Acute Gastrointestinal Hemorrhage Detected by Selective Scintigraphic Angiography

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Intra-arterial ^{99m}Tc colloid scintigraphy may have greater sensitivity than either standard intravenous scintigraphy or selective arteriography in detecting gastrointestinal bleeding. Ten millicuries of ^{99m}Tc colloid were administered directly into the superior and inferior mesenteric arteries (SMA and IMA) of patients who had undergone selective arterial catherization for the evaluation of gastrointestinal bleeding. In one patient, ^{99m}Tc-albumin colloid was administered directly into the IMA and identified diverticular bleeding. The bleeding had been occult to prior contrast arteriography and refractory to selective intra-arterial Pitressin® therapy. In a second patient who had undergone three negative provocative angiograms, selective SMA injection of ^{99m}Tc-sulfur colloid identified occult mesenteric varices secondary to portal hypertension. Selective intra-arterial scintigraphy should be valuable in detecting intestinal bleeding occult to conventional studies. This will help in directing further therapy and diagnostic evaluation.

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The detection of acute gastrointestinal hemorrhage by either intravenous sulfur colloid or contrast arteriography is dependent upon the rate of extravasation and the amount of the imaging agent delivered. Intravenous ^{99m}Tc-sulfur colloid scintigraphy has been reported to be five to ten times more sensitive in detecting lower gastrointestinal bleeding than contrast arteriography. In a dog model, Alavi et al. reported detecting a bleeding rate of 0.05 ml/min with scintigraphy, whereas Baum et al. reported a rate of 0.5 ml/min with contrast angiography (*1,2*). Therefore, intravenous sulfur colloid scintigraphy has been employed as a screening technique in order to localize the region of hemorrhage; however, follow-up contrast arteriography may be negative in more than 50% of patients with scintigraphic evidence of bleeding. This is because the hemorrhage is either not detectable, has ceased, or originates in the venous system which is poorly demonstrated by arteriography (*3*). In a recent animal study, Denham et al. reported that intra-arterial ^{99m}Tc-sulfur colloid scintigraphy may have greater sensitivity than either standard intravenous scintigraphy or selective arteriography in detecting gastrointestinal bleeding (*4*). They predicted that this approach may prove useful in the evaluation of patients with acute lower gastrointestinal bleeding in whom arteriography is negative but have a catheter still in place or in the follow-up of patients receiving intra-arterial Pitressin® infusion.

The following reports describe the clinical application of selective intra-arterial scintigraphy.

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CASE REPORTS

Patient 1

A 77-yr-old male presented with complaints of two to three loose bowel movements each day for 10 days. Twenty-four hours prior to admission he had experienced rectal bright red blood which was associated with a syncopal event. The physical exam was remarkable for signs of significant volume depletion and guaiac positive stool. The abdominal exam was benign.

Despite transfusion therapy with two units of packed red blood cells, the patient's hematocrit decreased 10% within 12 hr. A flexible sigmoidoscopy exam to 30 cm showed blood and diverticulosis but failed to identify the focus of bleeding. A conventional ^{99m}Tc-sulfur colloid scan was positive for extravasated activity in the region of the descending colon (Fig. 1). Subsequent selective contrast arteriography of the mesentary was negative; however, given the sulfur colloid study, a catheter was left within the inferior mesenteric artery (IMA) for the administration of Pitressin®.

Despite selective intra-arterial Pitressin® therapy, the patient continued to pass rectal blood. Ten millicuries of ^{99m}Tc-albumin colloid were subsequently injected directly into the IMA catheter and dynamic scintigrams of the abdomen were obtained according to the same protocol used for a standard intravenous study (Fig. 2). Extravasated activity was identified in the left lower quadrant following the venous phase of IMA circulation. This activity persisted on delayed images and radioactivity was identified within bloody stool passed by the patient. A curative left hemicolectomy was subsequently performed. The gross specimen showed diverticulosis.

