SCBM341 - Environmental Pathology

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Problem

- A 57 years old male, 160 cm height, 78 kg weight, works in the coal mine more than 30 years, smokes 1 pack/day since teenage and drinks everyday.

What are the risk factors for his health or illness?
What is Environmental Pathology?

It is the field that deals with the diseases caused by exposure to harmful external agents and deficiencies of vital substances.
Water pollution

Noise pollution
London Heathrow Airport

Air pollution

Hazardous waste
Particulate Matter

- Particles of different substances suspended in the air in the form of solid particles and liquid droplets
- Particles vary widely in size
PM Sources

Fine particles come from a variety of sources:
• diesel trucks and buses
• construction equipment
• power plants
• woodstoves
• wildfires

Lung Responses

• Functional changes: respiratory rate, respiratory depth and clearance
• Allergic
• Structural changes
• Cancer
Particles Clearance

• Nasal clearance
  – wiping or blowing
  – mucociliary transport

• Tracheobronchial clearance
  – mucociliary transport

• Pulmonary Clearance
  – Mucociliary escalator
  – Phagocytized by macrophages
  – Dissolve and be removed via blood or lymphatics
  – Direct penetration of epithelial membranes (ultrafine particles)
Nicotiana tabacum

TOBACCO SMOKE
Male erectile dysfunction
# Effects of Tobacco Smoke Constituents

<table>
<thead>
<tr>
<th>Substance</th>
<th>Effect</th>
</tr>
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<tbody>
<tr>
<td>Tar</td>
<td>-Carcinogenesis</td>
</tr>
<tr>
<td>Nicotine</td>
<td>-Tumor promotion</td>
</tr>
<tr>
<td>Phenol</td>
<td>-Tumor promotion, irritation</td>
</tr>
<tr>
<td>Benzophyrene</td>
<td>-Carcinogenesis</td>
</tr>
<tr>
<td>Carbon monoxide</td>
<td>-Impaired oxygen transport</td>
</tr>
<tr>
<td>Formaldehyde</td>
<td>-Toxicity to cilia and irritation</td>
</tr>
<tr>
<td>Nitrosamine</td>
<td>-Carcinogenesis</td>
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</table>
• Nicotine Stained Nails: The result of many years of holding

Destruction of collagen

Lines around the lips
Damaged Teeth and Gums

Cataracts

Hair loss
It is a lung disease involving destruction of alveoli and the surrounding tissue that supports the alveoli.

With more advanced disease, large air cysts develop where normal lung tissue used to be.
• The clusters of dilated air spaces which are conspicuous in the middle and lower lobes of the right lung and the lower lobe of the left lung. Both lungs are markedly enlarged.
• Lung showing centrilobular emphysema characteristic of smoking. Cut surface shows multiple cavities lined by heavy black carbon deposits.
Emphysema

Loss of alveolar septa,
Enlarged air spaces
Squamous cell carcinoma commonly starts in the bronchi and may not spread as rapidly as other lung cancers.
This is a squamous cell carcinoma of the lung. It is a mass that extends into surrounding lung parenchyma.
In this squamous cell carcinoma at the upper left is a squamous with a keratin pearl. At the right, the tumor is less differentiated and several dark mitotic figures are seen.
Adenocarcinoma usually develops on the outer boundaries of the lungs and is more commonly found in women than in men.
• This is a peripheral adenocarcinoma of the lung.

• Adenocarcinoma is the one cell type of primary lung tumor that occurs more often in non-smokers and in smokers who have quit.
Gland production and/or mucin production is diagnostic of adenocarcinoma.
Smoking and Female Reproductive Function

1. Earlier menopause
2. Fetal tobacco syndrome
Earlier Menopause

Liver

 Estradiol $\rightarrow$ Estrone

 Liver

 16-hydroxylation $\rightarrow$ Estriol

 Estrogenic activity

 Smoker

 Estrone $\rightarrow$ Methoxyestrone

 2-hydroxylation $\rightarrow$ Methoxyestrone

 No estrogenic activity
Fetal Tobacco Syndrome

It refers to the deleterious effects of maternal cigarette smoking on the development of the fetus.

