Pancreas Scanning with ^{75}Se-Selenomethionine

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Using ^{75}Se-selenomethionine some experiences of pancreas scanning and the evaluation of its clinical usefulness were reported. Shimadzu-scanner with 3″ NaI crystals, 10 or 5 cm focusing collimeter and spectrometer was used, and dot-and photoscans were performed. The intravenous administration dose of ^{75}Se-selenomethionine was 3 to 3.5 μCi/Kg. To enhance the accumulation of selenomethionine skim milk and glutamic acid and hydrochloric acid were administered before and after ^{75}Se-selenomethionine according to Sodee's method. In our experience this procedure gave good results in comparing with the use of pancreozymine and (or) sekretin. No pretreatment other than breakfast gave good result in normals but in chronic pancreatitis the accumulation of selenomethionine in the pancreas seemed to be poorer.

The space occupying lesions detected by this scanning were generally confirmed by surgical findings including cancer and cyst.

In many cases of chronic pancreatitis the decreases of uptake of ^{75}Se-selenomethionine in the pancreas were observed, when compaired with the count rate over the liver and background. In a case with the enhanced calcification the pancreas was hardly seen. It can be easily considered that the uptake of ^{75}Se-selenomethionine is influenced by impaired protein synthetic function in chronic pancreatitis. In our experiences, it seems to be useful for diagnosis of chronic pancreatitis to evaluate the activitity of ^{75}Se in the pancreas comparing with that in the liver or background, in addition to the pancreas scanning, although the further examination is required to establish the usefulness.

Application of Splenic Scintiscanning: Quantitative Estimation of Size of the Spleen and Examination of its Sequestration Function

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With recent development of the technique, scintiscanning of the spleen can be easily carried out and its clinical uses, which had rested on morphological diagnostic value, adorned itself with functional implication. For the purpose of its application to the investigation of the splenic diseases, some fundamental studies besides clinical application were performed in our laboratory as to quantitative assessment of splenomegaly and examination of its function. In this report results were presented and some problems were discussed.

"Methods and clinical uses."

Red cells labeled with ^{51}Cr and damaged by heat-treating, or labeled and damaged by treatment with ^{203}Hg or ^{197}MHP, are widely used for scintiscanning of the spleen.[1)-6)] Several problems especially concerning advantages and disadvantages of these methods

were already reported.[7] Further studies using these techniques suggested that selective use must be devised for the purpose of scanning corresponding to the characteristics of the methods. For an example, scintigrams of the huge spleen weighing 6655 g. in a case with reticulosarcomatosis were presented. For scanning such an large but hypofunctioning spleen, ^{51}Cr-heat-treating method is preferable because of retention and maintenance of constant value of ^{51}Cr activity in the spleen. Release of radiomercuri from the spleen and its accumulation in the kindneys can be applied to the diagnosis of left upper quadrant abdominal mass.

A case with tumor of left kidney was presented, in whom ^{203}Hg-MHP was used. Scintiscanning was performed 2 hours following the administration for the spleen, which was dislocated above with slight enlargement, and 5 days therafter for the left kidney, which was remarkably configurated. The tumor was disclosed to have neither functioning tissue of the spleen nor that of the kidney.

"Quantitative assessment of splenomegaly."

Preliminary studies were carried out with a model. Its cut surface was shown in the figure 1, and about 300 μCi of ^{51}Cr or 1 mCi of ^{99m}Tc was homogenously included in it. This model was put in water and radioactivity of each part was measured with 3×2 inch NaI crystal collimated with 37 hole 10 cm focusing collimator. Then the model was scanned with various cut off levels to decide which level would make the scanogram express real size of the model. If the level was chosen so as to cut off less than 30% of maximum counting rate the object produced, the most accurate size was obtained in its scintigram. Under this setting condition, the part of the model with thickness less than one fifth of that with which the part revealed maximum radioactivity might be sacrificed. Scintiscanning thereafter was always performed with this setting condition of the scanner.

Considering some complexity in splenic figure and localization in the body, scintigrams from the posterior, lateral and anterior view were taken in each subject and scan areas of the spleen in each scintigram were compared in 85 cases.

This gave us the information that representation of splenic size and shape was generally accomplished by lateral scan, but that, as the spleen enlarged from normal size to moderate degree and up to huge abdominal mass, its size and shape were expressed best in posterior scan, then in lateral scan and further in anterior scannogram. There were noticed also considerable individual variations due to the mode of splenic enlargement relative to left upper abdominal cavity. Therefore, the proposal of taking posterior, lateral and anterior scintigram was presented, in order, first, to obtain a correct solid image of this organ, and second, to express the splenic volume more quantitatively. For the latter purpose, the product of posterior, or anterior scan area, Ap or Ao, times lateral scan area, A1, was divided by their length in the common axis, r, and this value, which was regarded as splenic volume,[8][9] was then expressed in terms of cm^3 per kg of body weight and used as splenic volume index. Mean value of splenic volume in 9 normal subjects was 223 cm^3 with standard deviation of 29.6 cm^3, which indicates that in this calculation the volume was overestimated about 75%, because the figure in project of the spleen in cranio-caudal direction could not be obtained in the scintigram, and was regarded as a rectangle in stead of some semilunar shape. As for the splenic volume index, mean value was 4.42 cm^3/kg. with standard deviation of 0.71, normal range being from 3.00 to 5.84 cm^3/kg.