Patient 2

A 38-yr-old man with a previous history of total colectomy and ileorectal anastomosis for diverticular disease presented with several episodes of massive gastrointestinal bleeding. These epi-

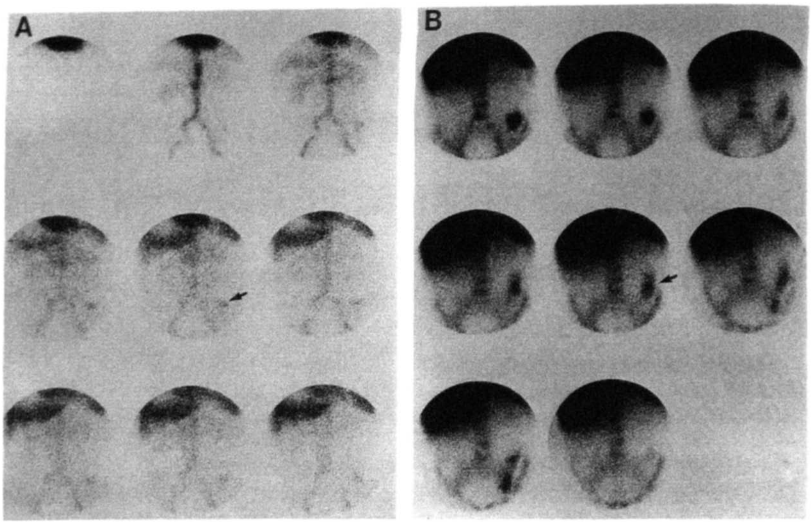

FIGURE 1. (A) Technetium-99m-sulfur colloid (10 mCi) was injected as an intravenous bolus followed by dynamic abdominal imaging at 3-sec intervals. (B) Extravasated activity appeared immediately in the left lower quadrant and continued to accumulate during static imaging (arrow).

sodes had occurred intermittently over the preceding months and prior diagnostic evaluation had included upper and lower endoscopy as well as several intravenous sulfur colloid and tagged red cell bleeding scans. The patient also underwent two provocative angiograms in which heparin, urokinase, and vasodilators were administered directly into the superior mesenteric artery. All diagnostic procedures failed to demonstrate a site of occult bleeding. During the current episode, a third provocative angiogram was also negative.

Intra-arterial scintigraphy was performed by administering 10 mCi of ^{99m}Tc-sulfur colloid directly into the superior mesenteric artery (SMA). This demonstrated significant extravasation of activity in the left lower quadrant (Fig. 3). A subsequent superselective contrast angiogram of the corresponding SMA distribution identified mesenteric varices during the venous phase. Hepatic vein pressure measurements confirmed portal hypertension due to previously unrecognized alcoholic cirrhosis.

A laparotomy confirmed the diagnosis; however, the mesenteric varices were so extensive that resection was not possible.

DISCUSSION

In a preliminary study with dogs, Denham et al. directly compared the sensitivity of selective intra-arterial injections of ^{99m}Tc-sulfur colloid to both intravenous ^{99m}Tc-sulfur colloid and standard contrast arteriography (*4*). While there were significant technical problems with using a dog model to simulate a controlled gastrointestinal bleed-

