➲ **Large arteries of aorta :-** leading to ;

- Unequal radial pulse .
- Unequal blood pressure .
- Unilateral clubbing .
- Ischemic manifestations as ; Pallor , pain , coldness , parasthesia .

☞ *Pressure on nerves :-*

➲ **Sympathetic chain :-** Horner's syndrome (mention).

➲ **Left recurrent laryngeal nerve :-** Hoarseness of voice , stridor , bovine cough & paralysis of vocal cord .

➲ **Vagus :-** Arrhythmia & dyspeptic manifestations .

➲ **Phrenic nerve :-** Hiccup & Diaphragmatic paralysis .

➲ **Spinal nerves :-** Brachial plexus → Brachial neuralgia , Intercostal nerves → Intercostal neuralgia .

☞ *Pressure on bones :-*

➲ **Sternum :-** Sawing pain & Pathological fracture .

➲ **Ribs :-** Pain , erosion & pathological fractures .

➲ **Clavicle :-** Pain & pathological fractures .

➲ **Spine :-** Pressure necrosis & Collapse of bodies → pressure on nerves → Paraplegia .

☞ *D'Espin's sign :-* Whispering pectroliquy heard below 2nd dorsal spin in adults & 4th dorsal spine in children , denoting mediastinal mass as lymphadenopathy , Normally , it is not heard .

4. Systemic symptoms and syndromes :-

☞ *Fever , anorexia , weight loss and other systemic manifestations .*

☞ *Syndromes :-* Cushing's , Hypoglycemia , Hypertension , Hypercalcaemia & Gynaecomastia .

☞ *Thymoma :-* Myasthenia gravis , Red cell aplasia , Myocarditis ,.Hypo & hyperglobulinaemia .

5. Pneumo-mediastnum :- which is presented by ;

☞ *Pain :-* (commonest) ; dull aching pain due to stretching of mediastinal structures & aggravated by breathing and changing position .

☞ *Dyspnea, dysphagia, dysphonia* with characteristic hot potato voice .

☞ *Associated subcutaneous crepitations .*

☞ *Mediastinal crunch .*

☞ *Acute mediastinitis :-* sub-sternal pain , chills , high fever and prostration ; they are treated by antibiotics and surgical drainage.

☆ Differential diagnosis of Mediastinal masses :-

Anterior compartment	Middle compartment	Posterior compartment
1. Thymus :- - Hyperplasia. - Cyst. -Thymoma :- benign or malignant.	1. Pericardium :- - Cysts . - Diverticulae .	1. Neural :- a. Peripheral nerves: - Neurofibroma. - Malignant tumor. b. Autonomic nerves: - Ganglioneuroma. - Neuroblastoma. c. Paraganglioma. d. Meningeocele.
2. Germ cell tumors :- - Benign cyst (dermoid) . - Malignant :- * Seminoma. * Non-seminoma.	2. Vascular :- - Aneurysm of arch. - Anomalous vessels.	
	3. Heart :- - Lt vent. aneurysm. - Cardiomeyally.	
3. Hodgkin's lymphoma.	4. Trachea and main bronchi :- - Bronchogenic cysts .	2. Oesophageal masses.
4. Thyroid :- - Retrosternal goiter. - Entopic thyroid.		3. Diaphragm :- - Hernia. - Tumors.
5. Parathyroid adenoma		4. Aortic aneurysm.
6. Morgagni's hernia		

☆ Masses may be found in more than one mediastinal compartment :-

1. Lymph node masses :-

- Lymphoma :- Hodgkin's or non-Hodgkin's lymphoma .
- Metastasis .
- Sarcoidosis .
- TB .
- Castleman's giant follicular hyperplasia .

2. Reduplication cysts :- Bronchial & Gastroenteric .

3. Vascular :- Aneurysm of the aorta and its branches .

4. Connective tissue :- Lipomatosis & Malignant fibrous histiocytoma .

N.B. :- The commonest mediastinal mass is L.N. , due to ; T.B. , bronchial cancer , pneumoconiosis , leukaemia , lymphoma & Sarcoidosis .

☆ Investigations of a case with mediastinal mass :-

A) Imaging techniques :-

- ☞ Chest X- ray :- (postero-anterior and lateral) .
- ☞ Computed tomography (CT) .
- ☞ MRI .
- ☞ Radio-active iodine studies :- in case of thyroid swelling .
- ☞ Contrast studies :- ***Ba*** Oesophogography, Angiography , Selective angiography & Myelography.

B) Biopsy techniques :-

- ☞ Trans tracheal and trans-bronchial aspiration biopsy .
- ☞ Percutaneous aspiration guided by C.T or ultrasonography .
- ☞ Mediastinoscopy and anterior mediastinotomy .

C) General approach to diagnostic investigation of mediastinal masses :-

- ☞ Most mediastinal lesions require tissue diagnosis e.g. ;
  - ⇨ Thyroid swelling ; cleared by 1^{131} scan .
  - ⇨ Granuloma ; it is densely calcified .
  - ⇨ Mediastinal lipomatosis ; diagnosed with C.T. .
  - ⇨ Lymphoma or other malignancies ; diagnosed by lymph node biopsy .
  - ⇨ Pulmonary TB and sarcoidosis ; appropriate tissue biopsy .

☆ Treatment of mediastinal masses :-

☆ All mediastinal masses either benign or malignant must be surgically removed , as ;

- ☞ They may enlarge and compress mediastinal structures .
- ☞ Bleeding , rupture or infection .
- ☞ Malignant degeneration .

☆ C.T or MRI must be dune for pre- and post-operative evaluation.

PULMONARY EMBOLISM

☆ Definition of Pulmonary embolism :-

- The pulmonary arteries become occluded by thrombus or other obstructive materials .

N.B. :- Venous thromboembolism (VTE) includes DVT & pulmonary embolism .

☆ Major risk Factors for venous thromboembolism :- [6 O]

☞ ***Operative :-*** abdominal , pelvic , bone surgery , Pregnancy and/or postpartum .

☞ ***Oncology :-*** cancer pancreas , stomach , lung lymphoma and leukaemia .

