Gallbladder Visualization During Technetium-99m-Labeled Red Cell Scintigraphy for Gastrointestinal Bleeding

David R. Brill

Section of Nuclear Medicine, Geisinger Medical Center, Danville, Pennsylvania

Localization of radionuclide activity in the gallbladder was seen on delayed views following injection of ^{99m}Tc-labeled red blood cells for gastrointestinal bleeding in five patients. The mechanism for this unusual finding probably relates to labeling of heme, the biochemical precursor of bilirubin. All patients had had prior transfusions. All but one had severe renal impairment, probably an important predisposing factor.

J Nucl Med 26:1408–1411, 1985

Since its original description in 1979(*1*), technetium-99m-(^{99m}Tc) labeled red blood cell imaging has found widespread use in the detection of gastrointestinal bleeding. Numerous communications attest to its sensitivity, specificity, and ease of performance (*1-9*). Recently, three patients have presented in our department in whom unexpected hyperconcentration of radionuclide activity was seen in the gallbladder on delayed images. This report describes those cases and postulates a mechanism for this unusual finding.

In each case, 20 mCi (740 MBq) of ^{99m}Tc-labeled red blood cells were used. Tagging was either by the in vivo method of Pavel et al. (*10*), or the modified in vivo method of Callahan et al. (*11*). All patients were imaged in the anterior projection using a high-resolution, low-energy collimator equipped large-field camera.* Images were obtained at 5-min intervals for the first half hour and less frequently thereafter, depending upon patient and camera availability and upon whether the patient was felt to be actively bleeding.

To determine the prevalence of this finding in our practice and to discern whether there were predisposing factors, we examined all labeled red blood cell scans performed in our institution for gastrointestinal bleeding. This examination uncovered two additional previously unrecognized cases.

Received Dec. 10, 1984; revision accepted Aug. 2, 1985.

For reprints contact: David R. Brill, MD, Section of Nuclear Medicine, Geisinger Medical Center, Danville, PA 17822.

CASE REPORTS

Case 1

A 68-yr-old female with a long history of diabetes mellitus, chronic anemia, and renal failure presented in acute congestive heart failure. Pertinent admission blood values were: hemoglobin = 7.5 g/dl, BUN = 210 mg/dl, creatinine = 6.0 mg/dl. She was treated for her cardiac problems, but on the twelfth hospital day, developed melena and falling hemoglobin levels to 4.8 g/dl, which required transfusion with 14 units of blood over 25 days. Standard radiographic studies and colonoscopy failed to reveal the source of bleeding.

A labeled red cell study (Pavel technique) revealed no abnormalities in the initial images, but showed activity in the colon and gallbladder (Fig. 1) on a 23-hr delayed image.

ERCP was performed to exclude hematobilia, and revealed a completely normal biliary tree and gallbladder. The patient experienced no further acute bleeding episodes, but continued to have heme positive stools and to require occasional transfusions. She was treated with cimetidine and antacids, and gradually stabilized. The source of bleeding was never discovered, and the patient was discharged.

Case 2

A 30-yr-old male with a 16-yr history of end-stage renal disease, three failed renal transplants, chronic cholecystitis, and hepatomegaly secondary to cytomegalic virus infection, was admitted complaining of weakness, diarrhea, and epigastric burning for 2 days. Admission blood studies included BUN = 135 mg/dl, creatinine = 8.0 mg/dl, and hemoglobin = 4.7 g/dl. Gastroscopy revealed gross blood in the stomach. He was immediately transfused with two units of packed cells; the next day imaging with labeled red cells was performed.

