DIAGNOSTIC NUCLEAR MEDICINE

Value of Selective Spleen Scintigraphy When Liver/Spleen Image Shows Equivocal Spleen Defects: Concise Communication

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A retrospective review was performed to determine the utility of selective spleen scintigraphy (SSS) in the evaluation of equivocal defects on liver/spleen (LS) image. Six of seven questionable features on LS image were classified on SSS to be definite defects in three, and normal in three. Three of seven patients had defects on SSS that were not seen on LS image. The inability of the LS image to exclude or delineate an abnormality in the spleen was attributed to an overlying left lobe of the liver in five, and to technique in one. The SSS is a valuable diagnostic tool in the further evaluation of equivocal spleen defects on LS image, and SSS may demonstrate abnormalities not demonstrated on LS image.

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The technetium sulfur colloid liver/spleen image (LS) has been used extensively in the evaluation of focal defects in the spleen (*1–6*). More recently, selective spleen scintigraphy (SSS) with Tc-99m-labeled heat-damaged red cells has also been used in the evaluation of various splenic abnormalities (*5,7–11*) and has been found useful in the clarification of various equivocal splenic abnormalities on liver/spleen image (*12,13*). To date there have been reported four cases with equivocal splenic defects on the Tc-99m sulfur colloid liver/spleen image, after which a SSS clarified the equivocal LS defect. This communication is a review of the patients at our institution who had equivocal splenic defects on LS image and who had subsequent SSS performed.

MATERIALS AND METHODS

A retrospective review was performed from February 1981 to June 1982 on all patients being evaluated for splenic abnormality who had (a) equivocal spleen defects on LS, and (b) SSS subsequently performed.

The LS images were performed on six of seven patients with a specific request to evaluate the spleen. Five millicuries of Tc-99m sulfur colloid was injected intravenously and images were obtained 10–30 min later in the posterior, LPO, left lateral, LAO, and anterior projections. All patients were standing if their medical status allowed. At the discretion of the physician, additional images were obtained. The initial anterior images were obtained with an information density (ID) of 2000 over the spleen and subsequent images obtained with the same time frame. One patient had the LS image performed to maximize visualization of the liver. The anterior image was obtained for 2000 ID over the liver with all the above images obtained with the same imaging time. Views of the spleen were adequate for interpretation. All images were obtained with a gamma camera, and the specific camera and collimator were noted on the technician's worksheet for each patient.

The Tc-99m-labeled heat-damaged red cells were prepared according to the following aseptic technique based on previously described procedures (*7,14*). One kit of pyrophosphate was reconstituted with 2 cc of saline. The contents of this kit (15.4 mg of stannous pyrophosphate) were injected into the patient. Approximately 20 min later, 10 cc of blood was withdrawn into a syringe containing 100 units of heparin. This was placed in a sterile screw-top tube and centrifuged at 1150

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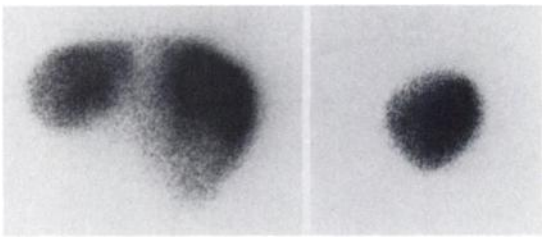

FIG. 1. Equivocal splenic defect is seen in lateral aspect of spleen on the left posterior oblique LS image (left), but SSS demonstrates no defect (right). Greater radioactivity in superior region of spleen on LS scan, relative to SSS, is most likely due to left lobe of liver, which is causing the false appearance of photon deficiency in lateral margin of spleen.

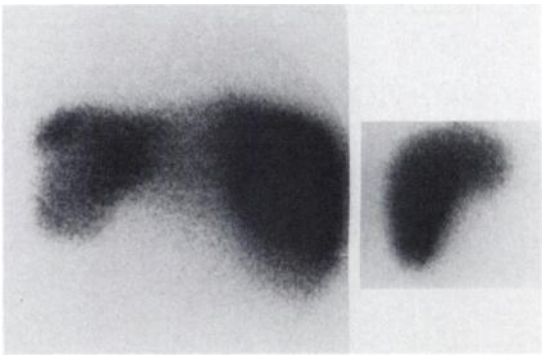

FIG. 2. Posterior L/S scan indicates apparent defect in lateral margin of spleen (left). Other projections did not establish whether this defect was real or was secondary to overlying left lobe of liver. SSS showed that "defect" was due to liver (right).

