



432 Surgery Team

17 Cardiac Surgical Diseases



Done By:
Lulu Alobaid

Reviewed By:
Mohammed Jameel

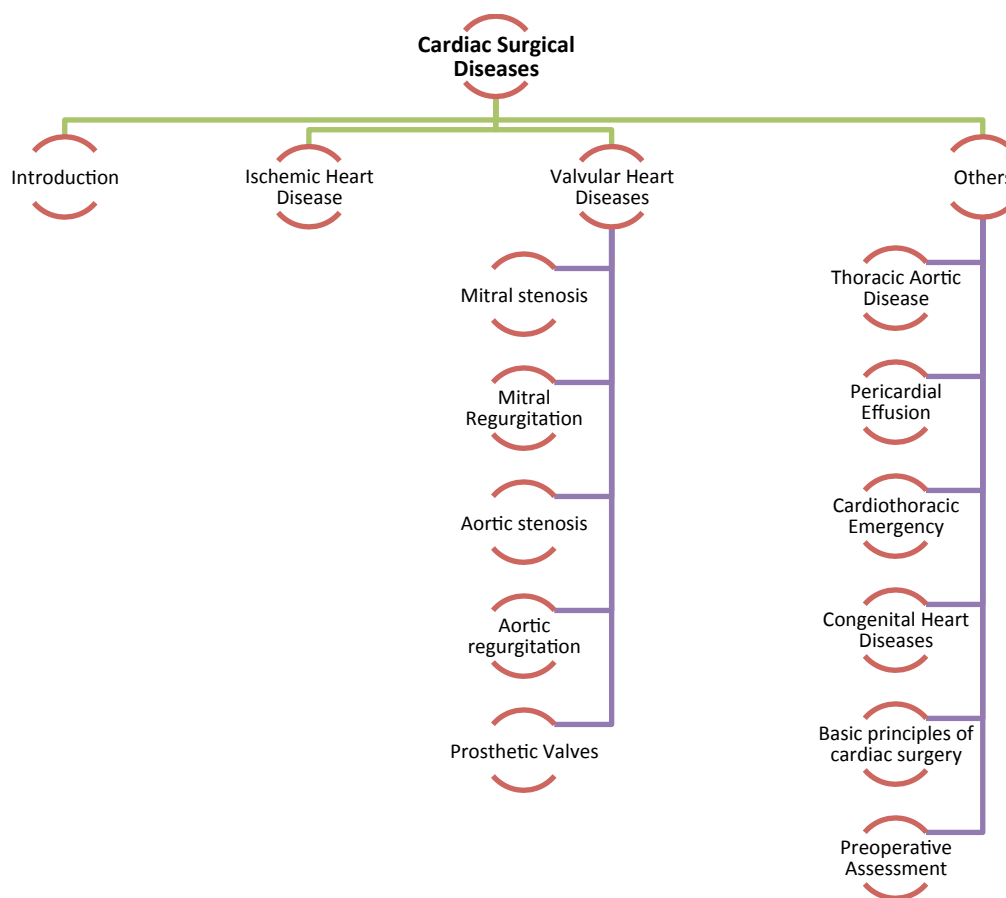
جامعة
الملك سعود
King Saud University



COLOR GUIDE: • Females' Notes • Males' Notes • Important • Additional

Objectives

1. Overview of diseases of heart, where surgery can play a role
2. Understanding of the Basic Principles of Cardiac Surgery
3. Information regarding pre-operative, operative and post-operative care in cardiac surgery



Introduction

• Cardiac diseases:

- Coronary Artery Disease
- Valvular Heart Diseases
- Congenital Heart Diseases
- Miscellaneous :
 - Aortic Diseases
 - Pericardial Disease
 - Cardiac Tumors
 - Trauma

• Modes of presentation of cardiac disease:

- Chest pain
 - IHD (Ischemic Heart Disease)
 - Aortic disease:
 - Dissection
 - Aneurism
- Shortness of Breath
- Palpitations
- Peripheral Edema
- Congestive Cardiac Failure
- Cyanosis and Clubbing in Congenital Defects
- Uncommon presentations
 - Pleural Effusion
 - Hemoptysis

• Common cardiac operations:

- Coronary Artery Bypass Grafting (CABG) (most common)
- Valve Replacement / Repair
- Repair of congenital defects like ventricular septal defect (VSD) or atrial septal defect (ASD)
- Heart Transplantation

Ischemic Heart Disease

Clinical manifestations:

- Asymptomatic (specially diabetic patients, they don't feel the usual classic pain)
- Symptomatic:
 - Angina pectoris: stable- unstable
 - Myocardial infarction
 - Complications of IHD: V.S.D., Ischemic mitral regurgitation, Ventricular aneurysm, Heart failure, Conduction defects.

