

Asbestos-related diseases

Asbestos-related diseases include:

1. **non-malignant diseases:** asbestosis, pleural plaques, acute pleurisy
2. **malignant diseases:** bronchogenic carcinoma, malignant pleural peritoneal mesothelioma, laryngeal and ovarian carcinoma.

Characteristics

Asbestos is a group of minerals (silicates) that exist in two forms – **serpentine** and **amphiboles**. Their common feature is a **fibrous structure**, with long and thin fibers. The fibers are **not flammable** and are **resistant** to acids and alkalis.

1. *Serpentine fibers* – chrysotile ("white asbestos")
 - The fibers are long, flexible, twisted, and intertwined (used in textile processing, the only asbestos that is industrially produced is chrysotile)
2. *Amphibole fibers* – 5 types: crocidolite ("blue asbestos"), amosite, anthophyllite, actinolite, tremolite,
 - The fibers are comparatively short, brittle, and very resistant to acids.

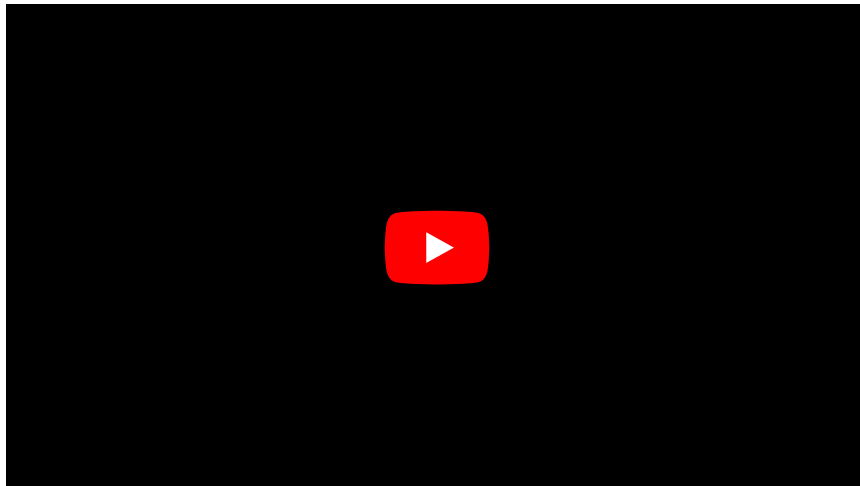
Occupational exposure

- This occurs during mining and transport (less common nowadays since it is packaged in plastic).
- Also, exposure can occur during processing and usage.
- Usage: asbestos-cement materials, roofing (eternit), pipes, cladding boards, textiles (protective clothing for firefighters and metallurgical workers), friction and braking equipment (formerly used to make brake pads).

Asbestosis

Asbestosis is a form of **interstitial fibrosis** of the lung. It is an asbestos exposure related disease. Asbestosis is a type of pneumoconiosis.

Asbestosis:



Pathology

After asbestos fibers are inhaled into the alveoli, the fibers provoke the immune cells in lungs and cause an inflammatory reaction. A part of this reaction is fibrogenesis in the interstitial space.

It seems to be histologically similar to the other interstitial pulmonary fibrosis, but it also contains ferruginous bodies.

Clinical notes

Patient history

Asbestosis development and presentation depends on the exposure time. The disease is chronic and progressive. It can manifest 20 years after exposure, when the symptoms become clear. It is very important to find out how the patient was exposed:

Occupational exposure

- workers involved in the manufacturing of asbestos products
- asbestos miners and millers
- power plant workers
- boilermakers
- shipyard workers
- firefighters.^[1]

Non-occupational exposure

Asbestos was used in the construction of the walls of many buildings including schools: teachers who work in these buildings are exposed to asbestos and therefore their lives could be endangered as well.^[2]

Symptoms

- **shortness of breath** – first when walking, climbing stairs, than at rest (asbestosis is a progressive disease)
- **cough**^[2]
- low blood oxygen level^[3]

The most common **complication is COPD**^[2], respiratory insufficiency, pulmonary hypertension, cor pulmonale.

Diagnosis

- physical examination, lung function tests
- X-ray imaging
- CT or MRI
- lung biopsy
- definitive diagnosis is based on a microscopic examination of a lung biopsy by a pathologist!

Therapy

Unfortunately, therapy is mostly supportive and is focused on treating the progressive respiratory failure:

- Treatment of COPD (bronchodilators, corticosteroids...);
- Oxygen therapy;
- Lung transplantation.^[2]

Notes

Other asbestos exposure related diseases are:

- mesothelioma
- lung cancer

Pleural hyalinosis

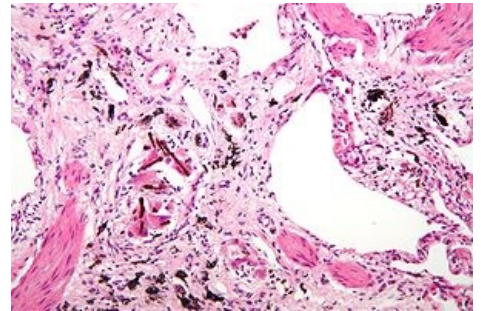
Demarcated pleural plaques and diffuse pleural thickening are characteristic. These result from the direct local inflammatory response to the presence of asbestos fibers in the pleural cavity. These fibers alveoli via the lymphatic system, and then injure the pleura, leading to inflammation and hemorrhage, and eventually adhesion formation via organization.

