Learning Objectives

• What is asbestos?
• Most important route of exposure
• Populations most heavily exposed
• Diseases associated with asbestos exposure
• Common findings on medical evaluation
Learning Objectives (continued)

• Chest radiograph findings
• Pulmonary function test findings
• Other tests that can assist with diagnosis
• Primary treatment strategies
• Instructions for patients
Asbestos: Description

• Asbestos is a generic term for a group of six mineral silicates

• Asbestos fibers are:
  – Very strong
  – Highly flexible
  – Resistant to breakdown by acid, alkali, water, heat, and flame
  – Non-biodegradable
  – Environmentally persistent
# Asbestos: Types

<table>
<thead>
<tr>
<th>Serpentine</th>
<th>Amphibole</th>
</tr>
</thead>
<tbody>
<tr>
<td>(93% of commercial use)</td>
<td>(7% of commercial use)</td>
</tr>
<tr>
<td>Chrysotile</td>
<td>Actinolite, Amosite, Anthophyllite, Crocidolite, Richterite, Tremolite</td>
</tr>
</tbody>
</table>
• Until 1975: Automobile, building construction and shipbuilding industries

• Until 1990: Contaminant in vermiculite
Asbestos: Occurrence in the United States

(continued)

• Today: Exists in older homes and commercial buildings
  – problematic when loose, crumbling, or disturbed
• Today: Still used in brake pads, clutches, roofing material, vinyl tiles, and some cement pipes
• Naturally occurring asbestos is found in parts of the U.S. areas in asbestos bearing rocks. It is released:
  – when disturbed
  – as rocks weather
**Populations At Risk**

<table>
<thead>
<tr>
<th>Past Exposures</th>
<th>Current Exposures</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Mechanics, construction workers, shipyard workers, and military personnel</td>
<td>• Construction workers, mechanics (brake pads)</td>
</tr>
<tr>
<td>• Secondary exposure in the workplace</td>
<td>• People in homes with friable asbestos materials</td>
</tr>
<tr>
<td>• Household contacts of workers</td>
<td>• People in areas where asbestos-bearing rock is disturbed</td>
</tr>
</tbody>
</table>

For information on where to find certified asbestos removal contractors in your state, contact your local department of health or environment.
Asbestos Exposure Pathways

• Most common exposure pathway:
  – Inhalation of fibers

• Minor pathways:
  – Ingestion
  – Dermal contact
Biologic Fate

- Asbestos bodies
- Lower airways and alveoli
- Pleural or peritoneal spaces or the mesothelium
Pathogenesis

• Asbestos fibers induce pathogenic changes via:
  – Direct interaction with cellular macromolecules
  – Generation of reactive oxygen species (ROS)
  – Other cell-mediated mechanisms

• These changes can lead to cell injury, fibrosis, and possibly cancer

• Asbestos is genotoxic and carcinogenic
Asbestos-Associated Diseases

• Respiratory diseases:
  – Parenchymal asbestosis
  – Asbestos-related pleural abnormalities
  – Lung carcinoma
  – Pleural mesothelioma

• Nonrespiratory diseases:
  – Peritoneal mesothelioma
  – Possibly, other extrathoracic cancers
  – Rarely, cor pulmonale or constrictive pericarditis
Parenchymal Asbestosis

• Diffuse interstitial fibrosis with:
  – Restrictive pattern of disease on pulmonary function testing (but can see mixed pattern)
  – Impaired gas exchange
  – Progressive exertional dyspnea

• Radiographic changes: >10 years

• Latency period: 20-40 years
Asbestos-Related Pleural Abnormalities

- Four types of abnormalities:
  - Pleural plaques
  - Benign asbestos pleural effusions
  - Diffuse pleural thickening
  - Rounded atelectasis

- Mostly asymptomatic, though some can cause dyspnea or cough

- Latency periods: 10-30 years (shorter latency is for pleural effusion)
Lung Carcinoma

• Risk depends on:
  – Level, frequency, and duration of exposure
  – Time elapsed since exposure
  – Age at time of exposure
  – Smoking history (synergistic)
  – Individual susceptibility factors (under investigation)

• Latency period: 20-30 years
Malignant Pleural Mesothelioma

• Tumor arises from the thin serosal membrane surrounding the lungs
• Rapidly invasive
• Rare, although incidences are increasing
• Long latency period: Usually 30-40 years
Malignant Peritoneal Mesothelioma

- “Doughy” feeling on abdominal palpation
- Male:female incidence is 1.5:1 (compared to 5:1 with pleural tumor)
- Rapidly invasive and rapidly fatal
- Often associated with high-dose asbestos exposures
- Rare
Other Extrathoracic Cancers

• Colon cancer
• Possibly cancer of larynx, stomach, kidney, esophagus
• Association with asbestos exposure remains controversial
• Regular colon cancer screening for people over age 50 years
• Screening for other extrathoracic cancers not recommended
Cardiovascular Conditions

• Cor pulmonale
  – Secondary to chronic lung disease
  – Mainly with severe parenchymal asbestosis

• Constrictive pericarditis
  – Secondary to asbestos-associated disease
  – Very rare
Risk Factors

• Nature and extent of exposure:
  – Concentration of asbestos fibers
  – Duration of exposure
  – Frequency of exposure

• Cigarette smoking
Diagnosis

• Medical evaluation of all patients should include:
  – Assessment of clinical presentation
  – Exposure history
  – Medical history
  – Physical examination
  – Chest radiograph and pulmonary function tests

