a procedure preserving the native valve is feasible	Urgent



Heart Failure

Ventricular Assist Devices

Indications	Absolute Contraindication
Frequent hospitalizations for HF ²⁴	Irreversible hepatic disease
Intolerance to neurohormonal antagonists	Irreversible renal disease
NYHA ²⁵ IIIb-IV functional limitations despite OMT	Irreversible neurological disease
End-organ dysfunction owing to low CO	Medical nonadherence
Increasing diuretic requirement	Sever psychosocial limitations
CRT ²⁶ nonresponder	
Inotrope dependence	
Low peak Vo ₂ (<14mL/Kg/min)	

Indication for Heart Transplant:

- Cardiogenic shock requiring mechanical assistance.
- Refractory heart failure with continuous inotropic infusion.
- NYHA functional class 3 and 4 with a poor 12 months' prognosis.
- Progressive symptoms with maximal therapy.
- Severe symptomatic hypertrophic or restrictive cardiomyopathy.
- **Medical refractory angina with unsuitable anatomy for revascularization.**
- **Life-threatening ventricular arrhythmias despite aggressive medical and device interventions.**
- Cardiac tumors with low likelihood of metastasis.
- Hypoplastic left heart and complex congenital heart disease.

Contraindications of Heart Transplant:

- Pulmonary hypertension (TPG > 15 mmHg, SPAP > 50 mmHg, PVR > 4 WU, PVRI >6)
- Systemic disease (anticipated to limit long-term survival)
- Elevated creatinine (>200 umol/L)
- Active infection
- Psychosocial (substance abuse, smoking, medical noncompliance)
- Malignancy (within 5 years)
- Morbid obesity (>140% ideal body weight)
- Marked cachexia (<60% ideal body weight)
- Osteoporosis
- Peripheral or cerebrovascular disease
- Diabetes mellitus with end organ damage

²⁴ Heart failure

²⁵ New York Heart Association

²⁶ Cardiac Resynchronization Therapy: The procedure involves implanting a half-dollar sized pacemaker, usually just below the collarbone. Three wires (leads) connected to the device monitor the heart rate to detect heart rate irregularities and emit tiny pulses of electricity to correct them. In effect, it is "resynchronizing" the heart.

Arrhythmias

Most common arrhythmia is **Atrial fibrillation**.

Arrhythmia		
Recommendations	Class	Level
Surgical ablation of AF should be considered in patients with symptomatic AF undergoing cardiac surgery. Like valve repair or replacement	IIa	A
Surgical ablation of AF may be performed in patients with asymptomatic AF undergoing cardiac surgery if feasible with minimal risk.	IIb	C
Minimally invasive surgical ablation of AF without concomitant cardiac surgery is feasible and may be performed in patients with symptomatic AF after failure of catheter ablation.	IIb	C




Thoracic Aortic Diseases

- Thoracic aortic aneurysm:** Symptoms are usually due to pressure on surrounding structures.
- Aortic dissection:** Tear in the intima allowing blood to enter and flow in a false channel. There are 2 lumens separated by the dissecting membrane

Aortic dissection	
Type A	Type B
<ul style="list-style-type: none"> Arising in the ascending aorta Are a medical emergency and require immediate surgery. Mortality rate up to (1 – 2%) 5% per hour. 	<ul style="list-style-type: none"> Arising in the descending aorta Carry a lower mortality rate and can be managed medically. May cause symptoms due to vascular compromise to other areas e.g. acute limb ischemia, renal ischemia, paraplegia, mesenteric ischemia.

