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Association of Asbestos Exposure with Lung Cancer

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ABSTRACT

Asbestos is a well-known mineral to cause lung cancer. The causal relationship between asbestos and lung cancer was considered in the 1930s and proved in 1955. The use of asbestos began to be restricted and prohibited in the 1960s, with the detection of conditions such as mesothelioma and lung cancer in workers. After the first quarter of the 20th century, asbestos was determined as a Group 1A carcinogen in the "Carcinogenic Substances" list by the World Health Organization and the International Cancer Research Center. Most of the asbestos enterprises in the world have ceased their activities since the end of the nineties due to the negative effects of asbestos on human health. Today, the operation and trade of asbestos are banned all over the world.

Asbestos, a speck of invisible fibrous dust, accumulates in the lungs when inhaled. It causes tissue damage in the lung due to its rough and hooked structure. Epidemiological studies have unequivocally revealed that asbestos exposure is the cause of diseases that can have fatal consequences such as lung cancer, mesothelioma, larynx and ovarian cancer, and asbestosis. Contact points of asbestos are environmental contact and occupational (industrial) exposure and asbestos exposure is an important public health problem in Turkey. To prevent serious lung diseases such as mesothelioma, lung cancer, and asbestosis, asbestos removal should be done by authorized persons and natural environments should be rehabilitated. In addition, the planning and implementation of educational activities aimed at raising public awareness about the harms of asbestos in rural areas are necessary.

Keywords: Asbestos, cancer, environment, human health, industry

Akciğer Kanseri ile Asbest Maruziyetinin İlişkisi

Süreç

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ÖZ

Asbest, akciğer kanserine neden olduğu iyi bilinen bir mineraldir. Asbest ve akciğer kanseri arasındaki nedensel ilişki 1930'larda düşünülmüş ve 1955'te kanıtlanmıştır. 1960'lı yıllarda işçilerde mezotelyoma ve akciğer kanseri gibi durumların saptanmasıyla asbest kullanımı kısıtlanmaya ve yasaklanmaya başlamıştır. 20. yüzyılın ilk çeyreğinden sonra asbest, Dünya Sağlık Örgütü ve Uluslararası Kanser Araştırma Merkezi tarafından "Kanserojen Maddeler" listesinde 1A Grubu kanserojen olarak belirlenmiştir. Dünyada asbest işletmelerinin çoğu, asbestin insan sağlığına olumsuz etkileri nedeniyle doksanlı yılların sonundan itibaren faaliyetlerini durdurmuştur. Bugün tüm dünyada asbestin işletilmesi ve ticareti yasaklanmıştır.

Gözle görülmeyen lifsi bir toz olan asbest, solunduğunda akciğerde birikir. Pürüzlü ve çengelli yapısı nedeniyle akciğerde doku hasarına neden olur. Epidemiyolojik çalışmalar, asbeste maruz kalmanın akciğer kanseri, mezotelyoma, gırtlak ve yumurtalık kanseri ve asbestoz gibi ölümcül sonuçlara yol açabilecek hastalıkların nedeni olduğunu kesin olarak ortaya koymuştur. Asbest temas noktaları çevresel temas ve mesleki (endüstriyel) maruziyettir ve asbest maruziyeti Türkiye'de önemli bir halk sağlığı sorunudur. Mezotelyoma, akciğer kanseri, asbestoz gibi ciddi akciğer hastalıklarını önlemek için asbest temizliği yetkili kişilerce yapılmalı ve doğal ortamlar rehabilite edilmelidir. Ayrıca kırsal alanlarda asbestin zararları konusunda toplumu bilinçlendirmeye yönelik eğitim faaliyetlerinin planlanması ve uygulanması gerekmektedir.

Anahtar sözcükler: Asbest, kanser, çevre, insan sağlığı, endüstri

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Introduction

Asbestos (Amyant) term; is a general expression used for some natural, fibrous silicate minerals that are resistant to fire, acids, and impacts and are non-conductive in the composition of magnesium silicate, calcium-magnesium silicate, iron-magnesium silicate, or sodium-iron silicate. The common feature of all of them is that they have a fibrous structure [1]. Asbestos fibers are as small as one-thousandth of a micron in diameter and the amount of asbestos is measured as the number of fibers per cubic meter [2]. It has been revealed that asbestos exposure is generally through the respiratory tract, and asbestos mixed with the digestive tract does not cause disease. However, asbestos fibers attached to clothes washed in water containing high asbestos can then pass to the lungs through respiration [1]. According to their mineralogical properties, there are two types of asbestos: "Serpentine" and "Amphibole". Serpentine group asbestos minerals; chrysotile (white asbestos), lizardite, and antigorite minerals. Amphibole group asbestos minerals are crocidolite (blue asbestos), ribecit amosite, tremolite (white amphibole), and actinolite minerals (Figure 1). Amphibole minerals are found in the group of inosilicates. Due to the minerals in the structure of the amphibole group and its physical properties, it has a high disease-causing effect [3].