Risk factors:

1. Smoking
2. Diabetes mellitus
3. Hypertension
4. Hyperlipidemia
5. Hereditary factors.

Laboratory Investigations:

- Routine investigations
- Cardiac enzymes
- E.C.G.
- Echocardiography
- **Coronary angiography**

Note(s):

☰ Chest pain and Shortness of breath are the most common presentations of cardiac patients.

☰ When the patient presents with chest pain First !! you have to R/O life threatening causes: IHD, aortic dissection, Pulmonary Embolism, tension pneumothorax.

Note(s):

☰ Even if the cardiac enzymes are normal at the beginning this doesn't exclude IHD.

☰ Angiography is used to show the number of vessels involved decide the type of Rx:

- 1- Medical
- 2- Angioplasty 80%
- 3- Surgery 20% (2+3 Revascularization therapy)

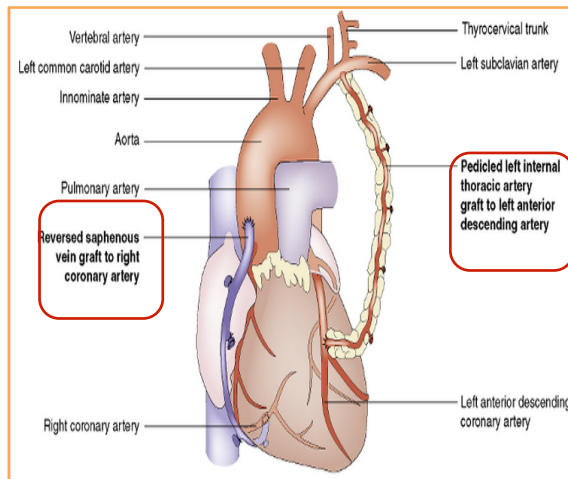
☰ Echocardiography shows LV function and presence of any valvular lesion

Indications of surgery: ⓘ

1. Failure of medical therapy or percutaneous intervention.
2. Left main coronary artery disease.
3. 3-vessel disease with left ventricular dysfunction; Three coronary arteries are affected.
4. Mechanical complications of myocardial infarction; include:
 1. Tamponade .2. Wall rupture .3. Chordae tendinae rupture .4. Valve weakening
5. Associated valve disease; patient with IHD + valve problems = refer to surgery.

Coronary conduits: ⓘ

1. Arterial: **Internal thoracic (mammary) artery** (Which originate from subclavian artery and better than radial artery)
2. Venous: Long saphenous vein.



Note(s):

Any patient with IHD has 3 options: 1. Medical Rx. 2. Percutaneous intervention: angioplasty, balloon dilatation and stenting. 3. Surgery.

- Left main coronary artery: this is the main stem of the left coronary circulation. If the blockage is before it branches to left anterior descending and circumferential artery then its indicated for surgery.

Types of surgery: (Coronary Artery Bypass Grafting in particular)

