DYNAMIC IMAGING OF THE SPLEEN

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Dynamic spleen imaging using a radiocolloid and an Anger camera has enabled us to evaluate the hepatic border of the spleen more accurately than if only static projections were done. This is due to the predominately venous blood supply of the liver while the spleen is supplied by arterial means. Also, certain avascular defects are shown more clearly when an appropriate flow study is done. The procedure is noninvasive and can be done as part of the routine static evaluation of the spleen.

The use of appropriate radiocolloids in spleen imaging has been widely adopted (*1,2*). It has been pointed out that the routine use of radiocolloid spleen scanning has one relative disadvantage: A majority of the radioactive colloid is cleared by the liver and, in patients who have significant enlargement of the left lobe of the liver, this may obscure the splenic outline (*3*). Because the liver has a dual blood supply that is largely venous, the spleen, which is supplied by the splenic artery, may be expected to appear before the liver (*4*). Thus a kinetic study may define the splenic border more clearly.

We have investigated the use of dynamic imaging to assess more accurately the splenic borders and also to determine the relative vascularity of splenic defects.

MATERIALS AND METHODS

Forty-six patients were studied as follows: With patients in either posterior or left anterior oblique positions referable to the Anger camera crystal, 10 mCi of ^{99m}Tc-sulfur colloid were injected in the anterior cubital fossa as an intravenous bolus. The position was selected based upon the suspected areas of involvement or patient safety considerations. A 4,000-hole 140-keV collimator was used in all cases. Five-second Polaroid exposures were obtained as well as 2-sec 70-mm exposures for 1 min. A 600,000-count static study was done immediately and 5 min after the dynamic procedure without moving the patient.

Additional right and left oblique views were done as well as the anterior, posterior, and lateral projections of a standard static study. The liver was also routinely studied at this time. During the study, information was continuously recorded on a digital computer magnetic tape system.

The static studies were interpreted before and after the inclusion of the flow or dynamic portion. Followup was obtained by surgery, angiography, or, when adequate, the clinical course.

RESULTS

A normal posterior flow study is shown in Fig. 1. The kinetic relationships of lung, aorta, kidney, liver,

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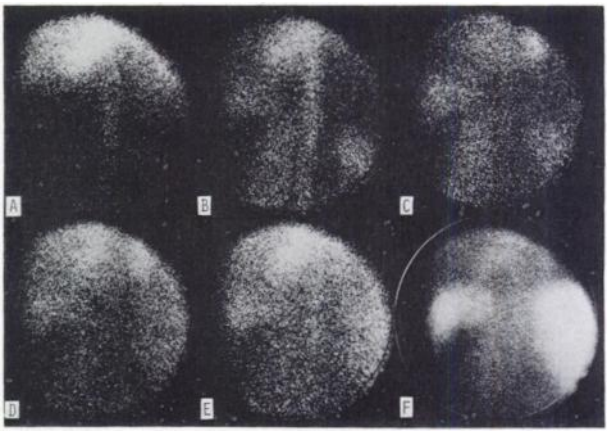

FIG. 1. Technetium-99m-sulfur colloid spleen flow done with patient supine. Note delayed hepatic uptake and early renal appearance.

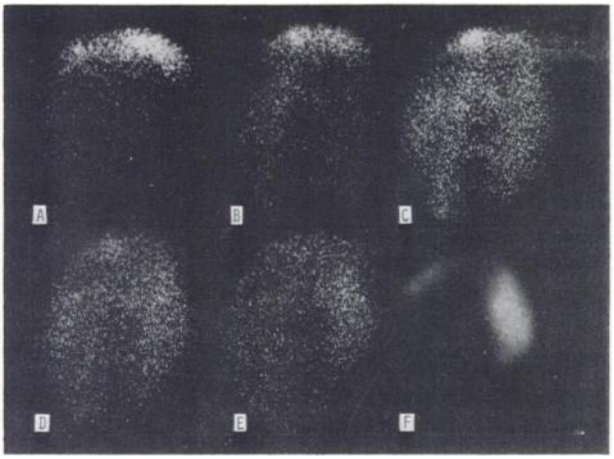

FIG. 2. Spleen flow in left anterior oblique position.

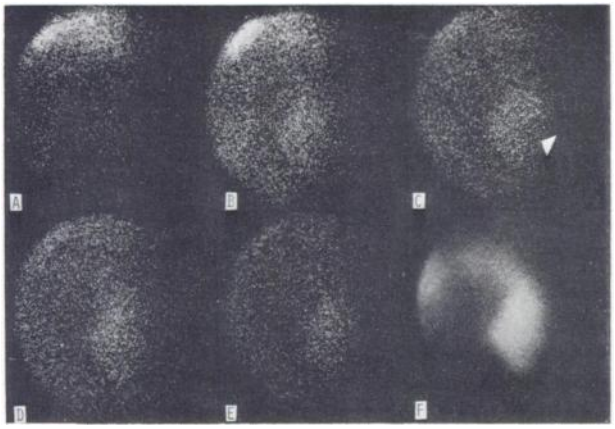

FIG. 3. Spleen flow in left anterior oblique position showing defects on inferior lateral aspect and superior medial aspect of spleen in patient with splenic hematoma.

and spleen are noted, especially the delayed hepatic appearance.

