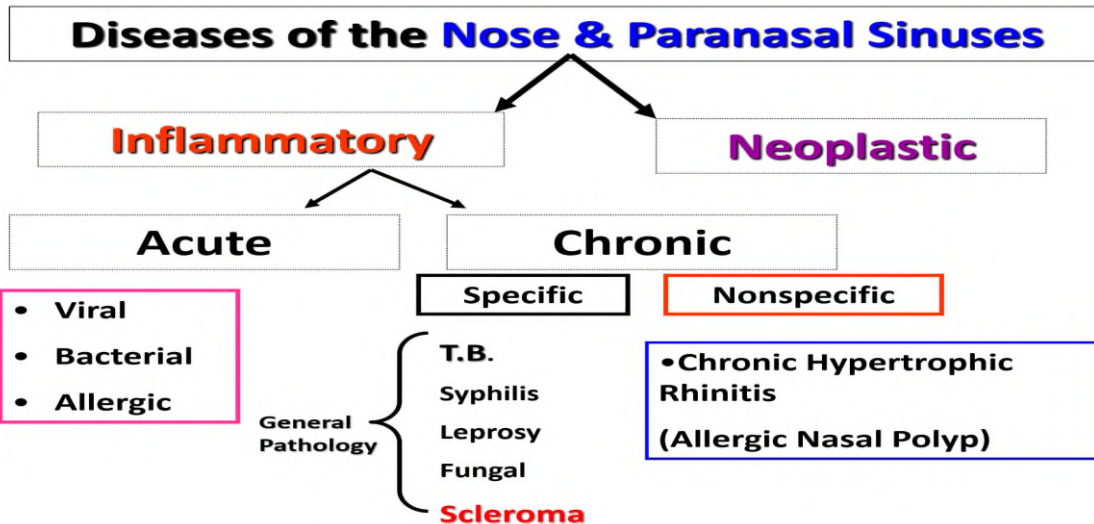


Dr. Hegazy Pathology

Respiratory
Module





DISEASES OF THE NOSE

Rhinitis

inflammation of the mucous membrane of the nose

Acute Rhinitis (Common Cold)

Sinusitis & Pharyngitis

Cause: viral (Rhinovirus) Usually mild and self limiting

Gross:

- The mucosa is edematous red & congested

Microscopically:

- Dense infiltration with **neutrophils, lymphocytes, plasma cells**
- Edematous stroma & Congested dilated blood vessels

Allergic Rhinitis

Type I hypersensitivity (Mast cell activation by IgE)

Chronic non specific rhinitis

Chronic hypertrophic rhinitis:

Repeated attacks of allergic inflammation ⇒ nasal mucosa **hypertrophied, thickened, & polypoid.**
(allergic polyp)

Nasal Polyp

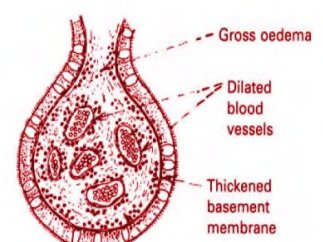
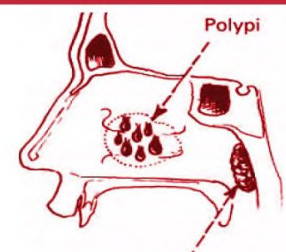
- **inflammatory not neoplastic.**

Gross

soft polypoid masses extending laterally from mucosa.

Microscopic

- **core:** loose C.T. with mucus glands & infiltrated with lymphocytes, plasma cells, macrophages, PNL, mast cells & **eosinophils.**
- **Covering:** **respiratory epithelium with hyperplasia, ulceration or squamous metaplasia.**



Chronic specific rhinitis (granulomas)

1. Syphilitic rhinitis:

- **Congenital syphilis:** gumma $\Rightarrow$ saddle nose.
- **Acquired syphilis:**

2. Tuberculous rhinitis: rare , complication of pulmonary tuberculosis.

3. Leprosy of the nose: $\Rightarrow$ ulceration and perforation of the nasal septum.

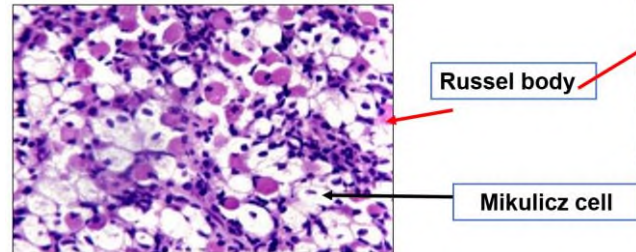
4. Rhinoscleroma.

Cause : bacteria (Klebsiella)

Obstructing nasal mass $\rightarrow$ infiltrated by histiocytes, lymphocytes, plasma cells

Contain **Mikulicz cells & Russel bodies**

Covering epithelium $\rightarrow$ **squamous metaplasia**



Acute tonsillitis

Organism **streptococcus haemolyticus** commonest

fever, tachycardia, leucocytosis, & enlarged cervical lymph nodes.

❖ Acute tonsillitis may be:

A- Acute follicular tonsillitis

- suppurative inflammation confined to **lymph follicles**
- **Pus accumulates in the crypts & appears on the surface as yellowish dots.**

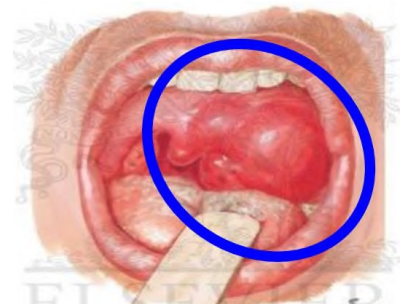


B- Acute parenchymatous tonsillitis:

suppurative inflammation in the tonsils & surrounding tissue.

C- Peritonsillar abscess (Quinzy):

- Rare, usually unilateral:
- **Abscess forms in the peritonsillar tissue & tonsil.**
- **Trismus (lock jaw).**
- Deviation of uvula to other side.
- Dysphagia.



Complications of acute tonsillitis

1. Spread, blood spread (toxemia septicemia pyemia)
2. Chronic tonsillitis
3. **Rheumatic fever, or diffuse glomerulonephritis may follow after two weeks.**

Chronic tonsillitis

may be:

1. **Chronic non specific tonsillitis:** due to repeated attacks of acute suppurative tonsillitis.
2. **Tuberculosis of the tonsils:** occurs rarely $\Rightarrow$ 1ry or 2ry T.B.

DIPHTHERIA

- infectious fever, affecting mainly children,
- **Causative organism:** exotoxigenic corynebacterium diphtheriae.
- **Mode of infection:** through the oral cavity.
- **Incubation period:** 1-7 days.

Pathological features

➔ usually in the URT. (rarely in the upper GIT)

1. First ⇒ Edema & hyperaemia of mucosa
2. formation of toxins causes : Epithelial necrosis + outpouring of large amount of fibrino-suppurative exudate.
3. exudate mixed + necrotic mucosa ⇒ **tough, dirty, grey superficial pseudomembrane.**

Complications

1. **Laryngeal obstruction** ⇒ **Suffocation** d.t. edema of the larynx & peripheral neuritis (paralysis).
2. **Toxemia & its manifestations.** FF + Myocardial necrosis + poly neuritis



Nasopharyngeal Carcinoma

Cause: Epstein Barr virus & genetic susceptibility

Clinically : repeated ear infection. mass in the nasopharyngeal region.

Usually asymptomatic till it gives metastasis to cervical LNs

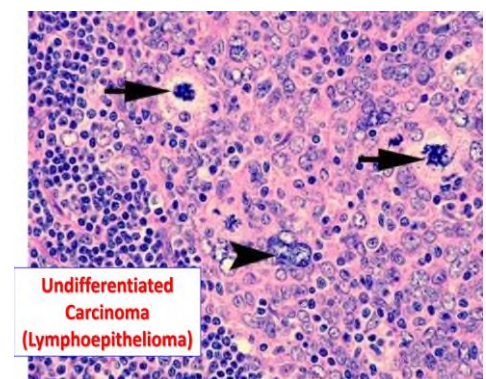
Microscopic:

3 histologic variants:

- (1) Keratinizing squamous cell carcinoma,
- (2) Non-keratinizing squamous cell carcinoma, &
- (3) **Lympho epithelioma:**

Undifferentiated carcinoma:

Sheets of large epithelial cells + dense reactive lymphocytes.
(vesicular nuclei & prominent nucleoli)



DISEASES OF THE LARYNX

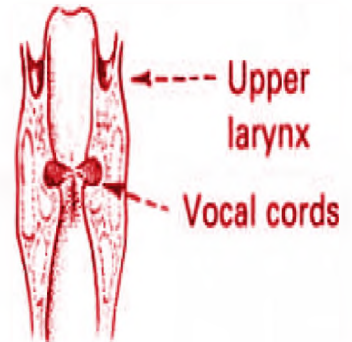
Laryngitis

Acute laryngitis

- bacterial , viral as in common cold,
- Irritation by fumes, or abuse of voice.

Chronic laryngitis

- **specific:** T.B., Syphilis, laryngoscleroma
- **non specific:** smoking, or on top of acute inflammation,



Laryngeal Polyp (Nodule) هامة

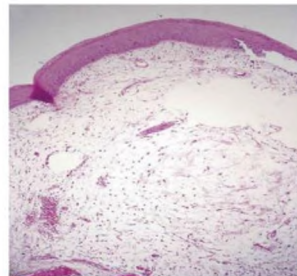
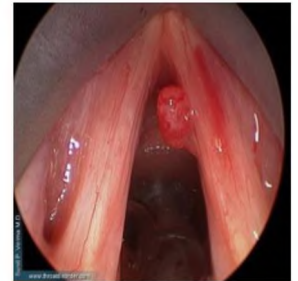
due to **smoking or misuse of voice. (singer's nodule).**
presents by hoarseness of voice.

Gross:

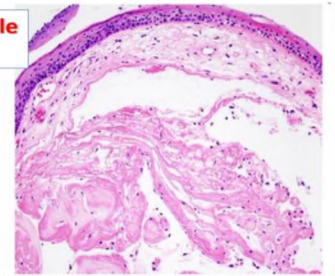
- ✦ Presents on the vocal cord. It can be bilateral.
- ✦ Hemispherical elevation **0.5cm diameter, with intact mucosa**

Microscopic:

- ❖ **Early stage:** Polypoid tissue ⇒ oedematous stroma + proliferated fibroblasts.
- ❖ **Late stage:** hyalinized stroma



Laryngeal Nodule (Polyp)



TUMOURS OF THE LARYNX:

I. Benign tumours

A- Epithelial: Squamous cell papilloma:

- ✦ arises on vocal cords
- ✦ One or multiple, sessile or pedunculated papillomata ⇒ ulceration, haemorrhage or malignant changes.
- ✦ **In children: multiple**, of viral origin & recurs after removal. (d.t. HPV)
on true vocal cord --> extend over false cords, epiglottis , subglottic area
- ✦ **in adults: single & precancerous.**
acanthosis, papillomatosis, mild hyperkeratosis & focal parakeratosis
Doesn't Extend



B- Mesenchymal: Fibroma, hemangioma & chondroma.

II. Malignant tumours: Carcinoma of the larynx *****

- males above age of 50 years
- Precancerous lesions are:
 - ^ Sq. cell papilloma
 - ^ Chronic laryngitis: **smoking, alcohol & asbestos.**
 - ^ **HPV** detected in 15% of tumours

Types of laryngeal carcinoma according to sites

Glottic (Intrinsic) (60-75%)

- Site:** on vocal cords.
- Growth:** Slowly growing
- well or moderately differentiated**
- lymphatics:** few
- Metastasis:** late
- Clinically:** (symptomizes early)
Interferes with vocal cord mobility
- prognosis:** relatively good.

Supra glottic (Extrinsic) (30%-35%)

- Site:** above vocal cords
- Growth:** rapidly growing
- poorly differentiated.**
- lymphatics:** Rich in lymphatics.
- Metastasis:** 1/3 early to cervical L.N.
- Clinically:** (symptomizes late)
- prognosis:** bad. (spread early)

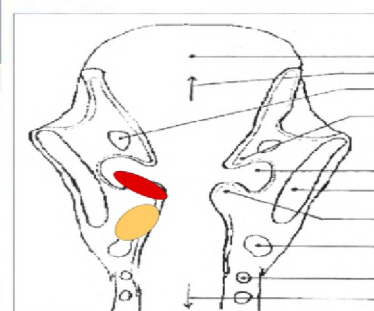
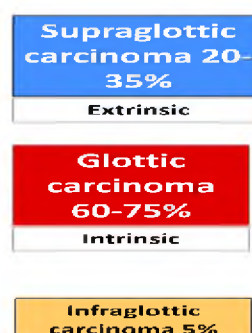
Subglottic (5%)

- below vocal cords.
- remain clinically asymptomatic until it presents as advanced disease

- Gross:** small nodule, then enlarges ⇒ Fungating or ulcerating mass.
- Microscopic:** Squamous cell carcinoma

Complications of cancer larynx

- Hemorrhage, ulceration, infection & obstruction.
- aspiration of infected necrotic tumour tissue ⇒ Lung abscess & bronchopneumonia
- Effects of metastases.
- Cancer cachexia (anaemia & weakness, wasting).