☞ ***Old age .***

☞ ***Oral contraceptive pills .***

☞ ***Obesity .***

☞ ***Others :-*** [2 C]

➥ *Congestive heart failure and post-myocardial infarction .*

➥ *Coagulation disorders :-*

- Deficiency of anti-thrombin III , protein C and protein S .
- Defective plasminogen . (or release of plasminogen activator) .
- Increased circulating coagulation protein factors V & VII .
- Hyper-reactive platelets .

☆ Predisposing factors to venous thrombosis (Virchow's triad) :-

☞ Venous stasis :- CHF , Prolonged bed rest , Post-operative & V.V. .

☞ Hyper-coagulability :- Dehydration , Polycythemia , After major operations or MI .

☞ Endothelial injury :- Thrombo-phlebitis , Trauma & Infusion with concentrated glucose

☆ Sources of the emboli :-

☞ **Peripheral veins :-** as ;

➥ Thrombi of deep veins :- ilio-femoral or calf vein DVT (> 90%) .

➥ Fat Embolism :- after fracture of long bones .

➥ Air embolism :- after air insufflation or neck surgery .

➥ Amniotic fluid embolism :- in pre-mature separation of placenta .

➥ Malignant emboli :- as from renal carcinoma .

➥ Parasitic emboli :- as Ascaris .

☞ **Right & Left side of the heart :-** as in ;

➥ Thrombi :- either on :-

- Rt side :- RA thrombi (HF , AF) & RV thrombi (Septal infarction) .
- Lt side :- Paradoxical emboli → pass through defect as ASD or VSD to Rt side of heart .

➥ Tumours :- Rt or Lt atrial myxoma .

➥ Vegetations :- in case of Infective endocarditis .

☆ ***Patho-physiological consequences of Pulmonary embolism :-*** depends on ;

- ☞ Degree of pulmonary arterial obstruction .
- ☞ Pre-existing cardio-pulmonary Status .
- ☞ Secondary effects e.g. local release of neuro-humoral substances .

☆ ***Patho-physiological changes in Pulmonary embolism :-***

☞ **Circulatory changes :-**

1. Haemodynamic changes :-

- Small and few emboli → no haemodynamic effects .
- Large emboli or a multiple small emboli → Systemic hypotension & Decrease in COP

2. Ventilation - perfusion imbalances .

3. Increased dead space ventilation .

4. Increase in alveolar ventilation .

5. Anatomic venous admixture :- due to opening of intra-pulmonary A-V shunts .

6. Systemic arterial hypoxaemia :- due to Venous admixture & Patent foramen ovale .

☞ **Hypocapnea :-** *due to Hyperventilation .*

☞ **Widening of alveolar arterial difference in PO_2 .**

☆ ***Categories of Pulmonary embolism (PE) :-***

☞ **Acute massive PE :-** large embolus lodge in the center of the pulmonary arterial tree .

☞ **Sub-massive PE :-** without pulmonary infarction [the most common type]

☞ **PE associated with pulmonary infarction .**

☞ **Chronic thrombo-embolic disease** → severe pulmonary hypertension .

☆ ***Clinical manifestation of DVT :-***

- ☞ Unilateral swelling with duskiness of the leg .
- ☞ Pain over calf muscles on dorsiflexion (Homan's sign) .
- ☞ There may be palpable tender cord in femoral triangle ⇨ Femoral vein .

☆ ***Clinical picture of PTE :-*** there are many forms of manifestations ;

A) Asymptomatic :- due to ;

- Small emboli .
- Fibrinolysis in pulmonary circulation .
- Double blood supply of the lung .

B) Sudden death :- dt massive embolism (> 85 % of pulmonary vascular bed is obliterated) .

C) Acute Cor-pulmonale (Large embolus) :- (> 50 % is occluded) , presented by ;

- ***Sudden sever retro-sternal pain :-*** due to ;
  - ✓ Mechanical distention of pulmonary artery .
  - ✓ Reflex coronary spasm .
  - ✓ Low COP (↓ pulmonary BF → ↓ coronary BF) .
  - ✓ High RA pressure (2^{ry} to high pulmonary BP) → resist emptying of sinus venosus → ↓ coronary blood flow .
- ***Shock & Syncope*** may occur rapidly due to marked ↓ in COP , ↓ BP & rapid weak pulse .
- ***Dyspnea .***
- ***Central cyanosis :-*** due to ;
  - ✓ Opening of pulmonary A-V shunt secondary to sudden ↑ in pulmonary BP .
  - ✓ Non-uniform constriction of distal arterial ways → under-ventilation of lung units with respect to their perfusion .
  - ✓ Lack of surfactant by non perfused lung .
- ***RSHF manifestations :-*** except oedema L.L. as the period is too short for it to develop .

D) Pulmonary infarction :- (Medium sized embolus) , presented by ;

- In first day :- Dyspnea , Pleural rub & Pleural pain (DRP) .
- In second day :- Cough , fever , Haemoptysis , haemolytic anaemia & haemorrhagic pleural effusion (blood) .
- Signs of pulmonary consolidation .

E) If Small embolus but repeated :-

- It leads to gradual obliteration of pulmonary vascular bed → Pulmonary HTN & chronic cor-pulmonale .

F) If infected embolus :- leads to → pneumonia & lung abscess .

G) General Collective signs of PE :-

- ☆ Tachypnea (RR > 20 / min)
- ☆ Tachycardia (pulse > 100 / min)
- ☆ Blood pressure :- there may be shock state .
- ☆ Elevated jugular venous pulse .
- ☆ Right ventricular gallop or murmur.
- ☆ Rales (crackles) .
- ☆ Accessory muscle use .
- ☆ Pleural friction rub .
- ☆ Central cyanosis
- ☆ Signs of pleural effusion .

N.B. Unexplained dyspnea associated with anxiety, tachypnea & tachycardia which persist during sleep should arouse suspicion of Pulmonary Embolism .

☆ **Investigations of Pulmonary Embolism :-**

A) Basic tests :-

1) **Chest X-ray :-** show the following findings :-

- Normal chest radiography.
- Elevated cupola of diaphragm on affected side .
- Evidence of pleural reaction or effusion .
- Parenchymal infiltrates .
- ***Fleischner's hump :-*** pleural-based wedge shaped parenchymal lesion → Pulmonary infarction .
- ***Fleischner's lines :-*** atelectatic bands at lung base .
- ***Westemark's sign :-*** unilateral increased density due to hypoperfusion of one lung .
- In case of acute cor-pulmonale :- there will be ;
  - ✓ Signs of pulmonary HTN :- e.g. Prominent central pulmonary artery & unequal size of pulmonary arteries .
  - ✓ Signs of RAH & RVH .

