

Cardiac Surgery

Lec: 1

Cardiopulmonary Bypass (CPB)

Is the method by which the physiological function of the heart and lung is replaced by a machine in anesthetized patient for a limited period of time during cardiac operation, it is required for most of cardiac operations.

Surgical Management Of Ischemic heart Disease:-

The Coronary circulation to heart is composed of Left and Right coronary arteries.

1. **Left Coronary artery** arise from Left coronary sinus and supply most of anterior wall, the apex and interventricular septum, it is divided to left anterior descending and circumflex artery.
2. **Right Coronary artery** arise from Right coronary sinus and supply SA and AV nodes and part of interventricular septum.

The coronary arteries liable to develop atherosclerotic changes this will narrow them and when the obstruction reaches the critical level it will prevent the transient of blood to myocardium and this will produce ischemic symptoms.

Cardiac Surgery

Lec: 2

Mitral Valve Disease: 1. Mitral stenosis:

Etiology:- 1. Rheumatic heart disease. 2. Calcific degeneration.

3. Cardiac Tumor like left atrial myxoma 4. Congenital mitral stenosis

Pathophysiology:-

The development of mitral stenosis is usually progressive in which the normal surface area of valve decrease from 4-6 cm² to about 1-1.5 cm² at this stage it is called Moderate mitral stenosis and patient become symptomatic . When valve surface area decrease to 0.8 cm² the condition called severe mitral stenosis.

2. Mitral valve insufficiency: Etiology:-

- | | |
|---------------------------------|----------------------------|
| 1. Degenerative disease 50-60 % | 2. Rheumatic fever 15-20 % |
| 3. Ischemic disease 15-20 % | 4. Endocarditis |
| 5. Congenital abnormalities | 6. Cardiomyopathy |

Pathology: The mitral valve composed of:-

- | | | | |
|-------------|--------------|-------------|-----------------------|
| 1. Annulus. | 2. Leaflets. | 3. Chordae. | 4. Papillary muscles. |
|-------------|--------------|-------------|-----------------------|

A defect in any one of these components may create mitral insufficiency.

Aortic valve disease: 1. Aortic stenosis: Etiology:-

- | | |
|---|-------------------------------|
| 1. Congenital 30 % (bicuspid valve). | 2. Rheumatic disease 10-15 %. |
| 3. Calcific valve stenosis 60 % (degenerative disease). | |

2. Aortic Regurgitation:- Etiology:-

- | | | |
|---------------------------|----------------------------|-----------------------------|
| 1. Degenerative diseases. | 2. Endocarditis. | 3. Rheumatic heart diseases |
| 4. Congenital. | 5. Aortic root dilatation. | |

Pathophysiology: - Blood will return from aorta to left ventricle during diastolic phase producing left ventricular volume overload and dilatation

CARDIAC SURGERY

Lec: 3

Congenital Heart Diseases:-

Atrial Septal Defect: - An opening in the interatrial septum which leads to mixing of blood from pulmonary and systemic circulation. It is

common and represents 7% of all congenital heart diseases; female to male is 3 to 1. It can occur alone or together with other congenital heart diseases. It may be essential for life and sometimes created surgically

PATENT DUCTUS ARTERIOSUS: Is a congenital anomaly caused by failure of closure of the duct which connects between the pulmonary artery and the aorta after birth, this will lead to excess flow of blood from aorta to pulmonary artery after reduction of high fetal level of pulmonary vascular resistance, symptoms depend on the size of duct, age at presentation and associated anomalies

VENTRICULAR SEPTAL DEFECT: A hole in the interventricular septum may be single or multiple and it represent about 40% of all congenital heart diseases, it causes shunt of blood from left ventricle to right ventricle under high pressure

TETRALOGY OF FALLOT:- Is congenital heart disease which presents with ventricular septal defect, overriding of the aorta to Right ventricle, hypertrophy of Right ventricle muscles and Right ventricle outflow tract obstruction, it may occur alone or with other congenital heart diseases

Cardiac Surgery

Lec: 4

Cardiac Trauma

May be either :-

1. Blunt Trauma

2. Penetrating Trauma:- Which is either due to:

- a. Stab wound b. gun shot c. iatrogenic e.g by chest tube.