Type B is better to be managed medically, if it is complicated you go for percutaneous insertion of tube graft through femoral artery if femoral artery isn't visible then surgery

Classification of aortic dissection

			
Percentage	60%	10–15%	25–30%
Type	DeBakey I	DeBakey II	DeBakey III
	Stanford A (Proximal)		Stanford B (Distal)

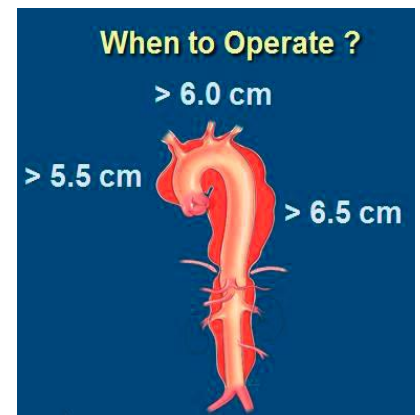
Patients with **aortic dissection** present with **uncontrolled hypertension**, and “tearing / ripping / cutting” pain. CXR shows **widened mediastinum**.



Aortic Aneurysm

Commonly accepted criteria for surgical intervention on ascending Aortic aneurysm:

- Connective tissue disorders: 4.5-5cm
- Bicuspid aortic valve: 5 cm
- Sporadic: >5.5cm
- Undergoing AVR: >4.5cm
- Growth of aneurysm >0.5cm/year



Cardiac Tumors

Primary Cardiac Tumors

Benign (75% of the cases)	Malignant (25% of the cases)
<ul style="list-style-type: none"> • Myxoma (most common) • Rhabdomyoma • Fibroma • Lipoma • Atrioventricular node tumor • Papillary fibroelastoma • Hemangioma 	<ul style="list-style-type: none"> • Rhabdomyosarcoma • Fibrosarcoma

- The most common tumors of the heart are **secondary**.
- Benign tumors should be resected to avoid the risk of embolization
- The 2 most common manifestations of cardiac tumors are:
 1. Obstruction
 2. Embolization
- Nonspecific symptoms as fever, fatigue, and myalgias can be associated with cardiac tumors.
- Echocardiography, CT < MRI can be used as diagnostic modalities.



Cardiac Surgery

Basic Principles of Cardiac Surgery:

- **Adequate Exposure** means you can see what you are doing during suturing.
 - Full or Partial Sternotomy²⁷ / Thoracotomy²⁸ / Robotic or Endoscopic
- **Bloodless Operative Field**
 - Suction and re-transfusion / Snaring or clamping of bleeding vessels
- **Static Operative Target** we need to stop the heart
 - Cardiac Arrest / Ventricular Fibrillation / Mechanical Stabilizers
- **Preservation of body perfusion**
 - Use of Heart Lung Machine / Off-pump Techniques
- **Preservation of Myocardium**
 - Off-pump Techniques / Hypothermia / Cardiac Arrest with cardioplegia

Pre-Operative Assessments for Cardiac Surgery:

Evaluation of patients referred for cardiac surgery aims to answer the following questions:

1. Is surgery appropriate for the condition
2. Is the patient fit to undergo the planned operation
3. Is there any co-morbidity that may affect operative management
4. Is the patient agreeable to surgery given the benefit-to-risk ratio.

Pre-Operative Investigations for Cardiac Surgery:

- Full Blood Count
- Blood Biochemistry
- ECG
- Chest X-ray
- Pulmonary Function Tests
- Other test according to systemic review of patient
- Echocardiography
- Angiography
- Carotid Duplex Scan²⁹
- Peripheral Duplex Scan

²⁷ Is a type of surgical procedure in which a vertical inline incision is made along the sternum, after which the sternum itself is divided, or "cracked".

²⁸ Is a surgical procedure to gain access into the pleural space of the chest.

²⁹ A carotid duplex scan is a simple and painless test that combines two types of ultrasound to look for blockages in your carotid arteries.

Usual Duration of Stay in Hospital:

- One day before surgery
- 3-6 hours OR time
- One day in ICU³⁰
- 4 -5 Days in Ward (post-operative)
- **Total** = 5 -7 days in hospital

Heart Lung Machine

In 1953, John Gibbon reported the first successful ASD³¹ closure using his heart-lung machine. It took him 20 years of work and experiments!

