Radionuclide study is utilized for early detection and regional assessment of ventilatory and perfusion abnormalities by imaging and quantifying the distribution of radionuclide-labeled lung-liner gas or radionuclide-labeled agents. In this lecture, the procedures of the radionuclide study of the lung, physiological meaning of the data, and the relationship between the results of radionuclide study and that of conventional methods were discussed. The procedure of Xe-133 inhalation study consists of mainly three phases, namely washin, equilibration and washout phase. Regional distribution of residual volume is measured in equilibrium. A mean transit time, calculated from washout phase, is approximated as one of sensible indices of airtrapping. Krypton-81m gas is also available in most of institutions. This gas is useful for evaluation of ventilatory disorders during tidal breathing, and for repeated study in short interval. Inhalation method of this gas is easy to perform and offers various informations on pulmonary physiology and disorders of ventilatory mechanism. Radionuclide study is also useful for detection of V2 mismatch. It is recently utilized for quantitative evaluation of blood flow distribution and ventilation and perfusion ratio. The modalities will be offer new informations of pathophysiology of the various pulmonary diseases.

The number of the test tubes used for the determination of thyroid hormones increased from about 1,450,000 in 1981 to around 7,000,000, which was the second large number to those used for the determination of tumor materials such as CEA and AFP. The use of newly developed FT4 and TGB is gradually increasing, since FT4 is considered to be the most valuable method to detect the state of the thyroid function, and TGB to detect the amount of major T4 binding site. It is noted that I-131 was replaced by I-125 in in vitro tests and by I-123 or Tc-99m in in vivo examinations. Ga-67 and TI-201 were also introduced for the scintigraphy of the thyroid gland, but their value in the differentiation of the malignant tumors from benign ones was still equivocal. The amount of I-131 used for the treatment in 1981 was 45,516 mCi, which is about twice as much as the doses used 6 years ago, indicating the increase in the number of Graves' patients treated with I-131.

It is expected in near future that the method to detect or to determine the anti-TSH receptor antibody or FT3 in the serum will be introduced and the radioimmuno-detection method will also successively developed to detect the presence and the localization of some kinds of malignant tumors.

The number of scintigraphy a year is around 8000 in our hospital. Liver, bone, tumors and thyroid scintigraphy make up two third of total examinations. I presented many interesting cases which scintigraphy was very useful in diagnosis. 1) Liver-spleen scan: On the screening test of the liver, it is said that the scintigraphy is the first choice in the decision tree. Small focal defect more than 1.5 cm could be detectable with the multidetector images, erect position images and single photon emission CT. But we should know about the limitations and pitfall of the scintigrams. 2) Hepatoma: Hepatoma, where positive gallium uptake into a "cold" lesion on a colloid liver scan, has been shown to be quite specific for malignant hepatoma. At the same time in hepatoma, there are many extrahepatic metastases such as bone, lung and lymph nodes. So whole body gallium scan is very useful for early detection of extrahepatic metastases of hepatoma. 3) Tumor of the right diaphragm: In a case of fibrosarcoma of the diaphragm, scintigraphy combined with colloid liver scan and MAA lung perfusion scan was helpful. 4) Bone scan: Bone scan is the most sensitive examination in detecting skeletal involvement in patients with malignancy. There are various kind of bone scintigrams.
such as focal hot spots, focal defects and high diffuse skeletal activity. The high diffuse skeletal activity was seen in patients with prostatic and stomach carcinomas. In these cases exposure time is very important for objective differentiation between pathologic and normal scan.

3) Tumor scan: Gallium-67-citrate has been found to be of value in the staging and re-evaluation of lymphomas as well as in detecting the extent and recurrence of lung tumors, malignant melanomas and so on.

Drug induced pneumonitis: Follow-up study of the patients treated with chemotherapy in malignancy, gallium-67-citrate whole body scan is very useful for detection of early stage of drug induced pneumonitis.

4) Thyroid scan: In the evaluation of the thyroid tumors, scintigraphy with radio-iodine or technetium-99m-pertechnetate and palpation are integral, but differentiation of benign from malignant nodules is difficult. Thallium-201-chloride accumulated in the cold nodule of the I-123 thyroid scan on both early and delayed scans in malignant thyroid tumors.

Cr-51 appearing in stool, and the amount of iron loss is calculated from blood loss.

Although In-111 is used as an erythroid marrow imaging agent, it is also uptaken by the bone, and the important informations such as plasma iron turnover rate, red cell radioiron utilization and etc. as obtained by ferrokinetics are not obtained. Although Tc-99m-colloid image is sharp and some similarity of the distribution of erythroid and phagocytic marrow is known, it does not show the erythroid marrow, but the distribution of phagocytes, and they are not always similar.

Platelet survival is measured by using Cr-51 or In-111. However, it can be determined by non-isotopic method as well and the case of examination is limited.

Lymphangiography is performed using Tc-99m-colloid. However, this method is not entirely clinically evaluated.

White cell survival is a transient pass in the peripheral blood as compared to its time of stay in the bone marrow and tissue, and the survival of white blood cell is not examined routinely.

Recently, the radioimmunoassay of erythropoietin was successfully established and it is available for the differential diagnosis of polycythemia vera and secondary polycythemia although the kit is not available yet.

HEMATOLOGIC NUCLEAR MEDICINE. H. Saito.
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Red cell production is studied by ferrokinetics and destruction by red cell survival study. These two are the most important series in hematologic nuclear medicine. One of them is not sufficient as an information on erythrokine'stics. Erythroid marrow distribution, extramedullary hematopoiesis and intramedullary hemolysis are demonstrable with Fe-59 by whole body linear scan and transverse linear scan over the liver and spleen. A sharp image is obtained by using Fe-52 and positron camera, and the quantitation of Fe-52 distribution is easier than that of Fe-59. However, radioiron utilization is not obtained by using Fe-52. Plasma volume, TIBC, UIBC and ferritin are determined when ferrokinetics is performed. Red cell survival and ferrokinetics are carried out at the same time.

As the use of C-14-cyanate is not allowed in Japan, we use Cr-51, and the computer analysis of Cr-51-RBC disappearance curve gives the informations on half survival (t 1/2), exponential disappearance rate, mean red cell life span, and effective survival, which is obtained by dividing the area under the Cr-51-RBC disappearance curve of a patient with that of normals. Random destruction is estimated from the exponential disappearance rate. Whole body counting is performed for the determination of Vit.B12 and iron absorption and loss. GI blood loss is determined from the amount of