

Occupational Health

HAZARDS OF THE WORK ENVIRONMENT

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in man. Many substances in the chemical and dye industries, which are capable of producing a hemorrhagic cystitis or methemoglobinemia, do not cause bladder cancer. The occupational diseases, with relatively few exceptions are not characteristically associated with occupational cancer.

CHARACTERISTIC SITES FOR OCCUPATIONAL CANCER

SKIN CANCER

Skin cancer is by far the commonest type of occupational cancer; and because precancerous lesions on the skin are readily visible, they are susceptible of early detection, and effective removal. Soot (which caused the early scrotal cancers in chimney sweeps), coal tar, shale oil, pitch, creosote, asphalt, fuel oils, crude mineral oil, and carbon black are all potentially carcinogenic to the skin. In the petroleum industry, wax pressmen and other workers exposed to petroleum fractions, with a boiling point above 700°F, can develop scrotal cancer, particularly when their trousers become saturated with the oil (3). Among other agents suspected of causing skin cancer are arsenic, and ultraviolet light. Skin cancer is not uncommon among farmers with heavy exposures to the sun. Workers exposed to external radiation, including X-ray and fluoroscopic equipment, can develop skin cancer unless adequately protected by proper shielding and other control measures discussed elsewhere (see Chapters 7 and 17, under Industry and Laboratories).

Skin cancers are usually squamous cell carcinomas, which develop slowly and cannot be differentiated, pathologically, from similar skin cancers, of non-occupational origin. A careful history of significant exposure is indispensable, therefore, for a differential diagnosis.

LUNG CANCER

The incidence of lung cancer is sufficiently great, in the general population, to be a matter of major concern, particularly because it has been steadily increasing in the last two or three decades. This increase has occurred during a period of tremendous technological development; when workers were being exposed to an increasing variety of chemical and physical agents, some of which are present, as irritant and toxic air contaminants, in the form of dusts, gases, fumes, mists, etc.; when community air pollution has gradually increased; and when smoking has become a universal habit. It is natural enough to speculate that these factors have been important in the increasing incidence of lung cancer. On the other hand, it is difficult to determine the respective contributions of each of these factors (4). Among the chemical carcinogens known to be capable of causing lung cancer, are certain of the

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OCCUPATIONAL CANCER

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very great, in the general term, particularly because of three decades. This tremendous technological development to an increasing variety of hazards are present, as irritant dusts, gases, fumes, mists, locally increased; and when natural enough to speculate on the increasing incidence of cancer, it is difficult to determine the result (4). Among the chemical hazards, cancer, are certain of the

chromates, nickel carbonyl, asbestos and arsenic. Whenever one is dealing with carcinogenic air contaminants, one must bear in mind that the eyes, nose and upper respiratory passages may also be involved under certain circumstances. Occupational lung cancers are characteristically bronchogenic carcinomas, of the squamous cell type. Metaplasia of the bronchial epithelium appears to precede the appearance of the tumor. These tumors develop slowly, and may not be diagnosed for many years after cessation of exposure to the etiological carcinogenic agent.

Chromates

Both American and European experience has confirmed the etiological role of certain of the chromates in the production of lung cancer. As a result of the independent studies of Machle and Gregorius (5) and Baetjer (6), the chemical compounds believed to be responsible are the hexavalent chromium compounds, Na and K monochromate or dichromate, and zinc chromate, inhaled as dust. Most of these cases were found to be bronchogenic carcinoma. An exposure of 4 years appeared to have been sufficient in some cases. In most cases, however, there were a great many more years of exposure. A characteristic latent period, of varying duration, between cessation of exposure and the development of the lung cancer has been observed.

Asbestos

Bronchogenic carcinoma, originally thought to be associated solely with the disease, asbestosis, has now come to be accepted as due to the inhalation of asbestos dust, even in the absence of asbestosis. The tumor is usually found in one of the lower lobes, where asbestos fibers are most numerous (7). In other types of bronchogenic carcinoma, the upper lobes appear to be more characteristically involved (8). Tumors have also been found to develop elsewhere in the body, particularly in the pleura and peritoneum. These pleural and peritoneal tumors are mesotheliomata, a very rare type of cancer at the present time. The fact that they develop at sites remote from the initial sites of deposition of the asbestos fibers in the lungs, has raised interesting questions of transport and migration. All of these tumors, found in persons exposed to asbestos dust, usually develop after very long latent periods, but they may apparently also develop following a relatively limited exposure. Some are not diagnosed until many years had elapsed since the last exposure. The precise type of asbestos fiber appears to be of some importance as an etiological factor (see Chapter 4).

Reviewing the changing medical picture over the years, resulting from exposure to asbestos dust, Gilson (9) suggests that, in the early

days, exposures were high and workers died young, perhaps from complications such as pneumonia or pulmonary tuberculosis. As living and working conditions improved, however, and tuberculosis became less prevalent in the community, workers lived long enough to develop progressive pulmonary fibrosis, and other features of asbestosis, often ending in cor pulmonali. Under modern conditions of exposure, on the other hand, workers develop only moderate degrees of asbestosis, and live long enough to develop bronchogenic carcinoma. He suggests that, in the mesothelioma, we are witnessing the very long-range effects of low-grade exposure to asbestos dust. This is an interesting historical perspective. The pathogenesis of this disease is quite obscure at the present time, and many conjectural model constructs are under intensive investigation.

Environmental exposures to asbestos dust are apparently not confined to the workers exposed. Here we find so-called "neighborhood cases," analogous to those found in relation to beryllium exposure—the development of the disease in persons who had never worked with these substances; and even those who live within a considerable radius of the plants. Contact with the dust on workers' clothing, when they are brought home to be laundered, is believed to be a possible explanation in some cases, but not all. It has been suggested that other coexisting sources of community air pollution, which go unrecognized at the present time, may play contributing roles. There are apparently great differences in individual susceptibility not only among workers exposed to asbestos dust, but among persons living in the neighboring communities..

Ionizing Radiation

The lung cancers which develop in miners exposed to radioactive ores are believed to be caused primarily by the radon gas given off and its degradation daughters. This has been discussed in Chapter 14, under Mining.

BLADDER CANCER

As in the case of lung cancer, bladder cancer has been on the increase throughout the world during recent decades, and this has stimulated intensive research as to the etiological factors involved. In industry, the carcinogenic aromatic amines include beta-naphthylamine, para-amino diphenyl, auramine and magenta. Benzidine is still controversial. Alpha-naphthylamine which had long been suspected of being carcinogenic is no longer suspect. It is now believed that because it is a contaminant of beta-naphthylamine, it was improperly included among the bladder carcinogens. Aniline, which had also been suspect, is not carcinogenic. There are a number of chemical agents which can produce cancer of the bladder in animals, but not in man.