Delayed Positive Gastrointestinal Bleeding Studies with Technetium-99m-Red Blood Cells: Utility of a Second Injection

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Two patients studied with technetium-99m-labeled red blood cells (RBCs) for gastrointestinal bleeding had positive findings only on 24-hr delayed images, at which time the site of bleeding could not be ascertained. In each instance, when additional delayed images suggested that active bleeding was occurring, a second aliquot of RBCs was labeled and injected. Sites of active hemorrhage were identified following further imaging in both patients. When delayed GI bleeding images are positive, further views should be obtained to ascertain if the pattern of intraluminal activity changes. If renewed active hemorrhage is suspected, reinjection with a second dose of labeled RBCs may identify the bleeding site.

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Scintigraphy with technetium-99m-labeled red blood cells (^{99m}Tc-RBCs) is commonly employed to investigate patients presenting with gastrointestinal (GI) hemorrhage from an unknown site (*1–7*). Although frequent serial images are obtained during the first 1–2 hr following injection of labeled RBCs, as many as 47% of positive GI bleeding studies detect extravasated RBCs only on images obtained 4–24 hr postinjection (*1–6*). These later images often demonstrate activity distributed throughout the colon, with the site from which the blood originated uncertain.

Two cases are presented in which delayed GI bleeding study images demonstrated accumulated colonic activity but also suggested the presence of active bleeding. In both cases, reinjection of the patient with a second dose of labeled RBCs demonstrated a site of active hemorrhage. The potential utility of a second radiotracer injection in patients with late positive GI bleeding studies will be discussed.

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CASE REPORTS

Case 1

Fifteen days following two resections of ischemic distal ileum, an 80-yr-old male began passing bright red blood and clots per rectum. A GI bleeding study with 851 MBq ^{99m}Tc-RBCs labeled by the modified in vitro technique (*8*) showed no definite site of bleeding up to 90 min, but a late delayed image at 24 hr revealed intraluminal accumulation of labeled cells extending from the transverse colon throughout the descending and sigmoid colon (Fig. 1). A focus of activity was also noted inferior to the right lobe of the liver, which appeared distinct from the colonic activity, and on an additional anterior image obtained 15 min later, activity at this site appeared somewhat more intense. This finding suggested that active bleeding was occurring, but the low count rate made it difficult to follow movement of activity to determine whether the bleeding site was in the transverse colon or possibly more proximally in the small bowel. In an attempt to clarify this matter, a second aliquot of RBCs was labeled with 777 MBq ^{99m}Tc and the cells were reinjected approximately 30 min after the last delayed image. The right upper quadrant focus of bleeding was identified on the immediate blood-pool image following the second injection, and the pattern of movement of the blood over the next hour indicated that the bleeding site was in the colon near the hepatic flexure. An area of deserosalized proximal transverse colon that had been oversewn during the patient's second surgery was considered the most likely source for the bleeding.

Case 2

A 56-yr-old male with past history including a subtotal colectomy for recurrent bleeding and polyposis, found to include Duke's B2 colon carcinoma and multiple telangiectasia in the gastric antrum seen on esophagogastroduodenoscopy, was admitted to the hospital following several days of recurrent melanotic stools. Nasogastric aspirate was negative on admission. A GI bleeding study with 740 MBq ^{99m}Tc-labeled RBC showed no definite site of bleeding up to 90 min. Delayed images at 24 hr postinjection demonstrated a collection of labeled RBCs in the right colon as well as a site of increased activity in the left upper quadrant that appeared to show increased activity on a subsequent image done 30 min later (Fig. 2). Because the patient appeared to be actively bleeding during this interval, an additional sample of blood was drawn, labeled with 925 MBq ^{99m}Tc, and reinjected. Serial images up to 50 min were unremarkable, but between 50 and

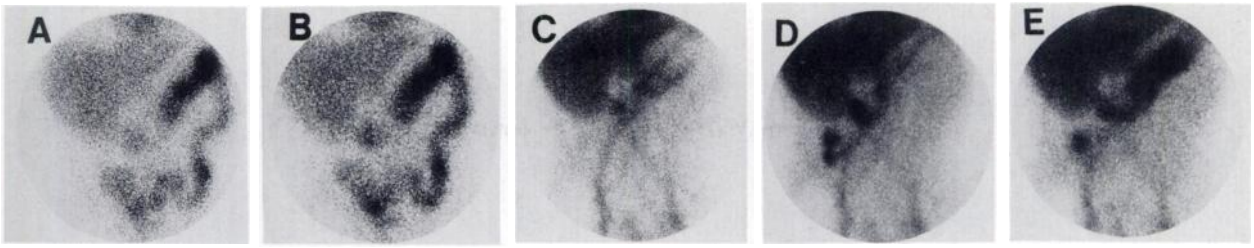

FIGURE 1
Case 1. (A) 24-hr delayed image (10-min acquisition time; 180,000 counts) reveals labeled RBCs from the mid-transverse colon distally as well as a focus of activity in the region of the hepatic flexure. This latter focus appears somewhat more intense on the follow-up image (B) 15 min later. Following injection of second dose of labeled RBCs, hepatic flexure focus was evident at 1 min. Subsequent images at 10, 20, and 60 min postinjection (C–E) demonstrate antegrade and retrograde movement of intraluminal activity within the colon.

60 min, a site of increased activity appeared in the left upper quadrant. Over the next 30 min, there was further accumulation of labeled RBCs in this location in a pattern consistent with filling of the gastric fundus, with movement of activity into the right and then left upper quadrant with the appearance of the proximal small bowel. Subsequent nasogastric aspiration confirmed the presence of blood in the stomach. However, angiography performed several hours after the radionuclide study was unable to identify active bleeding. The site of bleeding was presumed to be the abnormal vascular elements seen previously in the gastric antrum.

