LIVER SCINTIGRAPHY AND ULTRASONOGRAPHY FOR THE DIAGNOSIS OF FOCAL AND DIFFUSE DISEASES*

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(Received November 1990)

ABSTRACT

The scintiphotos and ultrasonophotos of 186 patients with focal and diffuse diseases of liver were collected and analysed. All the data were get from the in-patients of China-Japan Friendship Hospital. The Sigma 438 typed γ camera (USA) was used. Fifteen min after ^{99m}Tc-phytate were injected i.v., If any defect region was found, it was recorded as a SOL; the SSA 90A, SAL 77A and SAL 50A US scanners (Japan) were used, if any abnormal echo pattern was found, it was a SOL. Of 134 patients have done both examinations during 7 days, 122 patients had coincident results occupied 91.0%. For detection of SOL, the sensitivity of scintigraphy is 94.1%, specificity is 94.2%, accuracy is 94.8%; the sensitivity of US is 100%, specificity is 89.7%, the accuracy is 95.6%. The hepatic blood flow and blood pool study showed that 104 from 115 patients were coincident (90.4%). The spleen and liver accumulation ratio determination showed that 51 from 64 subjects were coincident (80.0%). The characteristic features of scintigraphy and US graphy were described in hepatoma, hemangioma, cyst abscess and cirrhosis. The advantages of these examinations were discussed and concluded that their procedures are valuable and widely available.

Keywords: Scintigraphy Ultrasonography Liver disease

1 EXPERIMENTAL METHODS AND RESULTS

We collected and analysed the scintiphotos and ultrasonophotos of 186 patients with focal and diffuse diseases of the liver. All the data were get from the in-patients of China-Japan Friendship Hospital. Their diagnoses were confirmed by the pathologic examination, and the biopsy samples were get by laparotomy or needle aspiration guided by ultrasound scanner or X- CT scanner. The criteria of pathologic diagnosis was based on "The International Historical Classification of Tumor" issued by World Health Organization.

In duration between scintigraphy and ultrasonography, no remarkable change of symptom and sign can be found. In 134 cases of this group, the duration were less than

* The Project was supported by the International Atomic Energy Agency

7 d. So that data of the above 2 examinations were comparable.

The Sigma 438 typed γ camera (Technicare Company, USA) was used. Fifteen min latter after 185 MBq–296 MBq of ^{99m}Tc–phytate (made in China) were injected intravenously started the scintigraphy. The images from ANT, POST, LT and RT views were given. If any radioactive defect region was found, it was recorded as a space occupied lesion.

We used the SSA 90A, SAL 77A and SAl 50A US scanners (Toshiba Company) for making transverse, sagittal real-time ultrasonography with real-time equipment. If any abnormal echo region was found, it was recorded as well.

The patients were: (1) 20 cases of normal subjects. (2) 122 cases of patients with SOL: They are 26 patients with hepatoma (malignant primary tumor), 7 with malignant secondary tumors of liver, 60 with hemangioma, 21 with cyst of liver, and 8 with abscess within the liver. (3) 44 patients with diffuse diseases of liver, including 26 patients with cirrhosis, 14 with hepatitis, 4 with fatty infiltration of the liver.

The comparison of scitigraphy and ultrasonography for patients with liver diseases was shown in table 1. In 134 patients, 81 had positive results and 41 had negative results in both examinations. There were 122 patients, who had coincident results in two examinations, which occupied 91.0% of this group.

Table 1

Comparison of the scintigraphy and ultrasonography for patients with liver diseases

		Scintigraphy			
		+	−	±	
U	+	81	7	0	88
	−	4	41	0	45
S	±	0	1	0	1
		85	49	0	134

If there are some radioactive defect regions in the scintiphoto or some abnormal echo pattern in the ultrasonophotos, such results were called positive (+). Associated such result with pathologic findings, if the SOL can be confirmed we call it a true positive result, if the SOL was denied we call it a false positive result. If no radioactive defect can be found in scintiphoto, or no any echo pattern in ultrasonophoto, that means no SOL. Associated such results with pathological findings, we can determined it is true negative or false negative.

Table 2 show us the detectable rate of SOL in liver by scintigraphy or ultrasonography in the 186 patients. According to the statistical criteria, the sensitivity of ultrasonography in detecting the SOL of liver is 100%, all the small lesions (diameter were 0.7 to 1.5cm) can be visualized; when some patients with cirrhosis or fatty infiltration of the liver were examined by ultrasonography, some

area looked like abnormal echo pattern.