Effect of smoking on birth weight. Mothers who smoke give birth to smaller infants.
Micronodular cirrhosis

Normal liver

Just add alcohol...
Alcoholic Liver Disease
• Micronodular cirrhosis of the liver
Acute Alcoholism

The liver cells show cytoplasmic accumulation of fat and hyaline.
• Cirrhosis of the liver
Hepatocellular carcinoma
Hepatocellular carcinoma
Fetal Alcohol Syndrome

• First recognized in 1968: Maternal ethanol consumption only one drink per day occurs the *fetal alcohol syndrome*.

• It is characterized by growth and developmental defects, including microcephaly; facial dysmorphology; and malformations of the brain, cardiovascular system and genitourinary system.

• CDC: Facial dysmorphismology
  1. Smooth philtrum
  2. Thin upper lip
  3. Small palpebral fissure

http://www.moondragon.org/obgyn/graphics/fasface.jpg
Fetal Alcohol Syndrome


http://www.dailysquib.co.uk/files.php?file=foetal_alcohol_syndrome2.jpg
Fetal Alcohol Syndrome

- It is hypothesized that acetaldehyde, a metabolite of ethanol, crosses the placenta and damages the fetal brain.
- Altered prostaglandin release and altered placental blood flow cause fetal hypoxia and growth retardation.
Pneumoconiosis is a term originally coined to describe the non-neoplastic lung reaction to inhalation of mineral dusts. ("conios" in Greek = dust)

1. Coal dust
2. Silica
3. Asbestos
Coal Workers’ Pneumoconiosis (CWP)

1. Anthracosis (Coal dust accumulation)
2. Simple coal workers pneumoconiosis
   - occurs after years of exposure to coal dust
   - coal nodules and emphysema
   - minimal defects in lung function
     Carbon laden macrophages in alveolar spaces and interstitium (nonfibrogenic)
Progressive Massive Fibrosis (PMF)

2. Complicated CWP = progressive massive fibrosis

- CWP in many years can progress to PMF
- Blackened large scars, dense collagen
- Compromised lung function

Black lung disease
Progressive massive fibrosis: Large black nodules in the lung and diffusely black parenchyma.
Silicosis

- Silicosis, also known as Potter's rot, is a form of occupational lung disease caused by inhalation of crystalline silica dust, and is marked by inflammation and scarring in forms of nodular lesions in the upper lobes of the lungs.

Amethyst quartz from Brazil
vermiculite
Silicosis

Advanced silicosis seen on transection of lung. Scarring has contracted the upper lobe into a small dark mass (arrow). Note the dense pleural thickening.
Silicosis

- The confluence of whorled, hyalinized, fibrous silicotic nodules.
Asbestosis

Asbestosis is a chronic inflammatory and fibrotic medical condition affecting the parenchymal tissue of the lungs caused by the inhalation and retention of asbestos fibers.
Asbestosis

This long, thin object is an asbestos fiber.
Ferruginous bodies are fibers of asbestos coated with an iron-rich material derived from proteins such as ferritin and hemosiderin. Ferruginous bodies are believed to be formed by macrophages that have phagocytized and attempted to digest the fibers.
Berylliosis

- Berylliosis, or chronic beryllium disease (CBD), is a chronic allergic-type lung response and chronic lung disease caused by exposure to beryllium and its compounds.
Berylliosis

Cytoplasmic star-like formation (asteroid body) is seen in a multinucleated giant cell in beryllium granuloma.
Answer

What are the risk factors for his health or illness?

- 1. Age → Joint, hypertension, hypercholesterolemia
- 2. High BMI → Obesity
- 3. Coal mine → Occupational and environmental Disease
- 4. Cigarette → Respiratory disease
- 5. Alcohol → GI or liver disease
References

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