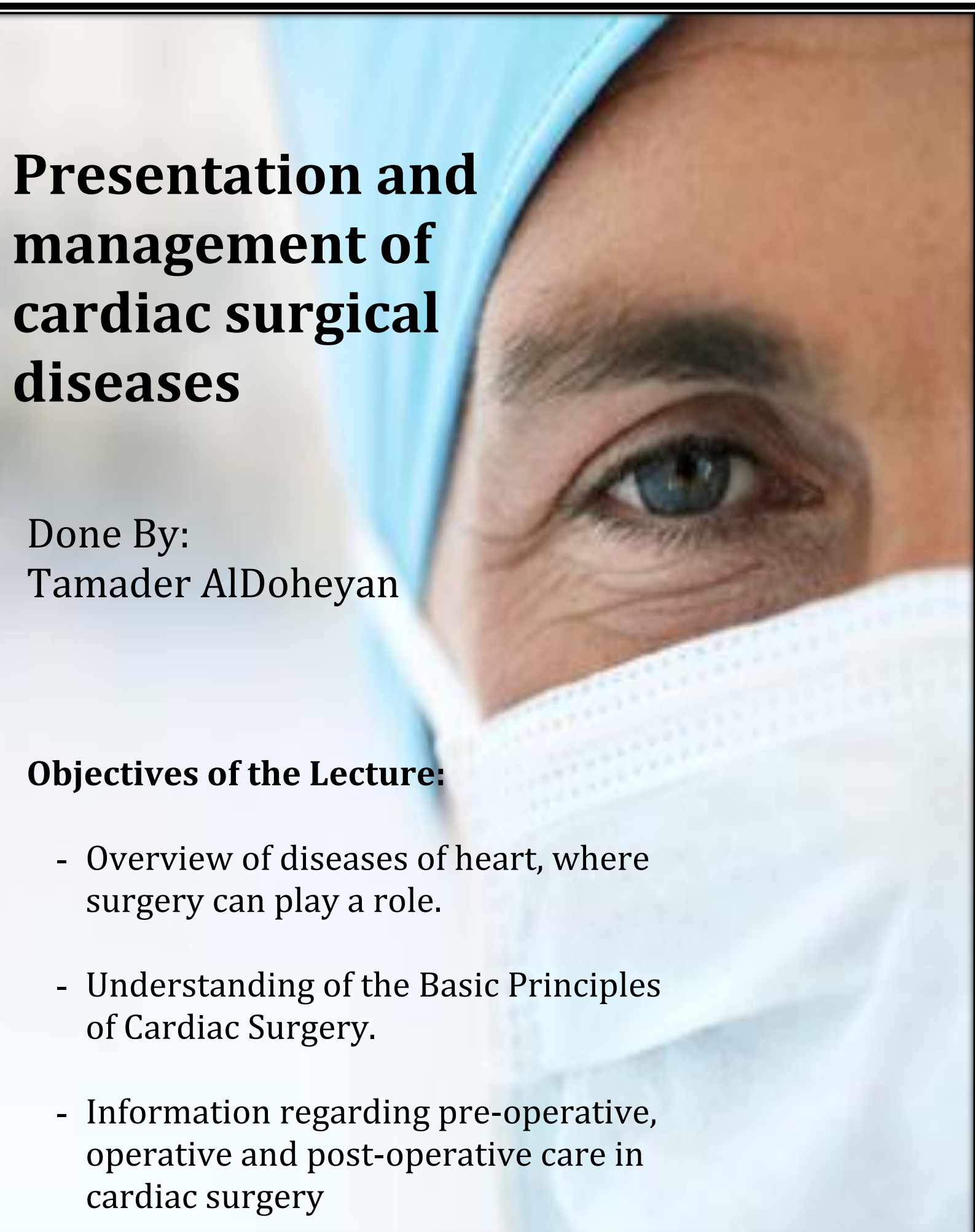
430 Surgery Team



Presentation and management of cardiac surgical diseases

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Objectives of the Lecture:

