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SMOKING AND PULMONARY CARCINOMA

by

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The increased incidence of pulmonary carcinoma registered in the last few years has aroused interest in the possible factors affecting its genesis. Intensive studies have also been made of the possible rôle of smoking on cancer of the lung.

As early as the end of the nineteenth century SOEMMERING suspected smoking to be associated with pulmonary carcinoma. At the turn of the century BROSCHE, obviously the first, succeeded in producing experimentally malignant proliferation on the skin of guinea-pigs by smearing it with 'tobacco-juice'. Later too the cancer-producing quality of tobacco tar has been investigated by means of experiments. Its relationship to cancer growths of the respiratory tract has been investigated also in Finland, according to a personal communication from ERMALA-HOLSTI-SETÄLÄ, and phantoms as well as animal tests have indicated that the absorption of tobacco tar and its accumulation in the respiratory tract is most pronounced in the regions where cancer growths are generally situated in man.

What the cancer-producing agent in tobacco actually is still awaits solution. Besides tobacco tar, arsenic among other substances (DOLL and HILL) has been suspected as a contributory factor. Arsenic is used for dusting the seedlings of the tobacco plant to expel pests. Investigations made by the KENNAWAY group prove, however, that even extensive statistics fail to support the hypothesis that tobacco treated with arsenic-containing preparations is more conducive to cancer than tobacco free from any contact with arsenic.

S. MUSTAKALLIO ascertained in 1944 that patients with cancer of the throat were almost without exception smokers, and that they had started

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to smoke at a considerably younger age than the patients of the comparative material not suffering from cancer of the respiratory tract. — Statistics published during the last few years in different countries on the smoking habits of patients suffering from pulmonary carcinoma or cancer of the respiratory tract generally indicate with increasing clearness an association with the smoking habit. Thus, for instance, of the 684 pulmonary carcinoma patients of the Americans, WYNDER and GRAHAM, only 2 per cent were non-smokers or light smokers and 96 per cent had smoked for over 20 years. The number of women among patients with pulmonary cancer has been found small everywhere, being only about 10—20 per cent. This has been ascribed to the fact that they smoke less. As it is of interest to know how Finland compares in this respect the writer has made the following investigation.

The material covers 351 cancer patients examined over the course of 16 years at the Central Institute of Radiotherapy of the University of Helsinki. The diagnosis was verified histologically and the patients were questioned at the time of taking their case histories about their smoking habit. Furthermore, the writer has placed 494 patients examined during the same period at the Central Institute of Radiotherapy in a special group. In these cases there was no biopsy verification of the diagnosis, but, judged from the clinical picture, roentgen examination, bronchoscopy finding (not infrequently) or operation, the condition was one of pulmonary carcinoma.

The control material has been collected by the writer from the Medical Out-Patient Department. Data on the smoking habit was obtained in 300 male patients of the same age living in similar circumstances. The inquiry was made, without selection, of every man over 40 years of age who attended the Department, from February 1 to March 14, 1952, and in whom there was no reason to suspect cancer. As a matter of curiosity the writer also chose 15 women over 30 years of age and not suffering from cancer as control material from the same hospital. None of the women smoked and had the writer continued the inquiry only the 24th woman would have been found to have been a smoker.

Results of the Writer's Investigations

The material covers only 15 women in whom the diagnosis is confirmed by biopsy; 2 are smokers. The figure for non-smokers among the 18 cases without biopsy verification is also 2. With such a small material of women no definite conclusions can be drawn and the study will consequently be restricted to men only.

Among 336 men with pulmonary carcinoma and in whom the diagnosis was verified histologically, smokers account for 99.7 per cent (*i. e.* there

Table I

Distribution of the material by sex and average age at start of investigation

	No. of cases	Per cent	Average age, years
Ca. pulm. Biopsy +			
Male	336	95.7	55.7
Female	15	4.3	49.9
Total	351	100.0	55.5
Ca. pulm. No biopsy			
Male	476	96.1	58.3
Female	18	3.6	57.0
Total	494	100.0	58.2
No cancer			
Male	300	95.2	56.2
Female	15	4.8	51.5
Total	315	100.0	55.9

was but one non-smoker). The ratio is approximately the same, or 99.2 per cent, in 476 cases without histologic verification. Of the 300 cases of the control material, smokers total 82 per cent (hence, 54 men are non-smokers).

Table II

Age at which men started smoking

	0-10 years		11-15 years		16-20 years		21-30 years		31 years	
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
1. Ca. pulm. Biopsy + Cases 301	53	17.6	86	28.6	133	44.2	27	9.0	2	0.6
2. Ca. pulm. No biopsy Cases 376	90	23.9	113	30.1	134	35.6	33	8.8	6	1.6
3. No cancer Cases 246	16	6.5	52	21.1	103	41.9	67	27.2	8	3.3

1 → 2¹ $\chi^2 = 1.60$, $f = 3$, $P \approx 65$ Per cent

1 → 3 $\chi^2 = 47.3$, $f = 3$, $P < 0.1$ Per cent

2 → 3 $\chi^2 = 65.3$, $f = 3$, $P > 0.1$ Per cent

¹ 1 → 2 comparison of groups 1 and 2

P = probability of the test hypothesis that the samples are drawn from the same population.

