

Scintigraphy with In-111-Labeled Red Cells in Intermittent Gastrointestinal Bleeding

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The site of active intermittent gastrointestinal (GI) bleeding could not be found in a patient until abdominal scintigrams with indium-111-labeled red cells suggested that the bleeding was in the ascending colon. Right hemicolectomy abolished the hemorrhages. The binding of In-111 to the red cell is such that vascular activity could be clearly seen over a 5-day period. Indium-111-labeled red cells might provide an excellent tracer to locate intermittent active GI bleeding.

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The source of intermittent gastrointestinal (GI) bleeding may be difficult to locate, since angiography (1), endoscopy, or Tc-99m sulfur colloid scanning (2) will show hemorrhage only at the time of bleeding.

A tracer that would remain in the circulation long enough to permit repeat imaging might offer a better approach to find the site of intermittent GI bleeding. Indium-111 has a physical half-life of 67 hr and, by virtue of its abundant 173- and 247-keV gamma emission, is ideal for gamma imaging. The In-111-oxine complex is rapidly and efficiently incorporated into the red cell (3).

Serial imaging after injection of In-111-labeled red cells can detect intermittent GI bleeding, as shown in this case history.

METHODS

The red cells of the patient were labeled with In-111 as follows: 10 ml of venous blood were taken into 60 units of heparin and centrifuged for 5 min at 1500 g. The supernatant plasma and buffy coat were removed. The red cells were washed twice with 5 ml of 0.15 M sodium chloride solution. The red cells were then resuspended into 2 volumes 0.15 M sodium chloride.

The In-111 oxine was prepared by the addition of 50 µg of oxine to 1 mCi (37 MBq) of carrier-free In-111 adjusted to pH 5.6 with 0.3 M acetate buffer.

The complex was extracted into an equal volume of chloroform, which was evaporated to dryness in a boiling-water bath. The residue was dissolved in 50 µl of propylene glycol and diluted with 150 µl of 0.15 M sodium chloride.

The red-cell suspension was incubated with 0.5 mCi (18.5 MBq) In-111 oxine complex for 15 min and washed twice with 0.15 M sodium chloride.

The labeling efficiency was 95%. The cells were mixed with the saved plasma and injected intravenously.

Studies in a normal volunteer had shown that the disappearance rate of In-111-labeled red cells from the circulation was 7.1%/day and that up to 5 days after administration ($93 \pm 2.9\%$) (1 s.d.) of circulating radioactivity was bound to the red cells.

CASE REPORT

A 67-year-old man was admitted because of recurrent rectal bleeding, with faintness, sweating, restlessness, and palpitations.

Three days before entry, he had four episodes of rectal bleeding.

On examination, the patient was pale. The blood pressure was 105/60 mm Hg, the pulse was 100/min. Abdominal examination and digital rectal examination were normal. The Hb was 8.9 g/dl. Hemostasis was normal. The nasogastric aspirate was negative. Proctosigmoidoscopy was normal. Total colonoscopy did not locate the origin of bleeding. The barium enema showed ten diverticula on the ascending colon. The barium meal was normal except for a duodenal diverticulum.

After admission, rectal bleeding recurred approximately every 18 hr. Thirteen units of blood were transfused over 7 days to keep the hemoglobin at 10 g/dl.

Abdominal scintigrams performed 10 min and 5 hr after injection of In-111-labeled red cells showed vascular activity but no bowel activity was seen. Rectal bleeding occurred ~22 hr after starting the labeled-RBC test, and an abdominal scintigram performed 24 hr after injection showed activity in the transverse colon. At 30 hr activity was seen in the descending colon, and it is likely that this was the activity previously in the transverse colon. No

