Kidney cancer in utility workers exposed to polychlorinated biphenyls (PCBs)

S L SHALAT,¹ L D TRUE,² LORA E FLEMING,³ PATRICIA E PACE³

From the Department of Epidemiology and Public Health and the Occupational Medicine Program, Department of Internal Medicine,¹ Department of Pathology,² and Occupational Medicine Program, Department of Internal Medicine,³ Yale University School of Medicine, New Haven, Connecticut 06510, USA

We wish to report a cluster of kidney malignancies (adenocarcinoma) that has occurred among three young male utility workers who were responsible for maintaining electrical transmission equipment including power transformers. Each was employed by a single public utility company during the same period and worked at some time repairing and maintaining transformers. The most common coolants used in these transformers until relatively recently were PCBs.

Kidney cancer is a relatively rare malignancy in young men with rates (kidney, renal, pelvis, and ureter combined) ranging from 1.3 to 100,000 person-years (py) for those aged 30–34 and increasing to 297/100,000 py for those aged 55–59.¹ The median age of highest risk is 55 and there is a 2:1 male to female ratio.²³ In animals ionising radiation may induce renal neoplasm; in man thorotrast (used as a contrast medium for renal and liver visualisation) was associated with an increased incidence of renal adenocarcinoma.² In addition, polycystic kidney disease and von Hippel Lindau disease carry an increased risk for renal cancer.

Additional recognised risk factors for kidney cancer include: smoking (including tobacco, pipe, and cigar⁴–⁶) and possibly the use of phenacetin.⁹–¹² Several occupational groups have been found in various case-control studies to carry an increased risk of renal cancer including: laundry and dry cleaners;¹³ newspaper web pressman,¹⁴ coke oven workers,¹⁶ and, possibly, professional and white collar workers such as doctors and other health care providers.¹⁷ Various occupational toxins have been implicated in the increased risk of kidney cancer, specifically cadmium,¹⁶ asbestos,¹⁸ organic solvents,¹³¹⁴¹⁸¹⁹ and tar, pitch, and petroleum products.¹⁵

The three subjects of this report worked as linesmen and maintenance workers for a public utility company and were engaged in servicing and repairing electric power transformers. In the course of this work they were reported to have been exposed to organic solvents, herbicides, electromagnetic fields, and polychlorinated biphenyls (PCBs). None of the three men admitted to any of the known personal significant risk factors for kidney cancer (except for one mild smoker). Possibly exposure to any one or combination of the above named agents may have been responsible for these malignancies.

Case 1—A 34 year old white man who had been employed by the utility company since 1971. Between 1979 and 1984 he was employed as a painter in a transformer repair shop in which old PCB oil was drained and the transformers were cleaned, prepped, and repainted before being replaced in service. Thus there was often extensive contact with numerous organic solvents and PCBs without any particular personal protection.

Case 2—A 43 year old white man who was employed from 1964 to 1978 as a linesman, a job that included repairing transformers and extensive contact with PCB oil. He also worked in the field repairing electric lines and was thus exposed to electrical fields and herbicides (the latter used to keep the powerline right of ways free from foliage).

Case 3—A 56 year old white man who was the working partner of case 1. He had worked for the utility company for over 35 years, including eight years as a painter primarily in the transformer department.

Each individual developed a primary renal adenocarcinoma. All tumours were unifocal, located within the centre portion of the kidney, and with a maximum dimension of 6–14 cm. None of the tumours exhibited capsular or vascular invasion or nodal metastases.

Pathological examination of the renal adenocarcinomas of all three cases showed the following characteristics. Case 1 showed a majority of solid sheets of cells having an eosinophilic granular cytoplasm and a minority component consisting of cuboidal cells forming irregular granular cytoplasm. Examination of the
tumour of case 2 showed solid sheets of cells with predominantly clear cytoplasm and associated necrosis; it had a prominent vascular component. The tumour of case 3 showed predominantly clear cells that in some areas grew in sheets and in other areas formed tubular and alveolar structures associated with broad fibrous septae. A moderately dense inflammatory infiltrate was also seen with this tumour.

Serum concentrations for PCBs were not raised in cases 1 and 2 but traces of pesticides, herbicides, and their breakdown products were found. The more definitive procedure of evaluation of adipose tissue for PCBs was not conducted. Of note, case 2 reported a rash consistent with chloracne; however, on examination of the medical records no such diagnosis had been assigned to this condition.

As noted previously the possibility that kidney cancer may be associated with workplace exposures is not new but no causal relation between occupational exposures and this condition has been shown. Utility workers are exposed to various chemical and physical agents that are possible carcinogens. These include, but are not limited to, organic solvents, herbicides, electromagnetic fields, and PCBs. We suggest that there is a need for an epidemiological investigation of renal adenocarcinoma and exposures that occur in the electric utility industry.

References


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