g for 5 min. The plasma and buffy coat were removed. Approximately 8–10 mCi of [^{99m}Tc]pertechnetate was added to the RBC fraction, vortexed gently, and allowed to incubate at room temperature for 5 min. Normal saline was added to bring the volume to the original volume. The RBCs were resuspended by vortexing gently. The tube was heated for approximately 35 min at 49°C in a water bath with constant agitation. This mixture was then centrifuged at 1150 *g* for 5 min and the plasma-saline layer removed. Sufficient 0.9% saline was added to bring the sample back to original volume, and 5 mCi of the Tc-99m-labeled heat-damaged red cells were reinjected into the patient. A small aliquot of this solution was used to determine labeling efficiency which ranged from 95 to 97.5%.

In six of seven patients, the LS and SSS were performed 2 wk after the LS image, and a previous LS image had been performed 6 mo earlier. Original interpretations were recorded, and patient records were reviewed.

RESULTS

Seven patient records were reviewed. The clinical data, LS image interpretation, SSS interpretation, and follow-up are presented in Table 1. In six of seven patients the SSS was of additional value in clarifying the equivocal defect in the spleen on LS image. In three patients (Cases 1, 2, and 3), the SSS was interpreted as normal and clarified the equivocal abnormality on LS image. In one patient (Case 4), the SSS was interpreted as equivocal and was of no additional value. In three patients (Cases 5, 6, and 7), the SSS demonstrated definite defects clarifying the equivocal abnormality on LS image.

TABLE 1

Case	Age/Sex	Presenting symptom/sign	LS image	SSS	Followup
1 Fig 1	21 M	Blunt trauma to LUQ, severe LUQ pain & tenderness	Equivocal splenic defect	Normal	Discharged; without sequelae at 1 mo
2 Fig 2	21 M	Motor vehicle accident, LUQ tenderness	Equivocal splenic defect	Normal	Discharged; without sequelae at 3 mo
3	20 M	Motor vehicle accident, LUQ pain & tenderness	Equivocal splenic defect	Normal	Discharged; without sequelae at 1 mo
4	42 M	Sudden pain in LUQ with fever, chills, and drop in hematocrit	Equivocal splenic defect	Equivocal splenic defect	Undetermined diagnosis
5 Fig 3	10 F	LUQ pain with endocarditis	Equivocal splenic defect	Multiple defects	Splenic infarctions (clinical diagnosis)
6	32 M	Acute LUQ pain during exercise, with no history of trauma	Equivocal splenic defect, splenomegaly	Multiple defects, splenomegaly	Multiple new infarcts (histopathological diagnosis)
7 Fig 4	30 F	Blunt trauma	Equivocal abnormal inframedial contour (LS scan six months earlier was normal)	Definite abnormal contour	Congenital lobulation (surgical diagnosis)

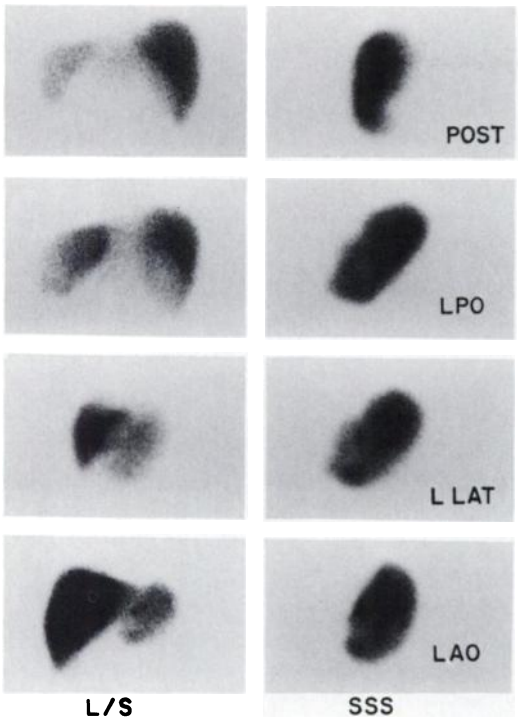

FIG. 3. Multiple views on LS image suggest defect in antero-inferior pole of spleen (left). SSS confirms presence of this defect (right) and shows additional defects in anterior margin of spleen, not seen on LS image. These are best seen in LPO and left lateral images. See text for discussion.

In those three the SSS also demonstrated other defects besides those seen on the LS image.