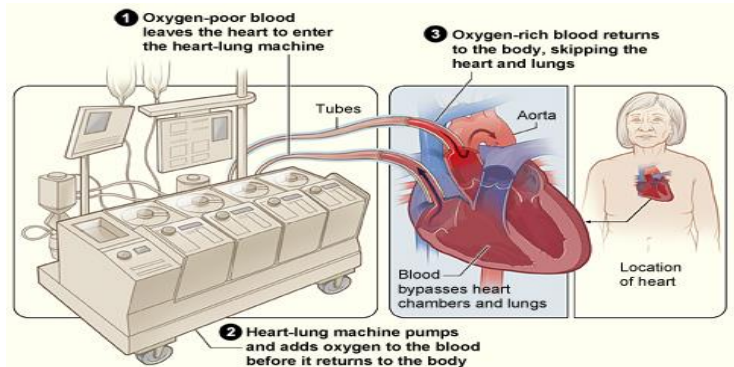
Aim of cardiopulmonary bypass:

The principal aim of CPB is to facilitate cardiac and thoracic aortic procedures by excluding the heart and lungs from the circulation whilst providing:

1. Adequate gas exchange (give O₂ and remove CO₂)
2. Systemic organ perfusion
3. Controlling body temperature.

Components:

- Roller pumps
- Blood Reservoir (cardiotomy reservoir)
- Oxygenator
- Heater-cooler unit
- Tubing and Monitoring console

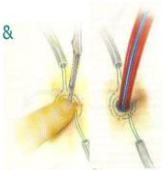


Limitation/Problems:

- Requires full anticoagulation
- Can cause micro embolism
- Initiates Systemic Inflammatory Response

Operation under ECC (1)

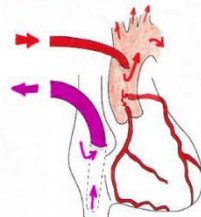
- Sternotomy
- Opening of the pericardium & exposure of the heart
- Confection of pursestring



- Heparin: high dose
- Cannulation, connections to tubing

Operation under ECC (2)

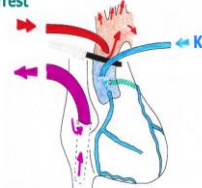
- Initiation of ECC



- Cooling

Operation under ECC (3)

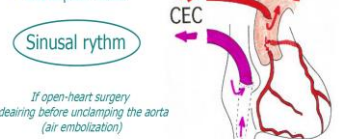
- Cardioplegic arrest



- Clamping of the aorta
- K⁺ injection into the coronary system: « chemical arrest » of the heart », flaccid heart

Operation under ECC (4)

- Release of the aortic clamp
- Sinusal rhythm
- Ventricular fibrillation: defibrillator
- Block: pace-maker



³⁰ Intensive care unit

³¹ Atrial septal defect



Complications of CPB:


1. Systemic inflammatory response due to contact of blood with the foreign surface of CPB circuit resulting in increased capillary permeability, interstitial edema, and subsequent organ dysfunction.
2. Coagulopathy caused by platelet dysfunction as well as dilution and consumption of coagulation factors.
3. Hemolysis.
4. Renal and splanchnic hypoperfusion.
5. Cerebrovascular accident.

Benefits of Off Pump CABG: (especially for old age)

1. Reduced incidence of stroke and cognitive problem.
2. Lesser renal dysfunctions.
3. Reduced inflammatory response.
4. Lesser coagulopathy and requirements of blood transfusion.
5. Reduced length of time in intensive care and hospital stays.
6. Reduced morbidity and mortality rate.

Pericardial Effusion

Definition: Progressive accumulation of fluid inside the pericardial cavity, may compress the cardiac chambers.