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The average age at which the smoking habit started was 15.7 years for male smokers with pulmonary carcinoma confirmed by biopsy and 15.3 years for patients without biopsy verification. The figure is 18.8 years for male smokers of the control material. Patients with pulmonary carcinoma have consequently commenced to smoke earlier, many in childhood. A striking feature is the high number of boys who started smoking at the age of 10 years or younger. With them the potential cancer-producing elements in tobacco have had time in the course of the patient's life to irritate the mucous membranes of the respiratory tract over a longer period, and in childhood mucous membranes may be more sensitive to irritation. In patients with pulmonary carcinoma confirmed by biopsy, irritation due to smoking has continued before the verification of the disease for 39.7 years on an average (42.0 years in patients with no biopsy verification) and for 32.1 years in patients without pulmonary carcinoma. The duration of the irritation is thus 8—10 years longer for cancer patients than for those of the control material.

Table III
Type of smoking (men)

	No. of cases	Ciga- rettes; No.	Per cent	Pipe; No.	Per cent	Cigars; No.	Per cent
1. Ca. pulm. Biopsy +	279	274	98.2	5	1.8	—	—
2. Ca. pulm. No biopsy	361	351	97.2	10	2.8	—	—
3. No cancer	246	229	93.1	17	6.9	—	—

1 — 2 $\chi^2 = 0.10$, $f = 1$, $P \approx 70$ Per cent

1 — 3 $\chi^2 = 8.33$, $f = 1$, $P \approx 0.5$ Per cent

2 — 3 $\chi^2 = 5.90$, $f = 1$, $P \approx 1.5$ Per cent

Cigar-smoking is rare in Finland at the social levels to which the patients of the material chiefly belong. Patients with pulmonary carcinoma are almost all cigarette-smokers. No difference has been found to exist between smokers of tipped and untipped cigarettes; all three groups contain an almost equal number of each.

Persons with pulmonary carcinoma have admitted, to a greater extent than the patients of the control material, to noticing that smoking causes irritation, the so-called smoker's cough. The percentage of patients with smoker's cough among 188 smokers with biopsy-verified pulmonary carcinoma is 87.2 (89.1 among 174 patients without a biopsy verification), whereas the figure is only 50 per cent for 246 smokers of the control material.

Table IV
Type of smoker (men)

	Heavy a)		Moderate b)		Light c)		Occasional	
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
1. Ca pulm. Biopsy + Cases	197	64.2	98	31.9	12	3.9	—	—
2. Ca pulm. No biopsy Cases	281	67.6	110	26.1	25	6.0	—	—
3. No cancer Cases	75	30.5	94	38.2	59	24.0	18	7.3

a) One packet (20) or more of cigarettes per day.

b) $\frac{1}{2}$ —1 packet of cigarettes per day.

c) Less than $\frac{1}{2}$ packet of cigarettes per day.

1—2 $\chi^2 = 0.90$, $f = 2$, $P \approx 65$ Per cent

1—3 $\chi^2 = 96.7$, $f = 2$, $P < 0.1$ Per cent

2—3 $\chi^2 = 110.6$, $f = 2$, $P < 0.1$ Per cent

Statistical treatment of the data has been carried out according to CRAMÉR. The results are identical for patients with pulmonary carcinoma with or without histological verification of the diagnosis, and the groups are also statistically equivalent.

SUMMARY

The investigation comprises 351 pulmonary carcinoma patients in whom the diagnosis was confirmed histologically and 494 patients with pulmonary carcinoma not verified by biopsy. The control material consists of 315 patients. The conclusions refer principally to men and the pulmonary carcinoma patients are almost all smokers who have smoked heavily for decades. In comparison with the control material, they have started smoking younger, often from childhood, and have smoked continuously for about 40 years, i. e. an average of 8—10 years longer than patients free from cancer. These circumstances are probably of significance in the genesis of pulmonary carcinoma.

ZUSAMMENFASSUNG

Die Untersuchung umfasst 351 Patienten mit Lungenkrebs mit histologisch bestätigter Diagnose und 494 Patienten, bei denen die pathologisch-anatomische Verifikation fehlt. Das Vergleichsmaterial besteht aus 315 Patienten. Die Schlussfolgerungen beziehen sich hauptsächlich auf Männer: die Lungenkrebspatienten waren fast alle seit Jahrzehnten starke Räucher. Im Vergleich zum Kontrollmaterial haben sie frühzeitiger zu rauchen angefangen, oft schon in der Kindheit. Sie haben regelmäßig etwa 40 Jahre lang geraucht, im Durchschnitt etwa 8—10 Jahre länger als die Patienten ohne Lungenkrebs. Dieser Umstand ist wahrscheinlich für die Genese des Lungenkrebses bedeutungsvoll.

RESUME

L'enquête porte sur 351 malades atteints de cancer du poumon confirmé histologiquement et 494 cas de cancer du poumon non vérifié par biopsie. Le groupe témoin comprend 315 sujets. Les conclusions concernent surtout des hommes et les malades atteints de cancer du poumon sont presque tous des fumeurs qui ont beaucoup fumé pendant des décades. Comparés au groupe témoin, ils ont commencé à fumer plus jeunes, souvent dès leur enfance, et ont fumé continuellement pendant environ 10 ans, c'est-à-dire en moyenne 8 à 10 ans de plus que les sujets indemnes de cancer. Ces faits sont probablement importants dans la genèse du cancer du poumon.

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