Simultaneous measurement of the clearance of damaged red blood cells from the circulation together with splenic scanning may provide a useful information for the assessment of splenic function not only in cases with splenomegaly but also in cases with a spleen of normal size.

The author wishes to express his sincere gratitude to Dr. M. Iio of Tokyo University and Dr. S. Kato of Abbott Laboratory for their kind help in obtaining $^{197}$Hg-BMHP and $^{203}$Hg-MHP.

3. DIAGNOSIS OF ABDOMINAL TUMORS BY THE COMBINATION OF ORGAN SCANNING METHODS

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Abdominal scintiscanning has been used for the diagnosis of the localization of abdominal lesions and for the clarification of the pathophysiology (1) such as detection of hepatic shunt in the disease of the abdominal organs including absorption functions of digestive system (2).

In this report, at first the recent development in radiopharmaceuticals for the organ scanning will be discussed with the demonstration of example of scans obtained in our laboratory. Secondly, clinical cases with abdominal tumor which can be diagnosed by using combination scintiscanning method. Lastly of the first clinical application of Nuclear Image Tube Camera which developed in our laboratory with the collaboration of Shimazu Seisakutio Ltd. will be presented. Both conventional scanner and this newer device will improve and contribute to the diagnostic technique in this field for the coming years.

(1) Radiopharmaceuticals for abdominal scanning.

The radiopharmaceuticals used for the abdominal scanning have made remarkable progress for the past several years. Now many of them are labelled with nucleides with a short half-life, low gamma energy and occasionally no beta, e.g. Au-199, Hg-197, Cs-131 and Tc-99m.

Since their gamma energies are low, they are easily collimated and shielded by thin lead collimator with high efficiency by small crysia scintigram obtained by such radiopharmaceuticals is much finer than that by nucleides with high gamma energies and would give us more precise information about the lesions. At the same time the short-lived radiopharmaceuticals reduce the danger to the patient and also make possible the large dose administration.

For the diagnosis of the abdominal tumor by scintiscanning, it is desirable to scan organs, such as pancreas, spleen, kidney or liver, successively in such a order by several different radioisotopes. Such examination could be performed safely within short period, since now varieties of radiopharmaceuticals are available at our hand.

The radiopharmaceuticals listed in the right side of Table 1. shows those which are used in our laboratory at the present time. All of them but Hg-203 MHP and Se-75 Selenomethionir are substances with a physically or biologically short half-life and can be used with radiation safety.

<table>
<thead>
<tr>
<th>Organ</th>
<th>Radiopharmaceuticals for Organ Scanning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liver</td>
<td>$^{198}$Au Colloid, $^{131}$I Rose Bengal, $^{99m}$Tc$\text{S}$_7, $^{125}$I AA, $^{131}$I AA, $^{197}$Hg MHP, $^{203}$Hg MHP</td>
</tr>
<tr>
<td>Spleen</td>
<td>$^{51}$Cr RBC, Heated $^{51}$Cr RBC, Sensitized $^{51}$Cr RBC, $^{203}$Hg Neohydrin</td>
</tr>
<tr>
<td>Kidney</td>
<td>$^{197}$Hg Neohydrin, $^{203}$Hg Saligen, $^{75}$Se Selenomethionin, $^{131}$I MAA, $^{99m}$Tc Albumin, $^{99m}$Tc$\text{S}$_7</td>
</tr>
<tr>
<td>Pancreas</td>
<td>RISA, $^{51}$Cr RBC</td>
</tr>
<tr>
<td>Perfusion Scan</td>
<td></td>
</tr>
<tr>
<td>Blood Pool Scan</td>
<td></td>
</tr>
<tr>
<td>Bone Marrow</td>
<td></td>
</tr>
</tbody>
</table>
Liver scintigram of normal and with hepatoma using 99m-Tc-2-S-7 colloid were demonstrated (slides). Tumor in the last case was located in the midportion of the liver and the left lobe seemed enlarged. But spleen scanning by Hg-203 MHP could indicate the presence of duplication of the enlarged spleen on the left lobe of the liver. Since the colloidal materials are also phagocytized by reticuloendothelial cells outside the liver, spleen is often delineated in liver scintigram in cases with liver diseases, especially liver cirrhosis.