Figure 2 shows normal flow in the LAO position. Of interest is the visualization of splenic and renal arteries, which are occasionally noted.

An avascular area secondary to splenic hematoma is shown in Fig. 3. The inferior lesion is seen only on the flow portion whereas the superior lesion is noted on both. These lesions were confirmed at surgery.

Figure 4 shows an unusual configuration due to the superposition of the left lobe of the liver and spleen. The flow study was again helpful in showing the extent of the spleen because of the delayed hepatic uptake.

Figure 5 is a digital representation of the flow kinetics of the major organs in this area in a patient with no splenic or hepatic pathology.

DISCUSSION

Dynamic imaging of the spleen using 10 mCi of ^{99m}Tc-sulfur colloid has proven useful in separating the spleen from the liver and lung, thus allowing a more accurate appraisal of the hepatic border of the spleen. In several cases a poorly defined avascular area on the static projection was more clearly defined on the flow portion of the study. This may be due to the early phase of the study that mainly visualizes vascular elements and the later static view that shows primarily reticuloendothelial accumulation.

The position of the patient for the flow study was determined by patient considerations. If the suspected area of involvement was anterior, then the LAO flow was chosen. If posterior, then a posterior flow was done. When the suspected site was not precisely known, a posterior flow was chosen. Generally, the posterior flow study gave greater image clarity, probably because the posterior location of the spleen allows for a more ideal geometric relationship to the detector.

The radiation burden is less than 4 rads to the liver (*5*). In most studies a counting rate of 100,000–200,000 cpm is obtained.

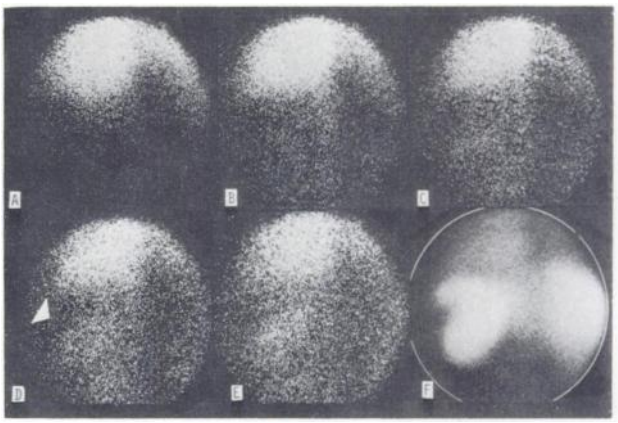

FIG. 4. Normal posterior study showing delayed uptake in left lobe of liver. This allows for inspection of superior border of spleen.

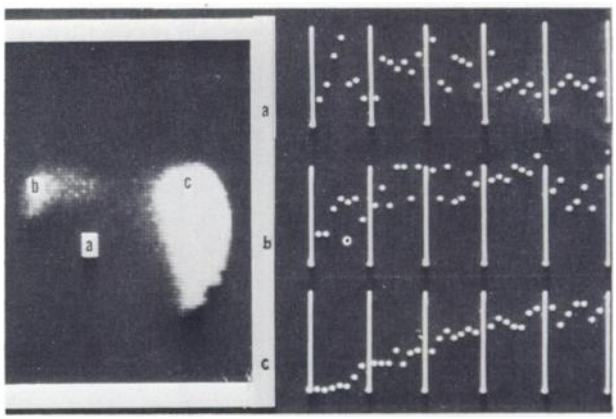

FIG. 5. Area-of-interest computer plot of counts versus time in normal subject whose study is shown in Fig. 1. Each dot represents 2 sec of accumulation counts. (A) kidney, (B) spleen, and (C) liver.

The ability to compare suspicious areas on the late static view accurately with areas of decreased perfusion on the dynamic study is simplified when using a colloid in the 50–300 millicron range. Several early attempts to correlate splenic anatomy with surrounding organs, using ^{99m}Tc-albumin or ^{99m}Tc-pertechnetate, were not successful because no reticuloendothial uptake occurs when a purely intravascular marker is used. A colloid has the advantage of giving early vascular information as well as later anatomic detail. In fact, if transparent film is used in the study, one must only superimpose the reticule to compare the vascular anatomy seen on the dynamic study with the reticuloendothelial distribution noted on static examination.

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