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## Unexpected rates of chromosomal instabilities and alterations of hormone levels in Namibian uranium miners.

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### **Abstract**

A common problem in determining the health consequences of radiation exposure is factoring out other carcinogenic influences. The conditions in Namibia provide a test case for distinguishing the effects of long-term low-dose exposure to uranium from the other environmental factors because of good air quality and the lack of other industries with negative health effects. Present records indicate a much higher prevalence of cancer among male workers in the open-pit uranium mine in Namibia compared with the general population. The objective of the present study was to determine whether long-term exposure to low doses of uranium increases the risk of a biological radiation damage which would lead to malignant diseases and to derive a dose-response model for these miners. To investigate this risk, we measured uranium excretion in urine, neutrophil counts and the serum level of FSH, LH and testosterone and analyzed chromosome aberrations in whole blood cells using fluorescence in situ hybridization. A representative cohort of 75 non-smoking, HIV-negative miners was compared to a control group of 31 individuals with no occupational history in mining. A sixfold increase in uranium excretion among the miners compared to the controls was recorded ( $P < 0.001$ ). Furthermore, we determined a significant reduction in testosterone levels ( $P < 0.008$ ) and neutrophil count ( $P < 0.004$ ) in miners compared to the unexposed controls. A threefold increase in chromosome aberrations in the miners compared to the nonexposed controls was recorded ( $P < 0.0001$ ). Most remarkably, cells with multiple aberrations such as "rogue" cells were observed for the first time in miners; these cells had previously been found only after short-term high-dose radiation exposure, e.g. from the Hiroshima atomic bomb or the Chernobyl accident. We conclude that the miners exposed to uranium are at an increased risk to acquire various degrees of genetic damage, and that the damage may be associated with an increased risk for malignant transformation. As expected, the chronic radiation injury of the hematopoietic system resulted in low neutrophil counts. Also, low hormone levels probably reflect damage to the gonadal endocrine system.

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**Publication type, MeSH terms, Substances**



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