DISEASES OF PLEURA

Inflammatory pleural Effusion

I. Pleurisy

1. Serofibrinous pleurisy	2. Suppurative (empyema) = pus in pleural cavity	3. Haemorrhagic <i>sanguinous inflammatory exudate</i>
Causes - in lung e.g. T.B, pneumonia, lung abscess, bronchiectasis. - Rheumatoid arthritis & systemic lupus erythematosus - Renal failure ⇒ ureamia - Diffuse systemic infections - Irradiation	Causes - suppurative lung diseases (lung abscess, bronchiectasis...) - infection below diaphragm e.g. liver abscesses - Lymphatic & haematogenous spread .	Causes - Haemorrhagic diathesis - tuberculosis - Rickettsial diseases - Neoplastic involvement
Fate resolution or organization (less common)	Fate - Resolution (less common). - Organization ⇒ fibrous adhesions Complications - Toxaemia - Lung collapse - Bronchopleural fistula	fate Resolution or Organization

II. Non inflammatory pleural effusions

1. Hydrothorax: collections of serous fluid within the pleural cavity.

✂ **Causes:** --> causes of Edema

- Cardiac failure.
- Renal failure.
- Cirrhosis of liver.

✂ **Effects:**

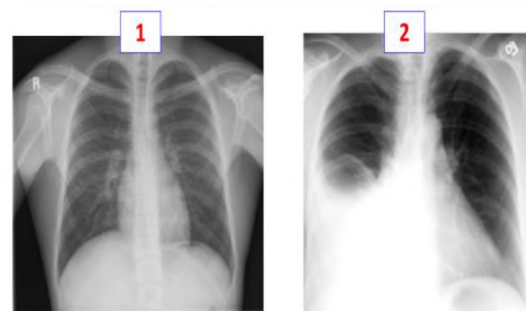
- compression & collapse of the underlying lung tissue.
- If the cause is removed, hydrothorax may be resorbed without permanent alterations.

2. Haemothorax: accumulation of blood into the pleural cavity.

✂ **Causes:** fatal complication of **ruptured aortic aneurysm**.

✂ **Effects:**

- Being fatal a death within minutes or hours, with no response within pleural cavity.
- Rarely, leakage of smaller amounts of blood is not fatal
- Organization and pleural adhesions.



3. Chylothorax: accumulation of milky fluid, of lymphatic origin, in the pleural cavity.

✧ Causes:

1. Malignancy within the thoracic cavity $\Rightarrow$ obstruction of the major lymphatic ducts.
2. right lymphatic or thoracic duct obstruction by metastasis

Pneumothorax

presence of air or gas in the pleural cavity.

✧ Types of pneumothorax:

1. Spontaneous pneumothorax

A. Idiopathic spontaneous pneumothorax

In young, healthy adults due to rupture of subpleural blebs
(paraseptal = distal emphysema)

B. secondary pneumothorax

Lung lesions as TB, lung abscess, carcinoma

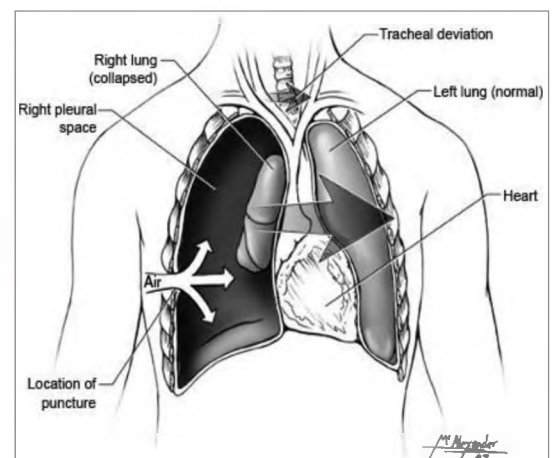
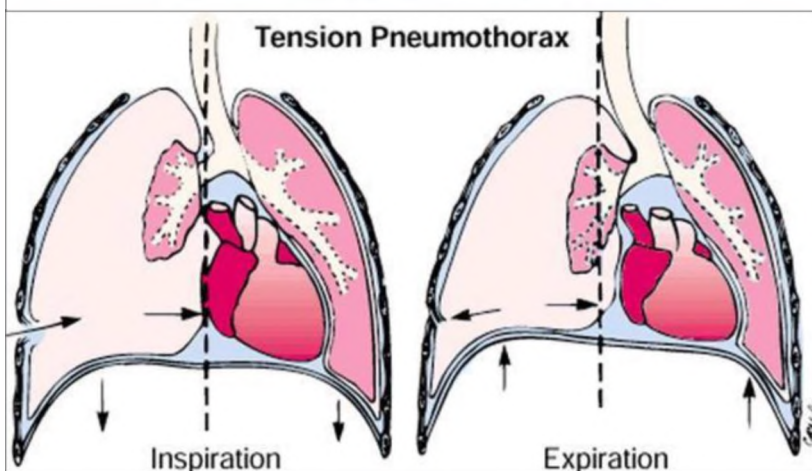
2. Traumatic pneumothorax perforating injuries to the chest wall

NB:

Tension Pneumothorax:

a life-threatening condition, caused by ball & valve leak a progressive accumulation of air

Tension Pneumothorax



Tumors of the Pleura

Malignant mesothelioma

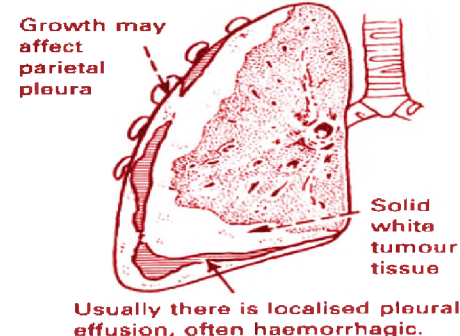
⇒ rare tumors, arises from either the visceral or parietal pleura.

⇒ P.F.: **asbestos** after latent period of 25 - 45 years.

Grossly

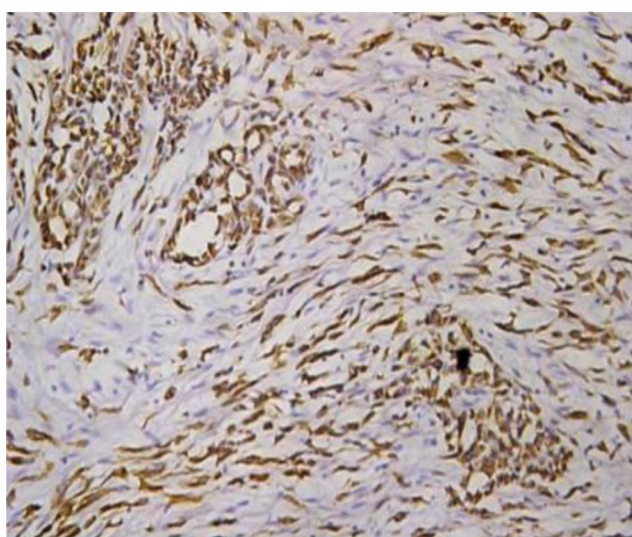
- lung is ensheathed by a thick layer of soft, gelatinous, reddish pink tumor tissue.
- extensive pleural effusion

MALIGNANT MESOTHELIOMA



Microscopically

- Sarcomatoid type (mesenchymal):** Appears as spindle-cell sarcoma or fibrosarcoma.
- Epithelial type (papillary):** Cuboidal or columnar, forming tubular and papillary structures.
- Mixed epithelial & sarcomatous type.**



Mesothelioma: Positive Immunohistochemical Staining Using **Calretinin**

Immunohistochemical Staining

	Mesothelioma	Lung Adenocarc
Calretinin	+	-
CK5/6	+	-
Napsin A	-	+
CEA	-	+
TTF1	-	+

Secondary Tumours of the Pleura

More common

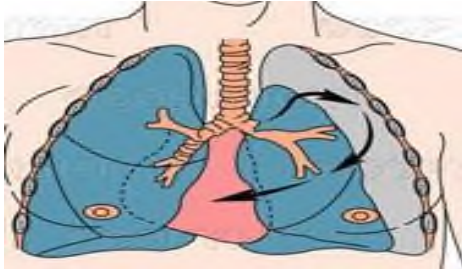
N.B

- Serous or serosanguinous effusions follow metastatic involvement, contain desquamated neoplastic cells.

PULMONARY COLLAPSE (Atelectasis)

1ry → (Neonatal Atelectasis) Neonatal Respiratory Distress Syndrome

2ry → Collapse of previously inflated lung

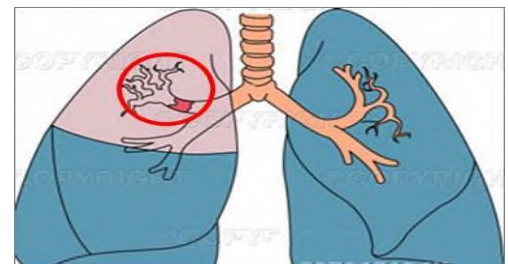
	I. Pressure collapse (compression collapse)	II. Absorption collapse (obstruction)
causes	1. Pleural effusion. 2. Haemothorax. 3. Empyema 4. Pneumothorax. 5. Mediastinal causes e.g. tumour, aneurysm. etc 	1. Acute complete obstruction ▪ Inhaled f. bodies & mucus plug ▪ postoperatively Mucous plug: poor respiratory movement + depression of cough reflex. 2. Chronic bronchial obstruction: ▪ tumours in bronchial wall, or ▪ Pressure on the bronchus from outside e.g. aneurysm, enlarged L.N. & tumour.
Pathogenesis	no obstruction Lung parenchyma by vascular changes & not from infection.	After obstruction, air gradually disappears (absorbed) Bronchial secretions accumulate behind obstruction ⇒ infected with suppuration. NB: In this collapse the lung does not change much in size.
Gross	▪ massive collapse واضح ▪ lung becomes very small ▪ mediastinum ⇒ shift to opposite side ▪ lies posteriorly against the side of vertebral column.	▪ lung volume - not much affected. ▪ affected segment is purple (bluish red) ▪ Mediastinum shifted to the affected side
Fate & Complications	Organization of the exudate on pleural surface ⇒ pleural thickening ⇒ prevents re-expansion of lung.	

III. Contraction collapse (rare)

fibrotic changes in lung or pleura due to organization of infection.

Microscopically

- ✦ The alveolar walls are collapsed (slit-like)
- ✦ Prolonged cases ⇒ proliferation of granular pneumocytes + progressive pulmonary fibrosis ⇒ condition becomes irreversible & prevents re-expansion



Acute Respiratory Distress Syndrome (ARDS)

Hyaline membrane disease or DAD (Diffuse Alveolar Damage)

caused by diffuse capillary & epithelial damage-with rapid onset of

- respiratory insufficiency (Life-threatening)
- Severe arterial hypoxia + Cyanosis

Causes:

Direct Injury

1. Pulmonary Infection

2. Aspiration of Gastric Content
3. Inhalation of Toxins
4. Fat Embolism
5. Near Drowning

Indirect Injury

1. Sepsis

2. Pancreatitis
3. Severe Burn or Trauma
4. Massive Blood Transfusion

Pathogenesis:

Macrophage release **Pro-inflammatory Cytokines (IL8, IL1, TNF) →**

Neutrophils Chemotaxis → Release of Proteolytic Agents

(proteases, oxidants, PAF & leukotrienes)

Alveolar Epithelial & Endothelial Injury

Vascular Permeability

Hyaline Membrane

pneumocyte type II lost

loss of surfactant

pneumocyte type I lost

loss of diffusion capacity

Gross Morphology:

Lungs are dark red, firm, airless and heavy

Microscopic:

Acute phase (early)

❁ Hyaline Membrane

- ↳ The most characteristic finding
- ↳ consists of fibrin rich edema fluid & remnants of necrotic epithelial cells
- ↳ alveoli, alveolar ducts & bronchioles

❁ Necrosis of alveolar epithelial cells

❁ Edema (intra alveolar & interstitial)

❁ Congestion of capillaries+ neutrophils.