Etiology:	Investigations:	Management:
<ul style="list-style-type: none"> • Traumatic • Pericarditis • Malignancy • Uremia, post irradiation • Postoperative, immunologic disorders 	<ul style="list-style-type: none"> • Plain x-ray chest • Echocardiography • CT scan <div data-bbox="587 1697 1072 1877" style="border: 1px dashed green; padding: 5px; margin-top: 10px;"> <p>To differentiate between CHF and pericardial effusion in huge cardiac shadow, you look to lung fields, if there is no evidence of pulmonary congestion it is pericardial effusion</p> </div>	<ul style="list-style-type: none"> • Treat the cause • Aspiration • Pericardiostomy <div data-bbox="1152 1684 1337 1845" style="text-align: center;">  </div> <p data-bbox="1129 1845 1366 1908" style="text-align: center; color: green;">Xray shows classic flask shaped heart</p>

Congenital Heart Diseases

Congenital Heart Diseases	
1. Acyanotic	2. Cyanotic
<ul style="list-style-type: none"> Patent ductus arteriosus Coarctation of the aorta Pulmonary stenosis Atrial septal defect Ventricular septal defect 	<ul style="list-style-type: none"> Tetralogy of Fallot Transposition of the great vessels Tricuspid atresia Total anomalous venous drainage Truncus arteriosus

