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Whole Body Natural U Distribution in Three Caucasian Men

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Abstracts of Papers Presented at the Meeting

Abstract

THAM-B.4 URANIUM DISTRIBUTION AND CONCENTRATIONS IN THE TISSUES OF WHOLE-BODY DONATIONS TO THE USTUR. *Kathren, R.*, Tolmachev, S. (Washington State University)*

This paper reports the distribution and concentration of measured uranium concentrations in the several hundred samples of soft tissues and bones from two whole-body donations to the United States Transuranium and Uranium Registries with no known occupational or other than natural chronic environmental (i.e. 'background') exposure to uranium. Both cases were Caucasian males aged 68 and 78 y, respectively, and long-time residents of the same geographic area, and thus likely to be representative of equilibrium levels of environmental uranium from chronic intake. The primary depot and highest concentrations of uranium were in the skeleton with the remaining uranium widely distributed throughout the soft tissues as a whole. Measured concentrations in bone averaged about 4 ng U g^{-1} wet weight with considerable variation among individual bones and bone samples with indication that uranium was a bone volume seeker. Soft tissue concentrations ranged over about an order of magnitude and averaged about 0.5 ng g^{-1} wet weight with the exception of the thoracic lymph nodes, which showed concentrations more than an order of magnitude greater than most of the other soft tissues. Uranium concentrations in the thoracic lymph nodes of the case with a smoking history were somewhat lower than those of the nonsmoking cohort, possibly suggestive of impaired particle clearance. The latter case also showed a possible anomalously high concentration of uranium in thyroid. The tissue distributions of the two background cases were compared with those in a previously reported third USTUR whole body donation with a documented occupational intake of uranium; the relatively recent study of element content in adult Chinese males; and the more limited data from empirical measurements of a few tissues reported in the open peer reviewed literature. Implications of the results from these measured postmortem cases were also examined with respect to the validity and applicability of the ICRP models and other biokinetic models and Reference Man data, and indicated refinements and significant differences noted.

Background

- Three USTUR whole-body donors (cases 0213, 0242, and 0425) with no known intake of U except for natural environmental were selected
- First cases known in which a whole body was analyzed for environmental U
- Can provide important information to verify or refine Reference Man and various models

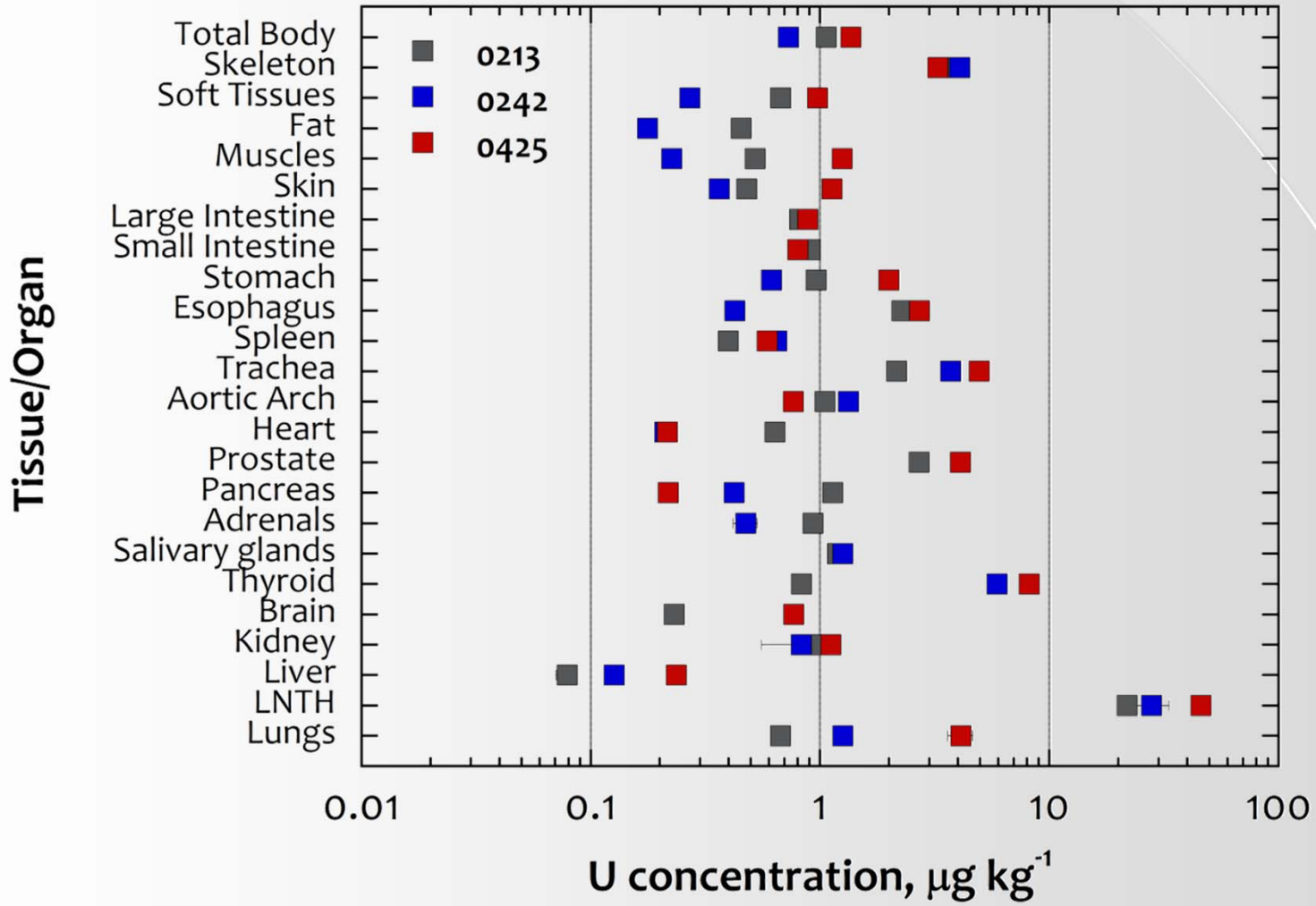
Tissue U Content

- Average total body U content in the three cases was 81.3±22.3 µg, of which 37.2±2.1 (46%) was in the skeleton
- Skeleton had a mean concentration of 3.79±0.45 ng U kg^{-1} wet weight and 11.72±1.49 ng U kg^{-1} ash
- Distribution was in bone volume and not predominately on bone surfaces

