A Long-term treatment of chelating agents, Zn-DTPA and CBMIDA, Reduces Cancers and Prevents Shortening of Life Span in Plutonium Administered Rats

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Body of Abstract: Although chelating agents have effects to excrete plutonium acceleratedly from the body in the early and delayed treatments after accident, no sure evidence that chelation therapy is effective to reduce plutonium-induced cancers and prevent the shorting of life span has been obtained. In general, a long term of chelation therapy is necessary to reduce the plutonium-induced risks, because the effects of chelating agents in the early and short-term treatments are not always high. So, we examined the effects of long-term of Zinc-diethylentriaminepentaacetic-acid (Zn-DTPA) and Catechol-3,6-bis(methyleneiminodiactic-acid) (CBMIDA) administrations on plutonium-induced tumors and shortening of life span in rats. Two hundred eighty female rats were divided into seven groups (n=40): rats of three groups were injected intraperitoneally with 0.185, 0.37 or 3.7 x10^5 Bq/kg of plutonium, and other three groups were administered the same doses of plutonium and then received intraperitoneal injection with 30 mmol/kg Ca-DTPA for the first 3 days and then replace to the oral administration of daily 30 mmol/kg Zn-DTPA in drinking water, respectively. The doses of 0.185 and 0.37x10^5 Bq/kg of plutonium are determined to induce tumors and shortening of life span, and the dose of 3.7 x10^5 Bq/kg induces early death of rats before tumor occurrences. Rats of one group were injected intraperitoneally with 0.37 x10^5 Bq/kg of plutonium, and then with 30 mmol/kg CBMIDA for the first 3 days and replace to oral administration of daily 30 mmol/kg of CBMIDA in drinking water. All rats were bred until they died and the urine and feces were collected periodically.

The lengths of life span in the all groups that chelating agents were administered were significantly prolonged compared to those of the respective dose corresponding (non-treated) groups. In the 0.37 x10^5 Bq/kg of plutonium groups, life span of Zn-DTPA group was longer than that of CBMIDA group. In the anatomical findings, incidence of bone tumors in the 0.185 and 0.37 x10^5 Bq/kg of plutonium groups reduced to 0 % from 10.5 and 12.5 % of non-treated groups, but increased to 12.5 % from 0 % in the 3.7 x10^5 Bq/kg. Those of liver reduced to 0% from 2.5 % in the Zn-DTPA but increased to 12% in 0.37 x10^5 Bq/kg, and increased to 12% from 2.5 % in the 3.7 x10^5 Bq/kg group.

The results demonstrated that a long-term administration of Zn-DTPA and CBMIDA was effective to prevent the shortening of life span by plutonium intake, and to reduce the incidence of tumors in the low dose plutonium groups, but in the high dose plutonium group the incidence of tumors rather increased, probably due to the reduction of plutonium to the dose-ranges that occur tumors and prolong of life span.