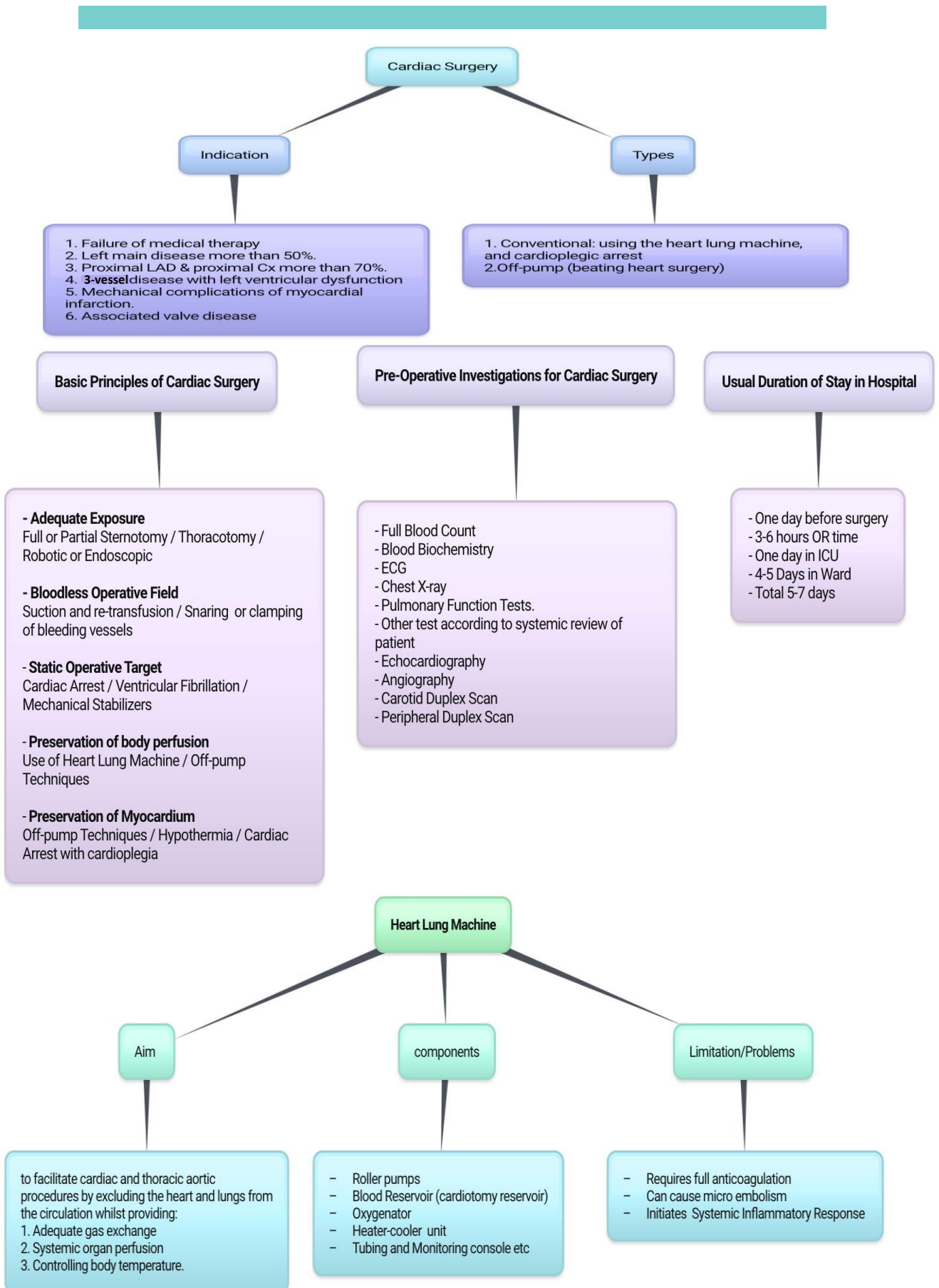
Cardiac Trauma

- Can be **blunt** or **penetrating**.
- In blunt cardiac trauma, the major challenge is **diagnosis**, while in penetrating cardiac trauma, the major challenges are **rapid resuscitation followed by emergent definitive surgery**.

1. Blunt Cardiac Trauma	2. Penetrating Cardiac Trauma
<ul style="list-style-type: none"> Myocardial contusion Pericardial tamponade Arrhythmia with cardiac arrest Disruption of valves and septum Coronary artery injuries Cardiac rupture <p>Management:</p> <ul style="list-style-type: none"> All patients with blunt chest trauma should undergo physical examination, CXR, ECG, and baseline cardiac enzymes. ECHO, C.T. may be needed Treatment depends on the nature of the injury. 	<ul style="list-style-type: none"> All patients with penetrating wounds between the right mid-clavicular and left mid-axillary lines from the epigastrium to the clavicles should be assumed to have injuries involving the heart until proven otherwise. The most commonly injured chamber is the right ventricle. The typical patient presents with signs of tamponade³² or hemorrhage. Emergent surgical exploration may be needed.

³² Patients with cardiac tamponade classically present with **pulsus paradoxus** (BP lowers during inspiration)

Summary





Ischemic Heart Disease

Symptomatic

Asymptomatic

angina pectoris

myocardial infarction

V.S.D., Ischemic mitral regurg, Ventricular aneurysm, Heart failure, Conduction defects.

stable

Unstable

Thoracic Aortic Disease

Thoracic aortic aneurysm

Symptoms are usually due to pressure on surrounding structures

Aortic dissection

Tear in the intima allowing blood to enter and flow in a false channel. There are 2 lumens separated by the dissecting membrane

Type A dissections

- Arising in the ascending aorta
- Are a medical emergency and require immediate surgery.
- Mortality rate up to 5% per hour.

Type B dissections

- Arising in the descending aorta
- Carry a lower mortality rate and can be managed medically

Valvular Heart Diseases

Mitral stenosis

Etiology: Rheumatic, Congenital
Symptoms:
1. Asymptomatic for many years.
2. Easy fatiguability.
3. Dyspnea, Orthopnea and PND.
4. Palpitations
5. Dysphagia, compression of left main bronchus
Signs:
1. Irregular low volume pulse.
2. Tapping non-displaced apex beat.
3. Loud S1
4. Mid-diastolic rumbling murmur.
5. Signs of PH: central cyanosis, Loud P2, T.R, P.R.
Treatment:
1. Medical
2. Balloon valvuloplasty
3. Closed mitral commissurotomy
4. Open mitral commissurotomy
5. Mitral valve replacement / repair