❁ Haemorrhage

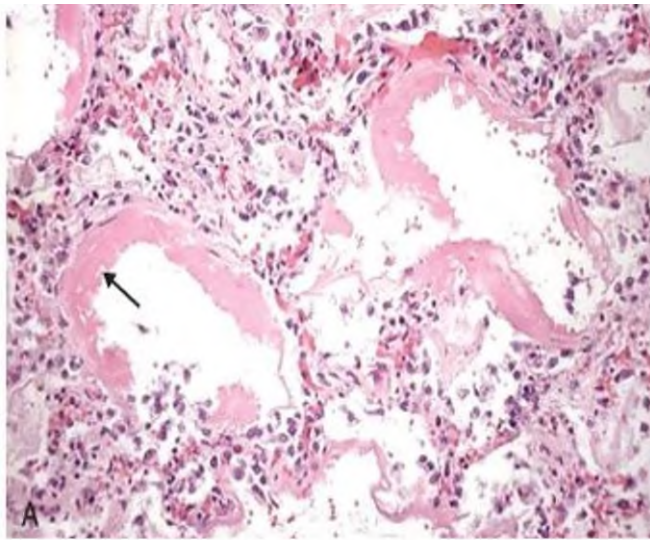
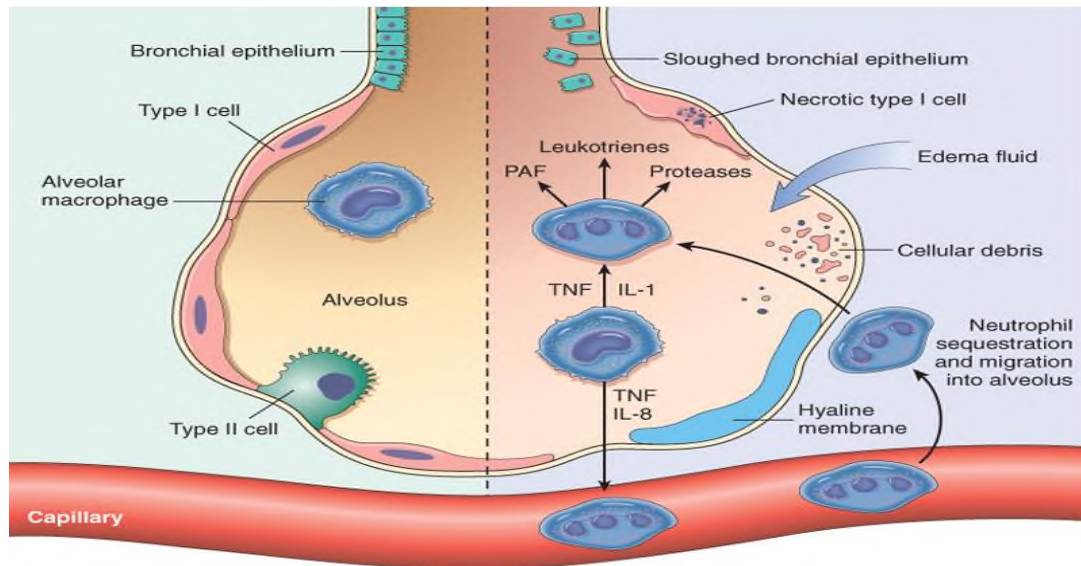
Organisation stage (late)

❁ Pneumocyte type II proliferation

❁ Fibroblast Proliferation

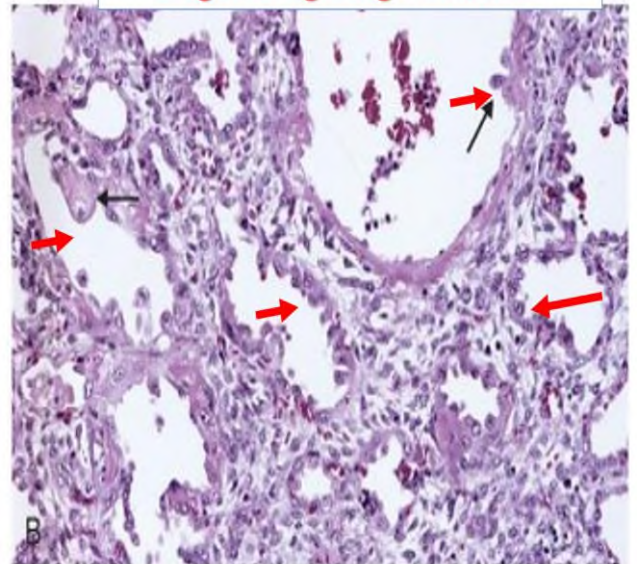
+ Collagen deposition → Intra & inter alveolar fibrosis

❁ Resolution is rare



Some alveoli are lined by pink hyaline membrane & others are collapsed

Organizing Stage of ARDS



Clinical: → bilateral opacities on chest imaging, cyanosis & severe hypoxemia

caused by an imbalance of

Pro-inflammatory Mediators (by Neutrophils): Proteases, Oxidants, PAF, Leukotriene

Anti-Inflammatory Mediators (Protective): Anti-proteases, Anti-oxidants, Anti-inflammatory cytokines

Neonatal Respiratory Distress Syndrome

Deficiency of surfactant in premature lung → alveoli collapse → atelectasis → hypoxia

- 60% of infants born at less than 28 weeks of gestation
- 30% of infants born between 28 to 34 weeks of gestation
- Less than 5% after 34 weeks of gestation

N.B. corticosteroids & labour stress → ↑ surfactant (so NRDS more in **caesarian labour**)
compensatory high level of insulin in infants of **diabetic mothers** → suppress surfactant

⇒ Diffuse pulmonary diseases can be classified into 2 categories:

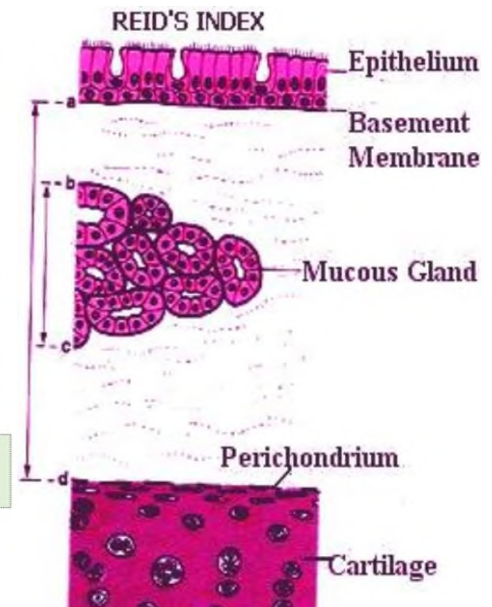
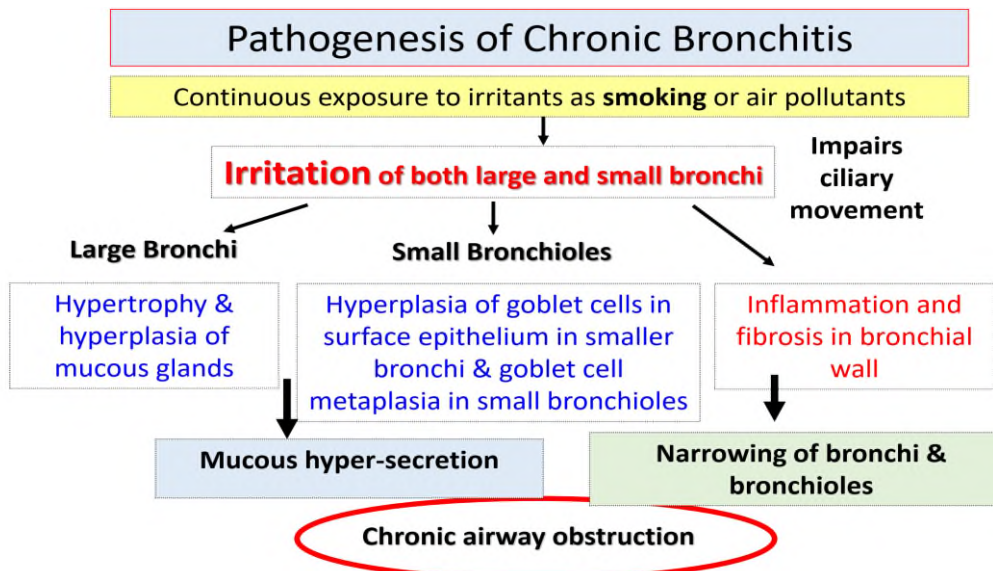
Obstructive Disease	Restrictive Disease
Characterized : ▶ ↑ resistance to air flow ▶ Partial or complete air way obstruction 1. Emphysema (loss of elastic recoil) 2. Chronic bronchitis (both 1&2 are called COPD) 3. Bronchial asthma (airway narrowing) 4. Bronchiectasis 5.	Characterized by: ▶ Reduced Expansion of lung parenchyma 1- Interstitial lung diseases e.g. ✦ Acute Respiratory distress syndrome ✦ Chronic diseases ⇒ pneumoconiosis, sarcoidosis & pulmonary fibrosis. 2- Extrapulmonary disorders e.g. - obesity, poliomyelitis & kyphoscoliosis

Chronic Bronchitis

Clinical definition

Inflammation of the bronchi with

Persistent Productive cough & sputum for at least 3 months in at least 2 consecutive years



Pathological features

Grossly:

- ✦ Hyperaemia & edema of mucous membranes of the lung
- ✦ Mucinous secretions or casts filling airways.

Microscopically:

- ✦ Epithelial changes as hyperplasia & squamous metaplasia
- ✦ Infiltration of bronchial & bronchiolar walls with chronic inflammatory cells → Fibrosis & EAO
- Enlargement of mucous glands layer with increase in **Reid index**

the ratio of thickness of the mucus gland layer to that of the bronchial wall
The Reid index normally < 0.4



Complications:

- Hypercapnia, hypoxemia & cyanosis
- EAO of pulmonary arterioles → pulmonary hypertension → **Core Pulmonale**

Chronic obstructive pulmonary disease (COPD): Include: Emphysema & Chronic Bronchitis.

Due to :

- loss of elastic recoil (in emphysema) a limitation of maximal air flow during forced expiration
- airway narrowing (in asthma & chronic bronchitis) a Expiratory air flow obstruction

Microanatomy of the terminal air passages

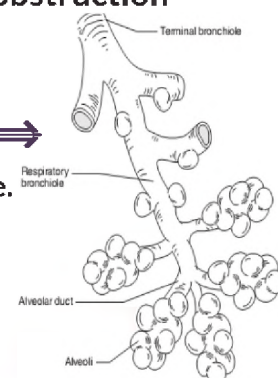
The respiratory acinus

It is the portion of lung tissue formed by the branching of a single terminal bronchiole.

The lung lobule

a hexagonal area of the lung, supplied by 3-5 terminal bronchioles

⇒ radiate from the center



Pulmonary Emphysema

permanent Abnormal dilatation of airspaces distal to terminal bronchioles,
+ destruction of their walls

Incidence of emphysema

- Centrilobular emphysema → most common (95%) & related to heavy smoking.

Types of emphysema

- The clinically significant types are: centrilobular & panacinar.

Centriacinar (centrilobular) emphysema:

- Male smokers. upper lobes.
- Affects, (The respiratory bronchioles) central (proximal) part of the acini
- Distal alveoli are spared.
- Microscopic:**
Dilated air spaces & Chronic bronchitis ⇒ centered around bronchioles & bronchi
- Patients tend to have chronic hypoxia & raised partial pressure of CO₂ (blue bloater)
- pulmonary hypertension & right ventricular failure.

NB:

Coal worker emphysema: Focal in nature, no ch. Bronchitis ⇒ Milder form rare RVF

Panacinar (Pan-lobular) emphysema:

- alpha1 -anti-trypsin deficiency. lower lung zone.
- Involves the entire acinus. respiratory bronchioles + alveoli, (acini are uniformly affected).
- barrel shaped chest, breathless rather than RVF
- Dyspnea, hypercapnea ⇒ Pink buffers
- Microscopic:** Enlarged air spaces d.t. destruction of septal walls & fusion of alveoli
The lungs are voluminous.

✧ Distal acinar (Para-septal) (alveolar) (Bullous) emphysema:

- ✦ Distal part of acinus (alveoli) are involved, while the proximal part (bronchioles) are normal.
- ✦ Adjacent to the pleura and at the margins of lobules.
- ✦ More severe in upper half of the lung.
- ✦ Enlarged air spaces reach 0.5 to 2 cm or may form cyst-like structures

✧ Irregular emphysema:

- ✦ common form of emphysema, associated with scarring.
- ✦ The acinus is irregularly involved.
- ✦ it is asymptomatic.

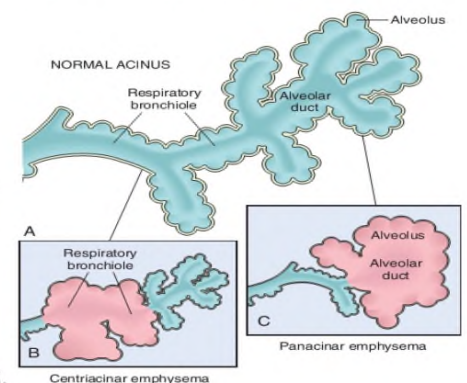


Pathogenesis of emphysema

- ✦ tobacco smoke & inhaled pollutants ⇒ induces inflammation
⇒ accumulation of macrophages & lymphocytes in the lung ⇒ Elastases, cytokines (including IL-8) ⇒ epithelial injury & proteolysis of the extracellular matrix (ECM).
- ✦ Anti Elastases ($\alpha 1$ -antitrypsin) (secreted by liver) antagonize inflammation & ECM proteolysis.
- ✦ Genetic factors e.g. ($\alpha 1$ -antitrypsin) & TGF- β gene polymorphisms ⇒ inadequate repair of elastin
- ✦ Thus emphysema can be thought of as resulting from insufficient wound repair.

Gross

- ✦ Lungs are voluminous (more in panacinar).
- ✦ The upper parts are more affected in the centrilobular type.
- ✦ Bullae are characteristic of distal-acinar type.



Microscopic

Destruction of alveolar walls without fibrosis large air spaces.