On scintigraphic images, the SOL were looked like a "cold" defect area, and it would be overlapped by the image of adjoining normal liver tissue when the radioactive defect were located in the deep site of the right lobe of liver. The capacity of detecting liver SOL by scintigraphy is lower than that by ultrasonography. In our research work, the sensitivity of scintigraphy is 94.1% only. The small SOL, whose diameter is less than 1.5 cm, cannot be revealled in scintiphoto (5 patients), some tiny, wide-spread SOL (hepatic metastases) were very easily manifest as heterogenety of radiocolloid distribution (2 patients).

Table 2

Evaluation of liver scintigraphy and ultrasonography for detection rate of SOL in liver

		Scintigraphy	Ultrasonography
Focal dis. of liver 118 cases	True positive (case)	111	118
	False negative (case)	7	0
Diffuse dis. of liver 68 cases	True negative (case)	64	60
	False positive (case)	4	7
	Undecided (case)	0	1
Sensitivity (%)		94.1	100
Specificity (%)		94.2	89.7
Accuracy (%)		94.8	95.6

The chief advantage of scintigraphy is its capacity to reveal the hepatocyte function. In patient with cirrhosis, even though the radiocolloid tissue is heterogenety, but the hepatocyte function were similar, so we cannot find out any radioactive defect on the scintillative images. Our research result shows the specificity of scintigraphy is 94.2%, which is higher than that of ultrasonography. The accuracy of scintigraphy for the detection of SOL in liver is 94.8%, similar with that of ultrasonography.

Maringhini A *et al.* reported that ultrasound has SOL in 22 of the 24 patients with hepatocellular carcinoma, the sensitivity is 95.8%, the specificity is 86.0%. The sensitivity of scintigraphy is 95.8%, and the specificity is 91.1%[1].

In our hospital, the ^{99m}Tc-labelled red blood cell flow studies and blood pool scintigraphy have been performed as an immediate sequel to radiocolloid imaging to display the delayed filling in the primary defect area. All the high radioactivity reveal the aboundence of the red blood cell.

A new diagnostic algorithm is proposed in which the blood flow and blood pool scintigraphy play a more prominent role in the diagnostic workup. If it is over filling and the radioactivity (+ +) of that area is equal to or more than that of heart, it can be suggested as a hemangioma. If it is a common filling (+), and the activity of that defect area is less than that of heart, but higher than the adjoining normal hepatic

tissue, we can suggest it as a hepatoma. Another characteristic feature of hepatoma is some radioactive images were found in the arterial phase of hepatic blood flow study. If it is no filling (-), no any radioactivity can be found in the primary defect area, it shows us there are some cystic fluid, pus or liquid full of ameaba in that defect area.

Table 3

Result of hepatic blood flow and blood pool study for focal diseases of liver

Diseases	Total cases	Filling	Cases	Coincident rate
Hepatoma	26	+	21	76.9%
Hemangioma	60	++	58	96.9%
Cyst	21	-	18	85.7%
Abscess	8	-	7	87.5%

In our research work (see Table 3) of 26 cases of hepatoma 21 cases were filling (+); of 60 cases of hemangioma 58 cases were over filling; of 21 cases of cyst 18 were no filling; of 8 hepatic abscess 7 cases were no filling. In total, 115 patients with focal diseases of liver, 104 cases were coincident, the general coincident rate was 90.4%[2,3].

The most widely used single indication for liver imaging is the suspicion of metastases in patients known to have a primary malignant tumor. Some primary tumors, such as colorectal carcinoma and renal cell carcinoma, appear to shed metastases that rapidly generate focal defects. Other tumors, such as cancer of the lung or breast, are often associated with hepatic metastases, that are tiny, wide-spread and very easily manifest as heterogeneity of radiocolloid distribution. In our research work, five patients with primary colorectal cancer, some focal defects appeared in the images of scintiphotos; two patients with primary lung cancer, no defect can be found[4,5].

