G. Blood, Bone marrow, Spleen and Reticuloendotherial System

Red Cell Labeling with Technetium-99m —Fundamental Studies and Clinical Application—

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A method for labeling red blood cells (RBC) in vitro with ^{99m}Tc by using CIS kit for ^{99m}Tc RBC label is presented. Two m*l* of whole blood are incubated with 0.3 μg of stannous pyrophosphate, follwed by removing the supernatant and incubation of ^{99m}Tc to RBC for 5–10 miuntes. After washing of two times, labeling yield of 91.7 $\pm$7.0% was obtained in 79 samples. Labeling is better at 37°C than in room temperature, and maximum labeling occurs after 5–10 minutes incubation with ^{99m}Tc. No dependence on hematocrit of each sample or volume of ^{99m}Tc from RBC was shown by repeated washes of the labeled cells and 10–20% of radioactivity to initial counts was lost in ACD, saline and plasma 24 hours after incubation in room temperature.

Circulating blood volume by ^{99m}Tc was measured and well correlated with that by ^{51}Cr ($r=0.98$, $p<0.01$), however, the values calculated from ^{99m}Tc were 4.8% higher than those by 51Cr which suggested the elution of ^{99m}Tc from labeled RBC. ^{99m}Tc method has the advantages that higher radioactivity can be obtained in small amount of blood, which is useful in the determination of blood volume in children or in small animals in the laboratory. The measurement of blood volume of the mouse was done by using ^{99m}Tc method. The results were 1.70$\pm$0.07 m*l* (6.35$\pm$0.18%/gm), which coincided with the values reported previously.

Spleen scintigraphy was performed by using the heated ^{99m}Tc labeled RBC in a 49$\pm$0.5°C waterbath for 15 minutes. The spleen images were fine and no difference was found in spleen size in comparison with ^{51}Cr heated RBC methods.

It was discussed that ^{99m}Tc RBC kit could be used not only to blood volume determination, spleen scan and ^{99m}Tc RBC angiography, but to white blood cell and platelet label by ^{99m}Tc.

Studies of Lymphocyte Kinetics and Its Organdistribution Using ^{51}Cr and ^{99m}Tc Labelled Lymphocytes

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Labeling ratio of ^{51}Cr for each peripheral blood cells per 10^6 cells were determined. B cells and monocytes were found to be more heavily labelled than T cells. Labelling ratio of granulocytes, erythrocytes were markedly lower than that of lymphocytes and monocytes and the radioactivity of platelets showed very low level as compared with the other blood cells.

In the mice, lymphocyte disappearance curve from the blood stream was formed two exponential

components. T1/2 of the first component was 0.63 hr and that of the second component was 48.5 hrs respectively. The organ distribution studies revealed that infused 51-chromium labelled lymphocytes circulated in and out of the spleen.

In patients with chronic lymphocytic leukemia, lymphocyte disappearance curve showed two exponential components as same as in the animal studies. T1/2 of the first component were 0.74 to 1 hr and that of the second component were 138.1 to 140 hrs. Blood lymphocyte pool and recirculating lymphocyte pool in the patients with CLL markedly larger than that of normal subjects. Infused ^{51}Cr labelled lymphocytes accumulated heavily in the spleen and liver in this case.

Scintiphotogram after the infusion of ^{99m}Tc labelled lymphocytes showed the accumulation of ^{99m}Tc radio activity in the spleen and the liver as same as the ^{51}Cr studies.

Quantitative Assessment of the Active Marrow Distribution by Scintigraphy —Deducation of a Hematopoietic Index in Hypoplastic Anemias by Multi-variate Analysis—

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The active marrow distribution was quantitatively assessed by measuring the activity in 26 local marrows in scintigraphy using technetium sulfur colloid. Each value was expressed in a ratio to the activity on the posterior pelvis area, of which two ratios, the one to the administration dose and the other to the liver activity, were taken in the consideration. With these 28 values multivariate analysis was carried out in hypoplastic anemias in order to elucidate the difference in the marrow distribution pattern from normal controls, the alteration associated with clinical exacerbation and remission and relationship to the ferrokinetics data.

In discrimination between normals and hypoplastic anemias by a linear function, misclassification of 18% was observed in the actual samples and the sternum and the distal humerus were the parts at first selected with 5% significance. A canonical discrimination analysis provided us with the first variate, which discriminates between hypoplastic anemias and normals with high loading of the sternum and distal humerus, and the second one, which discriminates between hypoplastic anemias in exacerbation and those in remission with high loading of the skull, the proximal radius and the posterior iliac crest. The result indicates that the marrow distribution pattern in remission does not necessarily tend to be normalized in quantitative aspect in hypoplastic anemias. Canonical correlation analysis revealed a significant relationship between an erythropoietic variate in ferrokinetics and the marrow distribution one with a coefficient of 0.62. Thus the quantitative representation and multivariate analysis brought about valuable informations in implication of the active marrow distribution oberved in hypoplastic anemias.