

ENVIRONMENTAL INFLUENCE IN THE INCIDENCE OF BLADDER CANCER

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Abstract. Bladder cancer remains a second most common cancer regarding the genitourinary tract; 7% of the newly diagnosed per year reveal male population and 2% are females. About half of the male patients are smokers and 30% of females diagnosed with bladder cancer are smokers, too. The occupational exposure to chemical, dye, rubber, printing and leather industries reveals 15–35% in men and 1–6% in women. We have made analysis on our hospital database in 5-year period considering diagnosed and operated patients with bladder cancer and their permanent place of working and living. The results showed that patients that worked and lived in an environment with selective and particular occupational exposure had more frequently appearance and reappearance of bladder cancer.

Keywords: bladder cancer, occupation, environment.

AIMS AND BACKGROUND

The correlation between cancer incidence and environmental and occupational circumstances exists since 1775 when Pott found a raised incidence of testicular cancer among chimney sweeps¹.

The cancer of the bladder is fifth leading cancer in men and tenth in women². It is three to four times more frequent in males than in females. The most likely probability of this difference in the incidence between male and female population is the difference in the smoking habits. Considering mortality rates it is eight leading cancer cause in males and the fourteenth leading cause of cancer death in women³. Its incidence is higher in more developed countries and regions⁴. About 50% of the male patients with bladder cancer are smokers as well as 30% of the female patients⁵.

For some decades ago it is well known that the etiology of bladder cancer is multifactorial. A thorough assessment of specific occupational exposures and

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their contribution to cancer risk requires consideration of related sources of risk such as cigarette smoking⁶. The main substances that are involved in bladder cancer induction from cigarettes are alpha- and betanaphthylamines. Other factors that are important in the etiology of development of bladder cancer are exposure to chemicals, dye, rubber, printing and leather industry and transportation. The presence of benzidine, betanaphthylamine and 4-aminobiphenyl in the occupational and living environment raises the incidence of bladder cancer.

During the late 1960s, 1970s and early 1980s, remarkable attention was given to estimating the magnitude of cancer that could be attributed to either occupational or environmental etiologic factors. For example, in 1967, Boyland estimated that 90% of cancers were due to chemical agents, with the remaining 10% due to viruses, genetics, and radiation⁷.

Higginson defined environmental factors as all exogenous agents, stating that 70 to 90% of all cancers were related to the environment^{8,9}.

Wynder and Gori defined environment as consisting of two components: lifestyle (tobacco, diet, etc.) and general environmental factors (air and water pollution, food additives, etc.)¹⁰.

The increased human cancer risk associated with the natural environment and the workplace is most likely to occur in relationship to four major sources of exposures to carcinogens: manufacturing, agriculture, power generation, and motor vehicle exhaust¹¹ (Fig. 1).

It is clear that a part of human cancers are etiologically determined by occupational exposures and by environmental exposures but as our society makes technologic advances, the nature of exposures and sources of human cancer risk also change, so the fraction of human cancers attributable to any particular category of etiologic agents may be expected to change from one decade to another. Certain types of occupational exposures and industrial jobs bear extra risk for the future development of bladder cancer¹². Environmental organic contaminants found in industrial pollution, tobacco smoke, and cooked foods include polycyclic aromatic hydrocarbons (PAHs), which have been shown to act as endocrine disruptors and tumor promoters¹³. Avoidance of tobacco smoking and incriminated occupational exposures, habitual intake of fresh fruits and vegetables, and prevention and control of urinary tract infections should be recommended for bladder cancer prevention¹⁴.

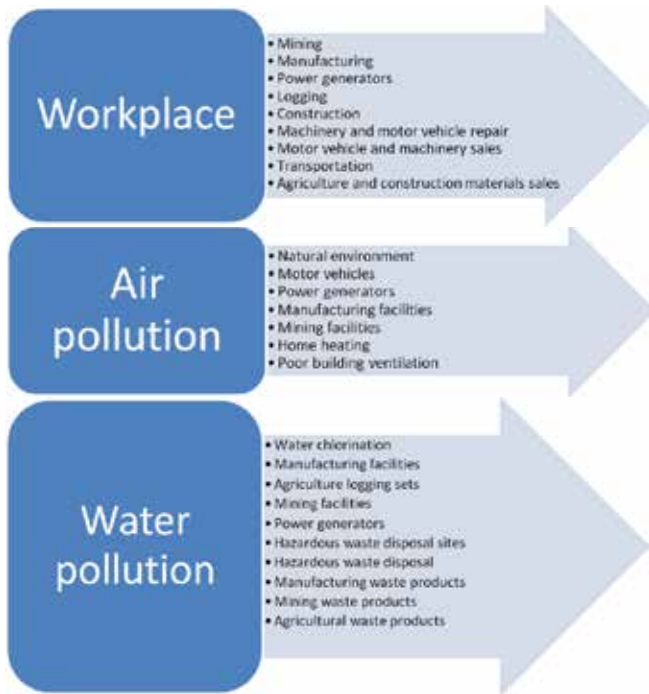


Fig. 1. Major sources of exposure to occupational and environmental carcinogens

EXPERIMENTAL

Epidemiologic investigations and clinical observations bring direct evidence of human cancer risk. That is the reason we made this retrospective study that includes patients with bladder cancer ($n = 377$), hospitalised and operated during the 5-year period (2010–2014). We reviewed our hospital data which have information about patients age, gender and occupation, obtained from previous interviews with the patient during hospital admission. We utilised this information in order to find or exclude correlation between the patients occupational environment and bladder cancer. In order to make this study more precise it was decided to make a case-control study, so we excluded female patients ($n = 56$) and included a control group of 313 male patients hospitalised for some other urological reason with no evidence of bladder tumor.

