Photorecording of Gamma Image Using Beta-ray of ^{90}Sr-^{90}Y and Its Application for Traverse Scanning

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Since the exposure of ^{90}Sr-^{90}Y beta-ray caused the blackening of X-ray film in the paper bag, a 5 mCi ^{90}Sr-^{90}Y beta-ray source was placed in a $3\times3\times5$ cm^3 2 mm thick lead box with a 0.3×0.4 cm^2 hole at the bottom and a lead shutter over the hole. To increase contrast and intensity, two image intensifying screens (Kyokko HS) were used on the both sides of X-ray film. The shutter was controlled with a magnet, which responded to the impulses arriving from ordinary scintillation scanner. Moving on the paper bag of X-ray film, the information from the detector of the scanner was recorded on the film by the exposure to beta-ray. Thus the light tight box and photorecording equipments were not needed. The response of the lead shutter to impulse was rapid and the contrast of gamma images of scanned tissues was an good as that of ordinary photoscintigram. The above device may be called "beta-ray recorder" and the results "beta-photoscintigram". The above mentioned beta-ray recorder was modified for the recording of traverse scan image; a 35×0.3 cm^2 slit instead of a 0.3×0.4 cm^2 hole, and a meta-acrylate wedge absorber of beta-ray instead of a 2 mm lead shutter. The wedge controlling exposure moved in response to count rate at a scanning. When the horizontally faced head of the detector with 20 cm focusing honey cone collimator moved back and forth, receiving impulse from a section of the body, the subject and film were turned 5 degree on the synchronized turntables.

The scintigram thus obtained was sufficiently clear and the size of the object was shown in fair agreement, however the distortion of image was observed, when the absorption of gamma-ray by the tissue near the radioactive object was very large.

This beta-ray recorder does not require such an expensive system for traverse scanning as Kuhl's did.

Preparation of ^{99m}Tc Compounds

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^{99m}Tc has been used extensively for scintillation scanning in recent years because its physical and chemical characteristics are very suitable for the purpose. But the preparations of ^{99m}Tc compounds must be performed by users themselves within a limited time. For this reason it was necessary to have established the rapid and easy preparation methods of them. In this paper the preparation methods of the compounds by Larson, Nelp, etc. were discussed and the purity and toxity of them from pharmacologic point of view were described. The preparation of ^{99m}Tc-Fe complex was also investigated and the variations of distribution of ^{99m}Tc-Fe complex in various organs of a rabbit after intravenous injection were measured.

^{99m}Tc-S-colloid

The method of preparing ^{99m}Tc-S-colloid by Nelp. etc., in which $Na_2S_2O_3$ had been used instead of H_2S gas, was studied. The effects of varying concentration of $Na_2S_2O_3$ on the colloid formation were examined. It was confirmed by paperchromatogram that more than 99% of ^{99m}Tc activity reacted with sulphur to form ^{99m}Tc-S-colloid at the 0.02 M $Na_2S_2O_3$ concentration. Meanwhile it was

also found experimently that intravenous injections of considerable dose of ^{99m}Tc-S-colloid of this concentration did not show any acute toxity on mice, rabbits, and dogs. Free $^{99m}TcO_4$ was not also detected in this ^{99m}Tc-S-colloid solution after autoclaving at 121°C for 20 min.

^{99m}Tc-albumin

In the method of McAfee et el, the effects of varying PH of tagging solution (^{99m}Tc-Fe complex) and PH of incubation mixture on yields of ^{99m}Tc-albumin were studied. Consequently sufficient yields more than 90% were obtained when the PH of the tagging solution retained between 5-7 and the PH of the incubation mixture between 1-3, which means that it is not necessary to ajust the PH of tagging solution and incubation mixture exactly with PH meter as describing in the literature. Free $^{99m}TcO_4$ was not detected by paperchromatogram in ^{99m}Tc-albumin prepared by this method but detected apparently by paper electrophoresis.

^{99m}Tc-Fe complex

^{99m}Tc complex was administered intravenously into rabbits and distributions of this activity were measured. It was cleared rapidly from blood of the animals after administration. The result of studying the distributions of this preparation in various organs showed the possibility of using this compound as a renal scanning agent.

Preparation of ^{35}S BSP and its Application to the Study of Removal Kinetics of Sulfobromphthalein

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For the kinetic analysis of sulfobromphthalein, it is important to study removal rate of BSP administered tracer dose. But conventional colorimetry cannot afford to measure small amount of BSP. It is necessary to use radiolabeled BSP with high specific activity.

Preparation of ^{131}I labeled BSP was tried following Tubis's method, but it was not useful because of instability and its different Rf in chromatogram from regular BSP. We succeeded in preparation of labelling BSP by S-35 using conc ^{35}S sulfonic acid during synthetic process. Contrary to the ^{131}I labelled BSP, ^{35}S BSP showed quite satisfactory stability of its label. After standing in room temperature for a month or in a refrigerator for two months no ^{35}S came off from ^{35}S BSP.

Identification check of ^{35}S BSP with stable BSP was performed in various ways with satisfactory results. Clearance study showed identical disappearance rate of ^{35}S BSP with cold labeled BSP. Radiochromatogram of ^{35}S BSP as excreted in bile demonstrated identity of this labelled compound with regular BSP as well as stable labelling of ^{35}S.

Counts of ^{35}S BSP was measured using liquid scintillation counter. One-half mililiter of plasma ^{35}S BSP was pipetted into 30 ml flask and 15 ml scintillator consisting of 150 ml dioxan, 125 ml anisole, 125 ml of dimethoxyethane, PPO and POPOP was added. The mixture was kept to stand for 15 min. and filtrated. The filtrates were counted in Tri Carb Liquid Scintillation Spectrometer.

Dose-clearance relationship of sulfobromphthalein using this compound and commercial BSP was studied in seven normal subjects and two hepatitics. After intravenous in- of ^{35}S labelled BSP, blood stmpling was perjection of 0.1 mg/kg of BSP including 10 μCi of ^{35}S labelled BSP, blood sampling was performed at 5, 8, 11, 15, and 30 min. Thereafter 1 mg/kg, 2.5 mg/kg, or 5 mg/kg of