ner .Additional factors affecting the visualization of the space-occupying defect in the liver are the size of the defect, the thickness of the liver in which the defect lies, the depth of the defect whithin the liver, the pertinent use of radioisotopes and the effect of the respiratory movement. Objections were to study the detectability of the filling defects in the liver phantom by using scintillation camera and the effect of the respiratory movement on it.

(Method)

Spherical plastic models were set in the center of the right and left lobe of the liver phantom as filling defects in our study. The thickness of the right lobe was 10 cm and that of the left lobe was 5 cm. The nuclides used here were $^{99m}$Tc, $^{131}$I $^{113m}$In and $^{198}$Au. The amount of radioisotope loaded into the phantom varies from minimum of 300 $\mu$Ci of $^{198}$Au and $^{131}$I to 6 mCi of $^{99m}$Tc. The spherical model of the defects were 5, 4, 3, 2 and 1.5 cm in diameter.

To evaluate the effect of the respiratory movement, the phantom was moved foreward and backwards on the rail in stead of the respiratory movement at the average speed of normal respiration.

(Results)

1. The minimal size of the defect which could be visualized with Anger Scintillation Cameara were 3 cm in the right lobe and 2 cm in the left lobe when the defects were set in the center of each lobe, whichever nuclides described above is used. However, when $^{99m}$Tc was used the spherical defect would seem to be detectable even if the diameter was 2 cm in the right lobe and 1.5 cm in the left lobe.

2. Respiratory movement decrease the detectability of the spherical defect in liver phantom. When the respiratory movement was 2 cm in distance, 4 cm spherical defect could be visual in both right and left lobe.

3. When the phantom was loaded with 6 mCi of $^{99m}$Tc optimal scintiphoto could be obtained in short time of 10 seconds without increase in brightness of the oscilloscope and the spherical defect measuring 3 cm in diameter could be visualized in the right lobe and 2 cm in left lobe.

(Summary)

Respiratory movement decrease the detectability of the filling defects in the liver but it is easy to stop breathing for ten seconds. $^{99m}$Tc and $^{113m}$In can be used at the higher unit of mCi without care of radiation dose.

Experimentally, good liver scintiphoto could be obtained without effect of respiratory movement in ten seconds, if 6 mCi of $^{99m}$Tc or $^{113m}$In is gathered in the liver. However, if this is applied clinically, there are some problems such as up-take ratio of radioisotope in the liver, increased radiation dose of examiner and troublesome procedure of making TcS colloid, etc.

## Radioisotope Diagnosis of the Liver

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The radioisotope diagnosis of the liver using $^{198}$Au colloid is performed by liver scanning and scintiphotography. These findings are compared with that of the selective hepatic arteriography from the point of view in detecting the liver tumor. The cases studied are primary liver cancer 13 (hepatoma 11, cholangioma 2), metastatic liver cancer 26 (gastric cancer 8, renal ancer 1, ureter cancer 1, colon cancer 4, papillary cancer 2, ovarian cancer 1, lung cancer 1), and control 11 (liver-cirrhosis 4, cholecystopathy 5, chronic pancreatitis 2).

The detection ability of liver cancer is classified into four grades: that is, not diagnosed (−), dagnosed (+), easily diagnosed (#), measurably diagnosed (卌). The detectability of each diagnostic methods is as follows: if that of hepatic arteriography is assumed to be 100%, liver scanning and liver scintiphotography are 61.5% and 90.4% respectively.

## Application of Digital Computer into Clinical Evaluation of Liver Scan

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The digital computer processing was carried out for differential diagnosis of liver diseases. Two methods, matrix and discriminant function were used for this purpose. In this series, 9 data from liver scanning (right width, left width, length of spleen, number of defect, bone marrow visualization, mottled appearance, faint appearance, elevation of the right lobe, and elevation of both lobes) and 11 laboratory data (serum protein, A/G ratio, icterus index, serum bilirubin, ZTT, TTT, GOT, GPT, alkaline phosphatase, BSP and total cholesterol) were selected, and 150 proved cases were chosen for the study.

Matrix method is very close to the thinking way of physician's diagnosis. Making the matrix of diseases and informations with many logical IF circuits, probability of a disease was output in order after these matrix elements logically. This method is most useful in picking up a few diseases from a large number of diseases. In our study, this method gave a good result in the diseases such as acute hepatitis, hepatic tumor, Banti's Syndrome, but poor result in chronic hepatitis and cirrhosis.

The discriminant function, one of the multi-variate analysis, was used to determine the discriminant coefficients between two respective liver diseases. Using the linear function of the data multiplied by the coefficients, proper answer of the disease could be obtained in 80% of the case on the average. Liver scan includes the continuous and discrete type of data and these data are not suitable for discriminant function in a strict sense, but in practice discriminant function could fairly support to make a differential diagnosis. In the above mentioned procedure, scan data or/and laboratory data were utilized and the results by these ways were compared each other. Hepatom could be differentiated by liver scan data alone, but the other liver diseases could not be done always because of shortage of informations.

## Classification of $^{198}$Au Scintigram of the Normal Liver

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Methods and Materials

An Aloka JSS-103 Scientiscanner, Cristal 3 × 2 inch (NaI), Collimator 19 holes Focus 10 cm honey cone were employed in this study. A