OCCUPATIONAL HEALTH

VIII

Chemical Hazards

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PROF. DR. WAQAR AL-KUBAISY

Pneumoconiosis

contents

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- ~~Pathogenesis~~
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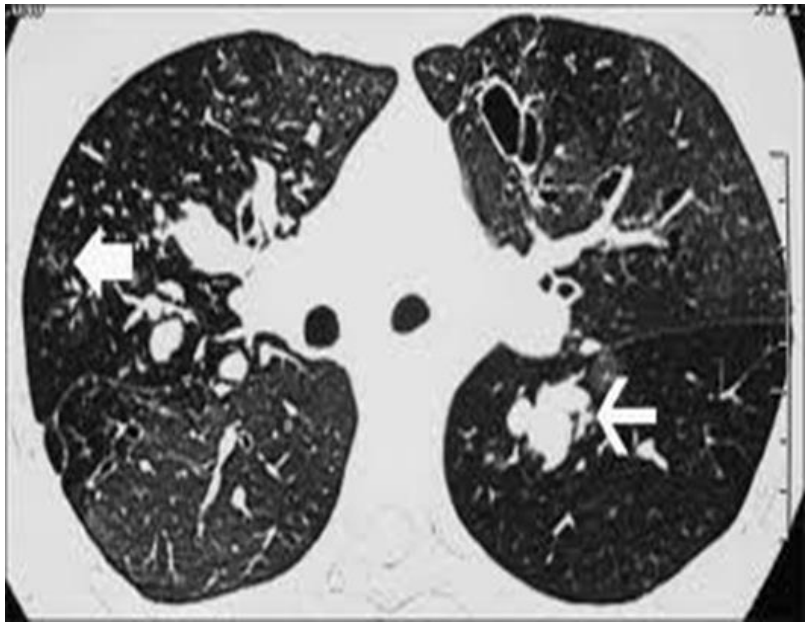


- **Individual diseases**
  - **– Silicosis**
  - **– Asbestosis**
  - **– Anthracosis**
-

silicosis

Silica crystals

- **Silica exists in 2 forms**

1. **Crystalline and**
2. **Amorphous forms.**

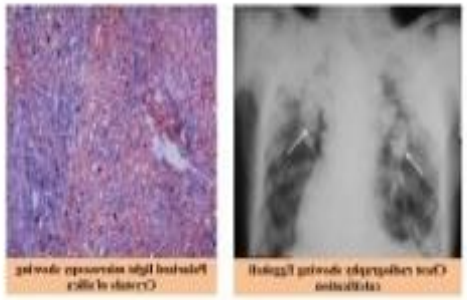
❖ **Crystalline silica not bound to other materials is called FREE SILICA, when bound it is referred as combined (silicates).**

❖ **Amorphous silica have relatively non toxic pulmonary properties.**

❑ **Silicosis**

refers to a spectrum of pulmonary diseases due to inhalation of various forms of FREE crystalline silica (SiO_2).

silicosis



Among the occupational diseases,

- silicosis is the major cause of
  - permanent disability and mortality.
- Develops with repeated and usually long-term exposure
  - to crystalline silica (silica dust)
- It is caused by inhalation of dust containing free silica or
  - ✓ silicon dioxide free crystalline silica (SiO2).

- The silica dust causes irritation & inflammation of the airways & lung tissue.
- Scar tissue forms when the inflammation heals, resulting
- in fibrosis that gradually overtakes healthy lung tissue.
- The fibrosis continues extending through the lungs
- even after exposure ends.

The incidence of silicosis depends upon

- the chemical composition of the dust,
- size of the particles,
- duration of exposure and
- individual susceptibility

✓ **The higher the concentration of free silica** in the dust, **the greater the hazard.**

✓ **Particles between 0.5 to 3 micron are the most dangerous because they reach the interior of the lungs with ease.**

✓ **The longer the duration of exposure, the greater the risk of developing silicosis.**

❑ *the* latent period *may vary from a*

- *the* latent period *may vary from a*
- ✓ *few months up to ≥20 years of exposure,*

depending upon the above factors.

