

OCCUPATIONAL AND NON-OCCUPATIONAL SCROTAL CANCER IN SWEDEN, 1958-1970

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Abstract. During the years 1958-70 the Swedish Cancer Registry received reports of 34 cases of scrotal squamous cell carcinoma. All were histopathologically verified. After a perusal of hospital records, health insurance and parish office records, conversations with patients, relatives, factory doctors, etc., concerning occupational history and exposure, it may be stated that 7 (21%) had undergone such exposure to oil as automatic lathe operators that a causal relationship might be considered to exist. Six (18%) had had some hand contact with oil. Twenty-one (62%) had had no contact with oil, among whom were 3 cases of multiple Mb Bowen, basalioma and/or squamous cell cancer, 1 case of internal multiple cancers, 4 with concurrent psoriasis, and 4 severe psychiatric cases. The majority of the cases (approx. 80%) were thus of non-occupational origin. Sixteen patients had died during the observation period, only one of whom had been subjected to lengthy exposure to oil and oil mist. This subject had developed a primary lung cancer.

Cases of occupational scrotal cancer have been reported from Great Britain (3, 4, 6, 8, 9, 11, 14) and in the Savoy Alps in France (10). On the other hand the incidence in the USA is unknown (5) and in Holland no occupational cases appear to occur (12).

The comparatively higher incidence in Great Britain than in other industrial countries is remarkable and no simple explanation exists. It may therefore be worthwhile to report cases of scrotal squamous cell carcinoma that have occurred in another industrialized country (Sweden) in order to illustrate the significance of the working environment (occupational factors).

A preliminary report has been published earlier (13).

The proportion of cases of occupational origin is now presented. The occurrence of subsequent primary cancers is reported in view of the high incidence in the respiratory and upper digestive tracts of patients with earlier scrotal epithelioma (14).

MATERIAL

The Swedish population figures are shown in Table I. The number of males of working age was 2.4 million in 1958 and 2.7 million in 1970.

The method of reporting to the Swedish Cancer Registry and its efficiency is described in "Cancer incidence in Sweden" (2).

The hospital records for all reported cases of scrotal cancer from 1958-70 have been procured and perused. The diagnosis in all cases was squamous cell carcinoma, histopathologically verified.

Particulars have also been collected from health insurance and parish office records, after which contact was made with factory doctors, patients and relatives to ascertain the occupational history and for discussion of the working environment and conceivable aetiological factors, in particular exposure to coal, tar and soot, pitch, creosote, anthracene oil and wax, lignite oil and wax, petroleum oil, tar oils, asphalt, wax, carbon black and carbon, hydrogenated coal oil and tar, arsenic (7). A detailed occupational history was obtained in each case.

RESULTS

The incidence of scrotal squamous cell carcinoma in Sweden is shown in Table II. One to five cases have been reported per annum, a total of 34 during a 13-year period. No rise in incidence was recorded during the latter part of the period. The age at onset varied between about 45 and 85 years, with the highest incidence (14 cases) between the ages of 60 and 69 (Table III).

Oil exposure

Of the carcinogens in question (7) oil was the only conceivable aetiological factor since exposure to the others was denied. The series was therefore subdivided as shown in Table IV.

Seven patients had been subjected to lengthy exposure to oil as automatic lathe operators, the scrotal

Table I. Swedish population figures (thousands)

	Total	Males	Males 16-66 years
1958	7 436	3 710	2 434
1970	8 081	4 036	2 701

Table II. Year of diagnosis for 34 cases of scrotal squamous cell carcinoma reported to the Swedish Cancer Registry

Year	Number	Oil-induced
1958	2	2
1959	1	—
1960	3	—
1961	2	—
1962	4	—
1963	5	—
1964	2	2
1965	3	—
1966	4	—
1967	2	2
1968	1	1
1969	4	—
1970	1	—
Total	34	7

region being contaminated. Further data on these 7 cases are shown in Tables II, III and V.

Six patients had been subjected to some oil exposure through hand contact with motor oils (Table IV). Their hands had been contaminated, but they had not been subjected to splash or oil mist and their working clothes had not been soaked with oil. One of these 6 cases had concurrent psoriasis, which had been treated with, among other means, arsenic.

