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Carcinoma of the larynx in workers engaged in the purification of naphthalene

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Summary

Exogenous factors are primarily involved in the genesis of cancer of the larynx. Nevertheless, the number of notifications of occupational disease no.31 (occupationally-induced cancer of the respiratory tract) is small. This paper reports on four cases of laryngeal cancer in a group of 15 persons who had been engaged in the purification of naphthalene; this incidence is highly significant. Chronic irritation of the mucous membranes and the effects of heat, coal-tar fumes and cigarette smoke have been indicted as syncarcinogenic factors. The possibility of occupationally-induced tumours should always be borne in mind in the case of workers exposed to these carcinogens.

Introduction

Exogenous causes are prime suspects in the causal pathogenesis of cancer of the larynx. Harmful chemicals are particularly important in addition to physical hazards in the form of mechanical, thermal and actinic irritation.

The number of persons occupationally exposed to the effects of carcinogenic substances is steadily increasing as a result of technical progress and the increasing use of chemicals. Although the number of occupational carcinogens used in industry has greatly increased, the number of suspected cases of occupationally-induced cancer which are reported annually remains small (see Table 1). The number of confirmed cases of occupationally-

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induced cancer has risen slightly in the last few years but the number of unreported cases is still large.

In the period 1957-1967, 20 (19 bronchial carcinomas and 1 laryngeal carcinoma [7]) out of 56 notifications of suspected occupationally-induced cancer were recognised as being due to occupational disease no.31 (occupationally-induced cancer of the respiratory tract).

Table 1: The number of new notifications of occupational disease no.31 in relation to the total notifications of occupational diseases and the new notifications of malignant diseases in men [9]

	1967	1968	1969	1970	1971	1972	1973	1974
Total occupational diseases	11,177	11,904	11,450	11,077	11,539	11,924	11,900	11,789
Occupational disease no.31	5	0	2	6	8	24	77	42
Larynx (161)	475	524	483		485	517		
Trachea, bronchus, lung (162)	6,249	6,547	6,553		6,726	6,496		
Total malignant tumours in men	26,347	27,132	26,965		27,400	27,322		

Author's observations

The author was aware of four cases of laryngeal cancer among a group of 15 workers who had been previously engaged in the purification of naphthalene [6]. This represents a 62-fold higher incidence of laryngeal cancer in this group of men when compared with the incidence of laryngeal cancer in the German Democratic Republic (GDR) for 1970 (6.8 per 100,000 males). Calculation of the significance of this difference with the t-test (Student's distribution) showed that the probability of error was 1% and that there thus was a highly significant difference between the incidence of laryngeal cancer in naphthalene workers and that in the remaining male population.

Since all workers in the group had been engaged in the same type of work, they had had the same opportunity for occupational exposure. Naphthalene purification was carried out from 1917 to 1968 and involved the processing of crude naphthalene, a product of coal-tar, to produce technical-grade naphthalene by repeated distillation processes. The distillation of Aroclor was also carried out in the same department from 1958 to 1968. Aroclor is a dibenzylidene diethyl ether, prepared from dimethylphenol and dichlorodiethyl ether, used in industry as a plasticiser for varnishes.

Tar and its derivatives have long been known to be occupational carcinogens [1]. Naphthalene, dimethylphenol and dichlorodiethyl ether have also been shown to be carcinogenic agents in animal experiments [5].

Chronic irritation of the mucous membranes occurred during the production process due to the sublimed naphthalene produced while charging the still with crude naphthalene, the residual vapour produced during the distillation of Aroclor, and the fumes of pitch produced when removing the residual naphthalene. In the case of workers in naphthalene purification, the actual carcinogenic factors are thought to be the fumes of coal-tar and the effects of heat [6].

Case histories

Patient 1. K.W., date of birth: 07.05.1904

Period of exposure 16 years. Latent period 16 years. Smokes 10 cigarettes/day and cigars. Repeated attacks of hoarseness; renewed hoarseness and breathlessness for 3-4 weeks before the first ENT consultation on 5th October 1964. Total laryngectomy on 23rd October 1964. Free from recurrences. At operation the tumour was found to involve the left vestibular ligament, the left vocal cord and arytenoid cartilage, the anterior commissure, the laryngeal surface of the epiglottis, the anterior third of the right vocal cord, and the left sub-glottal area. No metastases.

