

LUNG CANCER CASE-CONTROL STUDY OF BERYLLIUM WORKERS

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Background Beryllium compounds are toxic to the lungs, causing acute pneumonitis and chronic granulomatous lung disease. Cohort mortality studies have found elevated lung cancer mortality among beryllium processing workers compared to nonexposed populations, but none of these studies has evaluated the association between level of beryllium exposure and lung cancer risk. A nested case-control study of lung cancer within a beryllium processing plant was conducted to investigate the relationship between level of beryllium exposure and lung cancer.

Methods Lung cancer cases were identified by mortality follow-up through 1992 of a cohort of male workers at a beryllium alloy production plant in Reading, Pennsylvania. Each of 142 lung cancer cases were age-race matched to five controls using incidence density sampling. Calendar-time specific beryllium exposure estimates were made for every job in the plant and were used to estimate the cumulative, average, and maximum exposures of the cases and controls. Potential exposure to beryllium dusts or fumes, to various chemical forms of beryllium, and to several other agents were evaluated for each job, and considered in the case-control analysis. The potential confounding effects of smoking were evaluated using smoking data from a health survey conducted at the plant by the U.S. Public Health Service in 1968.

Results Lung cancer cases had shorter tenures and lower cumulative beryllium exposures than controls, but higher average and maximum exposures. After applying a 20 year lag, all exposure metrics were higher for cases than controls. Odds ratios in analyses lagged 20 years were significantly elevated for those with higher exposure compared to the lowest exposure category. Linear dose trends were absent, but lung cancer risk increased significantly with the log of the lagged exposure estimates. Smoking did not appear to confound exposure-response analyses, because smoking was not associated with exposure levels.

Conclusion The finding of an increased risk of lung cancer among workers with higher beryllium exposures when dose estimates were lagged 10 to 20 years, and lack of evidence for confounding by cigarette smoking, support the conclusion that beryllium is a human lung carcinogen. The lack of a linear exposure-response for most beryllium dose metrics must be interpreted with caution. A small number of beryllium air measurements were available during the 1940's and 1950's--when the majority of cases and controls were first employed--reducing the accuracy of job exposure estimates. Workers with the highest exposures often worked for only short periods in the 1940's; exposure mis-classification may have affected these workers preferentially, distorting exposure-response relationships.

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