Mitral Regurgitation

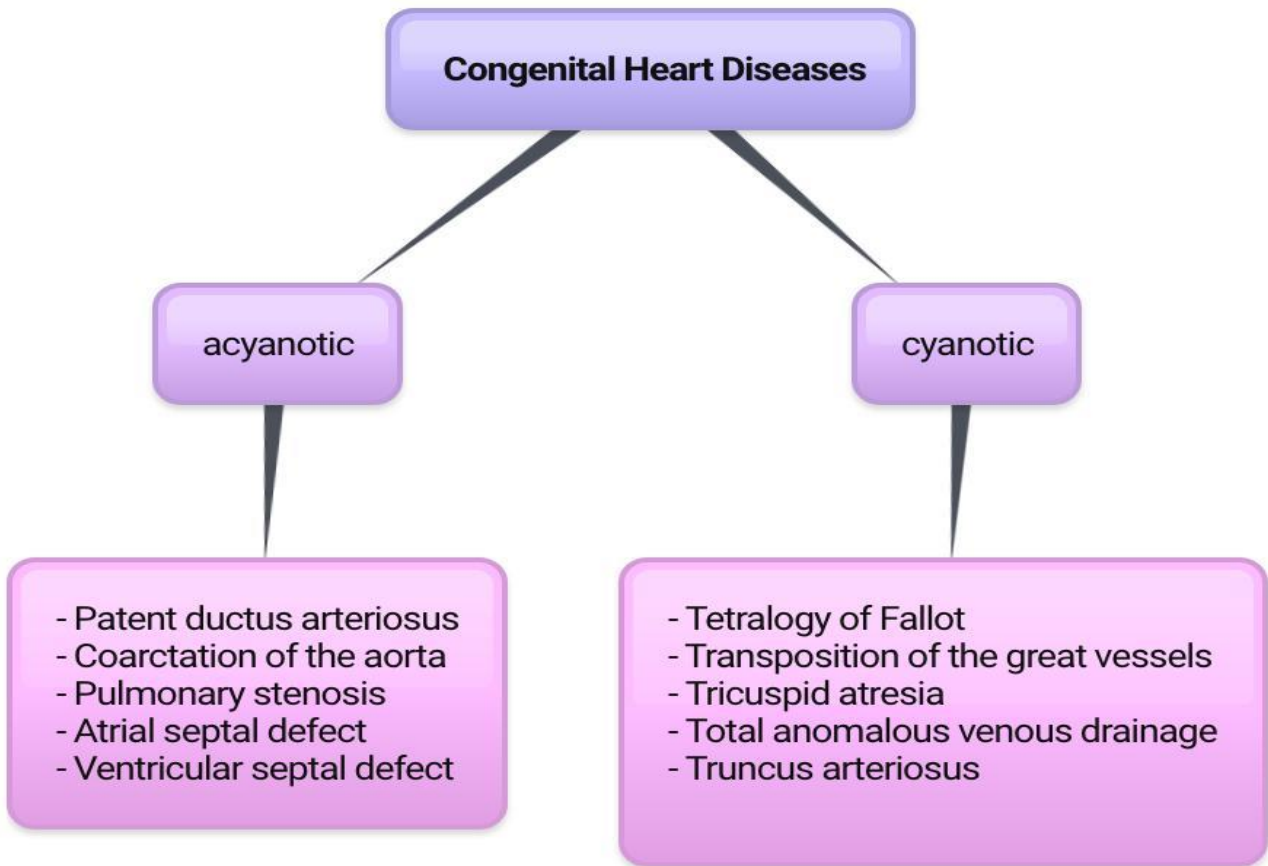
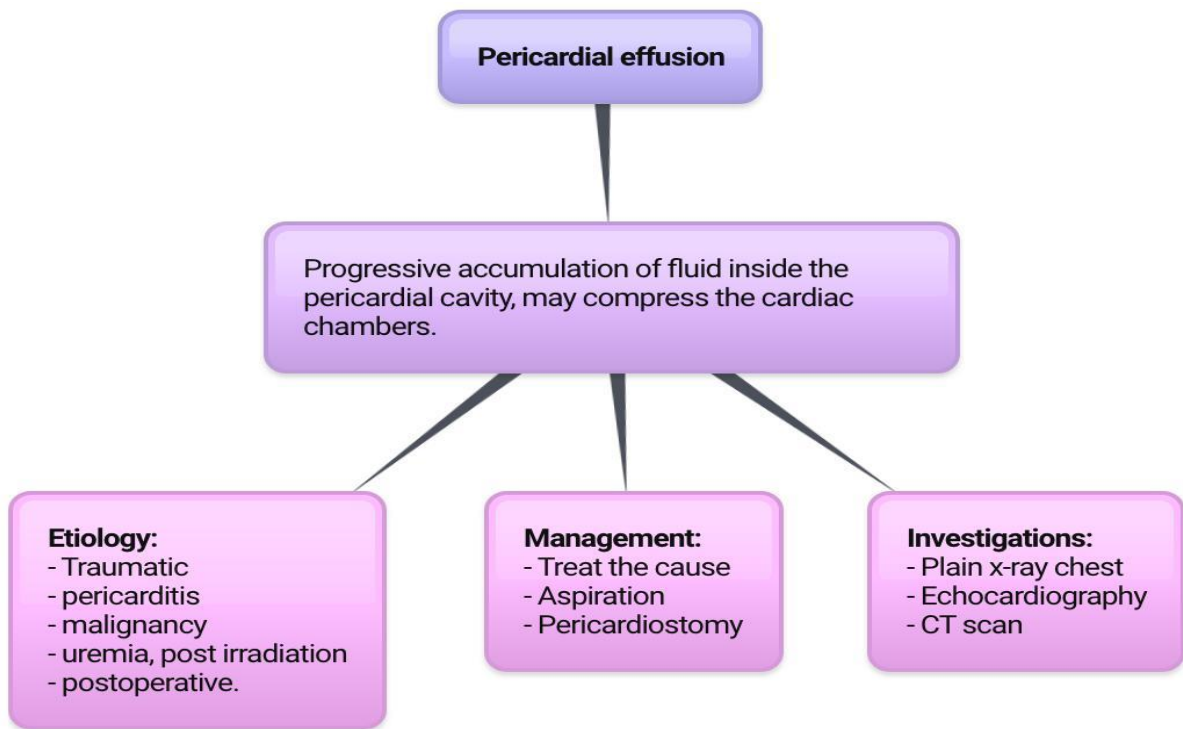
Etiology: Rheumatic, Degenerative, Endocarditis, Ischemic, Traumatic
Symptoms
1. Fatigue and weakness
2. Dyspnea, Orthopnea, PND
3. Pulmonary hypertension and right heart failure.
Signs
1. Displaced apex beat
2. Apical thrill
3. Apical pan-systolic murmur
4. Signs of pulmonary hypertension
Treatment
- Medical therapy
- Valve repair
- Valve replacement

Aortic stenosis

Etiology: Rheumatic, Congenital, Degenerative.
Symptoms:
1. Asymptomatic
2. Chest pain
3. Syncopal attacks
4. Dyspnea and CHF
Signs
1. slow-rising pulse
2. Small amplitude pulse
3. Sustained apical pulse
4. Harsh ejection systolic murmur.

Aortic regurgitation

Etiology: Rheumatic, Endocarditis, Connective tissue disorders, Aortic dissection or aneurysm.





Questions

1. **All the following are causes of mitral regurgitation except:**
 - a. Rheumatic
 - b. Degenerative
 - c. Endocarditis
 - d. Congenital

2. **Type A aortic dissections arises in the:**
 - a. ascending aorta
 - b. descending aorta

3. **Signs of mitral stenosis:**
 - a. Loud S2
 - b. Loud S1
 - c. S3
 - d. S4

4. **Pericardial effusion is a progressive accumulation of fluid inside the _____ cavity**
 - a. Myocardial
 - b. Pericardial
 - c. Endocardial

5. **All the following are Complications of prosthetic valves except:**
 - a. Thrombosis
 - b. Bleeding complications
 - c. Hypertension
 - d. Infective endocarditis

Answers:
1.d
2.a
3.b
4.b
5.c