Clinical Presentation depends on:

1. Site of injury 2. mode of injury 3. associated injuries

The Right ventricle is mostly involved by penetrating injuries in 42% of cases because it occupies the largest percent of the anterior surface area of heart followed by Left ventricle in 32% of cases and Right atrium in 15% of cases, Factor affect Mortality from penetrating injuries may be due to

1. Coronary artery injury
2. multiple chamber injury
3. Isolated left side injury
4. common tear of single chamber
5. Isolated right side chamber injury
6. Tangential injury which does not penetrate the endocardium

Clinical Presentation

A. Tamponade:- occur in 80% of cases of stab wound injuries and 20% of gunshot injuries.

B. Haemorrhagic shock occurs in 20% of stab wound injuries and 80% of gunshot injuries.

Cardiopulmonary resuscitation:- Measures done to manage person sustain cardiopulmonary arrest. cardiac arrest may be due to arrhythmia which may be due to

- a. Coronary artery diseases b. Anoxia C. electrolyte disturbance
d. Drug toxicity.

Thoracic Surgery

Lec : 5

Thoracic Surgical Approaches

Most thoracic operations done with the patient anesthetized and **Double Lumen endotracheal tube** is used which enable separate ventilation of each lung by blocking the ventilation from the side of surgery so that surgeon can work on deflated lung . Another benefit that secretions and blood from operated lung will not return to the contralateral lung on which we depend during surgery for ventilation.

Lung Abscess :- Is localized area of pulmonary parenchymal necrosis with tissue destruction and cavity formation.

Surgical drain is uncommon it is indicated in :-

1. Failure of medical treatment
2. Abscess under tension
3. Increase in size despite treatment
4. Other lung contamination
5. Abscess > 4-6 Cm in diameter
6. Inability to exclude cavitary carcinoma

Surgical drain either by :-

1. Chest tube or percutaneous drain catheter for abscess in contact with chest wall.
2. Thoracotomy and surgical cavernostomy to remove wall of abscess cavity usually by lobectomy especially with bleeding or pyopneumothorax

Thoracic Surgery

Hydatid Disease of the Lung:-

Is commonly caused by Dog Tape Worm known as *Ecchinococcus granulosus* which lives in the dog intestine (Primary host) and it shed eggs which may contaminate grass and Vegetables these may be ingested by sheep or human (Secondary host) and when the ova reach small intestine the *Embryo* hatch and penetrate the intestine wall and lodge in the liver or lung and develop into Primary Hydatid Cyst .

Massive Haemoptysis: - Is defined as expectoration of > 600 ml of blood with in 24 hour, the rate of bleeding necessary to produce respiratory compromise is highly dependant on the individual's prior Respiratory status.

Indications of surgery in Pulmonary Tuberculosis.

1. Complication from previous thoracic surgery to Rx T.B.
2. Failure of medical Rx leading to progress of disease, intra cavitory aspergellosis.
3. Complicated T.B with Massive haemoptysis,
4. Extra Pulmonary thoracic involvement.
5. T.B Fibrous Empyema.

Thoracic Surgery

Lung Cancer:- Is one of the Major Killer Cancers World Wide.

Etiology :- 1. Smoking accounts for 75% of all lung cancers especially Squamous and Small cell type.

2. Exposure to industrial compounds e.g. Asbestos, Zn , Cr

3. previous Hx of T.B with scar formation.

4. Cooking Oil Vapors and Indoor coal and wood burning.

Diagnostic Evaluation :- Assessment of Pt. with Lung Ca consist of 2 Stages:-

1.assessment of Primary Tu.

1. careful History taking regarding any pulmonary , nonpulmonary , thoracic , paraneoplastic symptoms

2. CT Scan with I.V Contrast to assess primary Tu. And its relation to contiguous structures

3. MRI used when Pt. has allergy to contrast material OR with suspected Mediastinal , Vertebral , Vascular invasion since MRI has excellent imaging of vascular structures

4. Tissue Dx May be obtained by:**A-Bronchoscopy:** Useful for Central Tumors to get Endobronchial Dx, also to visualize entire trachea-bronchial tree, Dxic Speciman May be Obtained by direct Forceps Biopsy of lesions seen followed by Bronchial Wash and Brush for cytological analysis, this will help to improve the Yield of Biopsy by picking up additional cells after disruption of lesion by biopsy forceps

B- TransthoracicFNAC is suitable for peripheral lesions not accessible by Bronchoscopy under fluoroscopy or CT guide.

C– Thoracoscopy is used to assess relation of primary tumor to other intrathoracic structures , also help to take biopsy from lesions not accessible by previous methods and Surgeon can proceed to Lobectomy after Frozen Section Dx.

D- Open Dxic Thoracotomy may be done when 1. there is deep seated lesion that yielded indeterminate biopsy results Or Lesions which could not be biopsied due to Technical reasons 2. inability to determine invasion of Mediastinal structures by any method other than palpation, in this situation all preparations must be carried out to proceed for complete Tumor resection if it is proved to be malignant in the same operation, therefore; this option is reserved only for resectable tumors.