Effects & complications: R.R.R

1. Dyspnea a Cyanosis. a Polycythaemia.
2. Pulmonary hypertension ➡ Right sided heart failure.
3. Barrel-shaped chest.
4. Bullae ➡ Pneumothorax
5. Haemoptysis.

clinical manifestations do not appear until at least one third of the lung parenchyma is damaged

Causes of death in emphysema:

1. Right sided heart failure.
2. Respiratory failure ➡ acidosis & coma.
3. Ruptured emphysematous bullae ➡ Massive lung collapse d. t. spontaneous pneumothorax.

Other Conditions related to emphysema

✧ Compensatory emphysema: (hyperinflation)

e.g. following surgical removal of diseased lung or lobe, near-by area of pneumonia, fibrosis or collapse.

✧ Interstitial emphysema:

Air in lung interstitium may extend to the mediastinal c.t. & neck → subcutaneous crepitation

A- patients on respirators (ventillators) (+ve ventilation pressure)

B- Lung injury by fractured rib or penetrating wound

Bronchial Asthma

chronic inflammatory disorder characterized by:

Intermittent & reversible attacks of airflow obstruction, bronchospasm

▪ characterized by:

- ↑ irritability of the tracheobronchial tree
- ⇒ paroxysmal contraction of bronchial airways,
- ⇒ Attacks of expiratory dyspnea, wheeze & cough.



Types

Extrinsic - atopic asthma

1. Type I (IgE mediated) hypersensitivity reaction to an extrinsic antigen.
2. Starts in the first 2 decades of life.
3. Family history.
4. ↑ Serum levels of IgE & eosinophils

Intrinsic - non atopic Asthma:

1. non immune mediated disease triggered by viral resp. tract infect., air pollutants, Drugs
--> lowers the threshold of subepithelial receptors vagal stimulation to irritants
2. adult
3. no family history
4. Normal serum levels of IgE (but eosinophils present)

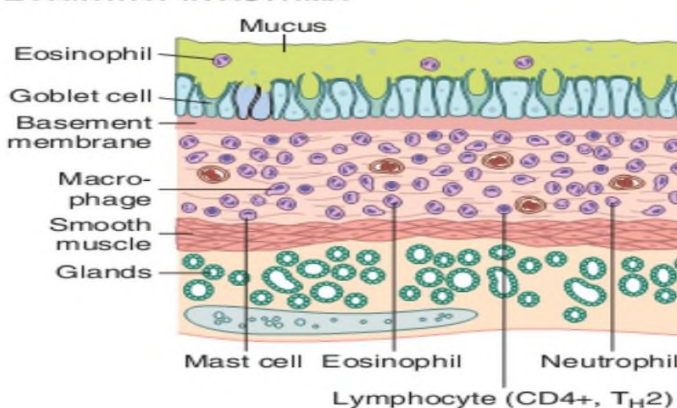
Pathogenesis of extrinsic asthma

Attack demonstrate 2 phases:

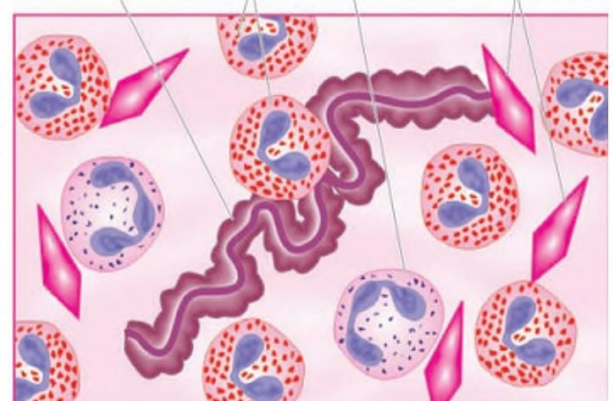
- ✦ Early phase: mast cell ⇒ Histamine, NCF, ECF (neutrophil & eosinophil chemotactic factor)
⇒ ↑ Vascular permeability, mucous production, bronchospasm → Expiratory wheezes
- ✦ Late phase: recruit inflammatory cells (Eosinophil) ⇒ epith. Damage
IL5



B. AIRWAY IN ASTHMA



Curschmann's spiral Eosinophils PMN Charcot-Leyden crystals



Grossly

- ✦ lung become over-distended with air
- ✦ patchy areas of atelectasis with occlusion of airways by mucous plugs.

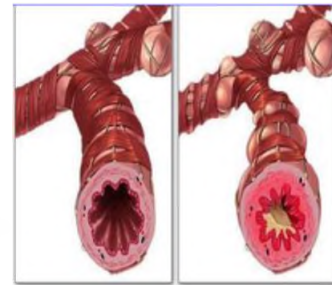
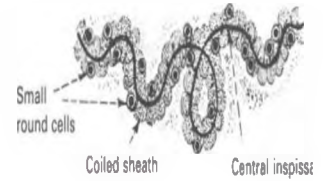
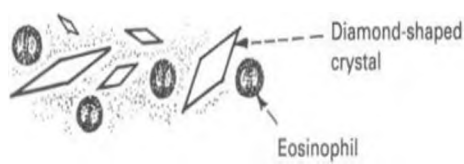
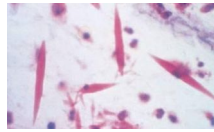
Microscopic

Mucus contain:

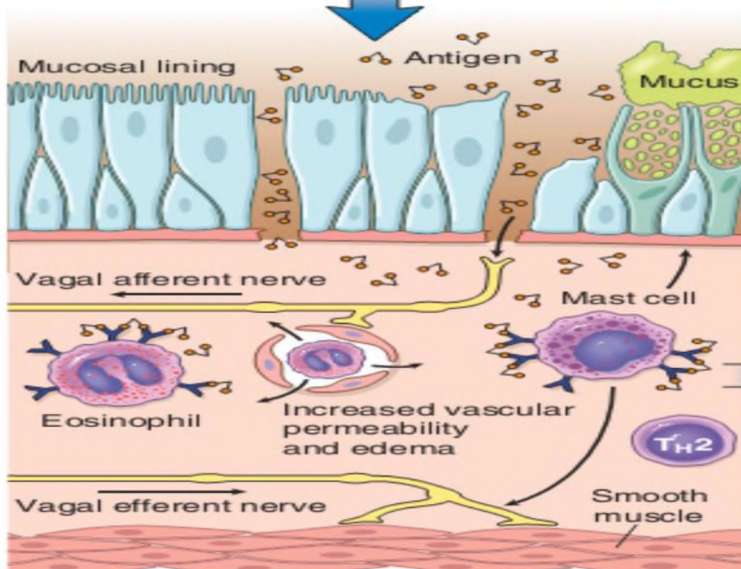
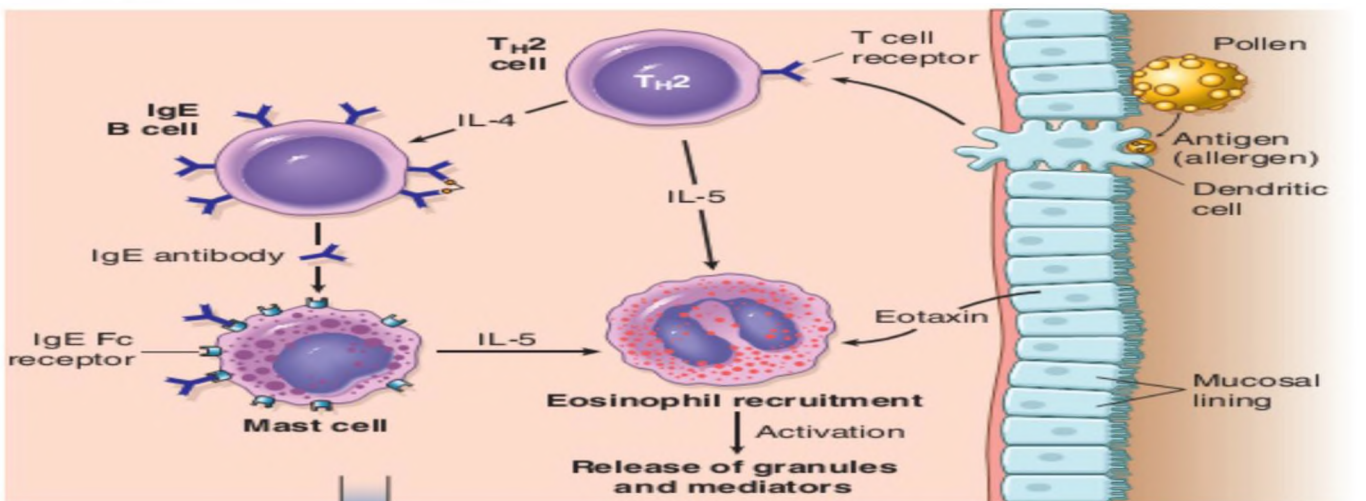
- ✦ Numerous eosinophils.
- ✦ **Curschmann spirals:** Whorls of shed epithelium
- ✦ **Charcot-Leyden crystals** (crystalloids made of **Eosinophilic proteins**).

Mucosa show:

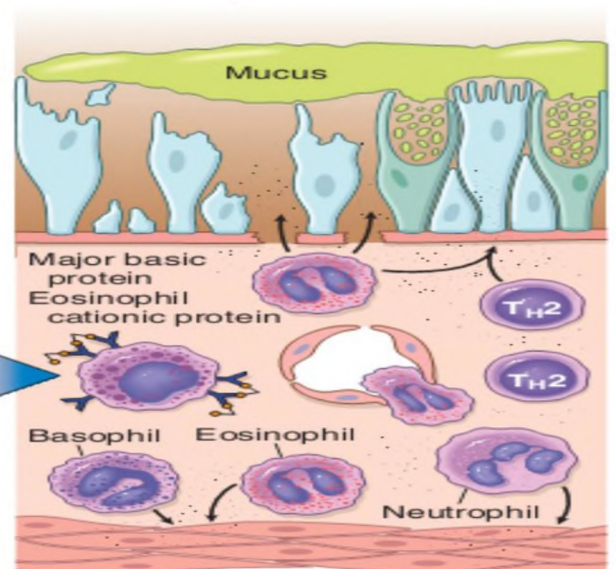
- ✦ **Goblet cell metaplasia** in bronchial epithelium
- ✦ **Thickening of the basement membrane** of the bronchial epithelium.
- ✦ ↑ submucosal glands & ↑ vascularity
- ✦ Edema & infiltration of the bronchial wall with inflammatory cells mainly
- ✦ **Hypertrophy of bronchial smooth muscle**



C. TRIGGERING OF ASTHMA



D. IMMEDIATE PHASE (MINUTES)



E. LATE PHASE (HOURS)

Bronchiectasis

Definition

- ✦ permanent dilatation of bronchi & bronchioles
- ✦ caused by destruction of the muscle & supporting elastic tissue & chronic necrotizing - suppurative infections

Predisposing factors

1. Necrotizing or suppurative pneumonia.
2. Bronchial Obstruction: by tumours, foreign body or mucus impaction.
3. Congenital or hereditary conditions:
 - ✦ Cystic fibrosis (mucoviscidosis) ⇒ obstruction & infection caused by viscid mucus.
 - ✦ Kartagener syndrome, autosomal recessive immotile cilia ⇒ impaired mucus clearance.

Pathogenesis

2 factors: **Infection & complete obstruction**

- ✦ **Infection** ⇒ chronic bronchial wall inflammation ⇒ fibrosis & weakening of the wall of bronchi.
- ✦ **complete obstruction** ⇒ collapse of alveoli dragging with it the fibrosed wall of the bronchioles ⇒ **their dilatation becomes permanent even if complete obstruction is removed.**
- ✦ Dilated bronchi will help accumulation of secretion ⇒ more infection & more fibrosis of the wall ⇒ more bronchiectasis.

Clinical features include cough, fever and **Abundant purulent sputum.**
on leaning (changing of position)

1. Cylindrical

Normal thin-walled tapering bronchi

Non-functioning alveolar tissue



2. Saccular

Saccular dilatations usually containing pus



Pathological features

✂ Grossly:

- + common in **lower lobes** of the lung. 
 - either:
 - cylindrical type:** more common, bronchi are diffusely dilated
 - saccular type:** less common. bronchi are diffusely dilated localized
- + **Bronchi ⇒ filled with pus.**
- + **Bronchial wall ⇒ destroyed & replaced by dense fibrous tissue.**
- + Covering pleura a pleurisy.

✂ Microscopically:

- + Dilated Bronchi & bronchioles
- + Lumen filled with acute inflammatory exudate (PNL & pus cells).
- + Wall of bronchi show intense acute & chronic inflammatory exudation (PNL, lymphocytes & plasma cells)
- + Bronchial epithelium:
 - **Destroyed ⇒ necrotizing ulceration.**
 - **hyperplasia & squamous metaplasia.**
- + **musculoelastic tissues ⇒ destroyed & replaced by fibrous tissue.**
- + Lung interstitium ⇒ replaced by fibrous tissue & infiltrated by chronic inflam. cells.