Histology: a solid immature squamous-cell carcinoma.

Patient 2. F.O., date of birth: 07.12.1905, date of death 02.07.1970

Period of exposure 31 years. Latent period 32 years. Smoked 10-12 cigarettes/day. Bronchitis since 1967. Hoarseness in mid-December 1968. First ENT consultation on 31st January 1969.

Biopsy and histological diagnosis of tumour on 4th February 1969. The tumour spread during in-patient treatment. An extensive bosselated tumour of the right vocal cord.

Bilateral enlarged lymph nodes in neck.

Histology: polymorphocellular undifferentiated carcinoma.

Patient 3. R.P., date of birth: 22.10.1901, date of death: 15.07.1973

Period of exposure 7 years. Latent period 13 years. Smoked 2-3 packets of tobacco per week. Hoarse since childhood. Dyspnoea since the early 1960s. Exploratory operation advised in 1971 due to a bosselated tumour in the centre of the right vocal cord. Acute deterioration on 1st January 1973; emergency tracheostomy, exploratory operation.

The circular and stenosing tumour involved the whole of the larynx.

Histology: horny squamous-cell carcinoma.

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Patient 4. E.E., date of birth: 07.10.1912

Period of exposure: 15 years. Latent period: 23 years. Smokes 15-20 cigarettes per day. Hoarseness since April 1972. First ENT consultation on 12th May 1972. Operation on 10th May 1973 with intra-operative histological examination. Total laryngectomy. Free from recurrences.

At operation the tumour involved the right vestibular ligament and the base of the epiglottis. Spread to the left vocal cord and prelaryngeal space, right ventricle and right vocal cord.

Histology: non-horny squamous-cell carcinoma.

Discussion

All these laryngeal carcinomas observed in naphthalene purification workers appeared after the age of 60. According to the GDR statistics [9], the general age-distribution of laryngeal cancer shows a 70% excess after 60 years of age with the mean age for occupationally-induced cancer of the respiratory tract being 62.5 years for the year 1975 and a mean exposure period of 18 years.

In the case of my patients, the mean period of exposure to mucosal irritants and carcinogenic substances was 17.5 years and the mean latent period was 21 years. Hueper [3] quotes the mean latency for cancer caused by tar as 20 to 40 years (range 1 to 50 years). In the case of malignant disease in industry, Bittersohl [2] found the latent period to be less than 10 years in 13.5% of cases, from 10 to 30 years in 43.5% of cases and upwards of 30 years in 43% of cases.

All my patients were smokers of more than 10 cigarettes per day or 2 to 3 packets of tobacco per week. Along with occupational carcinogens, cigarette smoke is regarded as a causal factor in the genesis of laryngeal cancer [4].

The histological findings did not reveal any particular features suggestive of occupational cancer. Squamous-cell carcinomas typical for the larynx were predominant; these carcinomas were present in 95% of the cases.

The spread of the tumours was very extensive by the time the disease was recognised and in two cases the enlargement of the lymph nodes in the neck was suggestive of the presence of metastases. For this reason, one of these patients with an increased surgical risk due to pulmonary emphysema, cor pulmonale and mitral valve defect was not

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operated upon, while the other patient refused operation. Two of the patients were operated upon in the University ENT Department in Halle and are free from recurrence after 12 and 13 years respectively.

In the case of two patients, the time from confirmation of the diagnosis of cancer to starting treatment was less than three weeks. Patient 3 declined an exploratory operation which had been advised two years previously and also refused a later operation. In the case of Patient 4, five biopsies were performed within one year due to a suspected tumour but none of these produced any evidence of malignancy. Nevertheless, an operation was performed owing to continuing clinical suspicion of a tumour and the intra-operative histological examination confirmed the diagnosis of a tumour which had already spread.

The expert medical assessment of my four patients, who were suspected of suffering from an occupational disease, led to the recognition of their malignant disease as occupational disease 31.

The possibility of a neoplasm caused by occupation should always be borne in mind with every tumour patient, the more so, if the patient has been exposed for more than 10 years to harmful chemical or physical agents in the workplace.

A review of substances which can act as carcinogens in humans or animals has been compiled by Teichmann and Schramm [5].

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