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

Cardiac Diseases

- Coronary Artery Disease
- Valvular Heart Diseases
- Congenital Heart Diseases
- Miscellaneous:
  - Aortic Diseases (Aortic aneurysm, Aortic dissection, Thoracic aortic aneurysm and penetrating thoracic aorta)
  - Pericardial Disease TB constrective pericarditis
  - Cardiac Tumour Myxomas, which account for 75% to 80% of benign cardiac tumors, may be either pedunculated or sessile. Most are pedunculated and are found in the left atrium attached to the septum. (Surgical indication)
  - Trauma (rare) Penetrating injury, Blunt trauma

Modes of Presentation of Cardiac Diseases

- Chest pain may be caused by angina pectoris, myocardial infarction, pericarditis, aortic dissection, pulmonary infarction, or aortic stenosis.
- Shortness of Breath
- Palpitations may indicate a serious cardiac arrhythmia.
- Peripheral Edema may be the result of significant right-sided congestive heart failure.
- Congestive Cardiac Failure
- Cyanosis and Clubbing in Congenital Defects
- Uncommon presentations
  - Pleural Effusion
  - Haemoptysis may be associated with mitral stenosis or pulmonary infarction.

Common Cardiac Operation

- Coronary Artery Bypass Grafting (CABG)
- Valve Replacement / Repair
- Repair of congenital defects like of VSD or ASD
- Heart Transplantation

VSD: ventricular septal defect

ASD: atrial septal defect

Ischemic Heart Disease

Clinical manifestations:

1. Asymptomatic
2. Symptomatic: most patients are symptomatics

- Angina pectoris: stable- unstable
- Myocardial infarction
- V.S.D., Ischemic mitral regurge, Ventricular aneurysm, Heart failure, Conduction defects.

➢ Risk factors:

-Smoking is the worst
-Diabetes mellitus
-Hypertension
-Hyperlipedemia
-Hereditary factors.

- Laboratory Investigations:

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

- Indications of surgery:

1. Failure of medical therapy or percutaneous intervention (PCI).
2. Left main disease (coronary artery)
3. Three Vessel disease with left ventricular dysfunction.
4. Mechanical complications of myocardial infarction.
5. Associated valve disease

- Coronary conduits:

1. Arterial: Internal thoracic artery
2. Venous: Long saphenous vein.

- Types of surgery:

1. Conventional: using the heart lung machine, and cardioplegic (Stoppage of electrical and mechanical cardiac activity).
2. Off-pump (beating heart surgery)

Valvular Heart Diseases

- **Mitral stenosis:**
  - Etiology: Rheumatic, Congenital

  - **Physical examination.** The typical patient is thin and cachectic. Auscultation reveals the **classic triad** of an apical diastolic rumble, an opening snap, and a loud first heart sound.

  - Investigations:
  - E.C.G. may be normal or may show P-wave abnormalities, signs of right ventricular hypertrophy, and right axis deviation.
  - X-ray chest a lateral chest x-ray with a barium swallow may detect left atrial enlargement.
  - Echocardiography is used to determine the morphology of the valve and the severity of the mitral stenosis.

  - Indications for surgery:

1. Symptoms: exertional dyspnea, pulmonary hypertension, hemoptysis
2. Severe mitral stenosis: area less than 1 cm.
3. Left atrial thrombus.

  - Treatment:

1. Medical
2. Balloon valvuloplasty
3. Closed mitral commissurotomy (opening of the fused commissures)
4. Open mitral commissurotomy

5. Mitral valve replacement (is required for patients with severe disease of the chordae tendineae and papillary muscles).

- **2. Mitral Regurgitation:**
  - Etiology: Rheumatic, Degenerative, Endocarditis, Ischemic, and Traumatic

- **Physical examination** reveals a holosystolic blowing murmur at the apex that radiates to the axilla, accompanied by an accentuated apical impulse.

- Echocardiography is the single most important diagnostic test for patients with clinical evidence of mitral regurgitation.