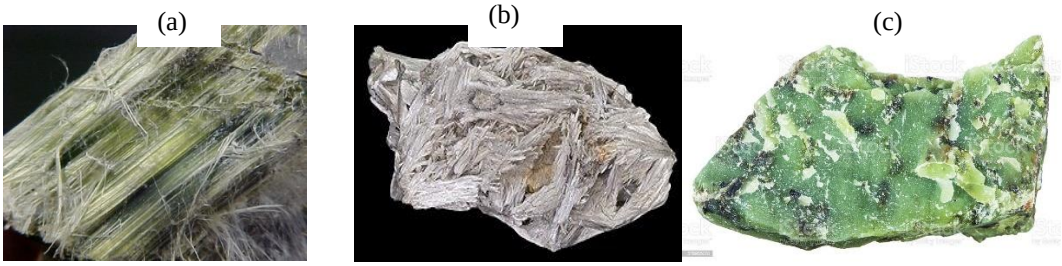

Figure 1. a) chrysotile b) tremolite c) lizardite

The most important asbestos mineral deposits in the world; It is found in China, Russia, Kazakhstan, Canada, Brazil, and Zimbabwe. In Turkey, the provinces of Eskişehir, Kütahya, Bilecik, Yozgat, Sivas, and Diyarbakır are the rural areas where contact is most intense. The total country reserve is around 1.5-2 million tons [4]. Most of the asbestos enterprises in the world have ceased their activities since the end of the nineties due to the negative effects of asbestos on human health. Today, the exploitation and trade of asbestos are banned all over the world [1].

Cancer is the second most common cause of death in countries of all income levels in the world and is responsible for the death of 8.8 million people according to the World Health Organization (WHO) 2015 data. About 70% of these deaths occur in low- and middle-income countries. Individual factors such as genetics, bad habits such as smoking and alcohol, diet, and environmental factors play a role in the emergence of these cancers. One of the reasons included in the environmental factors is asbestos [2]. Asbestos after 20th century the first quarter, it was determined as a Group 1A carcinogen in the "Carcinogenic Substances" list by the World Health Organization and the International Cancer Research Center [4].

Activities and Occupational Groups at Risk of Asbestos-Related Diseases

Asbestos materials were used in all buildings and facilities built between the 1930s and 1980s. Textile, automotive and aerospace industry, filters, shipbuilding, aircraft construction, cement production, automobile construction, insulation products, water pipe construction, petrochemical industry, gas masks, floor tiles, and coating sheets are other main areas where asbestos is used. Asbestos has been used in more than 3000 materials in the industry due to its pressure resistance, heat, acids, and strength [5].

Occupational asbestos exposure risks; auto mechanics, blacksmiths and farriers, steam boiler builders, bricklayers, molders, chemists, clothes ironers, cosmetics workers, firefighters, gas station workers, machinists, oil refiners, power plants workers, railroad workers, sand quarry workers, shipbuilders metal sheet makers, textile workers, pipe repairers, electricians, welders, sculptors, tinsmiths, flooring makers, glass factory workers, civil engineers, weavers, plumbers, underground asbestos pipe layers, geological engineers, and mining engineers are at risk for diseases [1]. In addition, shipbreaking workers, roofers, demolition workers, paint and decoration workers, plumbers, air conditioning workers, and telecommunication engineers are also included in this group [4]. In Turkey, we do not have enough data and information about asbestos exposure in the occupational environment to make risk assessments. However, according to the findings of the Turkey Asbestos Control Strategic Plan, it has been calculated that at least 35% of the annual cases are caused by the occupational environment [6].

Asbestos, which is an excellent insulation material, is frequently used in buildings manufactured before a certain date in the world. The most common asbestos usage areas in buildings; are insulation spray coatings, floor and ceiling coatings, partition walls, insulation

jackets, fire-resistant insulation panels, boilers, eternit sheets and joints, fire blankets, gasket elements, heaters, asbestos cement products, sewage pipes, and paper products [4].