2) **ECG :-** It is IMP to exclude MI as a cause of dyspnea & chest pain , it shows :-

- Sinus tachycardia :- It is the most common pattern .
- Atrial flutter .
- Classic pattern $S_1Q_3T_3$ is only present in 10-15 % of pulmonary embolism .
- Rt axis deviation & Rt ventricular enlargement .
- T wave inversion in right chest leads may be present in severe cases .
- Prolongation of QRS complexes due to recent Rt BBB .

3) **Arterial blood gases :-** (supportive for diagnosis of PE)

- It shows :- Hypoxaemia & Hypocapnia .
- Normal ABGs do not exclude PE .
- A normal alveolar arterial PO_2 difference is more specific evidence against PE .
- Finding of unexplained hypoxaemia should raise the possibility of PE .

4) **Catheterization :-** it shows ↑ in RV & pulmonary artery pressure .

5) **Laboratory data :-** they are not specific ;

- ↑ LDH , ↑ serum bilirubin & normal SGOT → Pulmonary infarction .
- ↑ LDH , Normal CPK & Normal HBD → to exclude MI .
- ↑ level of fibrinogen degradation products after pulmonary embolism .

B) Lung imaging :-

1) Helical (spiral) CT :- It has the following advantages in PE ;

- Rapid and non-invasive .
- Fewer potential complications .
- Sensitivity 95% and specificity 97%.
- Diagnosis of diseases other than PE .
- Less cost and time than lung scan or conventional pulmonary angiography .

2) Ventilation / perfusion lung scan (V/Q scan) :- it involves 2 scans ;

Pulmonary perfusion scan :-

- It uses ^{99}Tc & Macro-aggregated albumin (MAA) .
- It reveals areas of hypo-perfusion (cold areas) .
- It is highly sensitive , but it is not specific as it is +ve in pneumonia , atelectasis & malignancy .

Ventilation scan :-

- It uses Xenon (^{133}X) inhalation .
- It reveals areas of hypo-perfusion (Cold areas) .

N.B. :- If cold areas of perfusion scan concise with that of ventilation scan → Pulmonary embolism .

Fundamental facts underlying the use of V/Q scan :-

- It helps in identification of high risk patients .
- ↓ ventilation & ↓ perfusion *(matched defect)* → parenchymatous lung disorder (pulmonary embolism or infarction) .
- ↓ ventilation & normal perfusion *(reversed mismatch)* → airway obstruction or atelectasis.

3) Pulmonary angiography :-

- It is the most accurate diagnostic study for evaluating pulmonary embolism .
- Disadvantages of pulmonary angiography :-
  - ✓ Invasive and expensive .
  - ✓ Technical complexity .
  - ✓ Limited availability .
  - ✓ Mortality rate of about 1% .
- Pulmonary angiographic findings in acute PE :-
  - ✓ Primary findings :- Abrupt cut-off of the vessels & Intraluminal filling detect .
  - ✓ Secondary findings :- Absent , decreased or delayed filling of lung zone .

4) MRI .

C) Leg imaging :-

- **Ultrasonography (colored Doppler) .**
- **MRI venography .**
- **Ascending contrast venography (not preferred) .**

D) Echocardiography :-

- It will show Right ventricular enlargement .
- For evaluation of severity of core pulmonale and follows up of improvement.

☆ *Diffrential diagnosis of PE :-* from ;

- Other causes of acute chest pain .
- Other causes of Haemoptysis .
- Other causes of HF .
- Other causes of acute cor-pulmonale .
- Lung absess .

☆ *Management of Pulmonary embolism :-*

1. Identification of the high risk patients .

2. Prophylaxis to prevent DVT.

3. Diagnostic approach for patients with suspected DVT .

4. Treatment of acute PE :-

A) Prophylaxis against PE :-

- *Non Pharmacologic :-*
  - ✓ Graded compression stockings (TED stockings) .
  - ✓ Intermittent pneumatic compression boots .
  - ✓ Vena cava filters (e.g. Greenfield filter) .
- *Pharmacologic agents :-*
  - ✓ Low molecular weight heparin .
  - ✓ Mini-dose warfarin .
  - ✓ Antiplatelet (aspirin) .

B) Treatment of diagnosed acute pulmonary embolism :-

1) Heparin :-

- Loading dose 100 IU / kg given as an intravenous bolus .
- Maintenance dose 500-600 IU / kg (total daily dose of 30.000 IU for a 60kg patient)
- Adjust infusion rate until the APPT = 1.5-2.5 that of the control (45-75 sec) .
- It prevents extension & recurrence of thrombo-emboli & enhances fibrinolytic dissolution

2) Oral anticoagulants "warfarin" :-

- Adjust the dose international normalized ratio (INR) to be [ ] 2 & 3 that of the control .

3) Intravenous thrombolysis with streptokinase or urokinase :-

- Its use carries high risks and should be used only when indicated .
- Bolus (250000 U IV) followed by infusion of (100000 U / h) for 12-24 h .
- ***Indications :-***
  - ✓ Life threatening PE especially in presence of haemodynamic instability (shock)
  - ✓ Evidence of right heart dilatation on ECHO .
  - ✓ Deterioration symptoms and signs in spite of heparin therapy .

4) Additional drug therapy :- according to the condition ;

- Anti-shock measures :- with vaso-pressors to support circulation .
- Treatment of pain :- by analgesics as Pethidine (avoid morphine → suppress RC)
- Treatment of dyspnea :- Oxygen & respiratory stimulators as Coramine .
- Treatment of HF :- IV Digitalis & Aminophyline infusion (avoid IV fluid → ↑ HF)
- Atropine :- Vagal reflexes → ↑ coronary & pulmonary artery spasm .
- Anti-biotics :- for infection .
- Treatment of the causes & associated conditions .