DISCUSSION

The intermittent nature of most gastrointestinal hemorrhage makes the scintigraphic evaluation of patients presenting with this complaint difficult and often frustrating. Scintigraphy using ^{99m}Tc-sulfur colloid can detect active bleeding occurring during the first 10–15 min postinjection (*11–13*). However, because imaging with ^{99m}Tc-labeled RBCs can be performed for approximately 24 hr, this agent is generally better suited for detection of typically intermittent GI bleeding (*1–7, 14*). Indium-111-labeled RBCs have been used to provide an imaging window several days longer than ^{99m}Tc-RBCs (*15*), but experience with this tracer is limited.

In radiolabeled RBC GI bleeding studies, initial visualization of focal RBC extravasation identifies the region of the abdomen in which bleeding is occurring, while intraluminal progression of activity on subsequent images allows localization of the site of bleeding to either the small or large bowel (*16*). Ideally, frequent serial scintigraphic images should be acquired for as long as necessary to identify both intraluminal extravasation and movement of labeled RBCs. However, there are practical limitations to how long patients who are sometimes unstable can be studied, such that the initial imaging session is usually restricted to the first 60–90 min postinjection. For those studies in which bleeding is not seen on the early images, the time of injection has a definite impact on the timing of later imaging. In general, repeat images are readily obtained every several hours for studies begun in the morning, while patients injected in the afternoon or evening often only have follow-up imaging the next morning unless there is clinical evidence of renewed or increasing hemorrhage during the night. Regardless of the time of later acquisitions, once there has been more than a few minutes interval between sequential images, it may not be possible to associate intraluminal RBC activity with a specific bleeding site, other than to suggest that it is proximal to the locations where activity is visualized. Even identification of a focal site of RBC accumulation

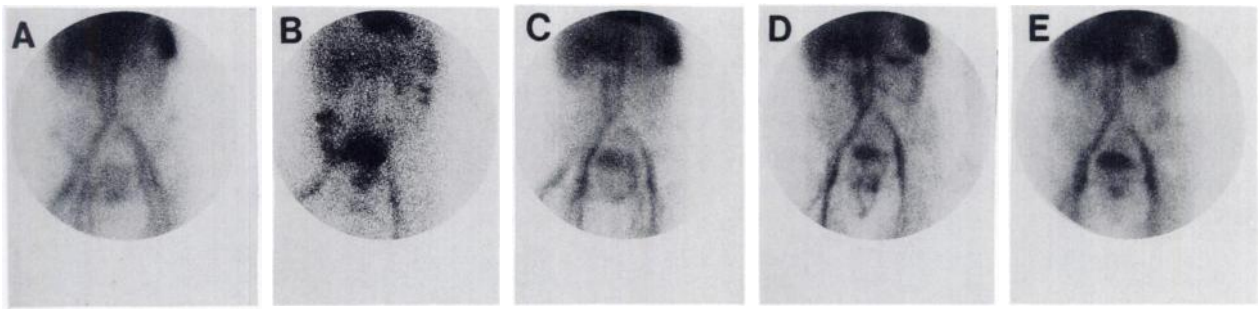

FIGURE 2
Images from Case 2 demonstrate right lower and left upper quadrant abdominal activity at 24 hr (B) that was not present at 1 hr postinjection (A). Images acquired following the second labeled RBC injection demonstrate appearance of focal activity in the left upper quadrant between 50 and 60 min in a pattern suggestive of stomach (C and D) as well as right and left upper abdominal activity suggestive of small bowel. Further accumulation of activity in these locations is evident by 75 min postinjection (E).

with enhancement on later images may not be diagnostic, as this may reflect a site of pooling rather than the actual bleeding focus. Use of a longer-lived radiolabel than ^{99m}Tc, such as indium-111 (*15*), can allow serial imaging over several days, but a longer imaging window does not overcome the uncertainty inherent in interpreting late delayed images which show multiple sites of RBC accumulation.

The present cases represent two of the eight delayed positive GI bleeding studies seen at this institution during a recent two-year period (*17*). As all eight studies did not have multiple serial late images, it is not possible to estimate how often a changing pattern of activity suggestive of current active hemorrhage might have been identified. The decision to reinject was made individually in each of the reported cases. In Case 1, even though increased activity in the region of the hepatic flexure was noted on the serial images, the low count rate and long imaging times precluded observation of movement of activity, making it impossible to rule out a small bowel bleeding site in this patient with known mesenteric ischemia. In Case 2, while the activity pattern suggested an upper GI source, it did not specifically indicate a gastric origin in a patient whose previous nasogastric aspirate and upper endoscopy had not identified active bleeding. The subsequent negative angiography in this case further illustrates the often illusory nature of intermittent GI bleeding.

If a delayed bleeding image shows definite intraluminal accumulation of RBCs, it is prudent to obtain later images over the next 15–30 min to ascertain if additional blood has accumulated focally to suggest that active bleeding may be occurring. If this appears to be the case, but the intensity and distribution of bowel activity is not sufficiently specific to pinpoint the likely bleeding site, reinjection of a second dose of labeled RBCs may provide more definite localization. For reinjections 18–24 hr after the original dose, activity will be 8–16 times greater than that remaining from the first injection, thereby rendering the previously identified extravasated RBCs barely if at all visible for the short imaging times required, while permitting ready visualization of an active bleeding site (Fig. 1). Although ^{99m}Tc-labeled sulfur colloid might be considered as the tracer for a second injection, the results from Case 2, in which the second study only became positive between 50 and 60 min postinjection, suggest that labeled RBCs are superior to sulfur colloid (*14*), even in this limited application.

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