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CHAPTER 1. ASBESTOSIS

Since the beginning of the present century it has been known that inhalation of asbestos dust over a period of years gives rise to a progressive, diffuse pulmonary fibrosis, called asbestosis. This disease therefore occurs in mining and milling of asbestos and in manufacturing processes using the mineral.

The basal parts of the lungs are first affected in asbestosis (*Shull* 1936). There is also a reaction from the parietal and diaphragmatic pleurae and the pericardium, in which structures secondary calcification occurs (*Ahlborg & Hansson* 1956). As the fibrosis progresses, emphysema and right cardiac hypertrophy develop. The clinical picture in asbestosis tallies with that in other pulmonary fibroses; dyspnoea, cough and weakness usually are present when the lesions are advanced. In fatal cases the immediate cause of death as a rule is given as complicating bronchiectasis, pneumonia or cardiac failure.

Many investigations (e. g., *Gloyne* 1933, 1935, 1936, *Nordmann* 1938, 1939, *Behreus* 1952, and *Merewether* 1947) indicate that asbestosis — in contrast to silicosis — not infrequently is complicated by carcinoma of the lung; in large autopsy series, between 10 and 20 per cent of persons with asbestosis thus were found to have coexistent pulmonary carcinoma. Concerning tuberculosis in asbestosis, opinions differ. While, for instance, German sources reported that among asbestos workers the incidence of tuberculosis was not higher than in the general population, British investigations showed this complication to be not uncommon, although less frequent than in silicosis (*Worth & Schiller* 1957).

The occurrence of asbestosis in various industries has been studied in many countries. The first case described in Sweden was observed in 1953 (*Ahlborg* 1956). It led to examination of 60 asbestos workers and thus resulted in the detection of 8 more cases (*Ahlborg & Hansson* 1956). The prediagnostic duration of exposure to asbestos ranged from 5 to 17 years; asbestos had been used by 7 of the men in insulation work and by 2 in spraying operations. These last 2 men had advanced asbestosis; 1 of them died soon after diagnosis. The insulation workers had milder lesions.

Technical conditions for asbestosis

Asbestos (Greek, = unquenchable) is the name given to mineral substance composed of fine, usually parallel fibres which may vary in length from a

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few microns to 15 cm[1]. In different types of asbestos the fibres differ in length, but as a rule they are pliable enough to be carded and spun into yarn which can be woven into tapes or sheeting. Asbestos belongs to the amphibole and serpentine minerals, whose best known varieties of asbestos fibre are actinolite, amosite, crocidolite (blue asbestos), tremolite and chrysotile. All are silicates but differ in composition. The most common are chrysotile, a magnesium silicate, and amosite, which is magnesium-iron-aluminium silicate. The silicic acid bound in asbestos constitutes about half of the mineral's weight.

Asbestos is mined mainly in Canada, South Africa and Siberia. Of the European deposits, the most important lie in Italy, Finland and Germany. Asbestos is found in many places in Sweden, for instance in Dannemora in the centre and Taberg in the south of the country, but it is not mined.

Some types of asbestos, because of their great tensile strength, high resistance to and poor conductivity of heat, are widely used in industry. To insulate pipes, radiators, exhaust ventilators, etc., slabs, tapes or braided tubing of asbestos may be used. When mixed with a binding agent and water asbestos can also be spread or sprayed on surfaces.

In Sweden the use of asbestos has increased considerably in recent years. During a 5-year period before the late World War we imported a total of 17,600 tons, whereas after the War, once the accumulated needs arising from our isolation had been met, no less than 46,500 tons were imported over a period of equal length (*Ahlborg & Hansson* 1956). A survey in 1958 showed that about 60 Swedish firms carried out work with asbestos. Most of this work concerned insulation in the building and ship-building trades. Among the remaining uses of asbestos was admixture with various technical products, for instance to make reinforced plastic material and paste for treatment of automobile chassis. Manufacture and processing of slabs, blocks, etc. and sawing, grinding and polishing of asbestos articles were also represented. The total number of workers involved was estimated to be between 300 and 400.

Many of the above-mentioned operations, particularly spraying of asbestos, manufacture of sheeting and certain insulation jobs, are very dusty. To eliminate or diminish the dust, wet substance is used as far as possible, and efforts are made to enclose the dusty operations and extract the contaminated air by exhaust ventilation. When the dust concentration cannot be satisfactorily reduced, the workers can be protected by respirators. Not infrequently, however, prophylaxis seems to have lagged behind; it is only fairly recently that the hygienic problems arising from asbestos have been seriously considered.

[1] Asbestos is defined in the British "Asbestos Industry Regulations, 1931" as "any fibrous silicate material, and any admixture containing any such material, whether crude, crushed or opened."

OWN INVESTIGATIONS

Our series of asbestosis comprised 11 cases. In 8 of them the disease was contracted from insulating work, in 2 from various jobs with asbestos, including spooling and weaving of brake linings, and in 1 mainly from spraying with asbestos. The year of diagnosis was as follows: 1950, 1 case, 1953, 1 case, 1955, 6 cases, 1956, 3 cases.

After the end of our observation period (1956) some further cases of asbestosis have been detected. According to *Ahlborg* (personal communication) the total of known cases up to 1960 was 15.