The third group, comprising 21 patients, denied exposure to oil (Table IV). They have been divided into five subgroups.

Table III. Age at onset of scrotal squamous cell carcinoma

Age (y.)	Number	Oil-induced
40-49	3	1
50-59	7	1
60-69	14	4
70-79	6	1
80-89	4	—
Total	34	7

Table IV. Oil exposure of 34 patients with scrotal squamous cell carcinoma

	Number
I. Lengthy exposure	7
II. Some exposure of hands	6 ^a
III. No exposure	21
(a) multiple Mb Bowen, basalioma or squamous cell carcinomas	3
(b) internal multiple cancers	1
(c) concurrent psoriasis	4
(d) psychiatric cases	4
(e) other	9

^a One patient had concurrent lengthy psoriasis treated, *inter alia*, with arsenic.

The first (a) contains 3 patients who in the course of the years had had multiple Mb Bowen, basalioma and squamous cell carcinoma. The first patient had his first skin tumour at 61 years of age and his scrotal cancer 23 years later, the second his first skin tumour at 45 years of age and his scrotal cancer 21 years later, the third his first skin tumour at 49 years of age and his scrotal cancer 1 year later. He was a psychiatric case (see *d* below) and had been in a mental hospital for about 30 years.

Subgroup (b) comprises one patient, with internal multiple cancers. He developed laryngeal cancer at 69 years of age, scrotal cancer 7 years later, and one year thereafter cancer of the colon which metastasized and led to death.

Subgroup (c) comprises 4 patients who at the same time had psoriasis. At least 3 of them had had

Table V. The course and mortality for 34 cases of scrotal cancer

Oil exposure	Total cases	Deaths	Causes of death
I. Lengthy	7	1	Oat-cell cancer
II. Some	6	2	(a) Oat-cell cancer (b) Scrotal cancer c. metastas.
III. None	21	13	(c) Scrotal cancer c. metastas. (4 cases) (d) Scrotal cancers and diseases of heart, lung, kidneys (2 cases) (e) Primary bronchial cancer (1 case) (f) Multiple internal cancer (1 case) (g) Heart-lung discases (5 cases)

lengthy peroral arsenic medication. There was no report of tar treatment having been given as well.

Subgroup (*d*) comprises 4 psychiatric patients. They had been in mental hospitals for decades and were so severely ill that they had been unable to perform any therapeutic work. The first had been admitted to a mental hospital at 27 years of age and developed scrotal cancer 45 years later, the second was admitted at 43 years of age, the scrotal cancer following 20 years later, the third at 41 years of age and developing scrotal cancer 36 years later. In the fourth case there is no definite information about the onset of his scrotal cancer in relation to his mental disease.

The remaining 9 subjects (*e*) denied exposure to the carcinogens (7). They were 3 clerks, 2 agricultural workers, 1 forest worker, 1 railwayman, 1 building worker and a policeman, the latter having been a horseman over a lengthy period (6).

COURSE AND MORTALITY

The course and the mortality for the 34 cases are shown in Table V. Sixteen patients (47%) had died during the observation period.

Lengthy exposure to oil (7 cases). Detailed particulars of these cases are shown in Table VI. The onset had come between 45 and 76 years of age, the oil exposure having varied between 15 and 38 years prior to the onset. They had been under observation for a minimum period of 5 years after the treatment (operation). Five cases had run a normal course. They had returned to the same job they had had before the onset and had been fully fit for work up

Table VI. Seven patients with scrotal squamous cell carcinoma and lengthy exposure to oil

Age at onset	Oil exposure (y.)	Observation after treatment (y.)	Course
53	38	15	Unremarkable
64	19	7	Unremarkable
68	ca. 38	7	Death at 75 years of age of pulm. cancer with metastases (oat-cell)
76	ca. 15	9	Unremarkable
61	38	5	Unremarkable
64	38	10	Unremarkable
45	20	5	Metastases to lymph glands in groins. Fully fit for work

to the normal age of retirement. In one case metastasization had taken place in regional lymph glands, but the patient had recovered and was fully fit for work after the operation. The seventh patient died at 75 years of age and the autopsy showed oat-cell cancer in the lungs with metastases (Tables V, VI). His smoking habits are unknown.

