Evaluation of Hepatic Hemangioma with Tc-99m Labeled Red Blood Cells

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Six patients with cold defects on sulfur colloid liver/spleen scans and no history suggestive of malignant disease were imaged with Tc-99m in vivo labeled red blood cells. Dynamic, immediate, and delayed static images of the liver were obtained on all patients, demonstrating accumulation of activity in the lesions over time in five patients. This correlates well with the suspected diagnosis of hepatic hemangioma. We suggest using this simple, non-invasive technique for evaluating the presence and the extent of hepatic hemangiomas.

Most photon deficient areas seen on liver/spleen scanning are non-specific findings representing either benign or malignant disease (*1*). The differentiation of these lesions is very important since benign disease often does not require any further therapy. Hepatic hemangiomas, which are the most common benign tumors of the liver (*1*), may cause cold defects on the sulfur colloid liver/spleen scan. These tumors are usually composed of dilated blood vessels which require no therapy once definitively diagnosed. The traditional method for evaluation of hemangiomas has been by contrast angiography, which is invasive and can be misleading since the findings can mimic those of malignant tumors (*2*). Tc-99m tagged red blood cells (Tc-RBC's) have been used extensively as a blood pool agent in nuclear cardiology with very high labeling efficiency and provide good delayed blood pool images (*3*). We evaluated six patients with suspected hepatic hemangiomas using Tc-RBC's and we found this technique to be very sensitive and specific for the evaluation of these lesions when comparing our results to those obtained with angiography, CT, or sonography.

Materials and Methods

Six patients were referred for Tc-99m sulfur colloid liver/spleen scans. Four of these patients had single, discrete, photopenic defects in the liver, one had two defects, and the remaining patient had an extremely large defect involving the entire right lobe of the liver. Clinically, none of these patients were suspected of having malignant disease and the possibility of hepatic hemangiomas was entertained. Twenty minutes after the injection of 1–2 mg stannous pyrophosphate, 20mCi of [^{99m}Tc] pertechnetate was injected and dynamic 5 sec images of the liver were obtained for 12 frames on a large field of view camera equipped with a general purpose collimator.

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TABLE 1. Scintigraphic Patterns of Hepatic Hemangiomas (N = 6)

Patient	Dynamic Flow Study	Immediate Statics	Delayed Statics	Discharge Diagnosis
1	↑	↑	↑	hemangioma
2	↓	↑	↑	hemangioma
3	↓ / =	↓ / =	↑ / =	hemangioma
4	=	↑	↑	hemangioma
5	↓	↓	↑	hemangioma
6	↓	↓	↓	cyst

KEY:
↓ : activity less than that of surrounding liver tissue
= : activity equal to that of surrounding liver tissue
↑ : activity greater than that of surrounding liver tissue

Static 500K images were taken immediately and delayed images were obtained up to six hours post injection. The positioning for the flow study and static images varied from patient to patient to optimize the cold defects seen on the sulfur colloid liver/spleen scans. All patients then had either contrast hepatic angiography, ultrasound, or CT studies performed on them within two weeks of the Tc-RBC studies.

Results

Table 1 summarizes our results. Of the six patients who were studied with Tc-RBC's, five (Patients 1 through 5) had a positive hemangioma study. Patient 6, the negative study, had a liver cyst upon sonographic evaluation. In the patients with hemangiomas, dynamic images showed increased perfusion to the lesion in one case (Patient 1), decreased perfusion in three cases (Patients 2, 3, and 5), and equal perfusion in one case (Patient 4). Immediate static images demonstrated decreased activity in one [Fig. 1(A)] and increased activity in three of the five diagnosed hemangiomas [Fig. 2(A)]. On delayed images, there were further increases in activity in these lesions [Figs. 1(B) and 2(B)]. Patient 3 showed small areas of increased activity interspersed within a larger, photon-deficient area on immediate images [Fig. 3(A)] which increased to an equivalent degree on delayed images [Fig. 3(B)]. This patient had the largest defect in the liver involving the entire right lobe on the Tc-99m sulfur colloid scan. The patient with the liver cyst had decreased activity on dynamic, immediate, and delayed images (Fig. 4).

Four patients (Patients 1 through 4) had angiographic findings typical of hemangioma, while one patient (Patient 5) had

a contrasted CT scan which was highly suggestive of hemangioma. Patient 6, who had decreased activity on dynamic, immediate, and delayed RBC images, had a liver ultrasound which revealed a typical cyst.

Discussion

The majority of hemangiomas are present at birth. They contain newly formed blood vessels and are categorized according to the lumen caliber of their vasculature. Histologically, they can have several different arterial and venous components (*4,8*).

Hemangiomas are the most common vascular benign tumors of the liver. They are usually cavernous in nature, containing large vascular spaces which are partially or completely filled with blood. The majority occur singly and can be quite large, are often asymptomatic, and can be found incidentally at surgery, autopsy, or during diagnostic investigations for an unrelated problem. Since there is little or no functional impairment, liver function tests are usually normal. Use of non-invasive techniques for accurate diagnosis is desirable since biopsy can lead to significant internal hemorrhage (*1*).