Table 4

Result of S/L determination for normal subject and diffuse diseases of liver

Diseases	Total cases	Cases (S/L 0.35)	Cases (S/L 0.35)	Coincident rate
Normal	20	0	20	100%
Fatty infiltration of liver	4	1	3	-
Hepatitis	14	1	13	92.9%
Cirrhosis	26	21	5	80.8%

We did the spleen and liver accumulation ratio (S/L) determination for the diagnosis of diffuse diseases of liver. Most patients with cirrhosis have the signs of portal hypertension, splenomegaly, asites, and atrophic liver, their S/L were increased prominately; when we use ^{99m}Tc labelled phytate, S/L should be greater than 0.35. In patients with hepatitis, the function of hepatocyte was damaged, but spleen is normal, so S/L should be normal, equal to or less than 0.35. Table 4 shows us the result of S/L

of normal subject and patients with diffuse diseases of liver. Of 64 subjects, 51 cases had *S/L* like that described above, that is the coincident rate is 80.0%[6,7].

There are some characteristic features in different diseases of liver, as follows[8]:

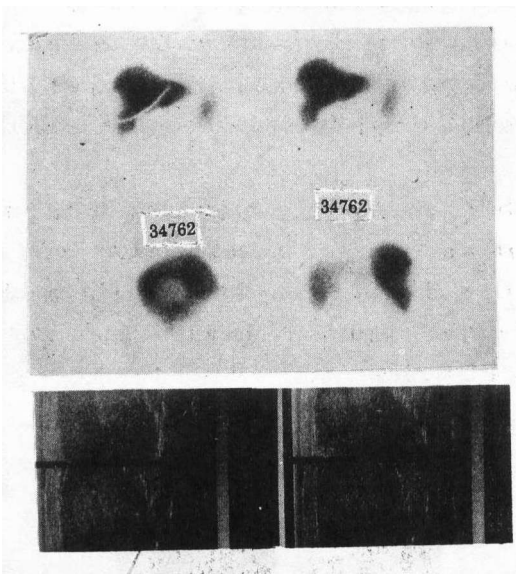

Fig.1 Hepatoma

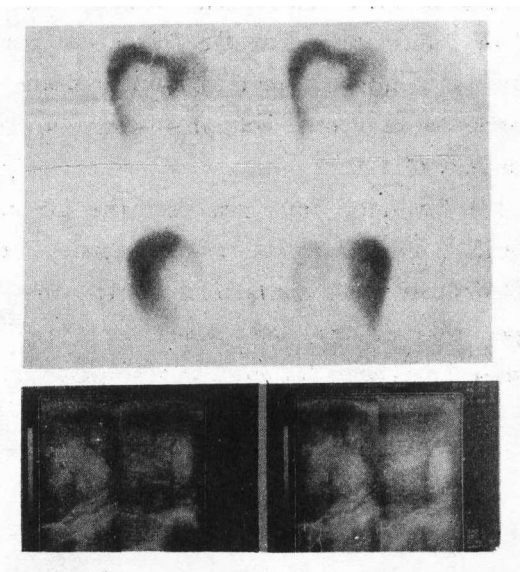

Fig.2 Hemangioma

(1) Hepatoma: The US feature is highly echogenic mass with a peripheral sonolucent halo, large complex mass protruding from the surface in a patient with cirrhosis and asites. The scintiphoto feature is the very laterally placed focal defect that some small defects were fused to be a big one (Fig.1).

