

CANCER IN THE GASTROINTESTINAL TRACT IN CHROMATE PIGMENT WORKERS

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ABSTRACT

Three cases of gastrointestinal cancer are reported in a group of 24 chromate pigment workers with more than three years of chromate exposure. The expected number of gastrointestinal cancers (I.C.D. nos 150-159) in the group was estimated to be 0.47. The results indicate an increased risk of gastrointestinal cancer in the chromate pigment industry.

An excess of bronchiogenic carcinomas in workers exposed to chromates in a dichromate producing industry has been reported a number of times^{1,2,7}. Increased incidence of lung cancer in chromate pigment workers has been reported twice^{5,6}. Inhalation of chromium in the hexavalent state in humans may thus give rise to lung cancer after an induction period of 10 to 25 years^{1,9}.

Little information is available about cancer development at sites other than the lungs in workers exposed to chromates. Single cases of cancer in the nasal cavities have been reported^{6,9}. The two cases of the maxillary sinus in chromate workers reported by Taylor⁹ were greatly in excess of the expectancy compared to the U.S. male population. So far, however, the number of reported cases is too small to justify any conclusions as to a causal relationship between inhalation of chromates and development of cancer in the nasal cavities.

On the bases of five cases of cancer observed in a small group of chromate workers, Teleky¹⁰ suggested a relationship between exposure to chromates and cancer in the gastrointestinal tract. Taylor⁹ reported a slight excess of gastrointestinal cancers in a similar group. A slight increase in the number of cancers in the gastrointestinal tract has also been reported in chromium electroplaters⁸, occupational exposure to nickel compounds and other industrial carcinogens could not, however, be ruled out in this group.

WORKERS, METHODS AND RESULTS

The group of chromate pigment workers previously described by Langård and Norseth⁶ was surveyed to record new cases of cancer which occurred by the end of 1975, with the same methods as described in the previous paper. The

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latest available figures for cancer incidence in Norway were used^{3,4}. The follow-up revealed that two more cases of cancer had developed within the group of 133 workers (Table 1). Both these cancers were found in a subpopulation of 24 with an exposure exceeding three years by the end of 1972. In both patients cancer was located in the gastrointestinal tract – as was one of the cancers referred to in the original paper (pancreas). No new cases of cancer were found in workers who by the end of 1972 had a shorter exposure time than three years.

TABLE 1
Cases of cancer among 133 chromate workers.

Site of cancer	No. of cases
Bronchus	3
Gastrointestinal tract:	
pancreas	1
stomach	1
large intestine	1
Prostate	1
Nasal cavity	1

Thus, at present the number of cases of cancer in the total population of 133 is eight – of which six have occurred in the selected population of 24 with an exposure exceeding three years. A total of eight workers in the selected population were dead by the end of 1975.

By the end of 1975 the number of workers with more than three years of employment in this factory increased. As the concentration of chromates in the working atmosphere has been considerably reduced since 1973, workers who exceeded three years of exposure in 1973 or later have not been included in the study. The chromate exposure levels as recorded in 1972 are shown in Table 2.

TABLE 2
Exposure to chromium in different working operations.

Working operation	No. of samples*	Chromium (mg/m ³)		
		\bar{X} min.**	\bar{X}	\bar{X} max.**
Sackfilling	5	0.43	0.43	0.70
	4	0.69	1.35	1.87
Mixing	5	0.13	0.35	0.74
	5	0.29	0.33	0.44

* Exposure over one shift (personal sampler)

** Min and max are given as 95% confidence intervals with log normal distribution

Case reports

The age of the patients, the time of diagnosis and length of exposure to chromates are given in Table 3. For the first patient (pancreas), no details of the working history are available other than those relating to his work in zinc

chromate production during the indicated period. The patient with a gastric cancer was mainly engaged in mixing raw materials for zinc and lead chromate production, and grinding the final products, which is a very dusty process. Otherwise he had worked as a pottery painter, and foundry joiner and also had

TABLE 3
Exposure time and age of 3 chromate pigment workers with gastrointestinal cancer.