• Radiologic and laboratory testing can include:
  – CT or HRCT
  – BAL
  – Lung biopsy (rarely needed)
<table>
<thead>
<tr>
<th>Disease</th>
<th>Signs and Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parenchymal Asbestosis</td>
<td>• Insidious onset of dyspnea on exertion</td>
</tr>
<tr>
<td></td>
<td>• Fatigue</td>
</tr>
<tr>
<td>Asbestos-Related Pleural</td>
<td>• Usually: None</td>
</tr>
<tr>
<td>Abnormalities</td>
<td>• Sometimes: Progressive dyspnea and intermittent chest pain (depending on the type of pleural abnormality)</td>
</tr>
<tr>
<td>Lung Cancer</td>
<td>• Usually: None (until later stages)</td>
</tr>
<tr>
<td></td>
<td>• Sometimes: Fatigue, weight loss, or chest pain</td>
</tr>
<tr>
<td>Mesothelioma</td>
<td>• Usually: None (until later stages)</td>
</tr>
<tr>
<td></td>
<td>• Sometimes: Dyspnea, chest pain, and fatigue</td>
</tr>
</tbody>
</table>
## Patient History

<table>
<thead>
<tr>
<th>Exposure History</th>
<th>Medical History</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Work history</td>
<td>• History of smoking</td>
</tr>
<tr>
<td>• Source, intensity, duration, and frequency of exposure</td>
<td>• History of other conditions</td>
</tr>
<tr>
<td>• Time elapsed since first exposure</td>
<td></td>
</tr>
<tr>
<td>• Workplace dust measurements or description of exposure scenario</td>
<td></td>
</tr>
<tr>
<td>• Use of personal protective equipment</td>
<td></td>
</tr>
<tr>
<td>• Paraoccupational exposures</td>
<td></td>
</tr>
<tr>
<td>• Sources of environmental exposure</td>
<td></td>
</tr>
</tbody>
</table>

Link to Taking an Exposure History CSEM and other publications in this series:  
http://www.atsdr.cdc.gov/HEC/CSEM/csem.html
Physical Examination

• Focus on lungs, heart, digits, and extremities

• Pulmonary auscultation to detect bibasilar inspiratory rales (not always present)

• Observation of other signs, such as clubbing of the fingers and cyanosis
## Pulmonary Function Tests

<table>
<thead>
<tr>
<th>Disease</th>
<th>Pulmonary Function Test Findings</th>
</tr>
</thead>
</table>
| **Parenchymal Asbestosis**           | • Reduction in FVC; normal FEV1/FVC Ratio  
• Reduction in FEF (25%-75%)  
• Restrictive pattern with decreased DLCO  
• Or, mixed obstructive/restrictive pattern (reduced FEV1/FVC associated with reduced FVC) |
| **Asbestos-Related Pleural Abnormalities** | • Often normal  
• Reduced FVC can be associated with diffuse pleural thickening                                |
Chest Radiograph Findings: Parenchymal Asbestosis

- Small, irregular oval opacities
- Interstitial fibrosis
- “Shaggy heart sign”

List of certified B Readers: http://www.cdc.gov/niosh/pamphlet.html
Chest Radiograph Findings:
Asbestos-Related Pleural Abnormalities

• Pleural plaques
  – Areas of pleural thickening
  – Sometimes with calcification

• Pleural effusions

• Diffuse pleural thickening
  – Lobulated prominence of pleura adjacent to thoracic margin (over ¼ of chest wall)
  – Interlobar tissue thickening

• Rounded atelectasis
  – Rounded pleural mass
  – Bands of lung tissue radiating outwards
Chest Radiograph Findings: Lung Cancer

• Same findings as those of other lung cancer etiologies
Chest Radiograph Findings: Mesothelioma

- Pleural effusions
- Pleural mass
- Diffuse pleural thickening
Other Tests

- CT and HRCT
- BAL and lung biopsy
- ABGs and pulse oximetry
- Colon cancer screening
# Disease Management

<table>
<thead>
<tr>
<th>Asbestos-associated Disease</th>
<th>Treatment Strategy</th>
</tr>
</thead>
</table>
| Parenchymal Asbestosis and Asbestos-Related Pleural Abnormalities | • Stopping additional exposure  
• Careful monitoring to facilitate early diagnosis  
• Smoking cessation  
• Regular influenza and pneumococcal vaccines  
• Pulmonary rehabilitation as needed  
• Disability assessment  
• Aggressive treatment of respiratory infections                  |
| Lung Cancer and Mesothelioma                                     | • Early diagnosis  
• Surgery  
• Chemotherapy  
• Radiation                                                        |
Communication with the Patient

- Obtain patient’s employer contact information to facilitate occupational exposure prevention (OSHA mandates PPE and medical surveillance)
- Counsel patient regarding smoking cessation
- Have patient consult you for health changes
- Provide and review patient education and instruction sheet with patient
Summary

• Asbestos exposures peaked in the United States in 1940-1980, but continue to occur today

• Inhalation of asbestos can lead to
  – parenchymal asbestosis,
  – pleural abnormalities,
  – lung carcinoma, and
  – mesothelioma
• Diagnosis involves
  – exposure and medical history,
  – physical examination,
  – chest radiography,
  – pulmonary function tests, and
  – other tests as needed
• Management focuses on:
  – Preventing further exposures
  – Smoking cessation
  – Monitoring to aid early detection
  – Patient education
For More Information

• Contact CDC-INFO
  – 800-CDC-INFO (800-232-4636)
  – TTY 888-232-6348
    24 Hours/Day
  – E-mail: cdcinfo@cdc.gov

• CDC Emergency Response:
  – 770-488-7100 - for state and local health department assistance

• Also refer to Where can I find more information? in the Asbestos Toxicity CSEM for a list of Web resources and suggested readings: