We were talking about the restrictive lung diseases (interstitial lung diseases) and they're:-

- Fibrosing diseases .
- Granulomatous diseases .
- Eosinophilic .
- smoking related .

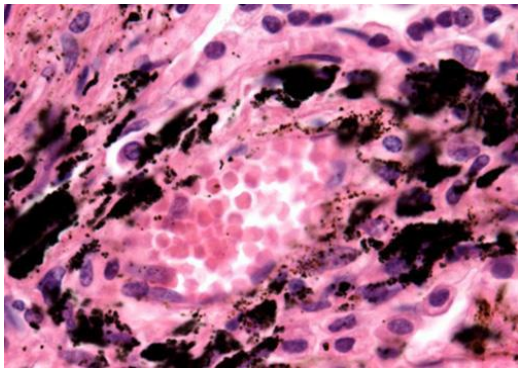
* Notes:-

1) Cough occur in restrictive lung diseases due to irritation .

2) During fibrosis the lungs are stiff so the compliance will decrease .

Pneumoconioses

Central diseases due to non-neoplastic lung reaction to inhalation of dust ; this dust can be coal , silica or asbestos .



A) Coal Worker's Pneumoconiosis .

The offending agent is coal that occur in coal mining .

Coal is composed mainly of carbon , usually in coal mines we have carbon and other minerals mixed with it .

Coal is an inert substance (not toxic/**not** directly fibrogenic) in contrast to silica and asbestos (they're reactive) .

Clinical consequences:-

- As coal is an inert substance it stays inside the macrophages for long time without causing a problem (Asymptomatic anthracosis) .
- Later we will start having fibrosis by stimulation of macrophages , releasing fibrogenic mediators (called simple worker's pneumoconionses) .

Definition of anthracosis : carbon ingested by macrophages (engulfed but not digested) , asymptomatic and can be due to coal , pollution or smoking ...etc .

So simple worker's pneumoconioses characterized by:-

1) Coal macule : can't be palpated as they're flat .

2) Coal nodule : can be palpated as they're raised .

The macule or nodule consist of dust-laden macrophages with delicate patchy network of collagen fibers inside .

- But when the fibrosis become dense/diffused we call it complicated worker's pneumoconioses or progressive massive fibrosis .

So massive means : too much fibrosis and it's bilateral .

Progressive means : it will progress regardless (even if the offending particle was removed) .

We will see also dense collagen and pigment ; multiple scars .

Clinical features:-

The symptomatic stage is the "complicated worker's pneumoconioses" while asymptomatic anthracosis and simple worker's pneumoconioses are asymptomatic .

Symptomatic stage indicates respiratory symptoms : Dyspnea and cough .

* Note : Coal will not increase the risk of lung cancer in contrast to silicosis and asbestosis .

* Note : Coal and silica will affect the upper zones of the lung while asbestos affects the lower zones .

B) Silicosis

Most common chronic occupational disease nowadays .

Occur due to inhalation of crystalline silica . SiO_2 form a complex structure called silica

Types of silica:-

1) Amorphous : more soluble type so it's less dangerous .

2) Crystalline : dangerous + lodge inside the lung causing inflammatory response .

It's dangerous as it's more toxic and fibrogenic (**directly**) .

Crystalline form includes quartz + others , and these quartz are the most dangerous and fibrogenic , especially "pure quartz" (but pure quartz are rare) .

So as a conclusion quartz are the most important form of silica than can cause silicosis .

* Note : If a person is exposed to little amount of pure quartz , while the other is exposed to large amounts of mixed quartz ; the one exposed to pure quartz is more likely to have fibrosis .

Quarts are used in glass industry .

Pathogenesis:-

The silica will be ingested by macrophages , these macrophages will produce several mediators but the most important in TNF (having a major rule in fibrosis) .