C) Surgical treatment :-

- *It has the following indications :-*

1- Documented iliofemoral vein thrombosis , with ;

- ✓ NO improvement after 2 hours of medical treatment .
- ✓ Contraindications to anticoagulants .
- ✓ Documented PE during full coagulation .
- ✓ Free floating thrombus .
- ✓ High-risk for fatal PE .

2- No iliofemoral vein thrombosis , but ;

- ✓ Long-term prophylaxis is necessary (e.g paraplegia) .
- ✓ High-risk for both PE and haemorrhage .

- *Methods :-*

- ✓ Pulmonary embolectomy (Trendlenberg's operation) using cardio-pulmonary bypass .
- ✓ Insertion of a suction catheter (Green field catheter) through femoral vein & used to remove the thrombus .

D) Prevention of further emboli :-

- Anticoagulants (see before) .
- IVC interruption :- either ;
  - ✓ Surgically :- by tent or occlusion .
  - ✓ Non surgically :- by introduction of a ballon device attached to catheter into IVC through neck or upper limb. .

PULMONARY HYPERTENSION

☆ ***Definition :-*** Systolic pulmonary arterial pressure > 30 & mean pulmonary artery pressure > 20mmHg

N.B. normal pulmonary artery pressure = 25/10 with mean 15 mmHg .

☆ ***Mechanisms and types :-***

☞ Pulmonary blood pressure = pulmonary flow & pulmonary vascular resistance

☞ Pulmonary hypertension occurs when there is increase in flow and / or resistance .

☞ There are 3 mechanisms for pulmonary hypertension :-

A) Increased pulmonary blood flow :- as in ;

- Left to right shunt :- hyperdynamic pulmonary hypertension .
- Left sided heart failure :- passive pulmonary hypertension .

B) Increased pulmonary Vascular resistance :-

- Hypoxaemia :- **vasoconstrictive** (passive & hyperdynamic) pulmonary HTN .
- Intravascular thrombosis & Embolism :- **obstructive** pulmonary hypertension .
- Pulmonary fibrosis , syphilis & Vasculitis :- **obliterative** (Chronic) pulmonary HTN .

C) Idiopathic pulmonary Hypertension .

☆ ***Causes of pulmonary hypertensive diseases :-***

A) Primary pulmonary hypertension :-

- ***Arteriolar (Precapillary) :-*** Dietary & familial primary pulmonary hypertension .
- ***Venous :-*** Pulmonary veno-occlusive disease .
- ***Capillary :-*** Pulmonary capillary haemangiomatosis .

B) Secondary pulmonary hypertension :-

- ***Pulmonary causes :-***
  - ✓ Airway diseases :- COPD .
  - ✓ Parechymatous diseases :- Interstitial pulmonary fibrosis & collagen diseases .
  - ✓ Vascular diseases :- Pulmonary embolism & Bilharziases .
  - ✓ Chest wail diseases :- Kyphoscoliosis & obesity .
- ***Cardiac diseases :-***
  - ✓ VSD - ASD - PDA → **Hyperdynamic** pulmonary HTN .
  - ✓ Mitral and aortic valve diseases → **Passive** pulmonary HTN .
  - ✓ Left ventricular failure .
  - ✓ Cardiomyopathy .
  - ✓ Left atrial myxoma .

☆ Clinical manifestations :-

✍ Symptoms :-

- *Asymptomatic* until sever .
- Symptoms due to ***underlying pulmonary or cardiac disease*** .
- ***Dyspnea on exertion*** is the most common symptom of pulmonary hypertension .
- ***Chest pain :-***
  - ✓ Angina like chest pain in patients with severe pulmonary hypertension .
  - ✓ It is due to right ventricular overload and myocardial ischemia .
- ***Syncope :-*** dt fixed low COP & vagal stimulation (associated with bradycardia)
- ***Hoarseness of voice :-*** dt pressure of Lt recurrent laryngeal n. by dilated Lt pulmonary A.
- ***Haemoptysis :-*** 2^{ry} to pulmonary venous congestion (e.g. mitral stenosis) .

✍ Physical examination :-

- In mild to moderate pulmonary hypertension → ***no signs*** .
- Signs of the causes :- mention examples .
- ***Neck veins :-*** Prominent or giant A wave .
- Signs of RVF .
- ***Cardiac signs of pulmonary HTN :-***

✓ *Inspection & palpation :- (Precordial examination)*

- ➲ RV apex → Heaving .
- ➲ Signs of pulmonary artery dilatation .
- ➲ Pulsation in pulmonary area .
- ➲ Signs of right ventricular hypertrophy .
- ➲ Diastolic shock over the second left space .

✓ *Percussion :-*

- ➲ Dullness on pulmonary area .

✓ *Auscultation :-*

- ➲ Wide splited second sound with accentuated pulmonary component .
- ➲ Ejection systolic murmur due to relative pulmonary stenosis .
- ➲ Early diastolic ***(Graham-Steell)*** murmur is heard [associated PR] .
- ➲ Pulmonary systolic ejection click .
- ➲ Over tricuspid area :- we can hear ;
  - ⇨ Pan-systolic murmur (relative TR) .
  - ⇨ Pre-systolic gallop (Forth HS) .

☆ ***Complication of Pulmonary HTN :-*** as those of RSHF (Mention) .

☆ ***Investigations :-*** (they are mentioned in details from lesson of → MS)

1- Electrocardiogram.

2- Chest x-ray.

3- Echocardiography.

4- Cardiac catheterization.

☆***Treatment of Pulmonary HTN :-*** It aims to :-

1- Treatment of the cause .

2- Treatment of the heart failure .

3- Decreasing the workload of the right ventricle .

4- ↓ Pulmonary HTN :- by using the following medications (ANPIR) ;

- ➲ ACEIS .
- ➲ Nifedipene & Amlodepine → CCBs .
- ➲ Prostacycline .
- ➲ Isoprenaline (β-agonist) .
- ➲ Regetine (α-blocker)

5- Improve life style of the patient ; through the following :-

- ➲ Pulmonary vasodilators :- Oxygen therapy (most effective) .
- ➲ Inhaled nitric oxide .
- ➲ Diuretics .
- ➲ Anti coagulant :- in primary pulmonary hypertension .
- ➲ Phlebotomy :- when the HCV > 55 to 60 % .

6- If the cause is established :- No treatment but , Lung with or without heart transplantation .