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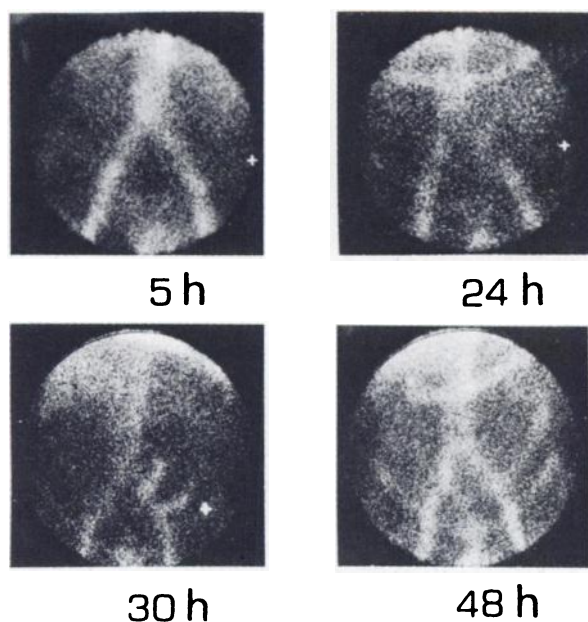


FIG. 1. Abdominal scintigrams at 5, 24, 30, and 48 hr. Note persistent vascular activity. No bowel activity is seen at 5 hr. At 24 hr, activity is seen in transverse colon. At 30 hr it is in descending colon. Radioactivity can again be located in transverse and descending colon at 48 hr. Marks correspond to anterior iliac crest.

rectal bleeding occurred from 24 to 32 hr after injection. However, at 47 hr, in the early morning, the patient again passed blood. One hour later, a scintigram showed activity in the transverse and descending colon.

Selective visceral angiography was negative, but the bleeding had stopped when it was performed. Because the labeled-RBC test suggested that the origin of bleeding was in the ascending colon, a right hemicolectomy was performed.

Examination of the resected hemicolon showed diverticula but did not reveal the site of bleeding. Arteriography of the ileo-caeco-appendicular artery of the resected hemicolon showed, or perhaps induced, a small extravasation at the site of a diverticulum, near the caecum.

Postoperatively, the bleeding did not recur. The disappearance of In-111-labeled red cells from the circulation was followed over a 5-day period. The disappearance rate of In-111 from the circulation, as measured in whole-blood samples, was 7%/day. Activity in the iliac vessels was always clearly seen on the scintigrams.

DISCUSSION

Red-cell labeling with In-111 oxine has not been studied extensively. Nevertheless, the In-111 binds strongly enough to the red cell to permit vascular imaging as long as 120 hr after injection. Bleeding in the GI tract could be detected over 48 hr.

Ideally, the scintigram must be performed at the time of active bleeding, since extravasated blood is unlikely to remain in the bowel at the site of bleeding. Nevertheless, continuous scintigraphic monitoring of the abdomen, waiting for a hemorrhage, is not

practical. This patient was scanned presumably 2 hr and 1 hr after an acute bleeding episode. Although the site of bleeding was definitely in the ascending colon, it had not been possible to locate the site more precisely before the operation. It is likely that the rectal bleeding was a complication of diverticular disease (4).

The sensitivity of a vascular tracer for the detection of acute GI bleeding may be lower than with the Tc-99m sulfur colloid method (1), since background activity is absent in the latter method. Tc-99m sulfur colloid must, however, be injected at the time of bleeding.

Indium is not excreted into the GI tract, and it is unlikely that it will cross the bowel wall once In-111-labeled red cells are digested. During a search for GI bleeding with Tc-99m red cells or Tc-99m albumin, continuous nasogastric suction will be necessary during the imaging period to remove unbound Tc-99m (5, 6). Secretion of pertechnetate in the upper small bowel and in the large bowel has been reported (7), and such unbound technetium could obviously induce erroneous interpretations. The physical half-life of Tc-99m may be too short to detect intermittent GI bleeding. A high elution rate of Tc-99m from the red cell (8) shortens the life of Tc-99m in the peripheral blood still more. In our patient the disappearance rate of In-111 from the circulation was 7%/day.

Absence of secretion of In-111 in the GI tract and its slow disappearance from the circulation after injection of In-111-labeled red cells suggest that In-111-oxine labeling of red cells and subsequent gamma-camera imaging show promise as a means of detecting and locating GI bleeding. The suspected sites can be evaluated further by endoscopy and/or angiography.

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