The *particles are ingested by the phagocytes which accumulate and block the lymph channels.*

Pathologically,

- silicosis is characterized by
- ❖ Fibrosis is initiated by silicic acid
- ❖ leading to a dense "nodular" nodular fibrosis,
- ➢ the nodules ranging from 3 to 4 mm in diameter in
- ❖ the upper part of the lung .
- Emphysema , and right heart failure ,
- Pulmonary TB may intervene in 50% of cases

- **The presentation and severity of silicosis depend on:**

➢ **Dust factors:**

concentration or

duration of exposure

➢ **Host factors**:

genetic factors,

cigarette smoking, and

presence of other pulmonary disease

Occupations with risk of exposure to silica dust

Mining
Tunneling
Quarrying Stone Quarries: محاجر الحجر
Sandblasting
Ceramics

Brick-making
Silica flour manufacture
Slate Pencil Industry
Agate Industry صناعة العقيق
Quartz Grindin gmillers,
pottery workers,
glass makers
abrasive worker

- **Presentation and clinical picture:**
  - **Spectrum of silicosis include:**
    - **Classic silicosis (simple) and complicated Progressive massive fibrosis (PMF)**
    - **Accelerated (simple) and complicated (PMF)**
    - **Acute**

I) Classic silicosis Chronic silicosis:

- the most common form,
- results from long-term exposure (10 to 20 years or longer)
- ❖ Result from low to moderate exposure to dust containing
- ❖ less than 30% silica content
- ❖ but may occur with shorter exposure.
- ❑ In early case patient may complain of cough, expectoration
- and if dyspnea is present it is not due to silicosis but is
- related to industrial bronchitis or concurrent smoking.
- ❖ By time dyspnea is apparent and is now related to silica exposure (simple silicosis). Late symptom
- ❖ Simple silicosis is a risk for development of complications

❖ X-ray:

The characteristic pattern of simple silicosis is

- **small round opacities** that range in size from **1-10 mm.**
- **common in upper lung zones** (**snow storm** appearance).
- **Hilar lymph nodes are usually enlarged or may calcify circumferentially producing the so called eggshell pattern of calcifications.**

- *Similar x-ray picture are seen in: Sarcoidiosis, Scleroderma, Amyloidosis,……,* ***However the background of small opacities reinforces the clinical diagnosis of silicosis.***

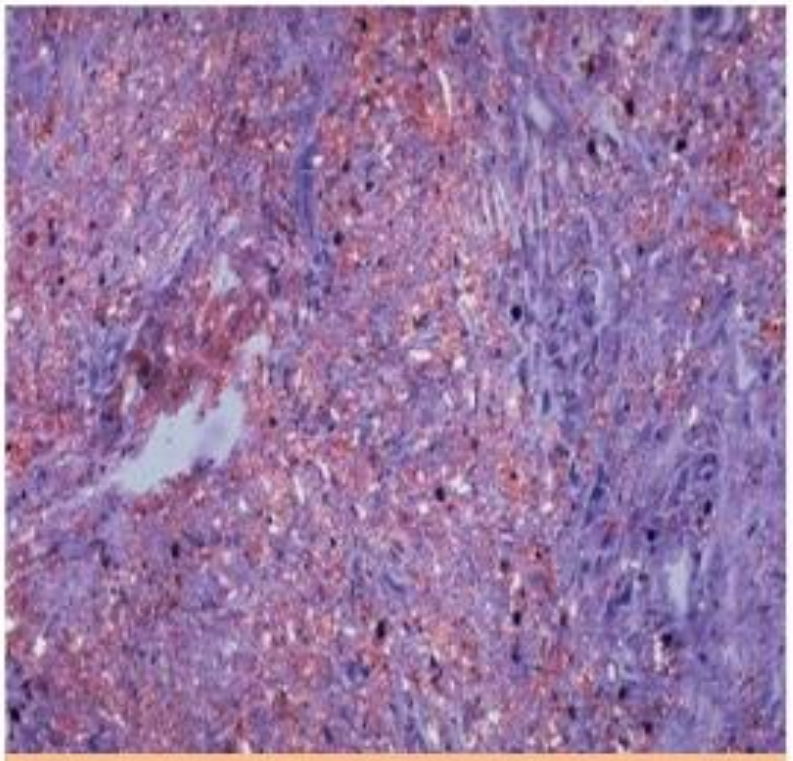
The silicotic nodule is the pathologic hallmark

- The silicotic nodule is the pathologic hallmark of silicosis,
  - Large opacities retract toward the hilum resulting in sub pleural areas of air space enlargement (appear as bullae).
  - Large opacities combine in the upper lung zones result in
    - loss of upper zone volume and elevation of both hila and
  - development of basilar emphysema

"**Eggshell" calcification**, when present, is strongly suggestive of silicosis

silicosis

Chest radiography showing Eggshell calcification



Polarized light microscopy showing Crystals of silica

▪ Diagnosis:

- History of silica exposure
- Chest radiographic abnormalities
- Pulmonary function tests show obstructive lesion.
- Absence of other illnesses that mimic silicosis as Miliary T.B,

❖ Lung function: In general when the radiographs show only small rounded opacities of low profusion of simple silicosis →

▪ no significant impairment in lung capacity is associated.