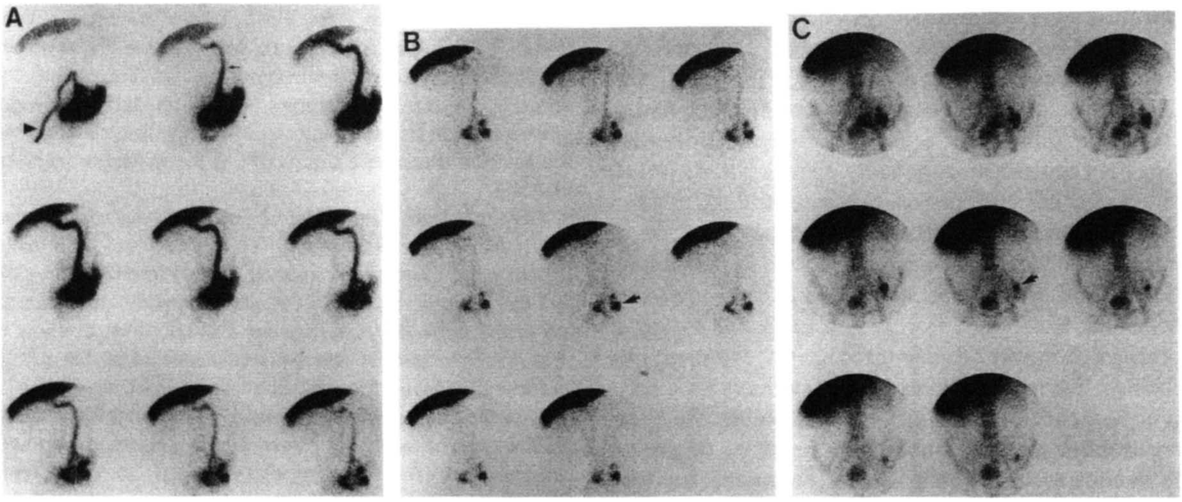

FIGURE 2. (A) Technetium-99m-albumin colloid (10 mCi) was injected directly into the IMA via an indwelling catheter (arrow head) followed by dynamic abdominal imaging at 3-sec intervals. Liver activity from the previous study was apparent. Portal vein activity (small arrow) was observed 3 sec after injection. (B, C) The late dynamic images and subsequent delayed images demonstrated persistent activity in the left lower quadrant consistent with extravasation (short arrow). Bleeding diverticula were identified on laparotomy.

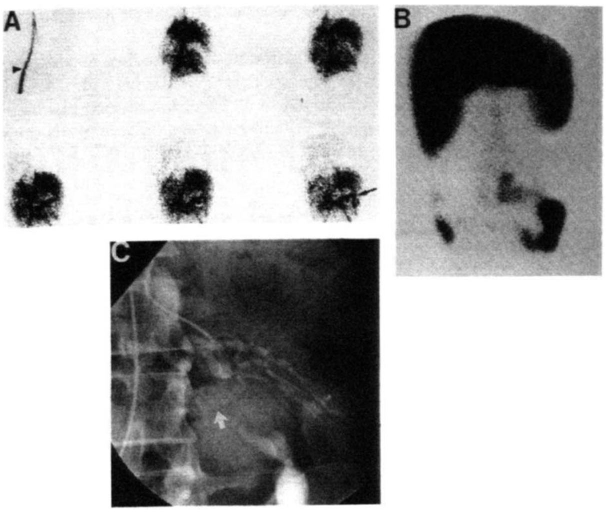

FIGURE 3. (A, B) Technetium-99m-sulfur colloid (10 mCi) was injected directly into the SMA via an indwelling catheter (arrow head) followed by dynamic abdominal imaging at 5-sec intervals. The venous phase (arrow) and a static image at 10 min demonstrated significant extravasation within the left lower quadrant. (C) Multiple mesenteric varices (white arrow) secondary to portal hypertension were identified on the subsequent superselective angiography.