Treatment :-

1. Early stage / stagel and II diseases Rxed by Surgical resection according to site of tumor mostly by Lobectomy

Pneumonectomy may be required for large central tumor involve distal main stem bronchus with inability to resect hilar L.Ns and is usually followed by post opt. chemotherapy (CRx)

Thoracic Surgery

Lec : 8

Safe Insertion Of Chest Tube:-

The insertion of chest tube requires a great attention to avoid damage of the structures near the pathway of insertion , previously they put the chest tube in the 2nd ICS(intercostal space) for Pneumothorax and in the 8th ICS for pleural effusion, Empyema, Haemothorax, with time they observe occurrence of many injuries to Subclavian vessel , Liver , Spleen , diaphragm during chest tube insertion through these levels, with time the idea of safe area for chest tube insertion is developed , they found that ICS.s (4, 5,6) are the safest spaces regarding the Horizontal levels While The Area between the Anterior Axillary and the Posterior Axillary Lines represent the safe Vertical extensions.

According to what mentioned above it is better to put the chest tube in the 4th or 5th ICS between the Anterior and Mid axillary Line and direct it upwards and anteriorly to the apex of hemithorax for the Mx of Pneumothorax While For the Mx of Fluid Collection (Haemothorax , Empyema , etc) the chest tube inserted through 5th OR 6th ICS between Mid and Posterior Axillary Line And direct it down wards and posteriorly.

Spontaneous Pneumothorax :- Means accumulation of air in the pleural space without any antecedent event.

Pleural Effusion :- Accumulation of Sterile fluid in the pleural space secondary to another condition which prevents normal passage of fluid from parietal pleural capillaries to pulmonary capillaries,

Empyema Thoracic :- Collection of infected fluid in the pleural space , it may be localized or involve the whole cavity, it is classified to:-

Chylothorax :- accumulation of chylous fluid in the pleural cavity , cause

1. Congenital :- atresia of Thoracic duct
2. Traumatic.
3. infection e.g TB lymphadenitis
4. Neoplastic.

Thoracic Surgery

Thoracic Injuries :- Account for 25% of all injuries, usually they life-threatening and occur due to bleeding but fortunately 80% can be managed conservatively by proper Dx and resuscitation.

Immediate Life Threatening Injuries :-

1. Air Way Obstruction
2. Cardiac Tamponade :- Lec 4
3. Tension Pneumothorax: ***Tension Pneumothorax is a clinical Dx. And Rx must not be delayed waiting for Radiological confirmation.*** Rx :- 1. Rapid insertion of large bore needle into 2nd intercostal space in the Mid-clavicular line of the affected hemithorax.

2. insertion of chest tube through 5th ICS between anterior and mid axillary line and direct it to apex of hemithorax.
4. Open Pneumothorax
5. Massive Hemothorax
6. Flail chest :-

Potentially Life Threatening injuries :-

1. Thoracic Aortic disruption
2. Tracheobronchial injuries :-
3. Blunt Myocardial injury :-
4. Diaphragmatic injury :-
5. Esophageal injury:-
6. Pulmonary contusion

Vascular Surgery

Obstructive Arterial diseases: - is generally divided to 3 kinds

1. Acute occlusion :- also called Embolic occlusion which arise either from

2. Chronic Occlusion : - caused by atherosclerotic diseases which may involve any segment of arterial system

3. Acute on chronic obstruction: - may develop at site of atherosclerotic narrowing which may be obstructed suddenly by an embolus , this will produce mixed features of acute and chronic disease

Investigations:-

1. General investigation: - include complete blood count, lipid profile, renal functions tests, ECG and Echo to assess cardiac function, CXR and Pulmonary function test to assess respiratory function.

2. Dopplar study

3. Duplex imaging study: -.

4. Angiography: -

a. the classical angio :-

b. the new modality CT angio:-.

Mx:-

1. In acute conditions :- usually the Pt. come to emergency department with acute symptoms of pain , cold limb and pallor , the initial steps to Rx such cases are :-

1. Optimize the intravascular volume by intravenous fluid infusion because in some cases dehydration increase the ischemic features

2. I.v heparin given as 7500 U loading dose followed by 5000 U infusion every 6 hours .(1+2) will increase flow through the narrow vessels and open the collaterals improving distal perfusion

2. Mx chronic obstruction

1. stop smoking, exercise and achieve ideal body weight

2. Control serum lipid level and blood sugar for diabetic pt.s

Aneurysmal diseases:

Aneurysm: - means dilatation of localized segment of the arterial system, classified :

1. according to wall thickness

a. True An. :-contain the 3 layers of the arterial wall (intima ,media ,adventitia) in the wall of An. Sac.

b. False An. :- in which single layer of fibrous tissue form the wall of An. Sac
e.g. Traumatic An.