(2) Hemangioma: The US feature is a

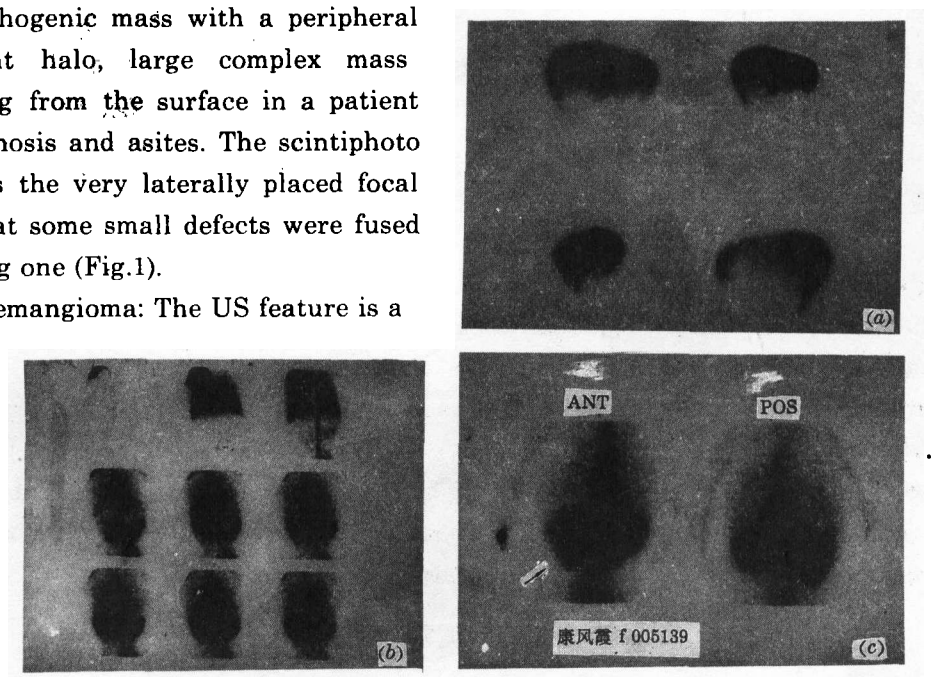

Fig.3 Scintigraphic study of liver hemangioma

(*a*) ^{99m}Tc-phytate scintigraphy (*b*) Hepatic blood flow study (c) Hepatic blood pool image

mass of high level echoes sharply delineated from the adjacent liver parenchyma without the hypoechoic halo, they were usually round and containing mosaic or network structure in it. In scintiphotos, hemangioma involving the liver may be manifest as focal defects with smooth round or elliptic boundary (Figs. 2 and 3).

(3) Liver cyst: The US feature is a no echo pattern, smooth walled and exibit marginal shadows, some cyst were displayed as no posterior wall enhencement. The hepatic scintiphoto indicates some small well-defined focal defects with smooth boundary (Fig.4).

(4) Pyogenic liver abscess: The US features are: A large mass containing fine internal echoes in its most dependent part was seen, or a large cavity with a well-defined wall containing debris. Small focal defects in the liver (usually at the upper part of the right lobe) occuring in clinical situations highly suggestive of abscess have been followed to resolution by scintiphotography.

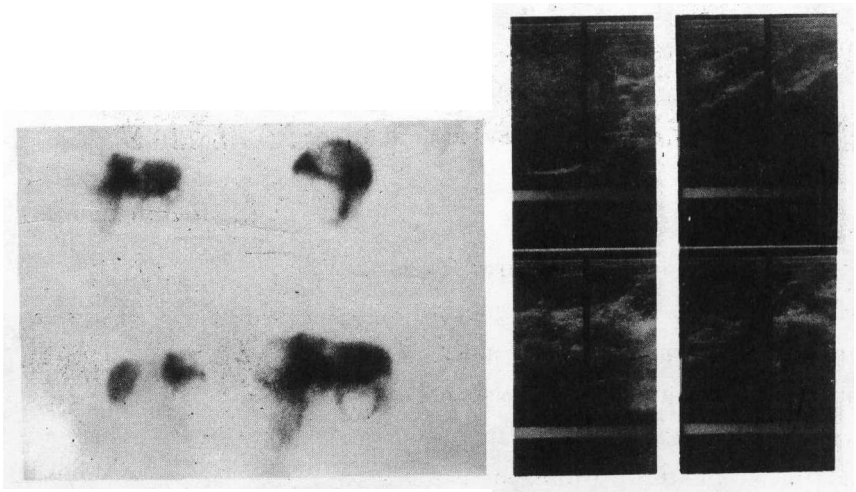

Fig.4 Liver cyst

(5) Cirrhosis: The US features are increase in parenchymal echoes, diffuse irregularity, attenuation sign, asites portal hypertension and splenomagaly. In scintiphotos, a left upper quadrant mass, hypotrophic right lobe of liver, extremely heterogenous uptake, a striking shift of radioactivity to the spleen and bone marrow, considerable pulmonary uptake of colloid.

(6) Fatty infiltration of the liver: US features show us the liver is quite enlarged with a rounded edge, high level parenchymal echoes. No focal defect can be found in scintiphotos, the size of liver image is enlarged.

2 CONCLUSION

We concluded that sensitivity for detection of liver diseases by scintigraphy or ultrasonography in general is high when appropriate interpretive criteria are

employed. Both of them clearly plays major parts in the study of the liver. They are non-invasive and repeatable, the whole body and gonadal radiation doses are small. No contrast agent is needed. The technique can be made portable and applied to the bedside. The basic real cost per examination is lower than X-CT or MRI. Their procedure are widely available.

ACKNOWLEDGMENTS

This investigation was supported by the International Atomic Energy Agency, United Nation. We appreciate the help of Prof. Wang Shizhen and Zhou Qian.

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