The age when work with asbestos was begun ranged from 16 to 52 years, and that when asbestosis was diagnosed from 33 to 63 years. In 10 of the 11 cases the diagnostic roentgenograms showed mild interstitial fibrosis or finely mottled infiltration, generally with thickening or calcification of the pleura. In the remaining case there was advanced asbestosis with diffuse, irregular linear densities around the hilus and down towards the base in both lungs. Between these densities were bullous rarefactions. There was basal pleural thickening and apical emphysema and the sputum contained abundant asbestos bodies.

Plate XXVII in the appendix shows a case of severe asbestosis.

The duration of exposure to asbestos ranged at diagnosis from 6 to 30 years in the insulation workers; it was 4 and 8 years, respectively, in the men who made brake linings and 17 years in the asbestos sprayer. The sprayer had the most advanced lesions. He died a few months after diagnosis, at the age of 63 years. The cause of death was asbestosis plus pneumonia[1]. Autopsy showed, in addition to the acute changes in the pulmonary parenchyma, fibrosis increasing in intensity towards the basal regions. Between reticular, slate-grey strands of fibrosis were spherical cavities up to the size of hazelnuts. The visceral pleura on both sides was diffusely thickened and calcified. The right side of the heart was hypertrophic. On microscopy the atelectatic pulmonary parenchyma was seen to be studded with broad strands of connective tissue and foci of nodular appearance. Within the connective tissue were abundant asbestos bodies.

This was the only death during our observation period. After 1956, however, 2 more deaths have occurred from asbestosis.

No signs of tuberculosis or pulmonary carcinoma were observed in the 11 men during the observation period[2].

[1] This case was described in detail by *Ahlborg & Hansson* (1956).

[2] After the observation period pulmonary cancer was found in 1 case.

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Roentgenographic progression occurred in 1 case only. This was a 56-year-old insulation worker with "at least 20 years of exposure", whose roentgenogram 6 years after diagnosis showed increase of pleural calcification and of generalized emphysema. He had continued work with asbestos after diagnosis[1].

Two of the men received disablement benefit. One of them, the man who died, was compensated at full rate. In the man with roentgenographic progression, disablement was first assessed as 15 per cent and later as 60 per cent.

DISCUSSION

Although asbestos has been used industrially in Sweden for several decades, no cases of asbestosis were diagnosed before 1950. The reasons seem to have been manifold: a relatively long period of exposure to asbestos dust is necessary to produce the disease, and exposed persons were not systematically examined before the first case was diagnosed; further, the number of persons at risk, particularly in the building industry, probably has greatly increased in very recent years.

Periodic medical examination of asbestos workers thus was instituted only towards the end of the period covered by our investigation (1931 to 1956), and not all the cases of asbestosis hitherto demonstrated had then been notified to the insurance authorities. The cases we have presented therefore comprise only a proportion of those at present known. They nevertheless show that also in Sweden asbestosis may constitute a grave health hazard. Among our 11 cases there were 3 deaths from occupational pulmonary disease. The time required to produce asbestosis was no more than about 5 years in 2 cases.

A survey of all asbestos workers in Sweden has been planned and should provide further knowledge of the risk of asbestosis. The problem of asbestosis is now being vigorously attacked by the factory inspection authorities, and we may anticipate that the risk will soon be reduced by technical prophylaxis. To prevent asbestosis it is essential that technical and medical measures should rapidly be enforced.

SUMMARY

Industrial use of asbestos has a fairly long history in Sweden, but asbestosis was not demonstrated in this country until 1950. After *Ahlborg* (1956) directed attention to the occurrence of this disease, further investigations showed that it was not rare.

At the end of our observation period (1956), 11 cases of asbestosis were known; the first was diagnosed in 1950. The work with asbestos had been insulating operations in 8 cases, making of brake linings in 2 cases, and spraying in 1 case. In 10 of the men the pulmonary fibrosis was mild at diagnosis and with or without pleural thickening or calcification. The remaining man had roentgenographically advanced disease. In no case was there coexistent pulmonary tuberculosis or cancer. The age at diagnosis ranged from 33 to 63 years and the preceding duration of exposure from 4 to 30 years.

One man died of asbestosis during the observation period[1] and in another case there was roentgenographic progression. Disablement benefit was awarded in 2 cases.

This investigation, despite its limited scope, indicates that in Sweden asbestosis is an important occupational health risk. Strictly enforced technical protection and medical supervision of exposed persons are therefore necessary, especially as the use of asbestos has considerably increased in the past decade.

[1] In 3 other cases the disease progressed after the observation period.

CHAPTER 2. TALCOSIS

Technical conditions for talcosis and earlier observations. Talc, which is a magnesium silicate, is widely used in the pharmaceutical and chemical industries and in rubber, cleaning material and paper works. In the deposits of talc, which are found over much of the world, the mineral occurs in more or less compact form, and sometimes as stone, as shown by the designations soapstone, speckstein and potstone. Commercial talc frequently contains small quantities of closely related compounds such as tremolite, antigorite, etc. On the other hand, admixture of quartz is relatively rare, and when it occurs the content of free silica is too low to be of pathogenic significance. In analyses by *Schultz & Williams* (1942) 25 specimens of talc were found to be free from quartz, 25 contained traces of this substance, and in 1 there was 3 per cent of quartz. In specimens of Swedish soapstone we failed to demonstrate quartz with a method that gives reactions down to 1 per cent of the mineral. Almost without exception, industrially used talc is in powder form and frequently it is milled near the mine. The dry, light talc dust everywhere present in these mills is a troublesome hygienic problem,

[1] After 1956 there were 2 more deaths, 1 from asbestosis alone and 1 from asbestosis with coexistent pulmonary cancer.

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