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Biodistribution of Gadolinium-Based Contrast Agent, and Concentration of Trace Elements in Normal and Nephrectomized Mice

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INTRODUCTION: Gadolinium (Gd)-based contrast agents have been used in medical MR-imaging. However, human nephrogenic systemic fibrosis (NSF) is reported in Gd-based contrast agent received patients with severe renal insufficiency. A depletion of endogenous Zn ion may contribute in the development of NSF. Gadolinium has fairly high sensitivity for neutron activation analysis (NAA) and it is useful to know Gd behavior in biological samples as an activable tracer. In general, NAA technique also quantitates essential trace elements in vivo such as Zn, Mn. In this study, we measured distribution of Gd and concentration of some minerals in selected tissue of four experimental conditioned mice using of NAA.

EXPERIMENTS: Twenty male 8-week-old ICR strain mice were used in this study. Ten mice were housed as normal, and another ten mice were partially nephrectomized. Five mice in each group was administered 2.5 mmol Gd/kg body weight of Gd-based contrast agent intravenously. Two days after administration, mice were sacrificed and dissected. The blood, femur, kidney, and liver were excised and weighted. The samples were freeze-dried and sealed into polyethylene bags for NAA. The sealed samples, reference materials, and standard of Gd were irradiated by neutron at Pn-2 site of Kyoto University Research Reactor Institute. The distribution of Gd and concentration of minerals were determined by using gamma-ray spectrometry.

RESULTS: The nephrectomized mice showed high Gd retention in each tissue compared to normal mice. The kidney showed high Gd retention behaviors due to normal process of excretion of Gd. Skeletal Gd distribution of nephrectomized mice were significantly higher than that of normal mice. Manganese concentrations in kidney of model mice decreased relative to normal mice. On the other hand, Mn concentrations in liver were comparable during four groups. Zinc concentration in the selected tissue showed no difference during four groups of mice.

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