N.B. :- If the question says → Discuss pulmonary HTN :- you should add bilharzial cor-pulmonale on the lesson of pulmonary HTN .

COR-PULMONALE

☆ ***Definition :-*** It is right ventricular enlargement with or without failure resulting from pulmonary diseases after exclusion of LSHF & congenital heart diseases .

☆ ***Causes :-*** The same causes of pulmonary hypertension except the cardiac causes (Mention)

☆ ***Types :-*** It is classified according to the onset of its presentation into :-

A) Acute cor-pulmonale :- due to ;

- Acute massive pulmonary embolism .
- Tension pneumothorax .
- Acute massive collapse .

B) Subacute cor-pulmonale :- due to ;

- Lymphangitis carcinomatosis (intrapulmonary metastasis) .
- Recurrent minor pulmonary embolism .

C) Chronic cor-pulmonale :- due to ;

- COPD (most common cause especially blue bloater type) .
- IPF .
- Thoracic wall deformities (Kyphoscoliosis) .
- Pickwickian syndrome (obesity - hypoventilation syndrome) .

☆ ***Pathogenesis of cor pulmonale :-***

- In ***acute*** rise of pulmonary pressure , right ventricle ↑ its COP until pressure in Pulmonary artery reach 50 mmHg then the ventricle fails .
- In ***chronic*** rise of pulmonary pressure , the RV can tolerate higher pressure before failure .

☆ ***Clinical picture of cor-pulmonale :-***

- Anorexia
- Discomfort in the right upper quadrant of the abdomen due to hepatic engorgement .
- Congested pulsating neck veins with prominent (V) wave appears in the jugular pulse .
- Pedal oedema .
- The liver often shows expansile pulsations which are synchronous with the heart beats .
- Hydrothorax and ascots are uncommon , even after RVF has occurred .
- A palpable cardiac impulse near the left sternal border and in the epigastrium .
- Tricuspid insufficiency manifested by a pan-systolic murmur , ...etc .
- Arrhythmias :- precipitating by Anxiety , Bronchodilators , ↑ sympathetic activity , Hypokalaemia & Respiratory failure with or without disturbances in acid-base balance

☆ ***Diagnosis of cor-pulmonale :-*** It requires the following ;

- Diagnosis of pulmonary HTN by the characteristic signs, symptoms and investigations.
- Exclusion of LSHF and congenital heart diseases .
- Diagnosis of the cause of cor-pulmonale .

☆ ***Prognosis :-***

- It is much better in patients with chronic bronchitis and emphysema in who blood gases can be maintained at near-normal levels.

☆ ***Differences between Bilharzial and hypoxic cor-pulmonale :-***

Parameter	*Bilharzial cor pulmonale*	*Hypoxic cor pulmonale*
◆ Aetiology of P.HTN :-	▪ bilharzial Granuloma ▪ End Arthritis bitterns	▪ 2ry to hypoxic V.C. of pulmonary blood vessels .
◆ Symptoms :-	▪ Low COP .	▪ Hypoxia & hyper apnea .
◆ Complexion :-	▪ Pale .	▪ Cyanosis .
◆ Pulse :-	▪ Thread .	▪ Pounding .
◆ Hand :-	▪ Cold .	▪ Worm .
◆ Spleen :-	▪ Enlarged .	▪ Normal or associated enlargement.
◆ Manifestations of P.HTN :-	▪ Evident .	▪ Masked by emphysema .
◆ Chest shape :-	▪ Normal .	▪ Barrel shaped .

☆ ***Treatment of cor-pulmonale :-***

- ***Treatment of the cause and the underlying pulmonary disorder .***
- ***Oxygenation & Oxygen therapy*** ⇨ long term oxygen therapy (LTOT) in COPD .
- ***Treatment for infection .***
- ***Bed rest .***
- ***↓ the workload of the right ventricle by decreasing pulmonary arterial pressure :-***
  - **Pulmonary vasodilators :-**
    - ✓ Calcium tumor blockers .
    - ✓ Prostacycline → powerful VD , short half-life ***(continuous infusion in acute cor pulmonale)***
  - **Nitric oxide :-** currently inhaled nitric oxide is used in ARDS .
  - **Other measures :-** carbonic anhydrate inhibitors
    - ✓ It is used to correct the alkalaemia induced by excessive diuresis .
    - ✓ *Side effects :-* metabolic alkalosis .
- ***Diuretics .***
- ***Phlebotomy :-*** standard treatment for the polycythemia if HCV > 55 to 60 % .
- ***Anti-coagulants (Warfarin is the drug of choice) :-*** used in ;
  - Management of primary pulmonary hypertension .
  - Low COP to ↓ incidence of venous thrombosis caused by venous stasis .
- ***Lung transplantation :-*** in case of primary pulmonary hypertension .

PERICARDIUM

Acute Dry Pericarditis

☆ ***Aetiology :-*** (PIRD)

- ☞ 3 P :- Post traumatic , Post-cardiotomy & Post-commisurotomy .
- ☞ 6 I :- Idiopathic , Infection (viral → Coxaki , bacterial → TB) , Infiltration , Irradiation , Infraction (transmural , Dressler's syndrome) & Iatrogenic .
- ☞ 3 R :- Rheumatic fever , Rheumatoid arthritis & Renal failure (Painless & terminal) .
- ☞ CD :- Collagen diseases (SLE) & Drugs (Procainomid , Menoxidile , INH , ...) .

☆ ***Pathology :-***

- ☞ Fine fibrinous adhesion [ ] 2 layers of pericardium → rub lay frication with lung motility .

☆ ***Clinical Presentation :-***

A) Symptoms :-

- ✯ General constitutional symptoms :- fever , ...
- ✯ Chest pain :- Retrosternal , radiate to shoulder & neck , Stitching , ↓ by sitting & leaning forward , ↑ with movement , lying down & respiration because pericardium is attached to central tendon of diaphragm .

B) Signs :-

- ✯ General :- fever .
- ✯ Local Cardiac signs :-
  - ✓ Pain :- ↑ by pressure with stethoscope (lower part of external surface of parietal pericardium is the only pain sensitive part of it) .
  - ✓ Pericardial rub :- to and fro (pathgnomonic) , lathery sound , no fixed relation to HS , ↑ by pressure with stethoscope & not disappear with holding respiration (DD from pleural rub which disappear) .