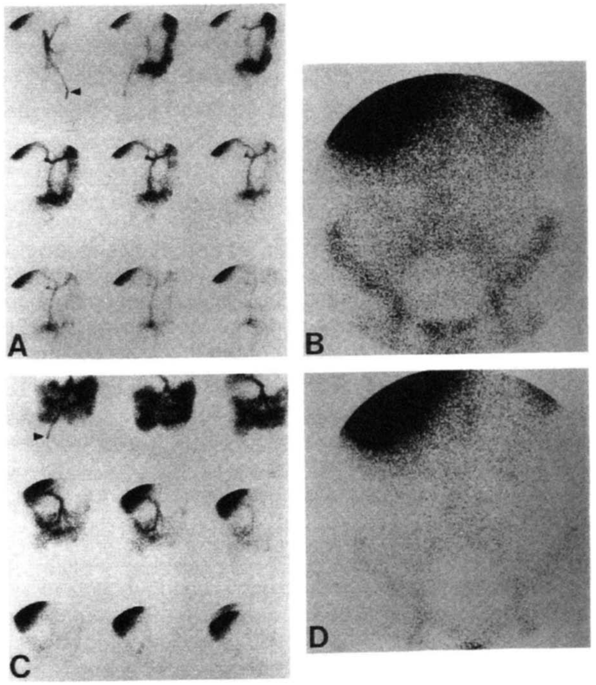

FIGURE 4. (A, B) Technetium-99m-sulfur colloid (10 mCi) was injected directly into the IMA via an indwelling catheter (arrow head) followed by dynamic abdominal imaging at 5-sec intervals. The dynamic series demonstrated normal IMA distribution with prompt transit and washout of the injected activity. There were no focal accumulations of activity remaining on the static 10-min image. (C, D) Dynamic and static 10-min images demonstrated normal SMA distribution and washout following selective sulfur colloid injection.

ing, preliminary results suggested that intra-arterial scintigraphy was superior to both intravenous and contrast arteriography at bleeding rates of 0.4 to 1.0 ml/min. This group proposed that the intra-arterial technique may be clinically useful in the detection of acute bleeding at the time of a negative arteriogram or in the follow-up of patients receiving intra-arterial Pitressin® therapy (*4*).

The cases presented here confirm the clinical potential of selective intra-arterial scintigraphy. In the first patient, negative arteriography was followed by the IMA injection of ^{99m}Tc-albumin colloid. This correctly identified the site of hemorrhage and confirmed continued bleeding despite treatment with intra-arterial Pitressin®. The second case demonstrated the ability of the arterial scintigraphy to detect a venous gastrointestinal bleed that had been occult to multiple provocative angiographic maneuvers and standard intravenous scintigraphy. It directed further subselective angiography, enabling the diagnosis of mesenteric varices.

While a controlled clinical comparison between the various imaging modalities was not attempted, in the above two cases selective intra-arterial scintigraphy clearly identified sites of hemorrhage that were not detected by selective angiography.

Selective IMA and SMA scintigraphy was performed in a third patient with gastrointestinal bleeding following negative standard ^{99m}Tc-sulfur colloid scans and arteriograms. The intra-arterial injections of the ^{99m}Tc-sulfur colloid were also negative, but these injections demonstrated the normal scintigraphic angiogram of the IMA and SMA distributions. There was prompt transit and washout of the injected activity. There were no focal accumulations of activity remaining on delayed images (Fig. 4).

The intra-arterial route of administration is only advantageous during the short period that the injected dose is present within the selective circulation. Labeled colloid was used as the intra-arterial agent in both this study and in the experimental work performed by Denham because of its rapid clearance from the vascular pool; however, since detecting a hemorrhage is dependent upon both the rate of extravasation and the amount of the imaging agent delivered, the larger dose and volume injected in red cell imaging may increase the probability of detecting the bleeding site. The technique itself may be performed as an adjunct to standard selective angiography. Since the catheter is already in place, there is no additional risk to the patient.

In conclusion, this technique should be valuable in detecting intestinal bleeding occult to conventional studies. This approach may prove particularly useful in the evaluation of patients with acute lower gastrointestinal bleeding in whom arteriography is negative but a catheter is still in place or in the follow-up of patients receiving intra-arterial Pitressin® infusion. This will help in directing further therapy and even further diagnostic evaluation.

