Experimental Study for the Purpose of Decreasing the Radiation Injury Due to Radioactive Mercuric Compounds

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With increased application of radioactive pharmaceuticals, exposure of patients to radiation has attracted grave attention. Especially when mercuric preparations are used, the kidney is exposed to a large dosis. To eliminate the radioactive substance as early as possible after receiving diagnostic informations is one of the measures to relieve the patient of radiation injury.

Male ddN mice were used as experimental animals. Tracer doses of various radioactive mercuric preparations were intraperitoneally injected to them, and radioactivity was daily measured for 3 days with animal bodies and their excrements, using the whole-body animal counter. And at 3 days, radioactivity of ^{203}Hg in various organs was determined with the well-type scintillation counter. From immediately after the radioisotope injection, various drugs (in doses varying by toxicity) were given every 24 hours, that is, once daily for 3 days, and effects on the retention, excretion and organ distribution of ^{203}Hg were examined to evaluate the eliminating activities.

Drugs that decreased the retention of ^{203}Hg-MHP and accelerated its urinary excretion were BAL, mercaptoacetic acid (MAA), 2-mercaptopropionyl glycine (MPG), DL-penicillamin (Pen.) and GSH. Furosemide conversely increased the retention. L-CySH, rongalite and EDTA elicited no change.

Drugs that were effective for elimination of ^{203}Hg-chlormerodrin were MPG, MAA, and Pen. BAL lowered ^{203}Hg concentration in the kidney, but elevated it in the liver and brain. GSH decreased ^{203}Hg in the brain and pancreas, but did not change its amount in the other organs. Furosemide increased ^{203}Hg in the liver and pancreas. EDTA, DTPA and rongalite exerted no effect.

The drug which was effective for elimination of $^{203}HgCl_2$ was BAL.

All the mercuric compounds were increased in body retention under fasting condition. Effect of eliminating them differed in different compounds.

Method for Rapid Preparation of ^{99m}Tc Labeled Compounds by Using Stannous Chloride

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Using small amounts of stannous chloride as reducing agent, various compounds, such as human serum albumin, IgG Globulin, Inulin and sodium paraaminohippuric acid were effectively labeled with ^{99m}Tc.

The material to be labeled is mixed with $^{99m}TcO_4$ of high concentration, and immediately after the addition of $SnCl_2.2H_2O$ (5-10 μg)

pH of the solution is adjusted to 2.5-3.0 by 1N HCl. Following continous mixing for 10 min, the reaction is terminated by addition of 1 drop of ascorbic acid (500 mg/ml) and subsequent adjustment of pH to neutral by 7% $NaHCO_3$. After fractionation by passing through properly prepared Sephadex column, the initial peak of radioactivities are pooled and further filtered through 0.22 μ of Millipore filter. Whole these procedures can be completed within 1 hour. The labeled compound is found to be sterile, pyrogenfree and nontoxic to animals and human subjects.

When albumin is labeled by this method, ^{99m}Tc activity is associated with several components, as a chelate, as unreacted pertechnetate, and as hydrolyzed forms as well as that which is bound to albumin.

Conventional analytical techniques—TCA precipitation, paperchromatography and anion exchange chromatography—all failed to separate labeled compounds from chelated material. Sephadex gel filtration was found to be a single analytical method of choice.

Reduction of the amount of $SnCl_2$ resulted in the decrease of labeling efficiency, and 5-10 μg of $SnCl_2.2H_2O$ were shown effective enough to reduce 20 mCi of $^{99m}TcO_4$ and to label 1 mg of Albumin with efficiency of more than 60%.

Mouse distribution study of ^{99m}Tc-Albumin did not differ significantly from that of ^{131}I-Albumin.

Sodium paraamino hippuric acid and inulin were also labeled, but less effectively. (30-50% efficiency).

After intravenous injection of these compounds into rat, movement of radioactivities from cardiac pool to both kidneys and then to the bladder was clearly observed by scintillation camera.

This method is very effective and rather simple, and is also considered to have promissing future for wide clinical applications.

The Use of ^{68}Ge-^{68}Ga Generator

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^{68}Ga has a half life of 68 minutes and decays by positron emission. It has the following advantages: (1) Its short half-life decreases the radiation dose to the organ. (2) It is available from a long half-lived ^{68}Ge generator (about 280 days). (3) It can be used with coincidence detection systems.

^{68}Ga is eluted using a 0.005M solution of EDTA. We have perfomed brain and kidney scintigraphies with ^{68}Ga EDTA. For the preparation of labeled compound, it is necessary to free ^{68}Ga from the EDTA chelating agent. ^{68}Ga-citrate may accumulate in malignant tissue. ^{68}Ga-citrate scan on patient with malignant lymphoma shows increased activity at the supraclavicular region. To compare the positron scan with conventional scan, the line source response is recorded in each method. The relative peak value is highest in positron scan and the FWHM of positron scan is superior to the dual detector system.