Abdominal Aortic Aneurysm:-

Is the most common type of large vessel An., it mostly involve the Aorta below Renal arteries. It may be presented as :-

Popliteal artery An.:- represent 70% of peripheral An. , 65% are bilateral , 35% associate with abdominal An. , pt. present with swelling behind knee , distal ischemia may occur due to thrombosis or distal embolization

Arterio-Venous Fistula(AVF) :- means communication between artery and vein which may be 1.Congenital 2.Traumatic

3.Iatrogenic AVF for hemodialysis , AVF leads to :-

Thromboangitis Obliterans (Burger disease):-

Characterized by segmental occlusion of medium size arteries , mostly involve leg but forearm also may be involved , it may be associated with thrombophlebitis of superficial or deep veins and Raynauds syndrome , it occur in male , smoker , age < 30 y

Gangrene :- death of macroscopic part of tissue usually affect distal part of limb dueto arterial obstruction , usually of 2 kinds

Vascular Surgery

Lec : 3

Venous System:

Varicose Veins: - defined as tortuous dilated veins which affect 5% of adult population. M > F but most Pt.s seek for Rx. Are F. there is +ve family history for inheritance through FOXC2 gene.

V.V develops due to defect in connective tissue and smooth muscles in vein wall leading to secondary incompetence in the valves , other predisposing factors are: -

- 1.DVT
- 2.Pregnancy
- 3.Pelvic tumors
- 4.Age
- 5.Weight and Height- heavy weight and tall pts. are more liable.
- 6.Diet – Low fiber diet leads to chronic constipation which → V.Vs
- 7.side - left > right
8. Occupation with long standing period.

D.V.T :- is the formation of semisolid coagulum with in the flowing blood in the venous system , it carries high risk of Pulmonary Embolism and Sudden death.

Etiology - 1. Change in vessel wall (endothelial damage).
2. Stasis leads to decrease blood flow through the vein.
3. increase blood viscosity

Risk factors for DVT- 1. Pt. factors a. age b.obesity c.varicosity
d.immobility e.pregnancy f.puerperium g.high dose Estrogene Rx
h.previous DVT.

2. Disease or surgery- a.Trauma or surgery esp. pelvic , hip.
b. Malignancy eps. Pelvic or abdominal. C. Heart failure
d. Recent MI e. Lower limb paralysis f. infection

Vascular Surgery

Vascular Injuries:-

Etiology:- 1. Penetrating injuries: a- Low velocity injuries like knife, pistol in which the damage is mainly confined to the wound tract.

b- High velocity injuries like missiles, gunshot which leads to soft tissue cavitation and impact injury to the bone here the involved artery usually destroyed and/or thrombosed for several Cms beyond the path of penetration.

2. Blunt trauma: a- Compressive force can damage arterial wall directly. b- Rapid deceleration may stretch the artery and leads to intimal tear since it is the least elastic layer of the arterial wall, blood will dissect under intimal flap leading to thrombosis of vessel. ***Operative Management:-*** all major arterial injuries should be repaired provided that the tissue they supply is viable and the general condition of the patient is satisfactory, the urgency of repair is directly related to the degree of ischemia, although every hour delay may diminish success rate, there is no absolute period beyond which repair is contraindicated, following steps must be done.

1. Ensure safe airways and breathing, control external bleeding with direct pressure and packing of bleeding site, proximal tourniquet is better to avoid, but if they are necessary the time period of its application must be calculated, antibiotic and tetanus prophylaxis are given, when present other injuries are evaluated and priority determined

2. A wide operative field is prepared including the other limb in cases of lower limb injury to allow Saphenous vein graft(SVG) harvesting when it is required, vertical incisions along the course of injured vessel are used and proximal and distal control of vessel obtained to decrease the amount of bleeding.

3. Both proximal and distal ends of injured vessel are dissected out, Embolectomy using Fogarty catheter of both segments done to remove any present clots, irrigation with Heparin/Saline solution done, both ends are trimmed and continuity of the vessel is re-established either by direct end to end anastomosis or when the lost segment is large by reversed SVG interposition, hemostasis secured, wound debrided, anastomosis must be covered with muscle or flap, drain put and incision closed.