Site of cancer	Time of diagnosis.		Exposure time
	Age	Year	
Pancreas	48	1972	1954-1957
Stomach	63	1975	1950-1952
Large intestine	67	1975	1955-1958

various outdoor jobs. The third patient (large intestine) was mainly engaged in handling and packing wet zinc chromate in the plant. For the rest of his life he had been an outdoor construction worker. The histological diagnosis was adenocarcinoma for the pancreatic and gastric tumors, while the large intestinal tumor was a carcinoma.

DISCUSSION

The small population referred to in this survey includes 133 workers of whom 47 had been exposed to chromate pigments for more than one year and only 24 for more than three years at the end of 1972. Most workers are still young and only a few have reached an age at which natural death may be expected. Calculations of standard mortality rates are therefore not carried out at this stage of the follow-up. Lung cancers in this population have been shown to be far in excess of the expectance compared to the cancer incidence in the general population⁶. According to the same calculation method as in the previous study for the I.C.D. numbers 150-159, the expected number of cancers in the gastrointestinal tract was 0.47 in the 24 workers with exposure time exceeding three years, and 0.71 when the 47 workers with exposure time longer than one year were included. The three cases of cancer reported in this paper therefore indicate an increased risk of cancer also in the gastrointestinal tract.

Both experimental and epidemiological research on the carcinogenicity of chromates have been directed mainly towards evaluating a relationship between exposure to chromates and cancer in the respiratory organs. This follow-up of our small population does not justify conclusions as to a causal relationship between human exposure to chromate pigments and an excess of cancers in other organs. The results, however, are suggestive.

The present results and the report by Teleky¹⁰ seem to justify renewed epidemiological studies of the occurrence of cancer in chromate workers including cancer at other sites than in the respiratory organs. Presuming that a causal relationship exists, this report indicates a slightly longer induction period, of 17, 25 and 20 years respectively, for gastrointestinal cancer than for cancer in the respiratory organs⁹.

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REFERENCES

1. *Baetjer, A. M.* Pulmonary carcinoma in chromate workers. II. Incidence on basis of hospital records. *Arch. Ind. Hyg.*, **2** (1950) 505-516.
2. *Bidstrup, P. L. and Case, R.A.M.* Carcinoma of the lung in workmen in the bichromates-producing industry in Great Britain. *Br. J. Ind. Med.*, **13** (1956) 260-264.
3. *Cancer Registry of Norway* Trends in cancer incidence in Norway 1955-1967. Universitetsforlaget, Oslo, Norway, 1972.
4. *Cancer Registry of Norway* Cancer registration in Norway. The incidence of cancer in Norway 1969-1971. The Norwegian Cancer Society, Oslo, Norway, 1973.
5. *Gross, E. and Kölsch, F.* Über den Lungenkrebs in der Chromfarbenindustrie. *Arch. Gewerbepath. Gewerbehyg.*, **12** (1943/1944) 164-170.
6. *Langard, S. and Norseth, T.* A cohort study of bronchial carcinomas in workers producing chromate pigments. *Br. J. Ind. Med.*, **32** (1975) 62-65.
7. *Pfeil, E.* Lungentumoren als Beruferskrankung in Chromatbetrieben. *Dtsch. med. Wochenschr.*, **61** (1935) 1197-2000.
8. *Royle, H.* Toxicity of chromic acid in the chromium plating industry (1). *Environ. Res.*, **10** (1975) 39-53.
9. *Taylor, F. H.* The relationship of mortality and duration of employment as reflected by a cohort of chromate workers. *Am. J. Public Health*, **56** (1966) 218-229.
10. *Teleky, I.* Krebs bei Chromarbeitern. *Dtsch. med. Wochenschr.*, **62** (1936) 1353.