➢ But later, shows a restrictive pattern lung changes

➢ decreased FEV1 /FVC %)

(forced expiratory volume in one second/ forced vital capacity

significant lung function loss

Lung function tests: ↓ FVC, ↓ TLC, ↓ FEV1, ↓ FEV1/FVC ratio → findings indicate a mix of restrictive and obstructive lung disease

Simple silicosis is a risk for development of complications

(1) Cardiorespiratory complications:

- Progressive massive fibrosis (PMF).
- About three fold risk of pulmonary and extra pulmonary T.B.
- Core pulmonale and Rt. side heart failure.
- Basilar emphysema associated with P.M.F increases the
- risk of spontaneous pneumothorax.
- The stiff lung and inability to expand well eventually lead
- to Death due to progressive respiratory insufficiency

(2) Immune mediated complications:

- Disseminated sclerosis (DS).
- Scleroderma.
- Rheumatoid arthritis and caplan's syndrome.

(3) Renal complication (a spectrum of nephropathy):
Glomerulonephritis or nephrotic syndrome
Tubular damage

(4) Cancer: by crystalline silica exposure.

II) Accelerated silicosis

- ❑ Results from exposure **to higher concentration of silica**
- ❖ **over a period** of **5-10 years.**
- ❖ **Due to a high exposure** to **fine dust of high silica content.**
- ❑ **clinical autoimmune connective tissue diseases are frequently associated.**
  - ✓ **Scleroderma**
  - ✓ **Rheumatoid arthritis**
  - ✓ **Lupus erythmatosis (LE)**
- ❑ **Condition is progressive even if worker is removed from exposure**

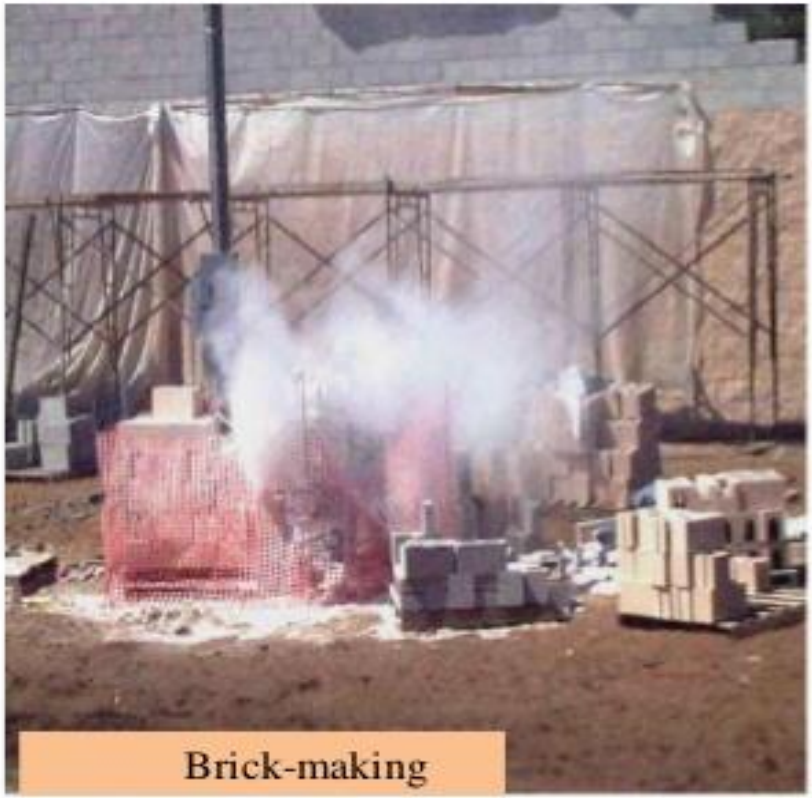
- Spectrum of silicosis include:
  Classic silicosis (simple) and (PMF)
  Accelerated (simple) and complicated (PMF)
  Acute