Tc-99m could provides us with many other scanning agents besides TcS7 colloid for liver and bone marrow scans, such as TcO4− for thyroid scan or brain scan. Tc-Albumin for blood pool scan or lung scan following radioaerosol inhalation, Tc(SCN)5 for liver scan, Tc-DNA for kidney scan and others. Therefore it was named as universal scanning agent by McAfee et al[4].

As one of other clinical applications of Tc-99m, Placenta scan using Tc-Albumin was demonstrated in slide. This pregnant woman was suspected placenta previa because of genital bleeding. But placental scanning showed that the placenta was located at the left-anterior side of the uterus. She could be delivered normally without cesarian section.

The six hours half-life of Tc-99m is long enough for scanning and the 140–Kev of gamma energy has satisfactory tissue penetration and yet can be collimated easily. From this point of view it is also said one of the most suitable radioisotopes for scanning.

Spleen scanning has previously performed using heated red cells tagged with Cr-51[9]. Since last year, Hg-203 or Hg-197 labelled 1-mercuri-2-hydroxypropaner has been developed in our laboratory with aids of members of Dinabot radioisotope laboratory[8]. Red blood corpuscles simply mixed with MHP are instantly damaged as well as labelled, and are rapidly sequestered by spleen. Therefore the MHP method is a easier way than the Cr-51 method. Spleen scanning was performed chiefly in cases with liver diseases, hematological disorders or abdominal tumor of unknown origin. Some examples were shown in slides. Generally speaking, the size of spleen by the scintigram in splenomegaly was large in a side-view than in front one as shown in slide.

When the spleen increases in size, it enlarges inwards and downward in the frontal plane, and in the sagital plane forward and downward.

Hg-197 Neohydrin with short half-life of 2.7 days, low gamma energy and no beta ray is much more favorable as a Kidney scanning agent than Hg-203 Neohydrin which remains in the Kidney for a long period[9]. However its short shelf-life and high cost did not encourage its wide-spread use in Japan. In this symposium we report briefly the merit of kidney scanning using Hg-203-Salygan[10] which has a biological short half-life, too.

Hg-203-Salygan was rapidly accumulated in the kidney after intravenous injection. Scanning should be performed between 15 to 60 minutes after administrations in which period radioactivity over the kidney did not change widely. After that, it was rapidly excreted into urine with the half-time of about 90 minutes calculated from the radioactivity decling curve other the kidney (Fig. l a). Therefore its radiation dosis to the kidney is markedly reduced as compared with Hg-203 Neohydrin and can be used repeatedly with safety. Since its shelf-life is long, it also has an advantage in economical point of view.

In case with renovascular hypertension due to stenosis of the left renal artery, renogram by Hg-203 Salygan was compared with that by I-131 Hippuran. In normal kidney Hg-203 Salygan uptake curve reaches to the plateau 30 minutes after injection. While in abnormal side radioactivity revealed slight increase in the initial phase suggesting dilution process, and the further accumulation of Hg-203 Salygan was not observed (Fig. l b). Although excretion phace was not observed in this case, Hg-203 Salygan uptake curve would differentiate abnormal kidney from normal as well as renogram by I-131 Hippuran. Soon after recording of uptake curve of Hg-203 Salygan kidney scanning was performed, which could reveal the small left kidney with reduced uptake. Hg-203 Salygan is able to diagnose the unilateral kidney disease and the degree of its atrophy similar to Hg-197 Neohydrin and with decreased radiation.

(2) Differential diagnosis of abdominal tumor by scintiscanning.

Six cases were demonstrated as examples of the usefulness of scintiscanning method for the