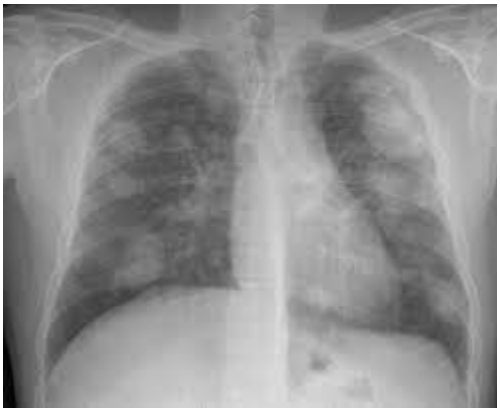
They discovered it by exposing mice to silica , if the mice was given anti-TNF the fibrosis won't occur .

Morphology:-

Silicotic nodules (raised) are pale , if silicotic nodules appear black meaning it's superimposed by coal/carbon .

Under the microscope the nodule contains collagen fibers (concentric in appearance) surrounding amorphous center .

* Note : affects the upper zones of the lung .



In early stages it affects the upper zones but with progression of the disease the whole lung will be affected .

It appears diffuse and bilateral .

Silicosis superimposed by coal/carbon (black nodules) .

Clinical features:-

Silicosis can progress to "progressive massive fibrosis (PMF)" causing respiratory symptoms : cough and dyspnea .

* Note : All the three diseases in this sheet caused by (coal , silica and asbestos) at the beginning they're asymptomatic but symptoms will appear once the disease course reach PMF (so discovered late) , and this implies that all three diseases end stage is PMF .

Patients with silicosis are at high risk of developing TB :-

As silica is **toxic** damaging the macrophages impairing their ability to engulf the TB bacilli .

* Note : HIV/AIDS will increase susceptibility to TB (impairs the immunity) .

There's debatable relationship between silica and lung cancer as experiments with silica alone is difficult due to contamination with carbon/smoking ; so epidemiological studies proved that silica is related to lung cancer NOT experiments .

C) Asbestosis

Form of crystalline silicate which has a fibrous geometry .

Pathogenesis:-

There're two distinct forms of asbestos (differs in shape , solubility ...) :-

1) Serpentine : has curly and flexible fibers (shape) , it's less dangerous thus it's more used in industry , also it's more soluble ; removed by the mucociliary elevator .

2) Amphibole : has straight and stiff fibers (shape) , more dangerous and more fibrogenic ; they lodge inside the lung .

* Note : both serpentine and amphibole forms of asbestos cause fibrosis .

* Note : asbestos affect the lower zones of the lungs in contrast to coal and silica .

They have the same mechanism of pathogenesis as silica and coal .

On the basis of epidemiologic studies , occupational exposure to asbestos is linked to:-

1) Parenchymal interstitial fibrosis (*asbestosis*) .

2) Pleural plaques . ← As asbestos causes fibrosis .

3) Pleural effusions .

4) Lung carcinomas .

5) Malignant pleural and peritoneal mesotheliomas . ← Asbestos act as a tumor

6) Laryngeal carcinoma . initiator and promoter .

Asbestosis will progress into diffuse progressive pulmonary interstitial fibrosis (PMF) .

Morphology:-

Asbestosis

Histological picture is UIP (note UIP is not specific) .

We see asbestos bodies which are seen as golden brown , fusiform with a translucent center. They consist of asbestos fibers coated with an iron-containing proteinaceous material . Asbestos bodies apparently are formed when macrophages attempt to phagocytose asbestos fibers; the iron is derived from phagocyte ferritin .

Pleural plaques

Is the most common manifestation of asbestos exposure . Characterized by fibrosis in the pleura (density in pleura) ; but we don't see asbestos bodies . Fibrosis occur because asbestos accumulate mainly in the sub-pleural space (close to pleura thus affecting it) .

Clinical features:-

The clinical findings in asbestosis are indistinguishable from those of any other chronic interstitial lung disease. Typically, progressively worsening dyspnea appears 10 to 20 years after exposure.

Pleural plaques are usually asymptomatic and are detected on radiographs as circumscribed densities.

The risk of lung carcinoma is increased about five-fold for asbestos workers . Concomitant cigarette smoking greatly increases the risk of lung carcinoma but not that of mesothelioma (which also increase in asbestos workers) .

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