Members of the two groups had more than 50 different occupations, so their jobs were categorised to 17 groups to assess the relationship between patient occupation and bladder cancer (Table 1).

Table 1. Occupation classification

	Job title	Case	Control
1	Textile	21	9
2	Mechanics	46	22
3	Carpentry	17	35
4	Printing industry	16	0
5	Rubber, chemical, dye industry	28	9
6	Driving trucks, buses	40	10
7	Farming	2	27
8	Shoe making/repair	1	1
9	Veterinary	3	9
10	Housework	0	1
11	Photography, cinema	9	3
12	Metalworking	53	26
13	Building industry	57	68
14	Office work	12	63
15	Agriculture	16	10
16	Medicine	0	10
17	Food sales	0	10
	Total	321	313

The mean age of cases group was 62.3 and controls group 63 with no statistical significant mean age difference between two groups. Overall exposition on occupational environment factors in case group was 23.4 years and in the control group – 25 years, with no statistical difference between them.

RESULTS AND DISCUSSION

When the results were summarised, it was found that the bladder cancer incidence is more frequent in groups that consist mostly of textile workers, mechanics, rubber, dye and chemical industry and metal workers. The leading fraction of occupational exposure is metalworkers since for a several decades metal industry was very well developed in the country. The presence of carcinogenic materials in their occupational environment significantly raises the incidence of bladder cancer appearance in the case group. As in the group of controls predominant occupation was not in close relation to the same carcinogenic material, the incidence of bladder cancer was significantly lower (Fig. 2).

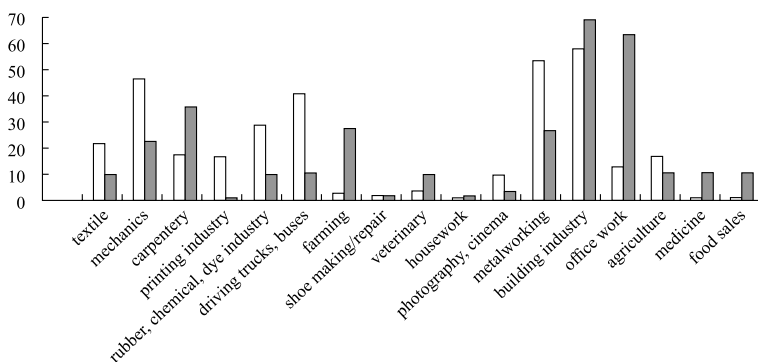


Fig. 2. Number of patients in case (white) and control (gray) groups regarding their occupation

The presence of carcinogenic materials such as aromatic amines in particular occupational environment makes that working environment more harmful with highly elevated risk of bladder cancer appearance or reappearance (Table 2).

Table. 2. Aromatic amines as most causative environmental carcinogens

Aromatic amines	Industry
2-Naphthylamine	paints, fungicides, metal and motor vehicle exhaust
4-Aminobiphenyl	tobacco smoke, rubber/chemical industry
Benzidine	dye production, rubber industry
Dichlorobenzidine	garment, leather, printing industry
Dimethoxybenzidine (orthodanisidine)	chemical, textile industry, processing plants
Nitrosodimethylamine/nitrosomorpholine	rubber industry

Besides aromatic amines there is a 4,4'-methylenebis(2-chloroaniline) which is a synthetic chemical for producing polyurethane parts and its particles could be inhaled from the air or be absorbed through the skin. Bladder cancer is proven in manufacturing factories of such types as well as that 2-year exposure may be sufficient to increase the risk, but the time between the exposure and cancer may be several decades¹⁵.

CONCLUSIONS

Since the level of exposures to occupational carcinogens is often quite high there is a huge reason for placing the study of working environment cancer etiology high in the priorities for research. It is especially important to firstly investigate potential occupational hazards in order to make adequate prevention. This is due to the fact that population spends approximately 35 to 50% of their lives in the work-place. In addition, there is the continuous production of new chemical com-

pounds that often have unknown association with human cancer risk and are likely to be encountered first. Working on understanding of the relationship between exposure to occupational materials and the ensuring risk of specific cancers still remains a challenge. There is considerable evidence of increased risk associated with particular occupations, industries, or agents. This is one particular reason that physicians should be able to identify and assess environmental threats, take a detailed environmental history and define physical, chemical and biological factors that could cause diseases¹⁶. Epidemiological and experimental research are needed regarding factors that may reduce the cancer risk, so an interdisciplinary approach to research into occupational and environmental factors associated with the occurrence of cancer also is essential. Specification of these factors is the basis of the most meaningful and comprehensive forms of prevention. Complementing reduction of exposures to carcinogens in the outdoor environment and in the workplace with reductions in exposures under the control of individual choice will maximise the potential for occupational and environmental cancer prevention. Unfortunately, there is a facility insufficiency that concludes the overall situation in the field of environmental protection, especially in practical skills, and knowledge that could be applicable¹⁷. The application of preventive measures to limit many exposures and eliminate others in the work-place and in the natural environment will enable us to achieve some reductions in cancer incidence, morbidity, and mortality.

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