DISCUSSION

In Cases 1, 2, and 3 with normal SSS, the equivocal splenic abnormality on LS image was retrospectively attributed to an overlying left lobe. This has been reported previously as a cause of false-positive defects in spleen on LS images, and various remedies (multiple images [*15*], standing images, [*16*,*17*], caudal-tilt images [*2*]) have been suggested to clarify this dilemma. Unfortunately, these measures do not always resolve the problem, and they cannot always be used. In such situations the SSS was of value. We did not perform caudal-tilt images, which might have been helpful in these cases. In addition, we do not believe that better intensities on LS image would have clarified the equivocal defects.

In Case 5 the SSS demonstrated not only a definite defect in the area of the antero-inferior equivocal defect on the LS image, but also multiple defects not seen on the LS image. Although the SSS was performed with a higher-resolution collimator than the LS image, and although intensities of the spleen on the LS image may have been more suitable, we do not believe this can account for the ability of the SSS to detect the defect, not seen on LS image, in the superior anterior margin of the spleen. We again attribute this to masking by the left lobe of the liver.

Case 6 (not shown) is similar to Case 5. Although more suitable intensities may have maximized the value of the LS image, the value of the SSS was again in part attributed to the absence of the liver shadow.

In Case 7, the technique, camera, and/or collimator cannot, we think, account for the failure of the LS image to detect the superior lateral defect. Better intensities would not have demonstrated the defect, and the LS images were performed with equal or higher resolution in the imaging system. Although poorly demonstrated in the reproduction images in the article, the original SSS shows faint activity in the liver, and this activity extends superolateral to the abnormality in the spleen on SSS. We suggest that when Tc-99m sulfur colloid is used, the relative activity in the overlying liver tissue and in the spleen combine to give the appearance of a smooth contour in the superolateral aspect of the spleen. In regard to the inferomedial defect, the SSS also demonstrated the abnormality better, but this superiority may be more apparent than real, since intensities were not ideal.

Although previous reports caution the physician against interpreting a spleen defect that is secondary to overlying left lobe of the liver, Cases 5 to 7 emphasize that the left lobe of the liver may mask an abnormality. Although extra views may reveal the abnormality, the physician will have difficulty in selecting the patients who need extra views.

Case 7 also emphasizes—as Smidt et al. have previ-

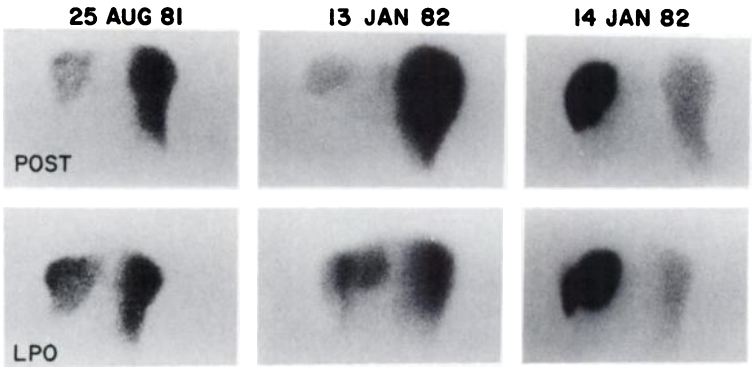

FIG. 4. SSS demonstrates two definite defects in superior lateral and inferior margins of spleen on 14 January 1982. The former was not detected on liver/spleen images of 25 August 1981 and 13 January 1982, and the latter was equivocal on liver/spleen image of 13 January 1982. Surgery confirmed presence of congenital lobulation corresponding to the SSS scan. See text for discussion.

ously reported (*18*)—that supposed spleen defects may be due to congenital deformities.

During the review period from February 1981 to June 1982, we estimate a maximum of 25 patients were studied to evaluate only the spleen. Six of the seven cases in this report were done for that purpose alone. Thus, the LS image had an equivocal splenic defect in six of an estimated 25 cases (24%) performed for specific evaluation of the spleen. Since the SSS clarified an equivocal splenic defect on LS image in five of 25 scans (20%), and since we are uncertain of the number of defects on LS image that were masked by the left lobe of the liver, we recommend, and now perform, the SSS as the initial study of choice when specifically evaluating spleen and when the clinical situation and preparation time allow. If an equivocal defect is noted in the spleen on the LS image, SSS should be considered along with transmission computer tomography and/or ultrasound in the further study of the equivocal splenic defect. A prospective study with rigid control of imaging technique must be performed to determine sensitivity and specificity of the LS radionuclide image (planar and tomographic), SSS (planar and tomographic), ultrasound, and/or transmission computerized tomography in the evaluation of the spleen. With such data, each individual institution could better determine its own diagnostic approach, based on prevalence of disease, radiopharmaceutical preparation time, expertise, etc.

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