☆ ***Investigation :-***

- ☞ ↑ ESR .
- ☞ Leucocytosis .
- ☞ ECG :- universal (in all leads) elevated concave ST segment upwards & inverted T-wave .

☆ ***Treatment :-***

- ☞ Analgesic .
- ☞ Antibiotic .
- ☞ Treatment of cause .
- ☞ Follow up :- for fear pericardial effusion .

Pericardial Effusion

☆ Aetiology :-

A) On top of pericarditis :- The effusion may be ;

- ☞ Exudate :- the same causes of dry pericarditis .
- ☞ Purulent :- pyogenic organisms .
- ☞ Haemorrhagic :- TB , malignancy & infraction .

B) Effusion without pericarditis :- It maybe ;

- ☞ Transudate :- due to generalized oedema with ;
  - ◆ High venous pressure in systemic congestion .
  - ◆ Hypoproteinaemia (NS or liver cirrhoses) .
  - ◆ Myxedema .
- ☞ Exudate :- which is either ;
  - ◆ Heamo-pericardium :- due to rupture of aorta , heart or coronary .
  - ◆ Chylous effusion (lymph) :-
    - ✓ Due to thoracic duct obstruction or injury .
    - ✓ *Characters :-*
      - ⇨ Milky white in colour .
      - ⇨ Rich in fat so cleared by addition of ether .
      - ⇨ Stained orange by sudden III .

☆ Haemodynamics :-

- ☞ In diastole :-
  - ◆ It interferes with diastolic expansion , specially if rate of accumulation is rapid → systemic congestion & some pulmonary congestion due to obstruction of pulmonary veins → Low COP.
  - ◆ It affects Rt > Lt side due to high pressure on Lt side .
  - ◆ It affects veins > arteries due to thick wall of arteries .

☆ Clinical Presentation :-

Symptoms

1- Systemic congestion symptoms (mention) .

2- Dyspnea :- due to lung congestion & mechanical pressure .

3- Low COP symptoms .

4- Pressure symptoms .

5- Pain (sense of heaviness) :-

- Due to stretch of infero-lateral parts of parietal pericardium & referred to shoulder by phrenic nerve .
- It is due to separation of the 2 layers of pericardium .

Signs

A) General signs :-

☆ Decubitus :- Prayer sign → lean forwards .

☆ Low COP signs :- mention .

☆ Systemic congestion signs :- e.g.

- Congested neck veins :- early (pulsating) , late (non pulsating) .
- Kaussmaul's sign :- Inspiratory filling of neck veins .
- Fredrich's sign :- Rapid deep Y-wave of neck veins .

☆ Pulse :- pulsus paradoxicus .

☆ Ewart sign :- dullness or bronchial breathing on left lung base due to collapse of left lobe of lung by pericardial effusion .

B) Local cardiac signs :-

☆ Invisible , impalpable apex .

☆ Dullness outside apex .

☆ Dullness over effusion .

☆ Dullness in 2nd left space .

☆ Shifting dullness :- done over the heard during & before inspiration .

☆ Wide bare area .

☆ Distant weak heart sounds .

☆ Complications :-

1- Constrictive pericarditis .

2- Acute cardiac tamponade :- due to rapid rate of accumulation (discussed later) .

☆ Investigations :-

1- X-ray :-

- Enlarged cardiac shadow .
- Change of cardiac size from day to night .
- Flask shaped (obtuse) or onion shaped (acute) heart .
- Change shape from position to other .
- Short broad supra-cardiac shadow .
- Obtuse cardiophernic angle → Rotché sign .
- Double contour :- heart & effusion .
- Stenciled border :- no separation [ ] chambers & borders .

2- ECG :-

- Low voltage (amplitude) .
- Changes in ST segment & T-wave ⇨ Electerical alternance .

3- ECHO :- Free space [ ] myocardium & pericardium (effusion) , because ECHO is reflexed on tissues , except in fluid → passes through it .

4- Cardiac Catheterization :-

- Early high pressure in right side (& even in Lt side) .
- Pressure of space outside tip of catheter .

5- Angiography :- There is shadow outside opacified heart due to dye .

6- Aspiration :- from bare area & out side apex , left sub-scapsular area (with +ve Ewart sign) & left side of subcostal angle .

7- Fluoroscopy (screen) :- [Continuous X-ray]

- Wide shallow without or with ↓ pulsations of shadow border ; Normally pulsations of heart appear in fluoroscopy .

☆ Differential Diagnosis :-

1- Constrictive Pericarditis .

2- Other causes of Low COP .

3- DD of aetiology .

4- Other causes of systemic congestion :- e.g. Cardiomegally (due to HF) ;

Parameter	Pericardial effusion	Cardiomegally
☞ Apex	✓ In-palpable , invisible	✓ Palpable , visible
☞ Percussion	✓ Dullness outside apex & Shifting dullness	✓ Not
☞ Auscultation	✓ Weak , distant HS	✓ Gallop
☞ Investigations :-		
◆ ECG :-	✓ as before .	✓ high voltage .
◆ X-ray :-	✓ as before	✓ Not
◆ ECHO :-	✓ as before .	✓ Not
◆ Catheterization :-	✓ as before .	✓ Not
◆ Fluroscopy :-	✓ as before	✓ Not

5- From T.B. & Rheumatic fever :-

Parameter	TB pericarditis	Rheumatic pericarditis
☆ Onset :-	◆ Gradual → chronic	◆ Acute .
☆ Toxaemia :-	◆ Moderate .	◆ Marked .
☆ Degree :-	◆ Marked effusion .	◆ Moderate effusion
☆ Valvular lesion :-	◆ No	◆ +ve .
☆ Other C/P :-	◆ Other TB manifestations .	◆ other rheumatic or valvular C/P .
☆ Fate :-	◆ Constrictive Pericarditis	◆ Not .
☆ Treatment :-	◆ Anti TB , steroid (if affect serous membrane) .	◆ Salicylate , Steroid but not anti TB .
☆ Tuberculin :-	◆ +ve .	◆ -ve

☆ Treatment of pericardial effusion :-

1- Treatment of cause .

