OCCUPATIONAL ASBESTOSIS AND RELATED DISEASES

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A 63-year-old man consulted an internist complaining of dyspnea on exertion. He reported the following: Except for the relatively recent onset and gradual worsening of his shortness of breath, his health had always been excellent. For more than 30 years, he had worked as a high school physical education instructor and coach. He had never smoked.

Physical examination revealed dry crackles in the lung bases. On pulmonary function tests, all lung volumes were reduced. Chest X-ray revealed irregular interstitial opacities in the lower zones of both lungs and bilateral pleural plaques.

Only by delving further into the occupational history did the physician uncover a key fact: During World War II, the patient had been employed in a shipyard for several years. His job had involved the spraying of asbestos insulation in a poorly ventilated, confined space without adequate respiratory protection.

He had asbestosis.

A challenge to physicians

A large number of Americans are at risk of developing asbestosis, a life-threatening disease for which there is no effective therapy. Before enactment of stringent government regulations in the 1970s, millions were employed in workplaces containing levels of airborne asbestos high enough to cause asbestos-related disease. Several million workers in the United States continue to be exposed to the fiber.

The individual presenting with features of asbestosis can represent a diagnostic challenge for the physician. The symptoms typical of asbestosis are insidious and occur in many other diseases. The radiologic differential diagnosis is also large. Lung function studies may show restriction and/or obstruction, but are not pathognomonic.

Because the latency period for this illness is usually 35–40 years, patients may fail to recall having worked with asbestos. In cases of so-called “bystander contact” with the mineral, has been demonstrated that persons situated near asbestos workers in the workplace can receive sufficient exposure to result in disease. It is also possible for individuals with no occupational history of exposure to develop asbestos-related illnesses. For example, family members of asbestos workers, and people living in the vicinity of asbestos mines and factories, have been diagnosed with the asbestos-related cancer mesothelioma.

In patients appearing to suffer from asbestosis, evaluation by specialists in occupational medicine can assist in:

- diagnosing asbestosis early so that supportive therapy can be instituted and unnecessary additional testing averted;
- monitoring for treatable cancer for which exposed individuals are at increased risk;
- dealing with medicolegal issues;
- identifying and treating other diseases which may be mistaken for asbestosis.

Regular medical screening is important for both past and present asbestos-exposed workers. Persons who have worked with asbestos but who are asymptomatic may also

need medical assessment. Workers with more than 10 years' exposure should be checked annually. All individuals currently working with asbestos, in addition to requiring special respiratory protection and training, are required by OSHA to undergo regular medical monitoring.

Asbestos

Asbestos is a fibrous mineral occurring in six major types, all of which are hydrated silicates—chrysotile, crocidolite, amosite, anthophyllite, tremolite and actinolite. Differences in chemical structure result in varied physical and biological properties. In the United States, 95 percent of commercially used asbestos is chrysotile, the serpentine type, which consists of relatively large, pliable, curly fibrils which tend to occur in bundles. The other forms of asbestos are referred to as the amphibolic group. They have needlelike fibers which can penetrate more deeply into the lung, in part accounting for their higher pathogenicity.

Over the centuries, asbestos has become well-known for its strength, durability, flexibility, incombustibility, resistance to corrosion by alkalis and most acids, spinability and effectiveness as insulation against heat and cold. Emperor Charlemagne of France is reputed to have impressed his enemies by passing an asbestos tablecloth through fire to clean it. Asbestos minerals were introduced into modern industry in 1878, and since that time their production and consumption have proliferated.

Today, asbestos has as many as 3,000 uses. The construction industry is its major consumer in this country. Among products which contain asbestos are cement pipes, flooring, millboard, automobile brake linings and clutch facings, roofing, thermal and electrical insulation, textiles, packings, gaskets and many others. More than 37,000 people are currently employed in the manufacture of primary asbestos products. Another 300,000 work in secondary asbestos industries. Several million are exposed to asbestos in industries such as brake repair, construction trades and shipyards.

Asbestosis

It has been reported that in the first century A.D., Pliny commented on the sickness of slaves who worked with asbestos. As commercial production began in the late 1800s, a few case reports appeared describing asbestos fiber inhalation in the workplace as injurious to the lung. The first reference to pulmonary fibrosis in an asbestos textile worker appeared in England in 1907. It was not until 1924 that Cook described in complete histologic and pathologic detail the presence of "curious bodies" in the lungs of asbestos workers and coined the term "asbestosis."

Asbestosis is currently defined as a diffuse fibrous pneumoconiosis resulting from the inhalation of asbestos particles. The principal lesion is fibrosis caused by fibers that become lodged in the respiratory bronchioles and alveoli. Alveolar macrophages engulf many of the fibers, resulting in cellular death and the release of mediators which appear to induce a chronic alveolitis and ultimately loss of functional alveolar capillary units. Bronchoalveolar lavage of exposed workers with or without radiographically evident asbestosis has revealed an increase in cellularity with an increase in the percentage of neutrophils or lymphocytes, implying a subclinical inflammatory response in the lungs of many individuals.

The pathologic diagnosis of asbestosis is based on the extent and severity of parenchymal fibrosis and the presence of asbestos bodies, coated asbestos fibers, in the lung parenchyma. Asbestos bodies usually have a beaded surface with clubbed ends. The core is generally a fiber of the amphibolic type; chrysotile asbestos is rarely found in the asbestos-body core. The number of asbestos bodies and the extent of fibrosis tend to correlate poorly.

Clinical findings

In most cases the disease emerges slowly and insidiously.