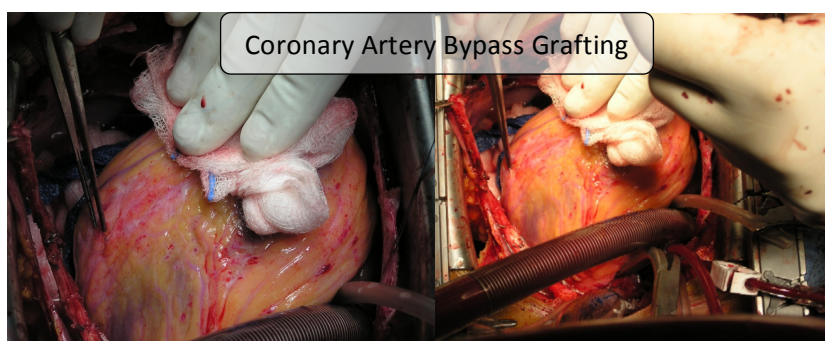
1. Conventional: the heart is stopped using the heart lung machine, and cardioplegic arrest. The machine is used to maintain blood and oxygen supply. Used in valvular and congenital cardiac surgeries (because we have to open the heart) you take the venous blood that's coming into the right atrium to the machine oxygenator then pump it back into the ascending aorta. You stop the heart using high potassium solutions and that will cut down more than 90% of the basal metabolic rate of the heart which gives you more time to work on the heart. Most cardiac surgeons spend about 1 to 3 and half hrs working on the hear)

2. Off-pump (beating heart surgery); When working on the coronaries, wedon't need to stop the heart because they're external features. But we must stabilize the area (where you're doing the anastomosis).* There's no difference in the outcome of two above methods in patient with no comorbid diseases whereas in patients with other comorbid conditions e.g. borderline kidney or liver function when you use the heart lung machine you may accelerate the disease process b/c it stimulates systemic inflammatory response.

Note(s):

Arterial grafts are better than venous; they have longer patency (In 10 years, 95% arterial grafts are patent, but only 50% of veins remain patent.

-Veins are normally under low pressure, so if they are used as coronary grafts, they are prone to high pressure from the aorta and atherosclerosis. The internal mammary artery is preferred (it is a smooth muscle artery, as opposed to the radial artery which is a muscular artery and may undergo spasm). Venous graft's patency may be improved by using antiplatelet medication and statins. But they are still not as patent as the internal mammary artery.



Valvular Heart Diseases (What's imp. For us are the indications of surgery).

• Investigations: E.C.G., X-ray chest, **Echocardiography** (Show us the area of stenosis and the degree of regurge)

	Mitral stenosis	Mitral Regurgitation	Aortic stenosis	Aortic regurgitation
Etiology	Rheumatic, Congenital normal valve: 4-6 cm Mild stenosis till 2 cm Moderate b/w 2-1 cm Sever stenosis below 1cm	Rheumatic, Degenerative, Endocarditis, Ischemic, Traumatic	Rheumatic, Congenital, Degenerative.	Rheumatic, Endocarditis, Connective tissue disorders, Aortic dissection or aneurysm.
Indications for surgery ① Imp.	1. Symptoms: exertional dyspnea (NYHA III-IV), pulmonary hypertension, hemoptysis 2. Severe mitral stenosis: area less than 1 cm. 3. Left atrial thrombus. (b/c patient with MS are prone to have AFib)	1. Symptomatic 2. Dilated left ventricle (LVESD >40). 3. Diminished ejection fraction (<60%). 4. Severe MR with AF or PH >50mmHg at rest or 60mmHg with exercise.	1. Symptoms (angina, shortness of breath, syncopal attacks). *Once the patient starts complaining of any of these symptoms, it's an indication. 2. Moderate to severe aortic stenosis in patients undergoing CABG. 3. Severe AS with EF < 50%	1. Symptomatic patients 2. severe AR in patients undergoing CABG or other valve surgery. 3. severe AR with EF <50% 4. severe AR with LVEDD > 75mm and LVESD > 50mm 5. Progressive left ventricular dilatation
Treatment ①	1. Medical in mild to moderate stenosis. 2. Balloon valvuloplasty (dilatation in stenosis w/o regurgitation) (the valve shouldn't be calcified at all !!) 3. Closed mitral commissurotomy (doesn't need heart-lung machine) (Not used anymore) 4. Open mitral commissurotomy (needs heart-lung machine) 5. Mitral valve replacement.	1. Medical 2. Mitral valve repair 3. Mitral valve replacement. (Repair is the preferred surgical option in regurgitation and is largely restricted to the mitral and tricuspid valves. It is superior to valve replacement, as the problems associated with prosthesis are avoided).	1-Medical 2-Aortic valve replacement. (In high risk patients e.g. the very elderly, those with patent ITA grafts or significant other co-morbidities, percutaneous replacement of the aortic valve may be considered (TAVI – transcatheter aortic valve insertion) where a biological valve on a holder is introduced percutaneously via the femoral artery or left ventricular apex).	Note(s): 📖 In MR asymptomatic patients can have a long latent period before the onset of symptoms as chronic M.R is well tolerated if L.V function is still preserved. 📖 Poor prognostic features in MR: 1. symptoms > 1 year
Clinically	<u>Symptoms</u> 1. Asymptomatic for many years. 2. Easy fatigability. 3. Dyspnea, Orthopnea and PND. 4. Palpitations 5. Dysphagia, compression of left main bronchus	<u>Symptoms</u> 1. asymptomatic 2. fatigue and weakness 3. Dyspnea, Orthopnea, PND 4. Pulmonary hypertension and right heart failure.	<u>Symptoms</u> 1. Asymptomatic 2. Chest pain 3. Syncopal attacks 4. Dyspnea and CHF	
	<u>Signs</u> 1. Low volume pulse. 2. Irregular pulse. 3. Tapping non-displaced apex beat. 4. Loud S1. 5. Mid-diastolic rumbling murmur. 6. signs of PH: central cyanosis, Loud P2, T.R. P.R.	<u>Signs</u> 1. displaced apex beat 2. apical thrill 3. apical pansystolic murmur 4. signs of pulmonary hypertension	<u>Signs</u> 1. slow-rising pulse 2. small amplitude pulse 3. sustained apical pulse 4. harsh ejection systolic murmur.	

Prosthetic Valves:

Types

1. Tissue Valves (Bio prosthesis)

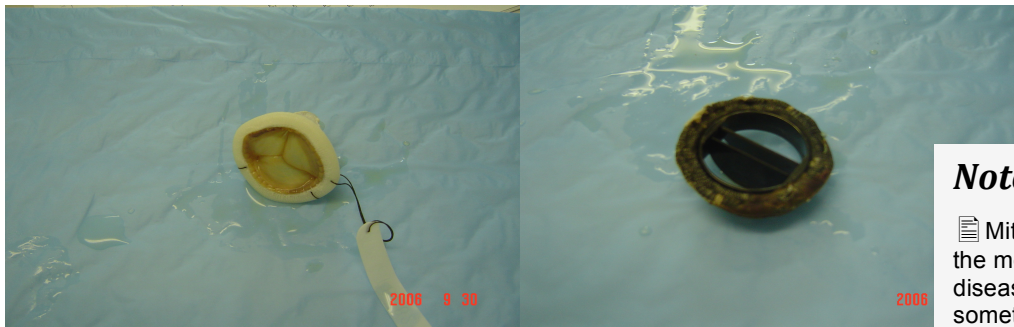
- a. No need to use long term anticoagulation.
- b. Limited and unpredictable durability

When to use tissue valves?

- 1. Old patients
- 2. Patient with contraindication to anticoagulants i.e. bleeding disorders
- 3. Non-compliant patients to anticoagulants e.g. psychiatric patients
- 4. Pregnant woman due to the teratogenic effect. Also, placental separation and abortion

2. Mechanical Valves

- a. Anticoagulation for life ⓘ
- b. Prolonged durability



* Complications of prosthetic valves:

- 1. Thrombosis
- 2. Bleeding complications (1,2 Anticoagulant related complications)
- 3. Infective endocarditis
- 4. Paravalvular leak
- 5. Degeneration of biological valves

Note(s):

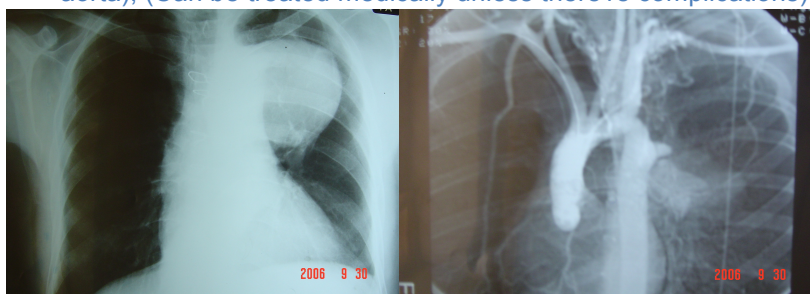
- ☰ Mitral and Aortic are the most common diseased valves, sometimes the tricuspid as well. Most of the tricuspid valve diseases are secondary to diseased mitral valve.
- ☰ Lifelong warfarin to prevent thrombus formation on the valve.
- ☰ Paravalvular leak: Space b/w the valve and the tissue of the patient due to infection, improper suturing, calcifications. If it happens you have to re do the procedure.