Weight and shape of the enlarged and surgically removed spleens were compared with scintigrams taken before the operation and splenic volume calculated from them. Representativeness and accuracy of these method were confirmed, considering modofication in size during the operation and same rate of overestimate in the calculation as in normal subjects.

The palpable width of the spleen under the costal margin was compared with splenic volume index in various cases, which implied the inaccuracy of the former as the representation of splenic size. There was considerable existence of latent enlargement of the spleen detected by this method, that is, in 8 out of 11 cases with hepatitis, 4 out of 10 with cirrhosis of the liver, 3 out of 6 with iron deficiency anemia, 2 out of 9 with hypoplastic anemia and in some cases with ac-

quired hemolytic anemia, paroxysmal noc-
topenic purpura and with hyperthyroidism.
turnal hemoglobinuria, idiopathic thrombocy-
Reduction in splenic size was recognized in 3 cases with hypoplastic anemia which had been treated with cortiscosteroids.

"Examination of the splenic sequesteration function."

Several reports have been published on the examination of splenic sequestration function by using slightly damaged red cells.[10)-15)] In this study ^{51}Cr labelled heat-treated red cells were used because of readiness of standardization for the degree of the damage produced, as well as of the conditioning of damaging red cells, which was carried out by puting the red cells in the waterbath at $49.5° \pm 0.5°C$ for 40 minutes.

Following the administration of thus treated cells, frequent blood samplings and measurement of their radioactivity per ml. of red cells were performed. The activities in the samples were plotted against time on semi-logarithmic paper, and the clearance rate, λ, was calculated from $T\frac{1}{2}$ of the disappearance of damaged cells. Splenic sequestration curve was simultaneously obtained by continuous recording of radioactivity over the spleen. Splenic sequesteration rate, λsp, was calculated according to the formula[8)] with assumption that, it would take place in a single exponential fashion.

Calculated λ and λsp, were compared in each subject. The value of λsp generally reflected that of λ, but dissociation between them was recognized in several cases, for which the possible explanation was made by predestructive pooling in the spleen selectively produced by damaged red cells, besides by the existence of their extrasplenic destruction.[8)]

Clearance rate of the damaged cells was observed to depend on the degree of their damage, which was influenced by individual variation in susceptibility of red cells. Therefore it was necessary to standardize the clearance rate for damage degree of treated red cells, for which their osmotic fragility was adopted and concentration of saline solution causing 50% hemolysis was used as the index. Close positive correlation between the degree of cell damage and the clearance rate in 8 normal subjects with the coefficient value of 0.95, gave us the regression line of the latter to the former.

Using this line, estimated value of clearance rate in normal subject, λe, was obtained with a certain damage degree of the red cells, which was administered to a certain case under the study and actual clearance rate of λ was obtained. This value λ was referred to the value λe and ratio of λ/λ_e was adopted as the clearance index. This ratio can be considered to set off the variation in the degree of cell damage and to reflect only the factors of the organ, mainly the spleen, which clears these cells. Normal range was decided to be 1 ± 0.235 corresponding to twice value of the standard error of estimate.

Values of clearance index in 65 various cases were compared in reference to the size of their spleen, and cases under the study could be divided into 5 main groups.

1. Normal size with normal function;
2. Hyperfunction with increased size;

Almost all cases with congestive splenomegaly and portal hypertension such as Banti's syndrome, cirrhosis of the liver, and extrahepatic portal obstruction, were included in this group. Cases with chronic hepatitis showed the tendency to belong to this group.

3. Normal or rather hypofunction with increased size;

Cases with tumor cells invasive splenomegaly such as chronic myelocytic leukemia, lymphoma, etc. were found to belong to this group.

4. Hyperfunction with almost normal size;

Most cases with iron deficiency anemia, and some cases with hypoplastic anemia were included.

5. Hypofunction with reduced size;

Some cases with hypoplastic anemia which had been treated with corticosteroids and blood transfusion, were pointed out. Other than these cases, the cases with hemolytic anemia, polycythemia, idiopathic thrombocytopenic purpura, and hyperthyroidism, showed sometimes hyperfunction with various size of the spleen.

These observations described above provided us with some information concerning pathologic physiology of splenic disease and clinical course especially in reference to the treatment of certain diseases. These studies would be valuable also for giving us more accurate advice to the indication of splenectomy.

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Splenic Scanning and Splenic Clearance in Our Clinic

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Splenic scanning, splenic clearance and external counting over the spleen, liver, heart and sacrum were performed by ^{51}Cr labeled heated red cell method and ^{203}Hg MHP method in 21 patients and 14 respectively.

Following venipuncture of labeled red cell, serial blood samples were taken, clearance, half time of radioactivity of blood was calculated. After one hour of venipuncture scintiscanning and then external counting