in the active bone marrow in proportion to erythroid cell counts and according to distribution of hemopoietic tissue. It was characteristic that in the cases of severe hypoplastic erythropoisis, the bone marrow activity was markedly decreased, and renal activity was remarkably increased. Localized hypoplasia due to tumour cell replacement was also detected. But in the slightly hypoplastic cases the evaluation of scan images was frequently difficult.

As a consequence, further investigation of metabolsim are needed for clinical application.

In-Chloride; As Bone Marrow Imaging and Tumor—Localizing Agents

Kazuyuki OYAMA, Kikuo MACHIDA, Sanshin HAYASHI, Akira AKAIKE, Ken HIRAKAWA and Tsutomu WATARI

Dept. of Radiology, Faculty of Medicine, University of Tokyo

Indium-111-chloride ($^{111}InCl_3$) was used as bone marrow and tumorlocalizing agents in 38 patients 46 scintigrams), who were suspected or diagnosed having malignant disease clinically, and who were irradiated to malignant disease.

The regions, where clinically suspected malignant disease, where abnormally accumulated on scintigrams, and where irradiated, were excluded to estimate the normal distribution of $^{111}InCl_3$.

The scintigrams were taken 24–72 hrs after injection of $^{111}InCl_3$ 1–3 mCi.

The percentage and score distribution of $^{111}InCl_3$ were appreciated on scintigram 48 hrs after injection in 23 regions.

As the liver showed the highest accumulation of ^{111}In on all scintigrams, the liver appreciated as 2+. Comparing with the radioactivity in the liver, other regions showed similar (2+), moderately decreased (+), severely decreased (−) accumulation on scintigrams.

The score is given one for 2+, 0.5 for +, 0 for −.

The score and percentage distribution are followings; liver 100 (100%), lumbar vertebra 58.5 (100%), mediastinum 55 (100%), nasopharynx 50 (100%), testis 47.5 (95%), heart 44.5 (89%), pelvis 43.5 (78%).

High accumulation in the lumbar vertebra and the pelvis show that $^{111}InCl_3$ would be effective as bone marrow imaging agent.

Irradiated bone marrow showed markedly decreased accumulation of ^{111}In. In a patient of seminoma with irradiation of 3200 rads to the pelvic area and 4800 rads to the para-aortic area 4.5 years ago, there is no evidence of accumulation of ^{111}In in these areas. This suggest that there would be no recovery of bone marrow activity after irradiation over 3200 rads.

Malignant disease in mediastinum, hilar region, and esophagus, is well visualized, when these areas are irradiated about 2000 rads or when malignant disease is recurrenced after irradiation, due to vertebral marrow suppression by irradiation and due to high tumor concentration of ^{111}In.

We conclude that $^{111}InCl_3$ would be effective as bone marrow imaging and tumor-localizing agents.

The Bone Marrow Uptak of ^{111}In-Chloride and Erythropoietic Activity

Yutaka TAKAHASHI*, Kiyoshi AKASAKA*, Kohichi SATOH** and Yasuhiko INAMOTO***

**Hematology Division of Internal Medicine*, ***Radiology, Tenri Hospital*

****Internal Medicine, Tsukaguchi Hospital*

Indium-111 chloride was introduced as a bone marrow imaging agent in expectation of reflecting the hematopoietic, especially, ertythropoietic activity. But there have been reported some counter data in the animal experiments. The purpose of this report is to clarify to what extent the marrow

uptake of ^{111}In-Cl represent erythropoiesis.

After intravenous administration of ^{111}In-Cl, ^{59}Fe-citrate and ^{99m}Tc sulfur colloid to three groups of rats, i.e., the control, phenyl-hydrazine treated and irradiated ones, the distribution of these three radionuclides in the femur, the spleen and the liver was examined. There was significant increase in the intrasplenic uptake of radioiron and also of radioindium, although in the lesser degree, in the phenyl-hydrazine treated rats, where remarkable enlargement and extra-medullary hematopoiesis were recognized. On the other hand, technetium colloid uptake was rather reduced. In the irradiated rats the spleens were atrophic and uptake of these three radionuclides was invariably decreased.

In forty cases having various degree of erythropoiesis, the following studies were clinically carried out.

Plasma disappearance of ^{111}In-Cl was remarkably slower, with half-time of 5 to 8 hours, than that of radioiron. This rate was significantly correlated with red cell iron turnover rate, not necessarily with plasma iron turnover rate, in 23 examined cases. Red cell incorporation rate of radioindium was only from 0.6 to 12 percent, extremely low value in contrast to radioiron.

Radioindium uptake in the local marrow was examined for 7 days in the selected 5 parts, i.e., the frontal skull, upper sternum, sacrum, proximal and distal femur. The uptake rate was faster and the amount was greater in erythroid-hyperplastic stage than in normalized stage after the treatment in hemolytic anemias and also in polycythemia veras. Whole body linear scanning enabled us to calibrate extra-hepatosplenic, i.e., bone marrow uptake ratio to adnimistration dosis. The change in this ratio with radioindium was in good accordance with erythropoietic change in those cases, while that with technetium was sometimes paradoxical.

In reference to erythropoietic activity determined by red cell iron turnover rate, delineation ability of the active marrow by radioindium was examined by scintiphotography and compared to that by technetium colloid. The marrow of erythroid hyperplasia was delineated with the indium as clearly as with the technetium. On the other hand, the functioning marrow in its hypoplastic state was just poorly defineated with the indium but was not necessarily so with the technetium.

These results led us to the following conclusions. In vivo behavior of indium chloride was not identical with iron. Erythropoietic activity was reflected by the marrow uptake of the radioindium only partially but more than by that of technetium colloid. Therefore, indium chloride is considered to be a suitable agent for marrow imaging, if general erythropoietic activity is the subject of examination at present.

Studies on Bone Marrow Lymphocytes. II. Cell Surface Immunoglobulin As Studied by Direct and Indirect Radioautography

Y. Yoshida*, S. KONDA* and K. KURIBAYASHI**

**Division of Mematology and Immunology, Department of Medicine, Kanazawa Medical University, **Research Institute of Metabolism, Kyoto University*

The density of suface immunoglobulin on small lymphocytes of bone marrow and spleen has been evaluated radioautographically by the direct and indirect methods.

Cell suspensions from C^{57}BL mice were exposed to I^{125}-labeled rabbit anti-mouse immunoglobulin in a wide range of concentration for 30 min at 0°C (direct method). In the indirect method, cells were reacted for 30 min at 0°C with graded dilutions of unlabeled rabbit anti-mouse immunoglobulin followed by further reaction with a sheep anti-rabbit immunoglobulin labeled with I^{125}. After washings, lymphocyte labeling was quantitated by radioautography. With increasing concentrations of anti-mouse immunoglobulin, the percentage of immunoglobulin-bearing cells in the spleen reached a plateau level (45–50%) in both methods. The lowest concentration of anti-mouse immunoglobulin at which the plateau was attained was 1/10 and 1/500 in the direct and indirect