Thoracic Aortic Disease

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

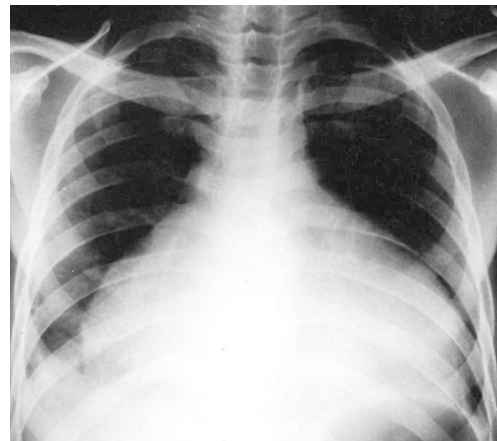
- 2 Types
- ➔ Type A: Involving the ascending aorta, medical emergency, (Immediate surgery b/c the mortality rate up to 5% per hour)
 - ➔ Type B: Arises in the descending aorta (NOT involving the ascending aorta), (Can be treated medically unless there're complications)

Male doctor skipped the rest, he only mentioned the red colored info.



Pericardial Effusion

- Progressive accumulation of fluid inside the pericardial cavity, may compress the cardiac chambers.
- Etiology:
 - Traumatic
 - Pericarditis
 - Malignancy
 - Uremia, post irradiation
 - Postoperative.
- Investigations:
 - Plain x-ray chest
 - Echocardiography
 - CT scan
- Management:
 - Treat the cause
 - Aspiration
 - Pericardiostomy (if the fluid is not accessible)



Cardiothoracic Emergency

1. Chest pain (causes):

- a. Myocardial ischemia
- b. Pulmonary embolism
- c. Aortic dissection
- d. Tension pneumothorax
- e. Rupture esophagus

2. Acute dyspnea (causes):

- a. Myocardial infarction
- b. Pulmonary embolism
- c. Spontaneous pneumothorax
- d. Bronchial asthma
- e. (foreign body) aspiration
- f. Stuck mechanical valve.

3. Chest trauma:

- a. Flail chest
- b. Traumatic hemo/pneumothorax
- c. Hemopericardium

Congenital Heart Diseases

ACYANOTIC

1. Patent ductus-arteriosus
2. **Co-arctation of the aorta**
3. Pulmonary stenosis
4. Atrial septal defect (ASD)
5. Ventricular septal defect (VSD)



CYANOTIC

1. Tetralogy of Fallot (VSD, overriding aorta, pulmonary stenosis, RV hypertrophy)
2. Transposition of the great vessels
3. Tricuspid atresia
4. Total anomalous venous drainage
5. Truncus arteriosus

Note(s):

📖 Median sternotomy is the most commonly performed cardiac procedure.

Basic Principles of cardiac surgery

1. Adequate Exposure
 - ▶ Full or Partial **Sternotomy** / Thoracotomy / Robotic or Endoscopic
2. Bloodless Operative Field
 - ▶ Suction and re-transfusion / Snaring or clamping of bleeding vessels
3. Static Operative Target
 - ▶ Cardiac Arrest / Ventricular Fibrillation / Mechanical Stabilizers
4. Preservation of body perfusion
 - ▶ Use of Heart Lung Machine / Off-pump Techniques

5. Preservation of Myocardium

- ▶ Off-pump Techniques / Hypothermia / Cardiac Arrest with cardioplegia

Heart Lung Machine

- Components :
 - a. Roller pumps
 - b. Blood Reservoir (cardiotomy reservoir)
 - c. Oxygenator
 - d. Heater-cooler unit
 - e. Tubing and Monitoring console. etc
- Limitation/Problems :
 - 1) Requires full anticoagulation
 - 2) Can cause micro embolism
 - 3) **Initiates Systemic Inflammatory Response**
 - 4) renal and splanchnic hypoperfusion
 - 5) cerebrovascular accident