- **Pleural plaques** – demarcated hyaline fibrous lesions - especially found in the submesothelial layer of the posterolateral parietal pleura. They are irregularly shaped, vary in size, and have a whiteish glossy surface. They calcify irregularly and form bizarre shapes (pleuritis calcarea).
- **Diffuse pleural thickening** – mostly affects the visceral pleura. It is accompanied by the formation of adhesions between the pleurae and fibrosis that permeates the lung parenchyma and interlobar spaces.

Clinical picture

Demarcated plaques are the most common manifestation of asbestos exposure. They are often an accidental X-ray finding, enlarge over time, tend to calcify, and do not cause problems. Diffuse pleural damage occurs most often after acute pleurisy with effusion and it affects most of the pleura. It usually spreads bilaterally, from the apex to the base.

Extensive plaques lead to exertional dyspnea, irritating cough, and persistent chest pain.



Lung biopsy, H&E stain, ferruginous bodies and interstitial fibrosis.

Diagnostic criteria

Pleural fibrosis that is at least 50 mm wide, 80 mm long, and 3 mm thick (on a CT) is diagnostic. In its proximity, *rounded atelectasis* is characteristic. Blending of the lesions into the parenchyma on a CT is described as *crow's feet*.

Examination methods

- Chest X-ray – bizarre demarcated shadows
- Diffuse thickening – general obscuration of the lung pattern
- CT, HRCT
- Pulmonary function - restrictive disease

Acute pleurisy

This is a localized reaction to the presence of asbestos on the pleura. It is asymptomatic in two thirds of cases, and the exudate formed does not exceed 500 mL and is usually absorbed spontaneously.

Clinical presentation includes breathing difficulties, cough, weakened breathing, and the disappearance of *fremitus pectoralis*.

Examination

X-ray, ultrasonography, thoracentesis.

Bronchogenic carcinoma

Carcinogenicity depends on the amount, time and the length of the fiber (above 5). It is an epigenetic carcinogen (IARC group I). It is involved in the development of all types of bronchogenic carcinoma - squamous cell, small cell, undifferentiated large cell, and adenocarcinoma. The risk for cancer development due to asbestos exposure is exacerbated by smoking (exposed smokers have a 50-90 times higher risk than unexposed non-smokers).

Malignant pleural and peritoneal mesothelioma

There is a **causal relationship** between mesothelioma and asbestos exposure: mesothelioma practically does not develop without asbestos exposure. Exposure to amphiboles is more risky (10 times greater risk).

Pathology

Mesothelioma can be localized or diffuse. Localized mesothelioma can expand and fill the entire hemithorax, while diffuse mesothelioma is multifocal with gray nodules on the pleura merging to form tumorous masses. Usually, there is a hemorrhagic pleural effusion and the tumor overgrows the lungs, eventually growing into the surroundings: the chest wall, mediastinum, abdomen...

Clinical picture

Manifestations include persistent pain and exertional dyspnea (sometimes the first symptom is significant resting dyspnea due to the effusion). In inflammatory effusion, the pain stops when the pleurae move away from each other; however, in this case it usually does not stop. Weight loss, subfebrile temperature, and symptoms of tumor organ damage are other manifestations.

Latency is a period of 30-40 years and cigarette smoking seems to have no effect on the duration of latency. It is progressing very rapidly despite treatment once manifesting and most patients die within a year of diagnosis.

Examination

- X-ray imaging – thickening of the pleura, extensive effusion, or signs of another asbestos disease
- CT, HRCT
- Exudate examination, pleura cytology
- The occupational risk of mesothelioma is highly underestimated in the Czech Republic.

Prevention

The import, production, and distribution of amphibole fibers are currently banned in the Czech Republic, and usage is restricted.

Therapy

There is no causal treatment for these conditions and therefore treatment is mainly supportive and includes oxygen therapy and bronchodilation in COPD.

Links

Sources

- BENEŠ, Jiří. *Studijní materiály* [online]. [cit. 24.02.2010]. <<http://jirben.wz.cz>>.
- PELCLOVÁ, Daniela. *Nemoci z povolání a intoxikace*. 2. edition. Praha : Karolinum, 2006. 207 pp. ISBN 80-246-1183-X.

References

1. The Asbestos Disease Awareness Organization (ADAO). *What are High Risk Occupations?* [online]. The last revision 2010, [cit. 2011-07-30]. <<http://www.asbestosdiseaseawareness.org/educational-resources/exposed-to-asbestos/>>.
2. KASPER, Dennis L – FAUCI, Anthony S – LONGO, Dan L, et al. *Harrison's principles of Internal Medicine*. 16th edition. New York : McGraw-Hill Companies, Inc, 2005. 2607 pp. pp. 1522. ISBN 0-07-139140-1.
3. American Lung Association. *Asbestosis* [online]. ©2011. The last revision 2011, [cit. 2011-08-06]. <<http://www.lungusa.org/lung-disease/asbestosis/>>.