- Indications for surgery:

Symptomatic, dilated left ventricle, diminished ejection fraction

- Treatment:

1.Medical
2.Mitral valve repair
3.Mitral valve replacement

- **3. Aortic stenosis:**
- Etiology: Rheumatic, Congenital, and Degenerative.

- Physical examination: The classic systolic crescendo and decrescendo murmur is heard best in the second right intercostal space. Radiation of the murmur to the carotid arteries is common, an associated thrill is often appreciated and a narrowed pulse pressure along with pulsus parvus et tardus is frequently found.

- Indications for surgery:

1. Symptoms (angina, shortness of breath, syncopaal attacks)
2. Severe aortic stenosis.

- Treatment:

1. Medical
2. Aortic valve replacement

- **4. Aortic regurgitation:**
  - Etiology: Rheumatic, Endocarditis, Connective tissue disorders, Aortic dissection.
  - Physical examination: The characteristic diastolic murmur is heard along the left sternal border. The duration of the murmur during diastole often correlates with the severity of the aortic insufficiency. The murmur radiates to the left axilla, the pulse pressure is often widened. Short, intense peripheral pulses (water-hammer pulses) are characteristic.

- Indications for surgery:

Symptomatic patients, Progressive left ventricular dilatation.

Types of Prosthetic Valves and their merits and demerits

- Tissue Valves (Bio prosthesis):
  - No need to use long term anticoagulation.
  - Limited and unpredictable durability.

- Mechanical Valves:
  - Anticoagulation
  - Prolonged durability

- Complications of prosthetic valves:

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

Thoracic Aortic Disease

1. Thoracic aortic aneurysm:
   Symptoms are usually due to pressure on surrounding structures.

2. 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

Pericardial effusion

- Progressive accumulation of fluid inside the pericardial cavity, may compress the cardiac chambers. A pericardial effusion volume as small as 100 mL may produce symptomatic tamponade if the fluid accumulates rapidly, whereas larger amounts may be tolerated if the fluid accumulates slowly.
- Etiology:
  - Traumatic
  - Pericarditis
  - Malignancy
  - Uremia, post irradiation
  - Postoperative.

- Investigations:
  - Plain x-ray chest
  - Echocardiography
  - CT scan

- Management:
  - Treat the cause
  - Aspiration
  - Pericardiostomy

- **Surgeries for Coronary artery diseases:**

- **Catheter-based coronary interventions:** A catheter is threaded through an artery from the arm or grain and into the coronary arteries. A balloon (angioplasty) is expanded in the diseased segment to push the vessel wall out and to relieve the obstruction. In most cases, a wire tube (stent) is placed in the artery to keep it from closing over time (restenosis). The stent may be bare metal or may be coated with a drug (e.g., sirolimus*) that elutes over time to prevent restenosis. Patients with stents are always on Plavix (clopidogrel) if they stop it thrombosis will develop.

- **Coronary artery bypass surgery (CABG):** Not all patients can be treated with a catheter-based intervention. Most commonly, anatomic considerations including chronic total occlusions, left main stenosis, and extensive lesions preclude a catheter-based approach. Coronary bypass surgery involves construction of bypass grafts to downstream segments of the affected coronary arteries to re-establish normal blood flow to the myocardium. Most commonly, the left anterior descending coronary artery is bypassed with the left internal mammary artery, and other target vessels are bypassed with reversed saphenous vein grafts constructed from the ascending aorta to the target vessel. There is strong evidence that CABG surgery increases survival in patients with left main disease, in those with three-vessel disease and decreased ventricular function, and in diabetics with three-vessel disease. CABG is highly successful at relieving angina pectoris: More than 90% of patients are free of angina 1 year after surgery.

*Sirolimus: also known as rapamycin, it is an immunosuppressant drug used to prevent rejection in organ transplantation.

Cardio Thoracic Emergency

1. Chest pain:
-Myocardial ischemia
-Pulmonary embolism
-Aortic dissection
-Tension pneumothorax
-Rupture esophagus

2. Acute dyspnea:
-Myocardial infarction
-Pulmonary embolism
- Spontaneous pneumothorax
- Bronchial asthma
-Foreign Body aspiration
-Stuck mechanical valve.