There are reports in the literature on the past use of radionuclide scintigraphy in the evaluation of the hepatic hemangiomas. Various radiopharmaceuticals such as Tc-99m albumin (*5*), In-113m-transferrin, I-131-HSA, Ga-67-citrate (*6*), and more recently, Tc-99m labeled red blood cells have been used (*1,8*). Acceptance for the routine use of scintigraphy has been slow (*5*), probably because of the wide variations in scan patterns seen. Although hemangiomas have a large blood pool, it may be somewhat "static" or "sluggish" rather than dynamic. Misconceptions about the circulatory dynamics of the blood pool within hemangiomas lead to the assumption that increased activity should be seen on dynamic and immediate static views. Thus, the studies were often terminated prematurely when no increased radioactivity was seen within the lesion, excluding hemangiomas as the cause for the abnormality. Consequently, false negative reports were frequent. After adequate mixing of the blood pool and labeled RBC's, static images may be obtained with delays from 30 min (*7*) to 12 hours (*8*), increasing the sensitivity and specificity in the scintigraphic detection of hemangiomas. Front et al (*9*) suggests that even though the vascular pool within a cavernous hemangioma may be quite large, its regional perfusion may be low. This leads to somewhat delayed visualization in some patients.

In our limited studies, we have established that the scintigraphic patterns most indicative of a hepatic hemangioma include a normal or decreased flow to the suspected area on the dynamic phase and focally increased activity on immediate static images with further increases seen at 1–2 hr or more post injection. Failure of the lesion to visualize at 2 hr post injection may necessitate continuing the study up to 6 hr post injection.

Conclusion

We feel that there are many advantages to this method over conventional methods, such as contrast angiography, presently used for the evaluation of hepatic hemangiomas. The nuclear method involves less costs, risks, and radiation exposure to the patient. It is a non-invasive method and was extremely sensitive and specific for evaluating hepatic hemangiomas in our

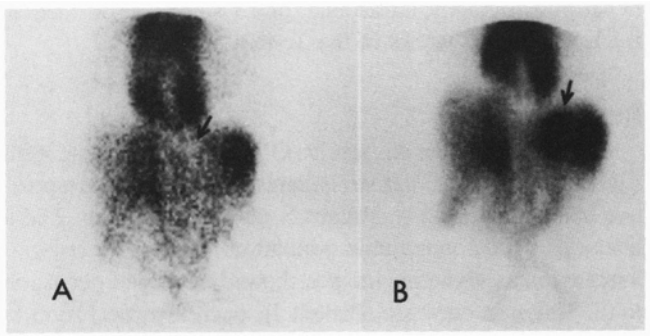

FIG. 1. (A) Immediate static image shows area of decreased activity (arrow); (B) 30 minute delayed image shows the same area, now with increased activity.

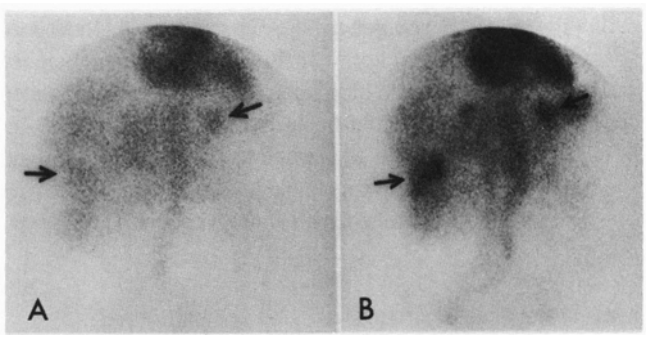

FIG. 2. (A) Immediate static image shows early increased activity in two areas (arrows); (B) 1 hour delayed image shows further increases in both areas.

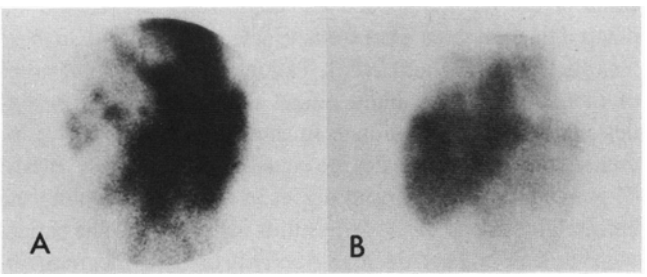

FIG. 3. (A) Immediate static images show large areas of decreased activity interspersed within areas of normal activity, involving the entire right lobe of the liver; (B) 2 hour delayed image shows "filling in" of the previously "cold" areas.

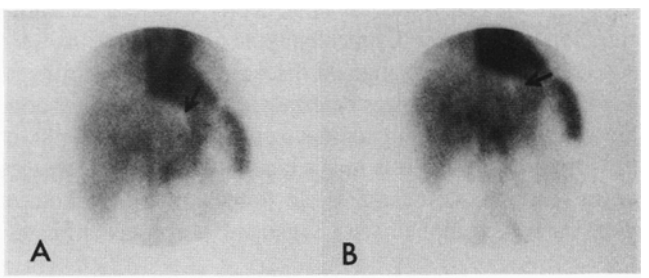

FIG. 4. Immediate (left) and 6 hour delayed (right) images show persistent "cold" area (arrows). Lesion was cystic by ultrasonography.

series. We therefore suggest using this technically and procedurally simple method in the initial evaluation of patients with a suspected hepatic hemangioma.

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