

Pulmonary heart disease

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(I) Pulmonary Hypertension

= mean pulmonary arterial pressure > 25 mmHg at rest or 30 mmHg with exercise

= abnormal cellular proliferation (eg. smooth muscle hypertrophy, fibrosis, neovascularization), thrombosis and imbalance between vasoconstriction (angiotensin II, leukotrienes, serotonin, thromboxane etc) and vasodilation (bradykinin, endothelin, nitric oxide, prostaglandins etc) \rightarrow increased pulmonary vascular resistance \rightarrow right heart failure \rightarrow decreased cardiac output

Causes and classification of pulmonary hypertension

1. **Pulmonary arterial hypertension:-**

idiopathic

familial

associated with : collagen vascular ds, liver ds, portal hypertension,
drug and toxin, thyroid ds, hemoglobinopathies

associated with : pulmonary venous or capillary ds

2. **Pulmonary hypertension with left-sided heart disease:-**

left-sided atrial or ventricular heart ds

left-sided valvular heart ds

3. **Pulmonary hypertension associated with lung disease or hypoxemia:-**

COPD, interstitial lung ds, sleep apnea, high altitude,
developmental abnormalities

4. **Pulmonary hypertension due to chronic thrombotic and/or embolic disease:-**

thromboembolic obstruction of pulmonary arteries

nonthrombotic pulmonary embolism (tumor, parasites, foreign
materials)

5. **Miscellaneous** (eg. sarcoidosis, compression of pulmonary vessels)

Symptoms = dyspnea (most common),
fatigue, chest pain, syncope, pedal
edema, palpitation, cough,
hemoptysis, hoarseness, Raynaud
phenomenon, cyanosis, sudden death

Diagnosis = increased brain natriuretic peptide
chest CT or MRI = enlargement
of main pulmonary artery,
right ventricular hypertrophy,
decreased caliber of
peripheral pulmonary vessels
echocardiography
cardiac catheterization

■ **Severity of pulmonary hypertension:-**

NYHA classification

hemodynamic values in cardiac catheterization

■ **Treatment of pulmonary hypertension:-**

life style changes

oxygen

diuretic, calcium blockers, inhaled or parental
prostanoids, anticoagulation, digoxin,
endothelin antagonist, phosphodiesterase
inhibitor (eg viagra)

surgery (heart-lung and lung transplantation,
pulmonary thromboendarterectomy, atrial
septostomy)

- **Liver disease** may develop pleural effusions (hepatic hydrothorax), pulmonary vascular dilation with hypoxemia (hepatopulmonary syndrome), pulmonary hypertension (from high cardiac output, or from increased pulmonary vascular resistance = portopulmonary hypertension)

(II) Pulmonary embolism

- **Most pulmonary embolism result from thrombi originated in pelvic or deep veins of leg (=deep venous thrombosis DVT) embolize to pulmonary arteries.**
- ***Risk factors of deep venous thrombosis and pulmonary embolism :-***
 - elderly, obesity, smoking, cancer, surgery/immobilization/trauma/bed ridden, heart disease (eg. heart failure), stroke, COPD, pregnancy, oral contraceptives, hypercoagulable syndrome eg. Sickle cell ds, protein C, S deficiency, hyperhomocystenemia, polycythemia, thrombophilia, thrombophlebitis, prior pulmonary embolism, central venous instrumentation, postpartum, sepsis etc.**

- massive pulmonary embolism → increase right ventricular wall tension → decrease right coronary flow and increase right ventricular myocardial oxygen demand → myocardial ischemia, cardiogenic shock, death.
- massive pulmonary embolism → risk of cardiogenic shock
moderate to large pulmonary embolism → right ventricular hypokinesis but normal blood pressure
small to moderate pulmonary embolism → normal blood pressure and right ventricular function
- pulmonary infarction → unremitting chest pain, hemoptysis
paradoxical embolism → stroke

Diagnosis of deep venous thrombosis

- symptoms eg. edema, erythema, calf tenderness, palpable cords, calf asymmetry, Homan's sign = pain associated with active and/or passive dorsiflexion of foot.
- plasma markers eg. D-dimer, P-selectin , microparticles
- compression ultrasound of lower limbs
- contrast venography
- impedance plethysmography
- spiral CT or MRI angiography

Diagnosis of pulmonary embolism

- Usually nonspecific. So suspicious particularly in patients with risk factors
- Symptoms eg. dyspnea, tachypnea (most common), pleuritic pain or hemoptysis, circulatory collapse, cyanosis, diaphoresis, cough, palpitation, DVT symptoms (calf or thigh pain and swelling), low grade fever
- Electrocardiogram = S1Q3T3, S1S2S3, right axis deviation, RBBB, right atrial enlargement, right ventricular hypertrophy
- Chest X-ray = oligemia, pleonemia of the obstructed lung, dilated hilar arteries, elevated hemidiaphragm, dilated pulmonary artery trunk, pleural effusion, atelectasis, infiltrate

- **Arterial blood gas = low PO₂**
low alveolar-arterial oxygen difference (≤ 20 mmHg)
 $= 150 - 1.25 (PCO_2) - PO_2$
- **Echocardiogram = 1. visualization of emboli in right atrium or ventricle, or pulmonary artery;**
2. right ventricular enlargement or dysfunction
- **Ventilation-perfusion lung scan=large, wedge-shaped, pleural-based perfusion defects in areas that ventilate normally and are radiographically clear**
- **SPECT perfusion lung scan**
- **Spiral chest CT or MRI angiography**
- **Pulmonary angiography = definitive diagnosis for pulmonary embolism**

Prevention and treatment of deep venous thrombosis and pulmonary embolism

- Intermittent pneumatic compression
- Graded compression elastic stockings
- Aspirin, heparin, warfarin
- Thrombolytic agents (tPA 100 mg intravenously for 2 hours) after spiral CT (confirmation of pulmonary embolism) in hemodynamically unstable patients (if no contraindication)
- In massive ileofemoral deep venous thrombosis at risk of limb gangrene, catheter-directed thrombolytic agent administered directly into the thrombus

- **Inferior vena cava filter indication:-**
 1. anticoagulants contraindicated
 2. pulmonary embolism (not DVT) recurrence in spite of adequate anticoagulants
 3. severe pulmonary embolism that any recurrence may be fatal
- **Catheter-tip embolectomy for acute massive pulmonary embolism**
- **Surgical pulmonary embolectomy for massive pulmonary embolism, hemodynamically unstable patients despite heparin and resuscitative efforts, failure or contraindication of thrombolytic therapy**
- **Pulmonary thromboendarterectomy for patients with chronic thromboembolic pulmonary hypertension (due to incomplete resolution of pulmonary embolism → pulmonary hypertension → right heart failure → death)**

(III) Cor pulmonale

= right ventricular hypertrophy and dilatation secondary to pulmonary hypertension caused by lung parenchymal disease (eg. COPD, interstitial lung disease as pulmonary fibrosis, high altitude, sleep apnea, chest wall deformity etc.) and/or pulmonary vasculature (eg. pulmonary thromboembolism, pulmonary veno-occlusive disease, pulmonary vascular tumors and malformations, pulmonary vasculitis etc) , unrelated to left heart.