The use of asbestos began to be restricted and banned in the 1960s with the detection of diseases such as mesothelioma and lung cancer in workers. Despite the legal regulations, as a result of intense use in the past years, there is still asbestos exposure in areas such as shipbreaking and urban transformation. In addition, the natural environment also causes asbestos exposure. Today, it is thought that there are 2 million tons of asbestos reserves in the world and the people living around these reserves are at risk [7].

Although industrial use is not very high in Turkey, exposure to environmental asbestos is an important health problem. For many years, especially in rural areas, it has been used as an insulation material on the roofs of houses, plaster, and whitewashes instead of lime, on walls, pottery material, road exhibition material, children's powder, and molasses soil. Asbestos fibers mixed with the room air remain suspended in the air for a long time and cannot land on the floor, so it is very difficult to clean completely [5]. In Turkey, diseases related to environmental exposure are more common in the field of asbestos than occupational diseases. Therefore, it cannot be determined how many of the cancers in Turkey are occupational, that is, due to working conditions.

It is thought-provoking that especially lung diseases and cancer cases have increased in recent years. In the study conducted by Uraz and Altıntop (2020), it has been proven that most of the buildings built 40, and 50 years ago were insulated with asbestos, and asbestos was used in the roof and cement. In addition, it has been used for many years as an insulation material in tiles, floor coverings, water tanks, roof coverings, plasters, boiler rooms, electrical cables, and panels in old buildings [9]. Figure 2 shows possible locations where asbestos may be found in the building.

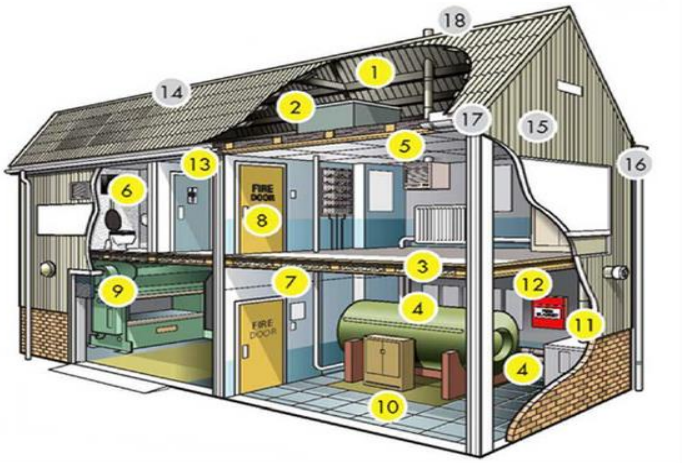

Figure 2. Asbestos where it hides [10]

As a result of intense use in the past years, the presence of asbestos is known today, especially in buildings built in ancient times and still standing. In the process of urban transformation, those who work in the demolition and dismantling works of buildings that are being demolished unconsciously and without taking the necessary precautions and those living in the surrounding area are exposed to asbestos fibers. The demolition of these asbestos-containing buildings poses a risk to the people around the building, especially the workers [7]. The result of this exposure will, unfortunately, be seen in the coming years.

The purpose of the "Regulation on Health and Safety Measures in Work with Asbestos", published on January 25, 2013, is to prevent the exposure of employees to asbestos dust during asbestos removal, demolition, repair, maintenance, and removal work, to protect them from health risks arising from this exposure, to determine limit values and other special precautions. Asbestos, a carcinogenic substance, is a great danger for those working in building demolitions. In terms of both employees and public health, "asbestos suspicion" should be considered in all buildings built until 2010 and precautions should be taken [8].

Asbestos exposure and diseases

Although pulmonary diseases caused by asbestos dust have been known for many years, it was only in the last century that attention was paid to the issue and precautions were taken. In the last 20-30 years, the damage caused by dust has been better understood and various dust control and dust suppression methods have been started to be applied in mining (underground and open pits, ore preparation and enrichment facilities), tunneling, and different branches of industry [11]. Because the period between

exposure to asbestos and the development of asbestos-related diseases is quite long (20-50 years), and it is very difficult to detect the disease during this period. For this reason, asbestos-related diseases continue to increase, and even in countries that banned the use of asbestos years ago, cases can occur over the years [7,12].