Complications include:

1. **Haemoptysis.**
2. **Abscess ⇒ gangrene.**
3. **Spread**
 - + **Pleural ⇒ empyema, pneumothorax, pyopneumothorax & bronchopleural fistula.**
 - + **mediastinitis & suppurative pericarditis.**
 - + **Blood ⇒ Septicemia & systemic pyemia ⇒ Embolic brain abscess**
4. **Heart failure ⇒ Cor pulmonale d.t. Fibrosis**
5. **Amyloidosis.**
6. **Squamous metaplasia ⇒ Bronchogenic Carcinoma**

Restrictive lung diseases

Chronic Interstitial Lung Diseases

- **Cause:** Unknown (most of them)
- **Similarities:** in symptoms, signs & radiologic findings: nodules, irregular lines or ground glass shadow
- **Grossly:** Lung scarring & end **stage honey comb lung** (+/-)
- **Mics.:** bilateral, patchy & chronic interstitial inflammation & or fibrosis, +/- intra alveolar component
- **Clinical:** **Reduced lung compliance, Hypoxia**
- **Complications :** Respiratory failure, pulmonary hypertension & cor pulmonale



Chronic Interstitial Lung Diseases

1. Idiopathic Pulmonary Fibrosis
2. Nonspecific Interstitial Pneumonia
3. Cryptogenic pneumonia
4. Collagen Diseases involving lungs
5. Sarcoidosis
6. Pneumoconiosis

Idiopathic Pulmonary Fibrosis

(Usual Pulmonary Fibrosis)

- **Age:** above 60 years, more in males
- **Clinically:**
 - dry cough & progressive dyspnea
 - Dry crackles heard during inspiration
 - Hypoxemia, cyanosis & clubbing occur late
- **Ch.ch. By:**
 - patchy, bilateral, progressive interstitial fibrosis.
- **Diagnosed by:**
 - clinical & radiological findings
 - after **excluding** collagen diseases & occupational interstitial lung fibrosis (pneumoconioses)
- **Pathogenesis:**
 - 1- Environmental factors (smoking, wood, gastric reflux,...)
 - 2- Genetic factor (mutated telomerase → familial IPF)

Repeated epithelial injury & repair

↓
Epith. release TGF beta

↓
Inhibit caveolin I in fibroblasts →

Abnormal repair → fibroblast & myofibroblast proliferation

- **Gross:**
 - outer surface → cobble stones
 - Cut surface → honey comb
- **Microscopic IPF:**
 - **earliest lesions:** cellular fibroblastic foci
 - **older lesions:** collagenous areas & less cellular.
 - if Both present → (*temporal heterogeneity*)
 - **end result:** **honeycomb fibrosis** = cystic structures lined by hyperplastic pneumocytes II or bronchiolar epithelium



Nonspecific Interstitial Pneumonia

Differ in:

Microscopic:

- **Cellular Pattern:**
 - mild to moderate interstitial inflammatory infiltration (lymphocytes & few plasma cells)
- **Fibrosing Pattern:**
 - single pattern → Either cellular or fibrous
 - NO** temporal heterogeneity or honeycombing

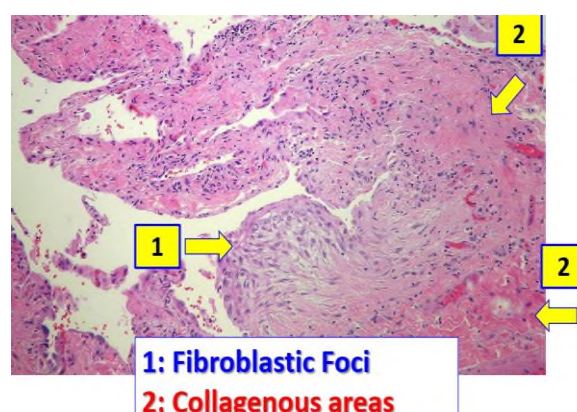
Cryptogenic Organizing Pneumonia

Ch.Ch.by presence of polypoidal plugs of loose organizing connective tissue in alveolar ducts & alveoli

Sarcoidosis

multisystem disease with affection of lymph nodes, lungs, spleen, liver, eyes, parotid glands

Ch.Ch.by interstitial non caseating granulomas & later fibrosis



Pneumoconiosis

Occupational lung diseases

- It is lung reaction to inhalation of mineral dusts, organic & inorganic dusts, chemical fumes & vapors.

✂ The lung reaction depends on:

1- Size of inhaled particles

particles 1-5 microns are entrapped at distal air spaces.

2- Reactivity

- Coal dust** is relatively inert, large amounts must be deposited to affect lung
- Silica & asbestos** are more reactive $\Rightarrow$ **fibrotic nodules** at lower concentrations.

I. Coal Worker of Carbon Dust Pneumoconiosis

1. Asymptomatic anthracosis:

2. Simple Coal Worker Pneumoconiosis (CWP):

Aggregated carbon laden macrophages, no pulmonary dysfunction

3. Complicated CWP (Progressive Massive Fibrosis-PMF): $\Rightarrow$ Core pulmonale

II. Silicosis

- Silica inhalation e.g. sand blasting, drilling, tunneling and stone cutting.

1. Acute Silicosis: very high level of silica $\Rightarrow$ interstitial inflammation

2. Chronic or Nodular Silicosis:

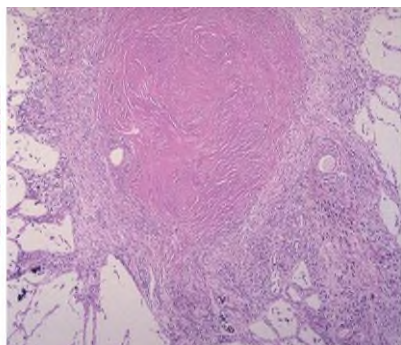
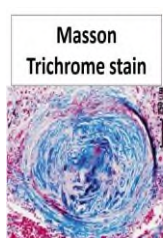
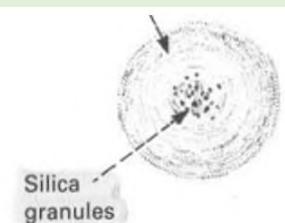
- ✦ **fibrotic nodules** in Upper lobes sub pleural.
- ✦ Nodules formed of concentric hyaline collagen surrounding an amorphous center.
- ✦ silica particles $\Rightarrow$ birefringent with polarized light

3. Complicated Silicosis (PMF)

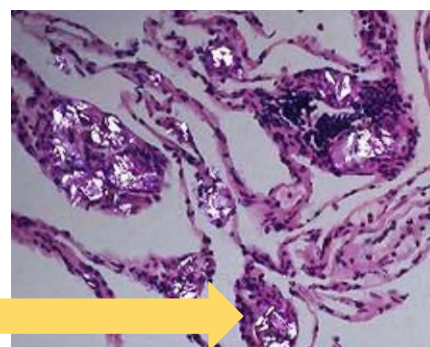
- ✦ enlargement & fusion of silica nodules > 2cm
- ✦ pulmonary massive fibrosis
- ✦ Silicosis $\Rightarrow$ increased susceptibility to T.B.



May show central cavitation or softening d. to:
T.B. or ischaemic necrosis



birefringent silica particles seen as **needle forms**.



III. Asbestos-Related Diseases

Asbestos is a crystalline fibrous silicates that form

Exposure: Mining, milling & fabrication of ores, ship yards insulators

Asbestos causes

- ✦ Parenchymal interstitial fibrosis (asbestosis) beginning in the lower lobes
- ✦ Pleural fibrosis. & Pleural effusions
- ✦ bronchogenic carcinoma
- ✦ Mesothelioma
- ✦ Laryngeal carcinoma

↓

▪Dyspnea

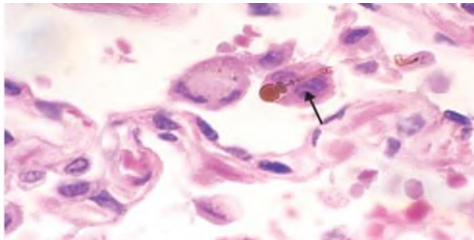
▪Cough

▪Appears after 10 years of exposure.

▪May remain **static** or → **pulmonary hypertension** and **cor pulmonale.**

▪Chest X- ray: irregular linear densities at the lower lobes

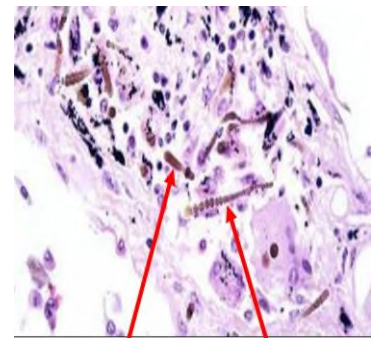
- Contraction of the fibrous tissue ⇒ **honey comb appearance.**



Asbestos body: beading & knobbed end

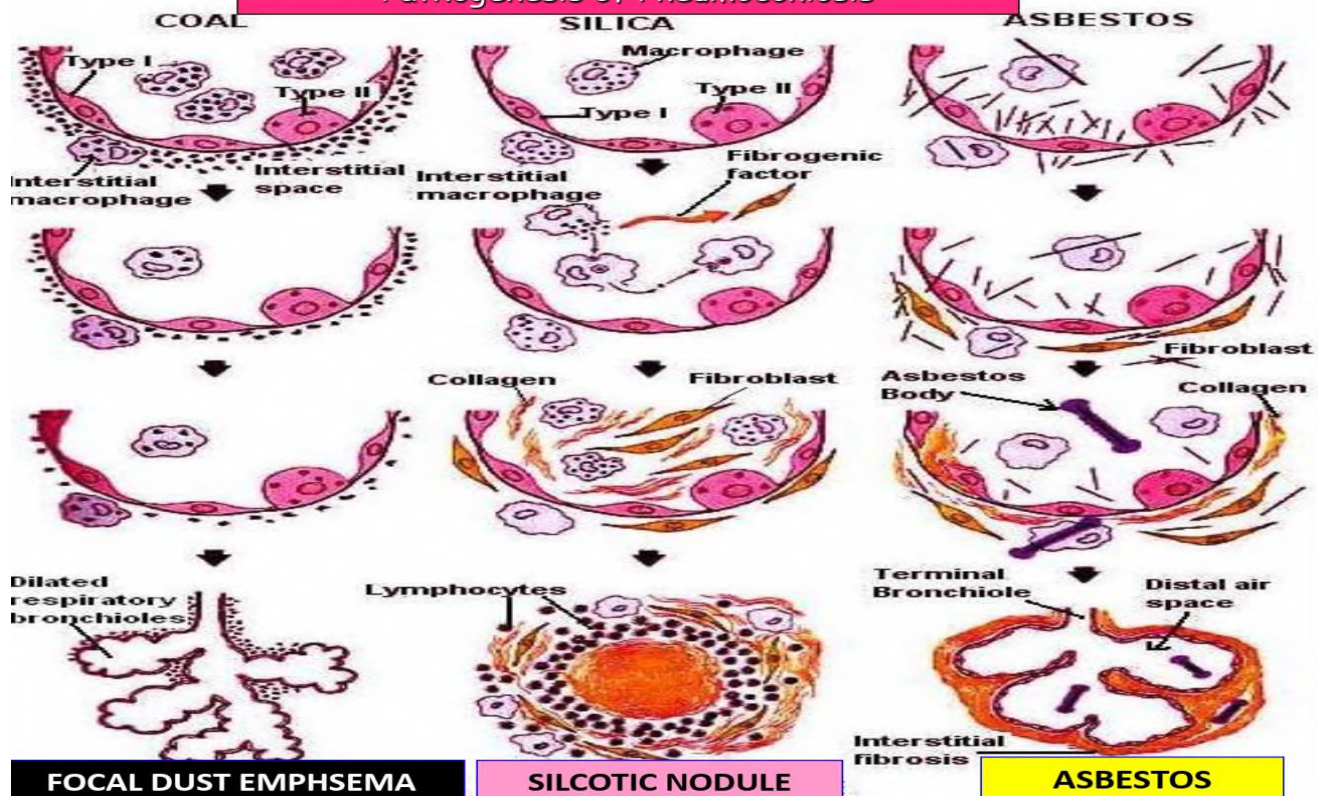
Pleura shows:

1. visceral layer → Fibrosis
 2. parietal layer → Fibro-calcific plaques
 3. Pleural effusion
 4. Mesothelioma
- X ray → multiple peripheral calcification
→ **egg Shell appearance**
(also in silicosis)



Asbestos fibers (Golden brown fusiform or beaded rods)

Pathogenesis of Pneumoconiosis



Pulmonary TB

1ry Pulmonary TB (childhood type)

1st time infection

Grossly : lesions (primary pulmonary complex)

1. Ghon's focus:

- Small rounded ⇒ 1 cm focus (may be yellowish white, cheesy caseous)
- **Site:** usually affect the right lung at:
the base of upper, or Apex of lower lobe usually peripheral, sub pleural.

2. Pulmonary lymphangitis : chain of tubercles along lymphatics

3. Hilar lymphadenitis: Hilar LNs become enlarged, ⇒ caseous & matted together



Microscopically:....

