Parental Occupational Exposure to Extremely Low Frequency Magnetic Fields and Childhood Cancer: A German Case-Control Study

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INTRODUCTION

Extremely low frequency magnetic fields (ELF-MFs) have been classified as a possible human carcinogen (group 2B) by the International Agency for Research on Cancer. Besides residential exposure of the children themselves, parental exposures to ELF-MFs (50 or 60 Hz) either preconceptionally or during pregnancy could also play a role in the development of childhood cancer. The aim of this analysis was to investigate, in a large sample of a German population-based case-control study, if children whose parents were occupationally exposed to higher levels of ELF-MF in the preconceptional time period had an increased risk of developing cancer [1].

MATERIALS AND METHODS

We used data from 2 population-based case-control studies conducted in Germany during the years 1992 to 1997, including cases with acute leukemia, non-Hodgkin’s lymphoma, tumors of the central nervous system, neuroblastoma, Wilms’ tumor, bone tumor, and soft tissue sarcoma. For both studies, cases aged 0 to 14 years were ascertained from the nationwide German Childhood Cancer Registry. The occupational history of both parents was collected by self-administered questionnaires and subsequent telephone interviews. For the preconceptional occupations, a job-exposure matrix was developed according to average ELF-MF levels estimated by an expert of the German Federal Institute for Occupational Safety and Health blinded to case-control status. Our primary analysis compared the cancer risks in children with paternal magnetic field exposures above 0.2 µT with the risks of children whose fathers were exposed to field levels at or below 0.2 µT. Odds ratios and 95% confidence intervals were computed by conditional logistic regression models for frequency-matched data sets.

RESULTS

The case group consisted of 846 (41.3%) children with acute leukemia, 159 (7.8%) children with non-Hodgkin’s lymphoma, 444 (21.7%) children with tumors of the central nervous system, and 600 (29.3%) children with other tumors. In total, 615 different job codes held by fathers in the preconceptional period were identified. Among the highest exposed occupations were metal workers, electric welders, locomotive engineers, and power plant operators. The adjusted regression analysis resulted in an odds ratio of 0.85 (95% confidence interval (CI): 0.70, 1.03) for leukemia in children with paternal magnetic field levels above 0.2 µT. The odds ratios for the other types of cancer were based on smaller numbers of exposed cases, and all were close to unity.
In an exploratory meta-analysis, we combined our results with the findings of previous studies addressing paternal exposure and childhood leukemia [2, 3, 4, 5]. As shown in Figure 1, the random-effects analysis resulted in a pooled risk estimate of 1.35 (95% CI: 0.95, 1.91). Given the high degree of heterogeneity (test for homogeneity, \( P < 0.01 \)) and the suggestion of publication bias (Egger’s test, \( P = 0.07 \)), this quantitative summarization has to be interpreted with caution.

![Figure 1: Meta-analysis combining the findings from previous studies and the current analysis regarding paternal occupational exposure to electromagnetic fields and childhood leukemia. For comparison, the most appropriate exposure category was chosen, i.e. exposure levels above 0.2 µT for studies presenting numeric values, otherwise the more general category of ‘occupationally exposed’ fathers.]

**CONCLUSIONS**

In this large population-based case-control study, children whose fathers were occupationally exposed to higher levels of ELF-MFs in the preconceptional time period did not have an increased risk of cancer. With regard to maternal exposures, the numbers were too small to derive firm conclusions. Considering the results of previous studies, there is still some evidence that childhood leukemia may be associated with paternal preconceptional exposure to ELF-MFs, although that was not confirmed by our study.

**REFERENCES**


