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Plutonium Metabolism: The Influence of Plasma Iron On Plutonium Excretion and Retention

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Abstract: A review of the published information on human plutonium excretion rates, following intravenous injection of know amounts of plutonium, are shown to vary significantly between subjects over a study period of 1 to 30 days post intake. The kinetics of iron metabolism in the plasma have been shown to be similar to plutonium. The rate of iron-59 tracer clearance from the plasma has been shown to be influenced by illness of anemia. Patients with illness of anemia related to low plasma iron levels will retain the tracer iron for longer time periods compared to normal subjects. A review of the injected subjects urinary plutonium excretion data also demonstrate that those patients with an illness of anemia had "abnormal" plutonium excretion rates during the first 20 to 30 day post injection period. Normal plutonium excretion is described by a sigmoidal function that approaches an asymptotic excretion rate of 0.01 % of the injected dose within a 30 day post injection period. Plutonium, like iron, has been shown to be contained in the maturating precursor red-cells in the marrow and in marcrophage cells released to the plasma from the marrow. It has been concluded that there is evidence within the injected subject's plutonium excretion data to show that plutonium clearance from the plasma is influenced by the amount of available iron in the plasma. The quantity of plutonium in the plasma also appears to be influenced by feedback of plutonium from red-cell precursor cells that are catabolized before entering the circulating plasma. The plutonium contained in the destroyed red-cell precursors cells is then returned to the plasma where it may be reused in the marrow, re-deposited at plutonium deposition sites or excreted as a function of the patient's plasma iron pool. It is noted that because of the delayed plutonium plasma clearance phenomena, the plutonium excretion curve is asymptotic and not described by a single term power function model over a long term study period from the day of intake. This plutonium kinetic model is offered to explain the observed delayed plutonium plasma clearance rate, the low concentration of plutonium in marrow relative to mineral bone, and the noted perturbations in plutonium excretion rates following intake of new quantities of plutonium.

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