Fate:

1. Good Fate 98%

- If high resistance ⇒ healing occurs by fibrosis, followed by calcification.
- Bacilli remains viable in the fibrous tissue for a long time

2. Bad Fate 2%

- When resistance is low ⇒ Lesion enlarges ⇒ Progressive spread Direct spread
 - 1) Pleura ⇒ TB pleurisy.
 - 2) Via blood: **Miliary TB.** Or Solitary organ TB.
 - 3) peribronchial spread ⇒ **TB bronchopneumonia.**

2ry Pulmonary TB (Adult type)

2nd time infection : exogenous reinfection or endogenous (reactivation of dormant focus)

Grossly : **Assmann's focus:**

- **At the lung apex** (more air , less blood)
- Sensitization ⇒ more caseation , less L.N. affection

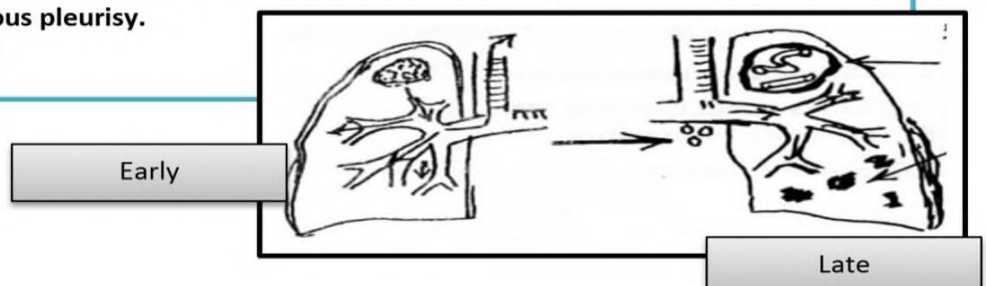
Microscopically:....

Fate:

- **Good immunity:** regression & healing by fibrosis
- **Moderate immunity:** **chronic fibrocaseous T.B**
- **Low immunity :** Acute pulmonary TB(**T.B. bronchopneumonia. Or Miliary T.B.**)

Chronic fibrocaseous TB

- Apical lesion will caseate in the center **(closed lesion)**
- when it opens into a bronchiole, drainage of the caseous material ⇒ **(open cavityTB)**
- TB cavity is sometimes traversed by a bronchus or an artery. ⇒ Risk of fatal hemoptysis.
- Chronic fibrinous & fibrous pleurisy.
- LN: usually not enlarged



Complications of chronic pulmonary TB

1. Hemoptysis:

- May be severe & fatal due to erosion of
⇒ large B. V. traversing TB cavity

- Hemorrhage
- Fibrosis
- Spread
- amyloidosis

2. Excessive lung fibrosis: ⇒ pulm. hypertension

⇒ Rt sided heart failure

(COR PULMONALE).

3. Pleural complications:

- **TB PLEURISY:** thickened pleura ⇒ Adhesion bet the 2 layers of pleura
- **TB EMPYEMA:** pleural cavity is filled e caseous material
- **TB PYOPNEUMOTHORAX:** presence of air & caseous material in the pleural cavity due to rupture of subpleural cavity into the pleural cavity.
- **PNEUMOTHORAX:** air in the pleural cavity

4. Direct extension of infection to nearby organs →

- TB pericarditis,
- TB of ribs & sternum,
- TB of opposite lung

5. TB laryngitis: ⇒ bacilli stick to the under surface of the vocal cord

6. TB ulcer in the back or TIP (more commonly) of the tongue

⇒ Due to passage of infected sputum.

7. T.B. enteritis: due to swallowing of infected sputum.

8. Blood dissemination: miliary TB when TB focus opens into a vein.

9. 2ry Amyloidosis due to chronic toxemia especially kidney ⇒ Nephrotic syndrome & renal failure

↓ Resistance & ↑ Dose of Organism Progressive Pulmonary T.B.

- Serious conditions complicating either 1 ry or 2ry pulm. TB.
- Occurs when the resistance is low and there is a big dose of infection

TB Broncho pneumonia

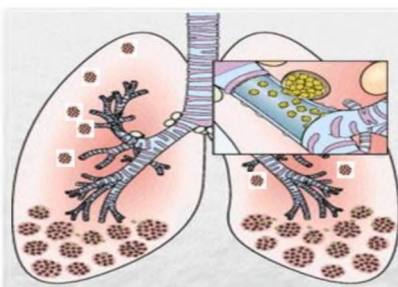
- spread of large no of TB bacilli along bronchi

Grossly:

- multiple scattered rounded or oval
- patches of caseation 1-2 cm in diameter
- Related to small bronchi.
Patches are fewer & larger than tubercles in miliary T.B
- The pleura may be thickened.
- The hilar L.Ns are enlarged & caseous.

Microscopically:

multiple patches of caseous TB reaction with little or no giant cells & no fibrosis.



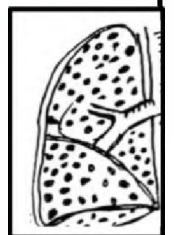
Miliary TB

- If pulm. Art. ⇒ Miliary TB of lungs.
- If pulm. Vein ⇒ generalized miliary T.B.

Grossly:

The lung is studded with:

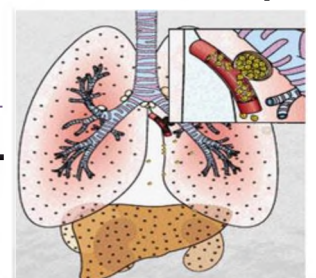
- enumerable small tubercles 1-2 mm
- distributed all over lung, on cut surface & Under the pleura, not related to bronchi.
- Hilar L.Ns ⇒ not affected.



Microscopically:

The lung tissue shows innumerable tubercles formed mainly of:

- ✓ epithelioid cells
- ✓ minimal caseation
- ✓ few or no giant cells
- ✓ surrounded by lymphocytes.



PNEUMONIA

Consolidation of lung tissue by intra-alveolar inflammatory exudate of infective origin.

Classification

1. Anatomy	2. Clinical	3. Aetiology
lobar pneumonia, bronchopneumonia	community-acquired pneumonia, hospital-acquired pneumonia, necrotizing pneumonia, aspiration pneumonia, pneumonia in immuno-compromised host	bacterial, viral, fungal, rickettsial, chlamydial & protozoal.

Bacterial Pneumonia: ➔ By Aspiration of pharyngeal flora

- ✦ 2 types (bronchopneumonia & lobar pneumonia)
- ✦ Depending on bacterial virulence & host resistance,
- ✦ The same organisms may in one instance cause bronchopneumonia & in another instance lobar pneumonia.

Lobar Pneumonia

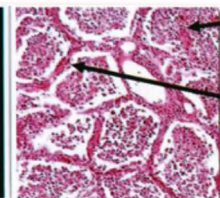
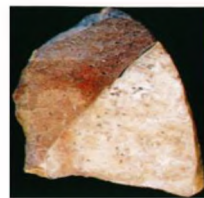
Diffuse, acute fibrinous inflammation affecting entire lobe of lung. Or most of it

Causative organism

- Mostly **pneumococci**,
- Occasionally, (staphylococci, streptococci, H. influenza).

Predisposing factors

- young adults
- Temporary lowering of the resistance
- Defective splenic function ➔ After splenectomy
Spleen removes pneumococci from the blood & produces antibodies to destroy pneumococci.



Acute inflammatory cells & RBC Filling alveolar spaces Uniformly.
Congested capillaries in the alveolar septa

Pathological features

- classic 4 stages
- But infrequently seen bec. of antibiotic therapy.

✦ First day: Congestion

✦ 2nd day: Red hepatization (consolidation)

- ✦ Alveoli filled with fibrinous exudate , (PNL & RBCs).
- ✦ alveolar walls are thickened + congested capillaries
- ✦ Gross: lobe is **red**, firm, liver like

✦ 4rd day: Grey hepatization:

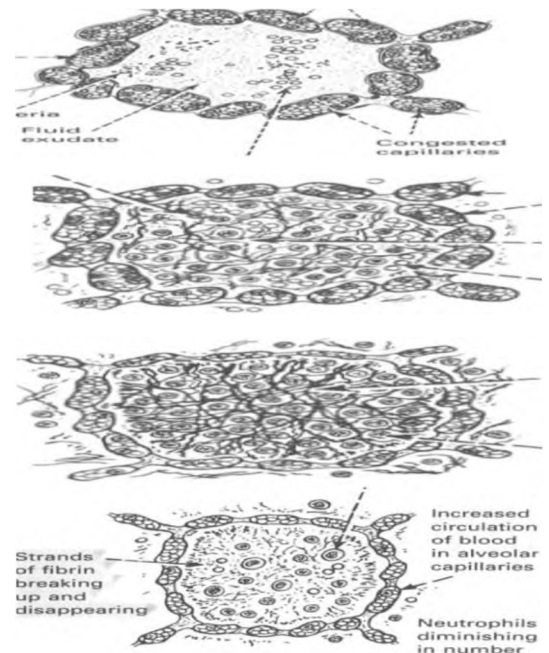
- ✦ red cells disintegrate &
- ✦ Remaining fibrinous exudate inside the alveoli,
- ✦ Gross appearance: lobe is **grey brown**
- ✦ Pleura shows fibrinous pleurisy.

✦ 7th day: Resolution final stage , alveoli infiltrated by MQ.

exudate is gradually degraded & absorbed by the lymphatics to the bronchial and hilar lymph nodes.

Clinical effects

- **fever, dyspnea, chest pain & friction Rup**
- Severe cough with small amount of thick **rusty sputum**. (autolysed RBCs)
- Recover suddenly after 7 - 8 days



Septic Bronchopneumonia (lobular)

- patchy consolidation of lung alveoli,
- suppurative inflammation affecting bronchi & the surrounding alveoli.

Causative organism

- The commonest causative organisms are :
Staph., strep., pneumococci & H. influenza.

Predisposing factors مناعة ضعيفة

occur in the two extremes of age:

- ✦ In infants & children
- ✦ In old age , diabetes

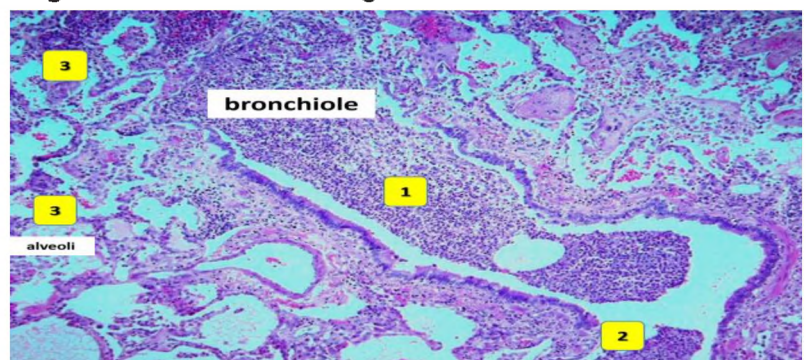
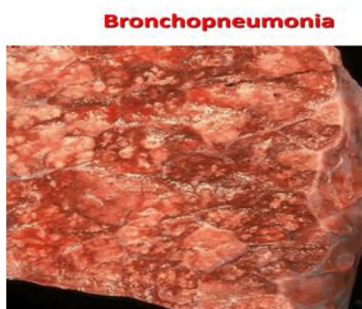
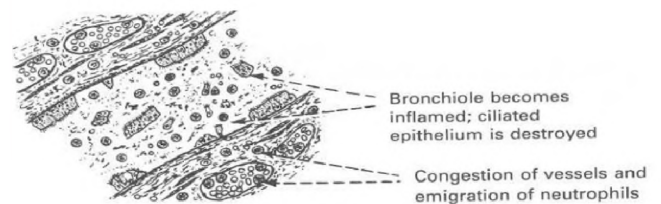
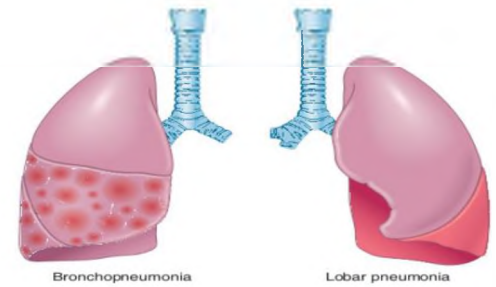
Pathological features

✦ Grossly:

- ✦ Usually bilateral & basal.
- ✦ lungs ⇒ heavy, dark red,
- ✦ Multiple consolidation areas 3 to 4 cm in diameter
- ✦ scattered all over the lung (more multilobar but may be in one lobe),
- ✦ consolidated areas are more easily palpated than visualized at postmortem examination.

✦ Microscopically:

- ✦ bronchi, bronchioles, and adjacent alveoli ⇒ filled with suppurative exudate
- ✦ lining epithelium is destroyed & bronchial walls are infiltrated with PNLs
- ✦ Interstitial tissue shows: vascular congestion & hemorrhage.



Complications of lobar & bronchopneumonia

- ▶ Organization of exudate ⇒ fibrotic scar tissue.
- ▶ Bronchiectasis (in bronchopneumonia)
- ▶ Direct spread: Empyema , Pericarditis
- ▶ Blood spread ⇒ meningitis, arthritis & Abscess formation.

Interstitial Atypical Pneumonia

- **Confined to the alveolar septa & interstitium.**
- **Atypical=** Absence of consolidation, Moderate amount of sputum
Moderate elevation of white blood cell count.