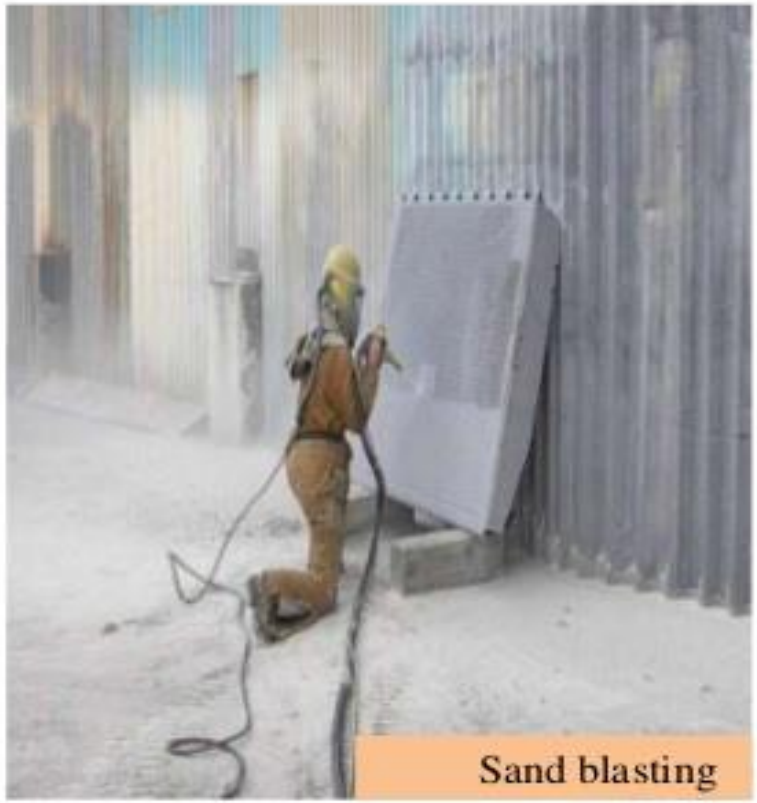
(III) Acute silicosis

- Results from over whelming(massive)excessive concentrations
- very heavy exposure to fine dust for months,
- shows symptoms within weeks to months of exposure
- 80% of cases occur as little as few years or even 1 year &
- End in death within several years due to respiratory failure.
- Fever , weight loss ,cough and dyspnea.
- It occurs more frequent in industrial activities
- where silica is fractures or crushed such as in
- sand blasting or rock drilling.

silicosis

silicosis

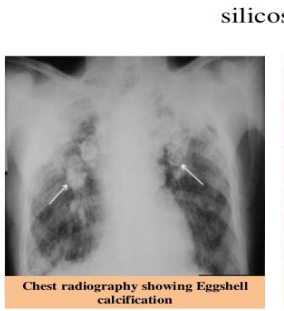

Brick-making


Sand blasting

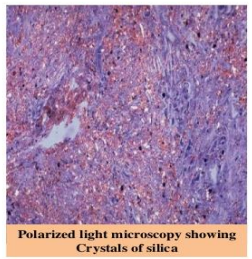
silicosis Brick-making Sand blasting

Clinical features:

- Chronic irritant cough
- Dyspnea (shortness of breath) that worsens with exertion.
- Fatigue
- Loss of appetite
- Chest pains



Chest radiography showing Eggshell calcification


Polarized light microscopy showing Crystals of silica

- With more advanced disease,
- impairment of total lung capacity (TLC) is commonly present
- Acute silicosis patients may also have fever and
- rapid, unintended weight loss.

❖ Chest X-ray of the shows "snow-storm" appearance

- the hallmark of silicosis is the silicotic nodule
- Chest radiography showing Eggshell calcification
- On histopathology

Polarized light microscopy showing Crystals of silica

Silico tuberculosis:

- Silicosis is progressive and what is more important is
- that silicotics are prone to pulmonary tuberculosis, a condition called "silico-tuberculosis.

- Pulmonary tuberculosis occurs in about 25% of patients with acute or classic silicosis

- in silicotuberculotics sputum rarely shows tubercle bacilli

TREATMENT:

- There is no specific effective treatment for the silicosis,
- Fibrotic changes that have already taken place cannot be reversed.
- There is no known method of intervention to prevent the condition's progression
- the only way that silicosis can be controlled is by:

(a) rigorous dust control measures, e.g., substitution, complete enclosure, isolation, hydroblasting,

good house-keeping, personal protective measures and

Cont. … TREATMENT:

good house-keeping, personal protective measures and

(b) regular physical examination of workers

- Silica exposure has to be stopped to prevent further damage to the lungs,
- Smokers should quit smoking.
- TB positive patients need to be put on anti- TB treatment
- The course of progression often extends over decades even after cessation of exposure.

❑ Prevention remains the most effective therapeutic approach


THANK YOU

Asbestos Diseases 2

Asbestosis

- Scarring of lung tissue reducing ability to take oxygen.
- Dose related disease ;repeated regular exposures.
- Debilitating disease and can be fatal.
- Latency period 10-20 years

Asbestos fibers