Preoperative Assessment

- Evaluation of patients referred for cardiac surgery aims to answer the following questions:
 - Is surgery appropriate for the condition?
 - Is the patient fit to undergo the planned operation?
 - Is there any comorbidities that may affect the operative management?
- Approach:
 - 1) History
 - 2) Physical examination
 - 3) Chest x-ray
 - 4) E.C.G.
 - 5) Laboratory investigations
- 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 Scan
 - Peripheral Duplex Scan
- Usual Duration of Stay in Hospital
 - One day before surgery
 - 3-6 hours OR time
 - One day in ICU
 - 4-5 Days in Ward
 - Total 5-7 da

Note(s):

📄 This is for a standard non complicated case. Duration may increase due to complications and in older patients.

Note(s):

📄 Carotid Duplex scan and Peripheral Duplex scan: To check if other vessels are affected too.

INDICATIONS OF CARDIAC SURGERY

IHD	<ol style="list-style-type: none"> 1. Failure of medical therapy or percutaneous intervention. 2. Left main coronary artery disease 3. 3-vessel disease with left ventricular dysfunction 4. Mechanical complications of myocardial infarction. 5. Associated valve disease
Valvular heart disease	Mitral stenosis <ol style="list-style-type: none"> 1. When symptoms of severe SOB appear like: exertional dyspnea, pulmonary hypertension, hemoptysis 2. Severe mitral stenosis : less than 1 cm opening 3. Left atrial thrombus
	Mitral regurgitation Significant shortness of breath : Symptomatic, dilated left ventricle, diminished ejection fraction
	Aortic stenosis <ol style="list-style-type: none"> 1. Symptoms (angina, shortness of breath, syncopal attacks) 2. Severe aortic stenosis
	Aortic regurgitation <ol style="list-style-type: none"> 1. Symptomatic patients 2. Progressive left ventricular dilatation
Thoracic aortic disease	<ol style="list-style-type: none"> 1. Aortic aneurism 2. Aortic dissection
Pericardial effusion	Drainage by catheterization unless the fluid is not accessible

IMPORTANT NOTES FROM EXTERNAL RESOURCES

Notes

Name of the book

Davidson's Principle and Practice of Surgery

SUMMARY

- IHD can be asymptomatic especially in diabetic patients.
- Coronary angiography is the Gold standard in diagnosing IHD.
- Arterial: Internal thoracic (mammory) artery is the best artery used in CABG.
- Echocardiography is the best in diagnostic test in valvular diseases.
- Once a patient with aortic stenosis develops any symptom of the triad (chest pain, SOB, syncopal attacks) the surgery is indicated.
- Patient with mechanical valve, anticoagulation is required for life but if it's contraindicated then we use tissue valve (Bio prosthetics).
- Heart lung machine may initiates SIR so, we try to avoid it in patient with comorbid disease and use the Off pump procedure (beating heart surgery).

Questions

1) For coronary artery bypass surgery, which one of the following conduits has proved to be the best in long term patency?

- a. Gastroepiploic artery
- b. Internal mammary artery
- c. Radial artery
- d. Reversed saphenous vein

2) Which one of the following coronary arteries is the most commonly involved in ischemic heart disease?

- a) Left anterior descending artery (LAD)
- b) Main coronary artery
- c) Obtuse marginal branches
- d) Right coronary artery

3) the most important pre-operative study in evaluating patients for coronary artery bypass grafting that will serve as a road map for the surgeon is?

- a) Cardiac catheterization
- b) ECG
- c) Thallium scan
- d) trans-thoracic echocardiography

4) Which of the following is a congenital acyanotic heart disease:

- a) Co-arctation of the aorta
- b) Tetralogy of Fallot
- c) Tricuspid atresia
- d) Truncus arteriosus



Answers:

1st Questions: B

2nd Questions: A

3rd Questions: A

4th Questions: A