Causative organisms

- ✦ **Viruses**
 - ✦ Respiratory syncytial virus ⇒ children
 - ✦ influenza types A & B ⇒ healthy adults
 - ✦ Cytomegalovirus ⇒ immunocompromised patients only
- ✦ **Mycoplasma pneumonia**
- ✦

Gross

- ✦ Patchy or may involve whole lobes
- ✦ Bilateral or unilateral with congestion of the trachea and bronchi.
- ✦ The affected lobes are red-blue congested

Microscopic

- ✦ **The walls of the alveoli only are affected:**
- ✦ septa are edematous
- ✦ decreased pneumocyte type I, hyperplasia in pneumocytes type II
- ✦ Infiltrated with mononuclear inflammatory cells (lymphocytes, histiocytes & plasma cells).
- ✦ **viral inclusion bodies (CMV)**
- ✦ **Alveolar spaces are free of cellular exudate.** → Hyaline membrane in severe cases

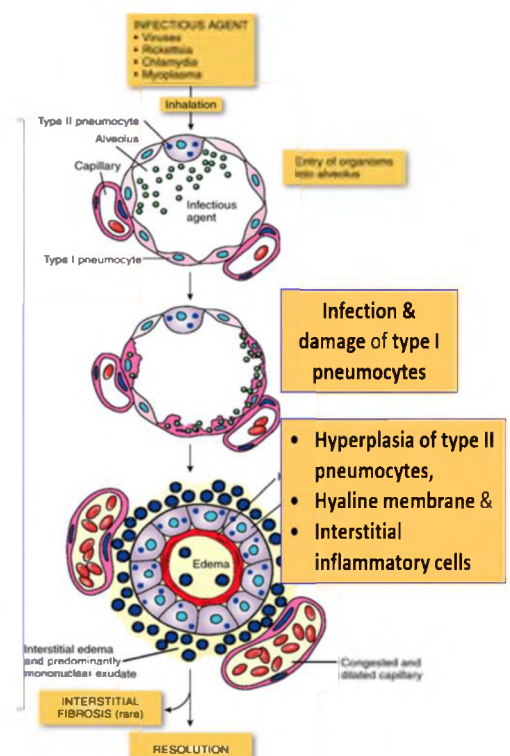


Patchy airspace small opacities and interstitial thickening throughout both lungs

NB:

Suppurative lung diseases include:

- **Bacterial pneumonia (mainly bronchopneumonia).**
- **Lung abscess.**
- **Bronchiectasis**



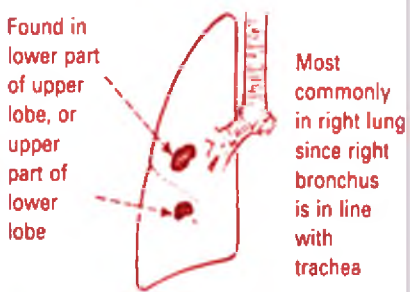
LUNG ABSCESS

- localized suppurative necrosis of lung tissue, **with cavity formation**

Causative organisms Staphylococci, streptococci, gram-negative organism & mixed infections.

- ✦ Abscesses vary in number (single or multiple) &
- ✦ Size (microscopic to many centimeters in diameter).

Classified into:

	1. Aspiration abscess	2. Postpneumonic & post bronchoectatic abscess	3. Pyaemic abscess
Method of infection	aspiration of infected material: in oropharyngeal surgical procedures, dental sepsis, coma, drugs & anesthesia.	Follows broncho & lobar pneumoniae.	septic emboli from infected thrombi or cardiac valve vegetations (ABE).
Morphology	Common in right lung, single. The acute abscess ▪ Rounded, lined by irregular necrotic tissue. ▪ Contain pus & air. (fluid level on X ray) The chronic abscess ▪ smooth fibrous wall. ▪ pleura ⇒ fibrinous pleurisy or empyema.	▪ Single or multiple ▪ Abscess is usually surrounded by a zone of pneumonia consolidation 	▪ Bilateral, multiple ▪ Small, yellow ▪ Surrounded by area of congestion

4. Miscellaneous cause

1. Traumatic penetration of the lung.
2. Spread from adjacent organs. (subphrenic abscess)
3. Pulmonary Actinomycosis & infected Hydatid cyst.
4. **bronchial obstruction**: Neoplasia + secondary infection

Complications of lung abscess Rupture, Spread, Progress

1. Haemoptysis.
2. Gangrene of the lung.
3. Spread:
 - Pleural complications a empyema, pneumothorax & pyopneumothorax.
 - Bronchopleural fistula: with serious effects.
 - Direct spread a mediastinitis & suppurative pericarditis.
 - Pyaemia. Embolic brain abscess along the vertebral system of veins.



4. Chronic abscess.
5. Amyloidosis.

TUMOURS OF THE LUNG

- **2ry metastases in lung are the commonest** → May be large (canon ball appearance)
- 1ry lung cancer

(bronchogenic carcinoma) (95%) of 1ry lung tumours (arise from bronchial epithelium)

5% are a miscellaneous group including:

- ✦ Carcinoid tumor
- ✦ Bronchial gland tumours (e.g., adenoid cystic & mucoepidermoid carcinoma),
- ✦ Mesenchymal malignancies (e.g. fibrosarcoma, leiomyosarcoma)
- ✦ Lymphoma
- ✦ Benign lesions (e.g. hamartomas)



Hamartoma

- Formerly was tumour-like malformation Recently → considered a benign tumour

■ Formed of:

cartilage, fat, fibrous tissue, bl. vessels & respiratory epithelium
in a **disorganized fashion**.

■ Chest X-rays & CT:

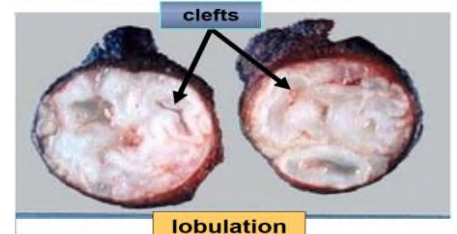
usually solitary, subpleural,
coin-like well circumscribed opacity, 3-4 cm in diameter

■ Gross:

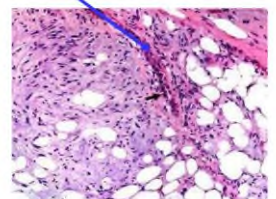
Well circumscribed mass
formed of:
glistening lobulated nodule of cartilage
+ few clefts. & lobulations

■ Microscopic:

Lobules of mature cartilage, clefts lined
by respiratory-epithelium, fat, smooth
muscle cells, & blood vessels.



clefts lined by respiratory
epithelium



Bronchogenic carcinoma

- Number 1 cause of cancer -related death
- Male : female ratio = 2:1
- ages 50-60
- **At time of diagnosis: More than (50%) of patients have already distant metastases.**
(25%) of them have regional lymph node metastases.

Etiology & pathogenesis

I. Smoking:

- ✦ Average smokers have a 10 fold greater risk,
- ✦ Heavy smokers (>40 cigarettes/day for several years) have a 20 fold greater risk.

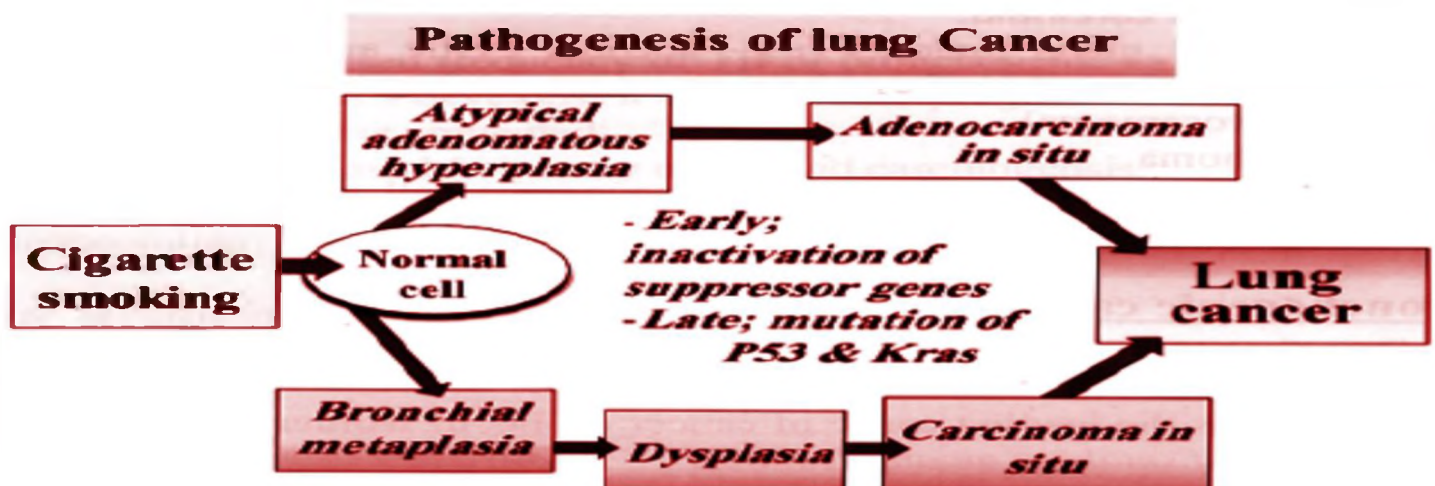
II. Industrial hazards:

1. radiation
2. **Asbestos:** ↑ risk 5 times in non smokers and 55 times in heavy smoker

III. Air pollution:

IV. Genetic factor:

- ✦ **Inactivation of P53 and P16 suppressor genes.**
- ✦ Activation of **EGFR & k-Ras oncogene** (especially in adenocarcinoma).



✧ Therapeutically bronchogenic carcinoma are classified into 2 groups:

1- Small cell lung cancer (SCLC)

- ✦ Very Early metastasis
- ✦ Not suitable to curative surgery.
- ✦ only be treated by chemotherapy with or without radiation.

2- Non small cell lung cancer (NSCLC)

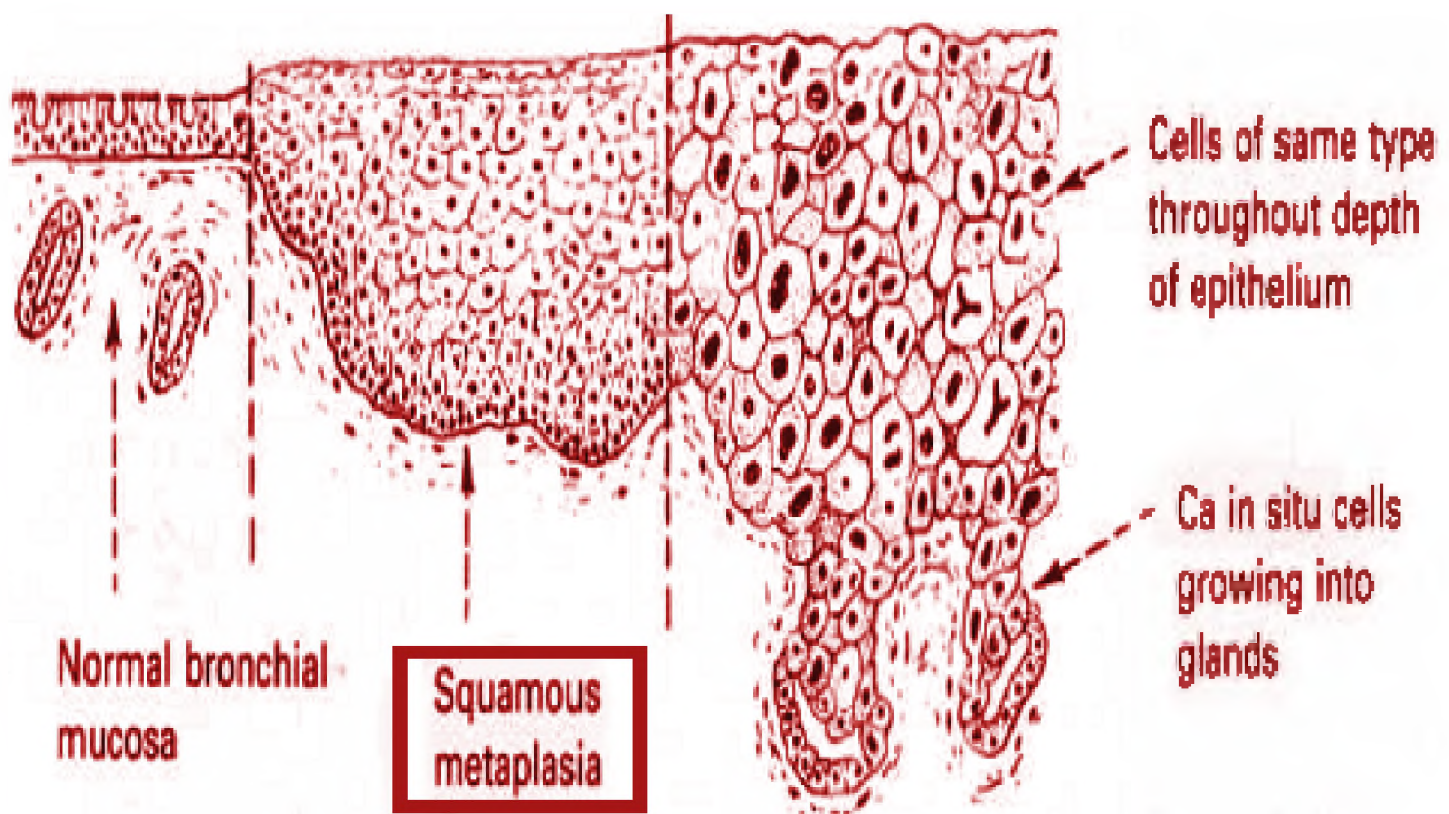
- ✦ Including squamous cell carcinoma, adenocarcinoma, & large cell carcinoma.
- ✦ better treated by surgery.