Some exposure to oil (6 cases). The minimum observation period was 10 years. Two of the patients died, one developing scrotal squamous cell carcinoma at 84 years of age and dying within one year. Autopsy in this case revealed oat-cell cancer in the lungs, with metastases. His smoking habits are unknown. The second patient was taken ill at 48 years of age and died within one year, of scrotal cancer with metastases to regional lymph glands. The direct cause of death was uncontrollable haemorrhage.

No known exposure to oil (21 cases). Thirteen patients had died, 4 of whom had scrotal cancer which had metastasized to pleura, lungs and brain. Two patients had scrotal cancer, but diseases of the heart, lungs and kidneys were stated as main cause of death. In one case the cause of death was a primary bronchial cancer (squamous cell carcinoma) with metastases. This was the patient with multiple Mb Bowen, basalioma and squamous cell carcinoma, who had been in a mental hospital for some decades. One case was the patient with repeated internal cancers, the cause of whose death was metastasizing cancer of the colon. In 5 cases the cause of death was cardiac, vascular or pulmonary disease. The shortest period of observation of the 8 survivors was 4 years.

DISCUSSION

A perusal of the cases of scrotal squamous cell carcinoma reported to the Swedish Cancer Registry showed that 7/34 (21%) could be related to an earlier lengthy exposure to oil as automatic lathe operator (Table IV). Six of the 34 (18%) had had some contact with different oils on the hands, but had not been subjected to the soaking of clothes and underclothes suffered by automatic lathe operators. Twenty-one (62%) had had no contact with oil, and 12 of them could be assigned to special subgroups (*a-d*) (Table IV). Nor had any of the patients had contact with soot, tar, coal, etc. (7).

The investigation has thus shown that the majority (about 80%) of the cases of scrotal squamous cell carcinoma seem to be of non-occupational origin.

This finding differs from results obtained in Great Britain.

A corresponding investigation from the Birmingham region during the period 1939-48 thus showed that, of 34 cases, 12 were caused by oil, 13 by pitch, tar, soot, etc., the remaining 9 being doubtful. The latter group included cases concerning which there was insufficient information.

From the Manchester region (11) 103 cases of scrotal cancer were reported during the period 1963-8. Full occupational histories were obtainable in 89 cases and only in 5 was no clear cause apparent. Fourteen had worked in occupations with possible risk and the remaining 70 had been exposed to wellknown carcinogens.

Henry (6) stated that in 21.6% of cases "there might be some doubt about the carcinogenic agents encountered or for which none could even be suggested".

The total number of males of working age in Sweden during the period studied was 2.4-2.7 million (Table I). The number exposed to oil ("at risk") is not known but is estimated at about 50 000. The corresponding figure for the Birmingham region is 130 000 (9). Earlier, however, 8 cases of oil-induced scrotal cancer have been reported among 250 men in a Swedish factory, representing an incidence of about 1 400 per million per year (1).

On the basis of the observation by Waterhouse (14) on subsequent primary cancers a study was made of the course and mortality for the 34 cases (Tables V, VI).

The minimum observation period after the treatment was 4 years and during this period primary lung cancer (oat-cell) had developed in *one* of the 7 subjects subjected to lengthy exposure to oil. This appears to be a "second primary". The other 6 patients could return to the same jobs and remained in good working fettle until 67 years of age, which is the normal age of retirement in Sweden.

Of the 6 patients subjected to some contact with oil on the hands one developed scrotal cancer at 84 years of age and died within one year; autopsy revealed oat-cell cancer in the lungs.

Of the 13 deceased patients who had had no contact with oil one had a primary bronchial cancer (squamous cell carcinoma). One patient had had a laryngeal cancer 6 years prior to the onset of scrotal cancer.

The smoking habits of the 16 deceased patients (47%) are, however, unknown.

Among the 34 cases from the Birmingham region (3) 9 died within 2 years. Only one of these deaths was unrelated to the carcinoma.

In 19 of the 50 deaths among the Manchester cases (11), the scrotal cancer was the underlying cause.

The present investigation has thus demonstrated one case of subsequent primary lung cancer, which could be related to exposure to oil mist (14).

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