Asbestos, invisible fibrous dust, accumulates in the lungs when inhaled. It causes tissue damage in the lung due to its rough and hooked structure. Depending on both the working time and the intensity of the dust exposure, even if the worker's exposure to asbestos fiber is over, asbestos-related occupational diseases are seen after many years. As a result of asbestos fibers reaching the lungs through respiration and accumulating there, some diseases occur as benign (benign) and malignant (malignant).

Benign diseases

- Pleural plaques
- Asbestosis
- Benign asbestos pleurisy
- Diffuse pleural thickening

Malignant diseases

- Lung cancer
- Malignant mesothelioma
- Other tumors

(GIS, kidney, pharyngolaryngeal)

The pleura is the thin membrane that covers the lungs. Pleural plaque is the thickening and calcification of the pleura as a result of asbestos exposure. Diffuse pleural thickening is a benign lung disease caused by exposure to asbestos. It is a thickening of the lining of the lung. Diffuse pleural thickening requires more asbestos exposure compared to pleural plaques [13]. Asbestosis (Lung Fibrosis) is a type of lung fibrosis that develops over a long period and causes widespread damage as a result of exposure to high doses of asbestos fibers [14]. Breathing and coughing are difficult. The severity of the disease depends on the amount of asbestos a person is exposed to and the duration of the exposure. The disease continues to progress even after asbestos exposure is discontinued.

The pericardium is a cone-like bag-shaped structure that surrounds the heart and great vessels. It provides lubrication during the contraction of the heart. The most well-known pericardial diseases are benign and malignant tumors. When the malignant tumor is mentioned, asbestos-related mesothelioma comes to mind. If tumors are benign, they are removed by operation, but malignant ones have no chance of operation. Mesothelioma, one of the malignant diseases caused by exposure to asbestos, is pleural cancer. It is expected that 5-10% of the population exposed to asbestos will develop mesothelioma. The most common symptoms of the disease are chest pain and shortness of breath. Less common symptoms include cough, weight loss, and fever. These symptoms are caused by a fluid accumulation between the chest wall and the lungs [8]. For mesothelioma formation, asbestos exposure generally requires an average of 20-40 years, but death occurs within 1 year after diagnosis [15].

Although there is no definite evidence that cancers other than lung cancer such as larynx cancer, gastrointestinal cancer, kidney cancer, and ovarian cancer **occur** due to asbestos exposure, are encountered in people who work with asbestos for 20 years or more [8]. It has been conclusively proven that all types of asbestos cause lung cancer. The causal relationship between asbestos and lung cancer was considered in the 1930s and proved in 1955. Asbestos has been shown to increase the risk of lung cancer on its own, independent of other etiological causes and tobacco smoking [16].

Gürbüz et al. (2004) followed up 301 (277 male, 24 female) cases diagnosed with histopathologically lung cancer between 1997-2000. 54% of these patients have asbestos exposure. Adenocancer was observed more frequently in patients who did not smoke and had asbestos exposure. Findings from the study showed that asbestos exposure by itself may increase the risk of adenocarcinoma. It has been calculated that the cancer risk in asbestos workers who smoke a lot and have lung fibrosis (increased connective tissue) is 50-90 times higher than in those who do not smoke and work in other occupations. The reasons for this high rate are that three carcinogenic factors such as smoking, asbestos, and fibrosis work in a way that activates each other [11].

Conclusion

In the past century, asbestos has been the most widely used intermediate in the industry because it is a low-cost, durable, and easily processed mineral. The negative externality based on the irreparable damage caused by the use of asbestos on human health in the medium and long term, which seems to be consistent with economic rationality in terms of these features, is too great for societies to bear.

Epidemiological studies have unequivocally revealed that asbestos exposure is the cause of diseases that can have fatal consequences such as thickening of the lung plaque, lung cancer, mesothelioma (cancer of the lung membrane, pleural cancer), larynx and ovarian cancer, and asbestosis (dust accumulation in the lungs, damage to the lung tissue).

Asbestos-related malignant and benign pleuroparenchymal lung diseases, especially lung cancer and mesothelioma, are preventable diseases with serious mortality and morbidity. To achieve this, it is necessary to determine and increase the knowledge and awareness of the public about asbestos with

appropriate methods. Asbestos removal must be done by authorized persons and natural environments must be rehabilitated. Contact points of asbestos are environmental contact and occupational exposure, and asbestos exposure is an important public health problem in Turkey. However, occupational diseases are completely preventable diseases if necessary precautions are taken. With these measures and rehabilitation studies, it will be possible to minimize the harmful effects of asbestos. Only in this way can these diseases be overcome.

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