Pathological Features of Bronchogenic Carcinoma

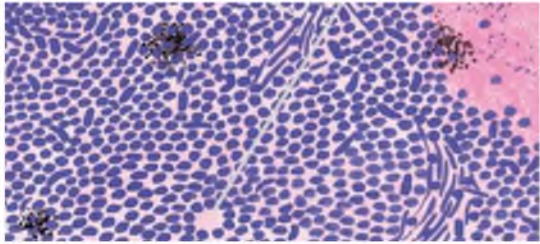
Site:

- Arises mostly around the hilus of the lung.
- Adenocarcinoma ⇒ periphery of the lung.

- Gross**
- Firm mass having greyish cut surface with areas of hemorrhage & necrosis.
 - grows as intraluminal mass ⇒ invades the bronchial wall & lung parenchyma.



Non small cell lung carcinoma

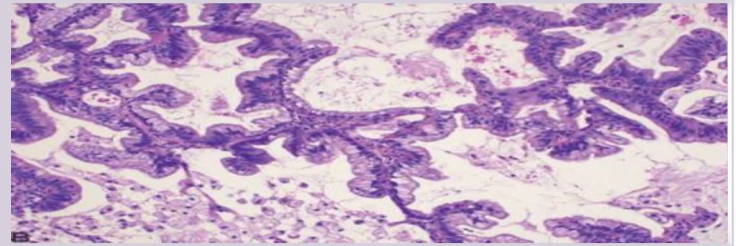
	Squamous cell carcinoma (Epidermoid) (35 - 50%)	Adenocarcinomas (15-35%)	Large cell carcinoma (10-15%).	Small cell carcinoma: SCLC (20-25%)
	- males. - Related to smoking. Central , hilar bronchi	common type in females non smokers, peripherally located may arise after lung scarring,	variable	Males Strongly related to smoking. Mostly hilar & central.
Predisposing lesion	Squamous metaplasia or dysplasia ↓ Carcinoma in Situ of the bronchial epithelium.	Atypical adenomatous hyperplasia AAH ↓ adenocarcinoma in situ < 3 cm ↓ invasive adenocarcinoma > 3cm	Represent sq. cell carcinoma & adenocarcinomas that are so undifferentiated	
Growth & behavior	Rapid growth Late metastasis	- Slow rate of growth, - Metastasize early.	variable	- Grow quickly, - Metastasize early, metastasis at presentation - Incurable by surgery, the most aggressive
Microscopic	squamous cell carcinoma cell nests	- Acinar - Papillary. - Solid masses - mucin-producing glands.	Cancer cells are large , with excess cytoplasm, large nuclei & prominent nucleoli	- small round or fusiform cells Lymphocyte like - scant cytoplasm & dark nuclei chromatin. - frequent Mitosis & necrosis E.M Neurosecretory granules Stained immubohistochemically by: Chromogranin, synaptophysin, neuron specific enolase, CD56 ⇒paraneoplastic syndrome

Adenocarcinoma in situ: called before (bronchiolo-alveolar carcinoma)

- lung peripheral **single nodule**, < 3cm
- Appear as **pneumonia like consolidation**

Microscopic:

- columnar-to-cuboidal cells,
- grow in a monolayer along the alveolar septa, no stromal invasion & no desmoplasia

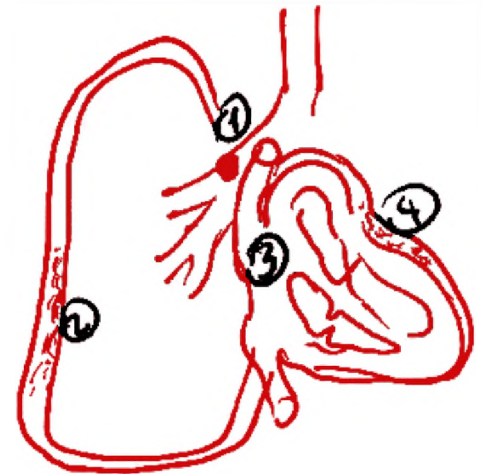


Spread of bronchogenic carcinoma

Local spread:

1. Bronchial:

- lumen obstruction causes pulmonary collapse,
- accumulation of secretions ⇒
bronchiectasis
Abscess or pneumonia



2. Pleural: Hemothorax, empyema, chest wall invasion.

3. Superior vena cava: compression ⇒ superior vena caval syndrome.

4. Pericardium: pericarditis with hemorrhagic effusion.

5. Bone involvement: ribs, sternum & spine result in pain, hypercalcemia & pathological fracture

6. Oesophagus: bronco-oesophageal fistula.

7. Nerves: **Pancoast tumour**



Pancoast's tumours

- Apical lung cancers in the superior pulmonary sulcus

⇒ Clinically:

- Invasion of **brachial plexus** ⇒ pain along the distribution of ulnar nerve.
- Invasion of **sympathetic chain** ⇒ **Horner's syndrome** (enophthalmos, meiosis, ptosis & anhidrosis)

Lymphatic spread:

Early, ⇒ regional intrapulmonary, hilar ⇒ extrapulmonary tracheobronchial & other mediastinal nodes ⇒ cervical, supraclavicular, axillary and more distant groups.

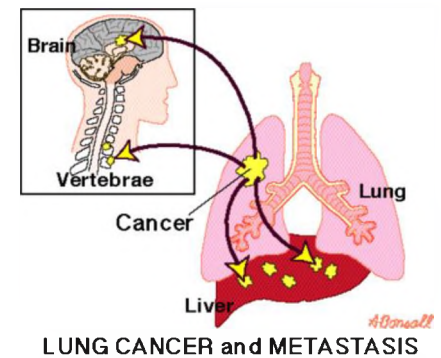
Blood spread:

Sites:

favorite sites of metastasis:

- **Adrenals** ⇒ (50%) of cases
- **Liver** ⇒ 30-50% of cases.
- **Brain:** involved in 20%. **Retrograde venous spread**
- **Bone** involved in 20%.

Thoracic vertebrae are retrograde venous



Clinical features

- Bronchogenic carcinoma is usually silent, Chronic cough & expectoration
- The symptoms may vary according to the site of the tumour & the tissue invaded.

paraneoplastic syndrome: in 3% - 10% of all lung cancer

1. **Squamous cell carcinoma** ⇒ Hypercalcaemia (release of parathyroid like hormone)
2. **Cushing syndrome** (ACTH)
3. **water retention.** (ADH)
4. **Neuromuscular** ⇒ myasthenic syndrome, peripheral neuropathy & polymyositis.
5. **Clubbing of fingers**
6. **Migratory thrombo-phlebitis, specially with adenocarcinoma** (trousseau syndrome)

Bronchial carcinoid

- Usually Locally Malignant
- Represent 1-5% of all lung tumors,
- 40 years of age.
- Sex: equal.
- Not related to cigarette smoking



collar-button



dumbbell

Pathological features

Grossly:

- spherical masses, project into the lumen of the bronchus ⇒ **collar-button lesion or dumb-bell lesion.**
- covered by intact mucosa.
- Mostly in main stem bronchi (typical),
- < 3 to 4 cm in diameter.

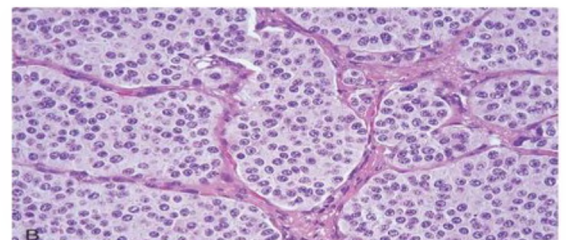
Microscopically:

⊕ Typical carcinoid (low-grade):

Nests, cords & masses of regular cells, uniform round nuclei, separated by delicate fibrous stroma. + infrequent mitosis.

⊕ Atypical carcinoid (intermediate grade):

- mitotic rate & focal necrosis.
- higher incidence of metastasis



E.M

shows neurosecretory granules in their cytoplasm.

Clinical features

1. May be asymptomatic (especially in peripheral carcinoids).
2. Bronchial obstruction, with cough, repeated infection, hemoptysis.
3. **carcinoid syndrome** (intermittent attacks of diarrhea, flushing & cyanosis).
4. Distant metastases rare.

Metastatic tumours of the lung

- ▣ **More common than 1ry tumors.**

Patterns of metastatic growth

- Multiple, discrete nodules scattered throughout all lobes; particularly in the periphery.
- **Cannon-Ball metastases** ⇒ blood-born, large metastatic nodules, originating from **renal cell carcinoma or testicular tumours (seminoma)**.

VASCULAR PULMONARY DISEASES

Pulmonary Embolism, Hemorrhage, and Infarction

Pulmonary hypertension

1ry pulmonary hypertension: idiopathic or congenital ⇒

plexiform lesions = (endothelial proliferation forms multiple lumina). (*BMPT-2 mutation*)

2ry pulmonary hypertension

✂ causes:

1- Lung diseases:

- Chronic obstructive or interstitial lung disease ⇒ fibrosis
- Ayerzas disease (B or S) (EAO of pulm arterioles)
- Recurrent pulmonary emboli

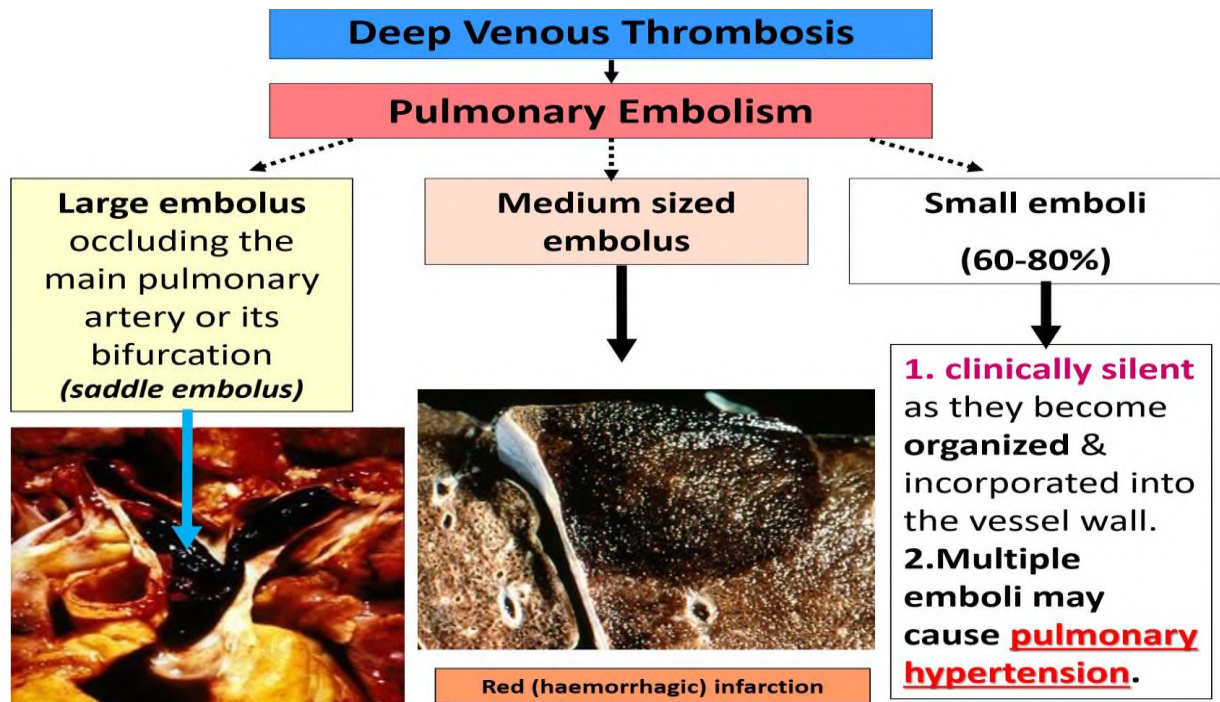
2- Heart disease e.g. mitral stenosis, Congenital left-to-right shunts

✂ MORPHOLOGY:

1. **pulm. Artery** ⇒ atherosclerosis
2. **medium-sized arteries** ⇒ thickening of the intima and media with narrowing of the lumina
3. **arterioles** ⇒ thickening, medial hypertrophy, & reduplication of internal elastic lamina.
Endothelial cell proliferation with formation of **Plexiform lesions**.

Pulmonary embolism

Source : usually Deep venous thrombosis (DVT) of lower limb



N.B:

DVT results from **hypercoagulability state**

Which may be :

1ry: Hypercoagulability Disorders

2ry:

- Obesity,
- prolonged bed rest or prolonged sitting (inairplanes),
- oral contraceptives & pregnancy,
- recent surgery & blood catheters (right atrial thrombi)
- cancer → paraneoplastic syndrome

Others types of emboli: Fat, Air, Amniotic fluid & Bone Marrow emboli