Uranium Miners Exhibit Greater Serum Cumulative Inflammatory Potential Than Other Miners

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Rationale: Uranium mining, previously conducted in New Mexico by mostly Hispanic and Native American workers, is associated with multiple comorbidities. We have previously reported that New Mexico uranium miners have a greater odds ratio of self-reported angina compared to miners employed in other extractive industries. Because miners are at an increased risk of vascular disease, we implemented a novel endothelial bioassay to assess serum cumulative inflammatory potential. In this study, we hypothesized that serum from uranium miners has a greater potential to upregulate gene expression (mRNA) of select chemokines - ICAM-1 (Intercellular Adhesion Molecule 1), VCAM-1 (Vascular cell adhesion protein 1) and CCL-2 (C-C Motif Chemokine Ligand 2), in cultured human coronary artery endothelial cells (hCAEC), than from other miners. Methods: Serum (5%) from 44 miners, screened at three mobile community clinics in New Mexico, was incubated with hCAECs for 4 hours. Endothelial CCL2, ICAM-1, and VCAM-1 relative mRNA expression was determined using qPCR. Gene transcription data was log₁₀-transformed for normality. Data were analyzed between two groups (uranium miners versus non-uranium miners) via a Mann-Whitney test for continuous variables and chi-square for categorical variables (using SAS). Other biomarkers assessed included HbA1C, Total cholesterol, High density lipoprotein (HDL), calculated low density lipoprotein (LDL-C), triglycerides, random glucose and insulin levels. Values were considered significant at p < 0.05.

Results: Of the 44 miners, 10 (23%) were uranium miners. 42 of 44 (95%) miners were men. Uranium miners were older than other miners (mean age 68 years vs. 58 years). LDL-C and HbA1c values were not different between the groups (mean values of 78 ± 39 mg/dL and 6 ± 1% for uranium miners respectively and 87 ± 36 mg/dL and 6.4 ± 2% in other miners respectively; p=0.56 and 0.97 respectively). The endothelial bioassay revealed significantly increased VCAM-1 expression (mean±SD: 1.56±0.48, p=0.01) and a strong upward trend for ICAM-1 expression (mean±SD: 1.15±0.16, p=0.06) in uranium miners. Conclusion: Serum from uranium miners showed a greater potential to activate VCAM-1 gene expression in coronary artery endothelial cells than in non-uranium miners. This novel finding contributes to the understanding of mechanisms by which occupational uranium exposure increases the risk for atherosclerotic coronary artery disease in miners.
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**Figure 1**: Differences in hCAEC CCL2, VCAM-1 and ICAM-1 gene expression following incubation with 5% serum from uranium miners or other miners (latter as controls). Box plot 5-line summary displays minimum, 1st quartile, median, 3rd quartile and maximum.

*Indicates statistically significant difference in gene expression.