- Dyspnea is common, at first occurring on exertion and progressing in severity until it may be present even at rest.
- Cough appears in the later stages of many cases and is usually dry or productive of small amounts of viscid mucoid sputum.
- Inspiratory rales sometimes may be heard in the posterior lateral basilar chest.
- Clubbing of the fingers may be observed in advanced stages.

Hemoptysis is not caused by asbestosis, and weight loss is not usual. If either occurs, lung cancer should be suspected.

The diagnosis of asbestosis usually rests on the history of exposure and the presence of parenchymal opacities on the chest radiograph according to a standard classification system. Although originally designed as an epidemiologic tool, the International Labour Organization (ILO) Classification of the Pneumoconioses has become a benchmark for legal purposes as well. The radiographic appearance of asbestosis is typically irregular opacities in the lower two-thirds of both lung fields. Pleural plaques seen along the lateral margins of the thorax and on the diaphragm are highly suggestive but not pathognomonic for asbestos exposure. Progression of radiographic abnormalities is usually observed despite removal of the patient from asbestos exposure.

Pulmonary function in asbestosis is characterized classically by a restrictive impairment with a reduction in forced vital capacity, total lung capacity, functional residual capacity and residual volume. Gas exchange abnormalities frequently occur as the disease advances. These are characterized by abnormal diffusing capacity, increasing hypoxemia during an exercise test, or resting room air hypoxemia. Obstructive physiology without bronchodilator responsiveness is also a common finding, even in nonsmokers with asbestosis. Radiographic changes can be seen in the face of normal pulmonary function. Alternatively, loss of lung volume and gas exchange may occur before abnormalities appear on X-rays.

Other asbestos-related diseases

In addition to asbestosis, three other major types of diseases have been conclusively related to asbestos exposure.

Benign pleural disorders include benign pleural effusions, pleural fibrosis, rounded atelectasis, and pleural plaques, with the latter being the most common manifestation of exposure to asbestos. Pleural plaques can be seen with or without asbestosis. Pleural plaques are felt to be markers of exposure and are not premalignant. They can be associated with pulmonary function abnormalities even in the absence of asbestosis. Asbestos fibers are sometimes identified using electron microscopy within the thickened pleura.

Lung cancer, either squamous cell or adenocarcinoma, is the cancer most frequently associated with asbestos exposure. The tumor often occurs in an area of fibrosis, usually in the lower parts of the lungs. As a rule, there is a dose-response relationship (the greater the dose of asbestos or the longer the exposure period, the higher the risk for developing lung cancer). The average latency period is 20–30 years.

The risk for lung cancer is greatly multiplied if the worker exposed to asbestos also smokes, so smoking cessation and regular monitoring of patients with a history of both smoking and significant asbestos exposure are essential so that lung cancer can be abated, or detected and treated early.

Mesothelioma, a cancer that arises in the pleura and the peritoneum, is so rare in the general population that it is said to be a "signal tumor" of asbestos exposure. More than 80 percent of cases occur in persons who have worked with asbestos. Risk may increase by a magnitude of five if exposure begins early in life. The usual latency period is 35–40 years. Asbestosis is present in a minority of cases, and there appears to be no relationship with cigarette smoking in the risk for mesothelioma. Most patients survive less than 12 months after diagnosis.

Radiographs of individuals with this disease usually reveal a large pleural effusion, frequently accompanied by a lobulated pleural density which encases a large portion of the lung. The pleural effusion is exudative, and malignant cells can be identified in up to two-thirds of patients on thoracentesis. Open pleural biopsy is preferred in order to obtain sufficient tissue for diagnosis. Needle biopsy of the pleura rarely provides enough information. Asbestos bodies are rarely found in the tumor.

Other malignancies with which asbestos has been associated include cancers of the bucchal cavity, pharynx, larynx, gastrointestinal tract (stomach and colon), kidney, pancreas, ovary, lymphatic system and eye. Medical surveillance should therefore include attention to these organ systems in addition to the lungs.

Occupational and environmental health services at National Jewish

Among the occupational and environmental health services offered by the National Jewish Center for Immunology and Respiratory Medicine are evaluation of patients with suspected or confirmed asbestosis, treatment when appropriate and requested by the referring physician, respirator fit-testing, and design and implementation of prevention programs to assist in identifying and reducing workplace exposures.

The Center is one of only a few medical institutions nationwide providing state-of-the-art diagnosis and treatment of occupational and environmental disorders. National Jewish has also been designated a Specialized Center for Research on interstitial lung diseases by the National Institutes of Health.

Staff of the Department of Occupational Medicine include physicians board-certified in occupational, internal and pulmonary medicine, industrial hygienists, occupational health nurses, epidemiologists and respirator fit technicians.

Specialized clinical services include:

- classification of X-rays by certified B readers using the ILO classification system;
- complete pulmonary function testing, including body plethysmographic measurements of lung volume and exercise physiology assessment;
- a full range of other diagnostic tests, including bronchoalveolar lavage and open-lung biopsy when indicated;

· medical treatment, rehabilitation, and psychosocial counseling.

The Center's comprehensive Industrial Respiratory Protection Program provides quantitative respirator fit-testing meeting all federal standards and hands-on training of workers in respirator use by certified respirator technicians and industrial hygienists. Education and training are offered in recognizing and preventing workplace risks and problems, including seminars on the health hazards of asbestos exposure.

To consult with a specialist in occupational and environmental medicine at National Jewish, to refer a patient, or to obtain additional information call 800-222-5864 ext. 1733 (toll-free) or (303) 398-1733.

References

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