2- Aspiration :-

✍ *Types :-* It is either ;

- Diagnostic :- show for criteria of each type .
- Therapeutic :- to relieve tamponade .

✍ *It has the following conditions :-*

- It is done under screen to avid touching myocardium → AF & to avoid entrance of lung air to pericardium → hydro-pneumo-pericardium .
- It is done at sites :- previously mentioned .

3- If recurrent :- we do Pleuro-pericardial window ;

✍ Fluid is drained in Mediastinum or pleura so ; fluid spread over large surface area → absorbed by lymphatics .

CARDIAC TAMPONADE

➲ Definition :-

- Rapid (acute) accumulation of 300 c.c. fluid in pericardium .
- Accumulation of 1 L in any duration (Sub-acute) .

➲ Causes :-

- Trauma → Cardiac perforation .
- T.B.
- All acute causes of pericardial effusion .

➲ Types :-

A) Acute :- It is diagnosed by [Boeck's triade] ; which is composed of ;

- Rising venous pressure → congested neck veins .
- Falling arterial blood pressure .
- Small quiet heart → No auscultated heart sound .

B) Sub-Acute :- Pericardial Effusion .

➲ C/P , Investigations & D.D. :- as Pericardial effusion .

➲ Treatment :-

- Treatment of HF .
- Aspiration :- Explain .

Constrictive Pericarditis

[Pick's Disease]

☆ ***Aetiology :-*** Idiopathic , Infection (TB) & ?On top of Pericardial Effusion .

☆ ***Pathology & Clinical presentation :-***

A) Symptoms :-

- Fibrosis [ ] layers of pericardium → pressure on right & left sides → interfere with diastolic expansion → systemic congestion & Low COP , **BUT** ; heart is not enlarged so , no pressure symptoms are seen & patient can lie flat .
- Lung oligaemia → lung congestion → dyspnea which ↓ by conversion of pericardial effusion to constrictive pericarditis by compression on pulmonary artery .

B) Signs :- (4 No , sign , sound)

- No dullness out side apex & No shifting dullness .
- No Ewart sign & No prayer decubitus .
- Freidrich's sign :- more apparent .
- Pericardial chock :-
  - ✓ It is Diastolic sound , heard at the same site of S_3 .
  - ✓ Cause :- Due to sudden arrest of ventricular expansion during diastole as there is NO space for this expansion → turbulence of blood & production of sound .

C) Complications :- AF due to MS , ASD & Constrictive Pericarditis .

☆ ***Investigation :-***

1- X-ray :- Globular heart , 50% show calcifications .

2- ECG :- changes in ST segment & T-wave .

3- ECHO :- No free space .

4- Angiography :- no space outside opacified heart .

5- Catheterization :- high equal pressure in all champers , i.e. , end diastolic pressure is equal in all chambers (pathognomonic) .

☆ *Treatment :-*

A) Pericardiectomy :-

- Avoid myocardial injury to guard against arrhythmia & AF
- Begin with left side first , because if started by right side → ↑ blood flow to lung then to the obstructed left side → lung oedema .

B) Anti-TB drugs :-

- Because it is the most common cause .
- Taken for 6 m before operation & 1 year after it .

Adhesive Pericarditis

There is Fibrous tissue between heart & surrounding structures as ;

- Sternum .
- Oesophagus .
- Mediastinum .

Findings in Adhesive Pericarditis :-

- Fixed , shifted Cardiac apex .
- Broad Bent sign :- Retracting of lower end of sternum & intercostal space with each systole
- Kinking of barium filled esophagus .

Cardiomyopathy

☆ ***Definition :-*** It is a disease of cardiac muscles in absence of known primary cardiac aetiology (the cause may be systemic)

☆ ***Causes :-***

A) Primary :- Post partum (purpeurial) ⇨ No cause .

B) Secondary (systemic Aetiology) :- (ETMCNI)

1- Endocrinal :- hypothyroidism , Acromegally & Addison's disease .

2- Toxic :- alcohol & Emitine .

3- Metabolic :- DM , amyloidosis & Glycogen storage diseases .

4- Collage disease :- Vasculitis .

5- Neurological :- Freidrich ataxia , Myotonia atrophica & Duchenne myopathy . (do ECG) .

6- Infection .

☆ ***Clinical Presentation :-*** (Clinical types)

1- Dilated (Congestive) cardiomyopathy :- It occurs in the following conditions ,

- Congestive heart failure (RSHF or RSHF on top of LSHF) .
- Dilated left & right ventricle with MR , TR .
- Thrombo-embolism (common) .
- Arrhythmia .

2- Obstructive Cardiomyopathy :- in case of IHSS & Fredrich's ataxia .

3- Restrictive cardiomyopathy :-

- It is due to infiltration of heart as in amyloidosis .
- C / P :- constrictive pericarditis (if right side) or HF (if left side) .
- It is liable to thrombo-embolism .

☆ ***Investigations :-*** X-ray , ECG , ECHO (all as HF) & Biopsy → infiltrated myocardium .

☆ ***Differential diagnosis :-*** from Rh.HD , CHD , HTN , Coronary HD & cor-pulmonale .

☆ ***Treatment :-*** Definitive treatment is Cardiac transplantation ; but ;

- In dilated type :- Treatment of HF & arrhythmia , give Anti-coagulants .
- In obstructive type :- β-blockers & CCB .
- In restrictive type :- No treatment (for fibrotic endocardium) → exercise & treatment of HF & Thrombo-embolism .

Aortic Aneurysm

☆ *Aetiology :-* Congenital , Traumatic , Inflammatory (syphilitic & mycotic) & atherosclerosis .

☆ *Site :-* Ascending aorta (most) , Aortic arch (less) & Descending aorta (rare) .

☆ *Clinical presentation :-*

A) Aneurysm of ascending aorta :- (many signs & minimal symptoms)

☞ *Inspection & palpation :-*

- Systolic expansile pulsation over A_1 , 1st ICS & supra-sternal notch .
- Palpable S_2 & systolic thrill over aortic area .
- Apex normal or displaced down & out due to associated AR → LVH & LV is pushed down by aneurysm .

☞ *Percussion :-* dullness over aortic area .

☞ *Auscultation :-* (over aortic area)

- Loud rising S_2 .
- Ejection systolic murmur (relative AS) .
- Early diastolic murmur (AR) .

☞ *Large aneurysm :-* gives the picture of mediastinal syndrome (write in brief) .

B) Aneurysm of arch of aorta :- (many symptoms & minimal signs) .

☞ *Pressure on surrounding :-* clinical picture of mediastinal syndrome .

☞ *Supra-sternal pulsation .*

☞ *Rupture of aneurysm :-* either in ;

- In trachea → fatal haemoptysis .
- In oesophagus → fatal heamatesis .
- In pericardium → fatal heamopericardium .
- In outside → fatal external haemorrhage .
- In pleura or Mediastinum → rare .

☞ *Tracheal Tug :-* upward suspension of larynx show → conducted pulsation from aneurysm .

☆ Complications :-

- ☞ Rupture .
- ☞ Thrombus formation .
- ☞ Pressure on surrounding → mediastinal syndrome .
- ☞ Dissection → Dissecting aortic aneurysm .

☆ Investigation :-

- ☞ Plain X-ray (screen) :-
- ☞ Fusiform or saccular aneurysm with marked pulsation .
- ☞ Irregular calcification in its wall .
- ☞ Aortography .
- ☞ Wasserman's test :- for syphilis .
- ☞ CT .
- ☞ ECHO .

☆ Treatment :-

- ☞ Medical :- Bed rest , antibiotics (if the cause is infection) .
- ☞ Surgical :-
  - Excision & graft .
  - In dissecting aneurysm → use composite graft
  - In case of AR → use graft contain aortic valve .

N.B. :- Chest pain in aortic aneurysm is of 2 types :-

- ➲ ***Aoralgia :- Retrosternal sawing pain due to stretch of surrounding sympathetic Fibers around aorta .***
- ➲ ***Neuralgia :- brachial or intercostal pain due to compression on roots of spinal nerves .***

Dissecting Aortic Aneurysm

☆ Clinical presentation :-

- ☞ As Aortic aneurysm .
- ☞ It gives clinical picture similar to that of Acute MI but with the following differences ;

Parameter	*Dissecting Aortic aneurysm*	*Acute MI*
◆ ***Chest pain :-***	✓ start acute .	✓ Start acute .
◆ ***Character of pain :-***	✓ Tearing pain . ✓ Maximum from the start .	✓ Compressing . ✓ Building up pain
◆ ***History of :-***	✓ Atherosclerosis . ✓ Sever HTN . ✓ Marfan's syndrome .	✓ Anginal attack .
◆ ***X-ray :-***	✓ Widening of aortic lumen . ✓ Ca sign :- > 1cm thick aortic wall .	✓ Not effective .
◆ ***ECG :-***	✓ Free , except LVH .	✓ Infarction changes .
◆ ***Cardiac enzymes :-***	✓ Insignificant .	✓ High enzymes .
◆ ***ECHO :-***	✓ Diagnostic .	✓ Diagnostic .

Syncope

☆ ***Definition :-*** Sudden transient loss of consciousness due to sudden transient generalized brain ischemia .

☆ ***Aetiology :-*** (H , 2C , 2V)

A) Hypoxia :- ↓ O_2 supply to brain

- Hypoxic cor-pulmonale .
- Sever anaemia .
- Congenital Cyanotic HD ⇨ Tetralogy of Fallot (F_4) .

B) Cardiac :-

- ↓ Filling :- sever tachycardia & cardiac tamponade .
- ↓ Pumping :- acute HF , sever bradycardia & cardiac arrest .
- Obstruction :- stenotic valve .
- Cyanotic spills :⇨ central cyanosis .
- Adam's stoke attack .

C) Cerebral :-

- Hypertensive encephalopathy .
- Hyperventilation → CO_2 wash → respiratory alkalosis & cerebral VC .
- Thrombosis & embolism .

D) Vasomotor :- [orthostatic , postural hypotension]

- During transmission from supine to upright position , pressure ↓ > 30 mmHg as in ;
  - ✓ Brain stem or spinal cord lesion (factors control diameter of b.v. → VMC) .
  - ✓ Hypovolaemia → Addison's disease .
  - ✓ Neuritis (DM , alcohol) & lumbar sympathectomy .
  - ✓ Ganglion blockers .
  - ✓ Huge varicose veins .
  - ✓ Flabby muscles in prolonged recumbency .
  - ✓ α-Blockers .
- In all these conditions , there is failure of normal VC of LL vessels to shift blood to brain during change of position from spine to upright position .

E) Vasovagal :-

- **In females :-**
  - ✓ Sudden pain , bad news or sights due to reflex vagal stimulation .
  - ✓ Diagnosis :- Bradycardia .
  - ✓ Treatment :- SC Atropine .
- **In males :-**
  - ✓ Sensitive carotid sinus syndrome as in shaving & tight tie
  - ✓ Trauma to sensitive area (trigger zone) .

☆ *Causes of exertional syncope :-*

- AS → Commonest .
- MS .
- Infective endocarditis .
- Obstruction of outflow of LV → hypertrophic obstructive cardiomyopathy .
- Sever pulmonary HTN :- due to bilharzial cor-pulmonale .

☆ *Treatment :-*

A) Emergency treatment :-

- Place patient with face up on bed or floor .
- Lift the LL .
- Loosen clothes .
- Drash water on face .
- Check pulse & blood pressure :- Tachycardia → Shock or bradycardia → vasovagal attack .
- Cardio-pulmonary resuscitation .
- If there is cardiac arrest → treatment of cardiac arrest .

B) Treatment of the cause :-

- Vaso-vagal :- Atropine .
- Hysterical :- sedation or irritation (saline or alcohol SC) .

N.B. :-

➲ *If u found a person in unconscious state , test pulse (brady or tachy ?) .*

➲ *Adam's stoke attack :-*

✓ *C / P :- No pulse , no blood pressure , syncope , cyanosis ± convulsions .*

✓ *Time :-*

- *Arrest during conversion from idio-ventricular focus to another one .*
- *Transmission from 2nd to 3rd degree heart block .*

✓ *Treatment :- I.V. ephedrine (keep V.rate at 35-40) , No lactate , Mixture (glucose + Insulin + K) , Temporary pace maker & Perminant pacemaker if all methods fail .*

GOOD LUCK

The KING of Medicine