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SELF-STUDY TEST
Gastrointestinal Nuclear Medicine

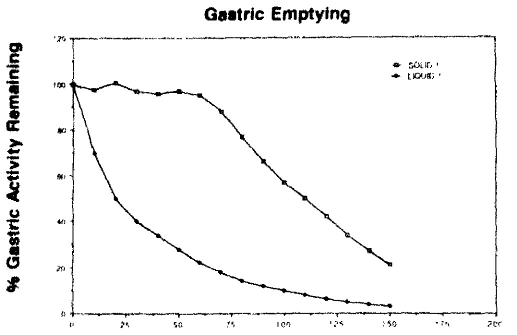

Figure 19B

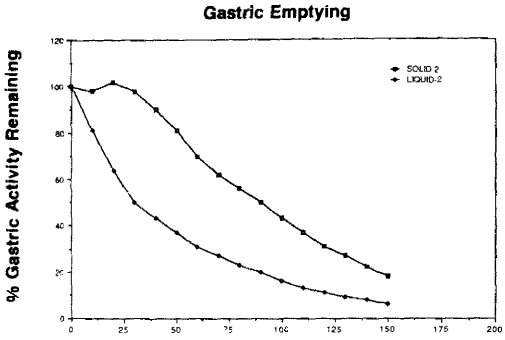

Figure 20B

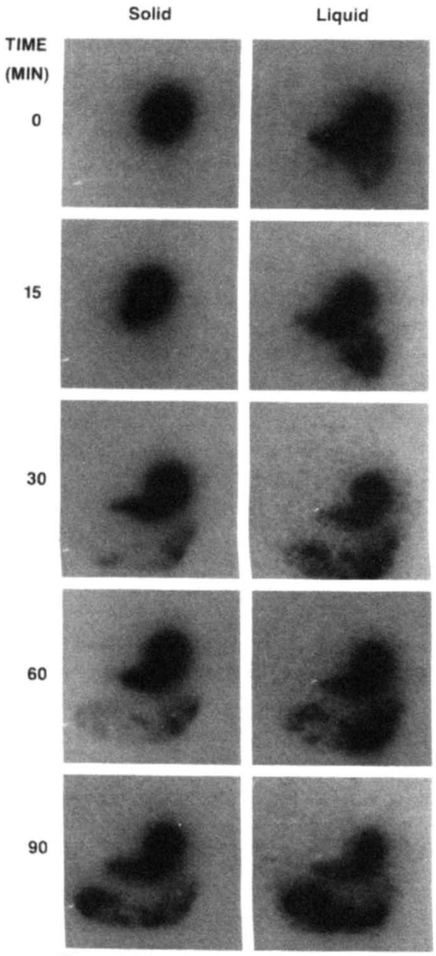

Figure 20A

TABLE I

	Study 1	Study 2	Study 1	Study 2
	Liquids*		Solids†	
$T_{1/2}$ (min)	25	30	105	90
Normal	< 45 min		< 110 min	

*300 ml water with 150 μCi ^{111}In-DTPA.
†Sandwich: two eggs scrambled with 300 μCi ^{99m}Tc-sulfur colloid and toast.

You are shown images (Fig. 21) at 1, 60, and 90 min, respectively, after ingestion of 1 g of sucralfate labeled with 10 mCi ^{99m}Tc-human serum albumin (HSA). This patient has had endoscopy and there is biopsy evidence for reflux esophagitis and Barrett's esophagus. Which of the following statements concerning the findings in this study are true?

30. The activity seen in the distal esophagus at 60 min is most likely due to concentration of free [^{99m}Tc]pertechnetate by ectopic gastric mucosa.

31. The subject likely has unhealed ulcerations due to reflux esophagitis.

32. The activity in the distal esophagus at 1 min (arrow) could be due to impaired esophageal clearance of the tracer.

33. There is evidence for diffuse erosive gastritis.

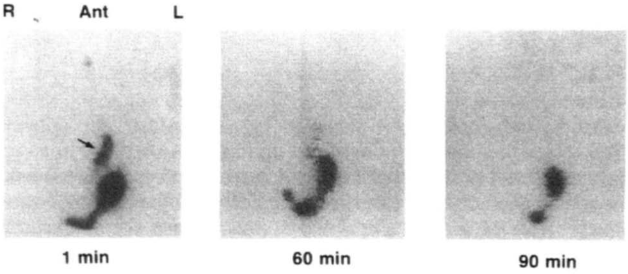

Figure 21

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