Soft Tissue Concentrations of U

- Soft tissue concentrations ranged over about an order of magnitude, averaging about 0.5 μg kg^{-1} wet weight for all tissues except the thoracic lymph nodes which averaged 32.3 times the mean soft tissue for the three cases

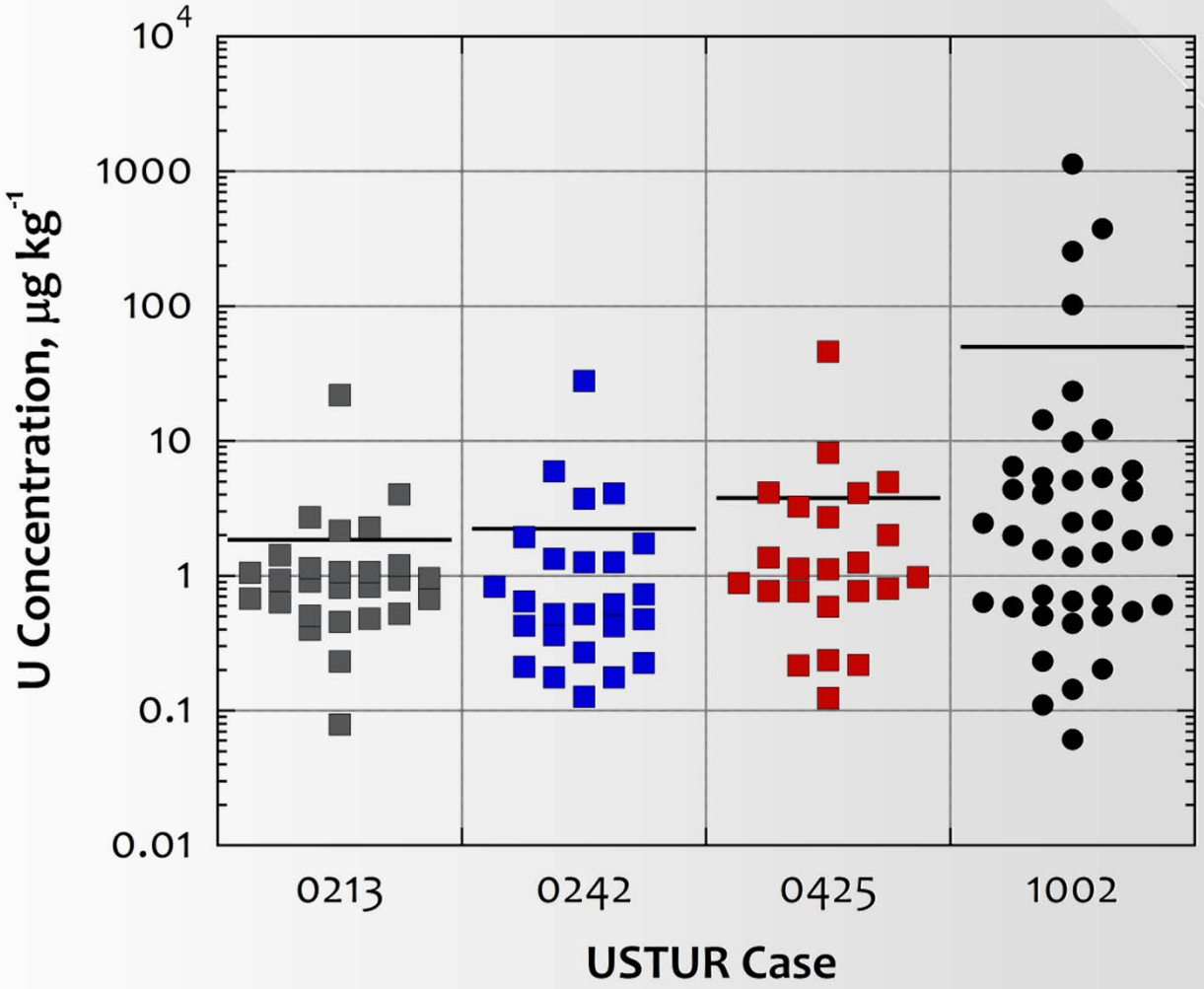
Tissue Concentration



Kidney

- Kidney content of U averaged 0.385±0.21 µg for the three cases, an order of magnitude lower than the 7 µg put forth for Reference Man
- The lower content and concentration in the kidney do not support a significant long term depot for U in the kidney as has been proposed in most biokinetic models for U

Comparison of U Concentration



Thyroid

- Elevated U concentrations about an order of magnitude greater than the average soft tissue concentration were measured in the thyroids of two of the three background cases. This was also observed in a whole body case with a documented exposure to U (Case 1002)
- Inconsistent with Reference Man
- Not observed in the data for Chinese men
- Artifact or suggestive of a possible long term depot in this organ

Implications for Modeling

- Assuming equilibrium between intake and excretion, the tissue data suggest a transfer coefficient from blood to skeleton of 0.14 with a residence half life in the skeleton of 4,950 days (13.56 years), significantly greater than the 1,500 day half time proposed by ICRP