3. Chest trauma:
-Flail chest
-Traumatic hemo/pneumothorax
-Hemopericardium

Congenital Heart Diseases

- The incidence of congenital heart disease is approximately 3 in 1000 births.
- Etiology: In most cases, the etiology is unknown. Rubella occurring in the first trimester of pregnancy is known to cause congenital heart disease (e.g., patent ductus arteriosus). Down's syndrome is associated with endocardial cushion defects.
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1. Acyanotic:
-Patent ductus arteriosus is a blood vessel that allows blood to go around the utero's lungs.
-Coarctation of the aorta (a severe narrowing)
-Pulmonary stenosis
-Atrial septal defect
-Ventricular septal defect (Ventricular septal defects are the most common congenital heart defects).

2. Cyanotic:
-Tetralogy of Fallot most common cyanotic congenital heart defect
-Transposition of the great vessels (TGA) occurs when the **aorta** arises from the morphologic **right ventricle** and the **pulmonary artery** arises from the morphologic **left ventricle.** This results in two independent parallel circuits.
-Tricuspid atresia
-Total anomalous venous drainage
-Truncus arteriosus is a rare type of heart disease that occurs at birth (congenital heart disease), in which a single blood vessel (truncus arteriosus) comes out of the right and left ventricles, instead of the normal two vessels (pulmonary artery and aorta).

Basic Principles of Cardiac Surgery

- Adequate Exposure
  - Full or Partial Sternotomy / Thoracotomy / Robotic or Endoscopic
- Bloodless Operative Field
  - Suction and re-transfusion / Snaring or clamping of bleeding vessels
- Static Operative Target
  - 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

Heart Lung Machine

- Components:
  - Roller pumps
  - Blood Reservoir (cardiotomy reservoir)
  - Oxygenator
  - Heater-cooler unit

- Tubing and Monitoring console etc
- Limitation/Problems:
  - Requires full anticoagulation
  - Can cause micro embolism
  - Initiates Systemic Inflammatory Response

Preoperative assessment of cardiac surgical patients

- 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

Preoperative assessment of cardiac surgical patients

- 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 days

MCQs:

1. Which of the following forms of congenital heart disease is most common?
A Transposition of the great vessels
B Tetralogy of Fallot
C Atrial septal defect
D Patent ductus arteriosus
E Ventricular septal defect

2. A 78-year-old previously healthy man is admitted to the emergency department complaining of angina, dyspnea, and near syncope. Electrocardiogram is normal, and a loud systolic murmur is heard in the second right interspace with radiation to the carotids. What is the most likely diagnosis in this patient?
A Myocardial infarction
B Pericarditis
C Mitral regurgitation
D Aortic stenosis
E Aortic insufficiency

3. Which of the following is not a risk factor for coronary artery disease?
A Hypertension
B Smoking
C Diabetes
D Renal failure
E Hypercholesterolemia

4. A 72-year-old female patient is admitted with unstable angina. Cardiac catheterization reveals severe triple-vessel coronary artery disease. The optimal treatment of this patient would include which of the following?
A Coronary artery bypass surgery
B Observation
C Medical management (nitrates, Î²-blockers)
D Coronary angioplasty
E Tissue plasminogen activator

5.A 72-year-old patient with a history of syncope and dyspnea presents for evaluation for peripheral vascular surgery. Physical examination reveals a systolic crescendo-decrescendo murmur that radiates to the carotid arteries. As he is symptomatic, his diseased valve would typically have an area of less than which of the following?
A 1 cm^2
B 1.5 cm^2
C 2 cm^2
D 3 cm^2

E 4 cm^2

6. A 29-year-old man is evaluated for a cerebral vascular accident. Physical examination reveals a systolic ejection murmur at the left second interspace and a fixed split second heart sound. What is the most likely diagnosis?

A Ventricular septal defect
B Atrial septal defect
C Mitral stenosis
D Aortic insufficiency
E Ventricular aneurysm