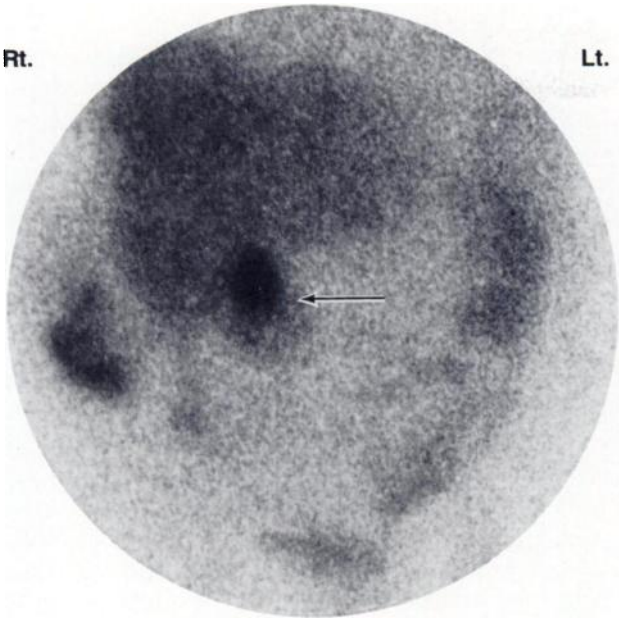

FIGURE 1
Case 1: 23-hr anterior image showing gallbladder (arrow) and ascending colon hyperconcentration

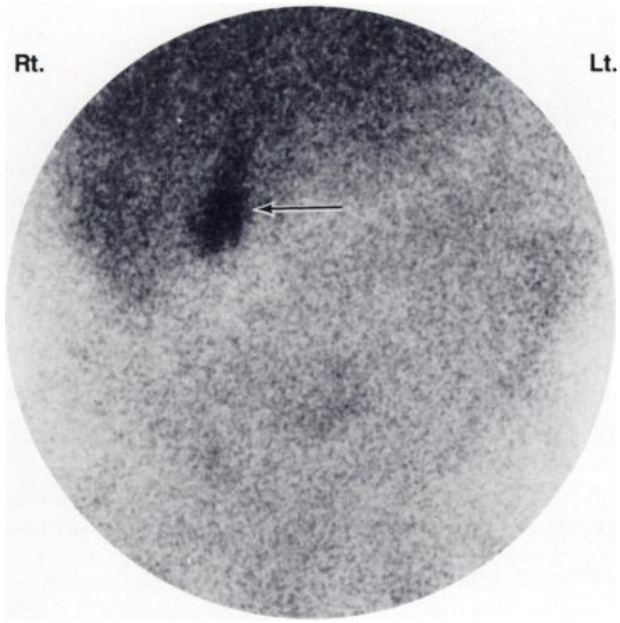

FIGURE 2
Case 2: 19-hr anterior image showing gallbladder (arrow) concentration

A labeled red cell study (Callahan technique) revealed no source of bleeding over 19 hr. Activity was seen in the gallbladder at that time (Fig. 2).

Subsequent to the blood loss study, the patient was stable for a time, but experienced another acute bleed 5 days later. Gastroscopy revealed a mucosal tear in the gastroesophageal junction which was treated with a Minnesota tube. Hematobilia cannot be excluded, but the bleeding can be better explained by this lesion. The patient recovered uneventfully and was discharged.

Case 3

A 66-yr-old female with Down's syndrome and severe mental retardation was admitted with melanotic stools. The week prior to admission, she had been hospitalized with a bleeding doudenal ulcer, for which she received cimetidine, antacids, and transfusion with eight units of blood. Admission blood values included BUN = 21 mg/dl, creatinine = 1.0 mg/dl, hemoglobin = 6.1 g/dl. In this case, there was no history of renal disease.

A labeled red cell study (Pavel technique) was performed, but earlier images revealed no source of bleeding. By 5.5 hr, the most intense concentration was in the right kidney and gallbladder (Fig. 3).

After the scan, the patient was stable for 3 days, but then developed an acute hemorrhage which required laparotomy. An acute duodenal ulcer was identified and oversewn. The gallbladder was normal on inspection. As in Case 2, hematobilia cannot be completely excluded, but the bleeding is better explained by the ulcer, as subsequently, the patient experienced no further bleeding.

Other cases

Review of all 70 prior labeled red blood cell imaging procedures performed at our institution for gastrointestinal blood loss yielded two additional previously unrecognized cases. Both patients were in their late seventies. Both were azotemic (BUNs were 115 mg/dl and 90 mg/dl; creatinines were 5.5 mg/dl and 4.8 mg/dl, respectively). In both patients, the in vivo labeling technique of Pavel was employed and in both, delayed visualization of the gallbladder (20 hr and 4 hr) was found.

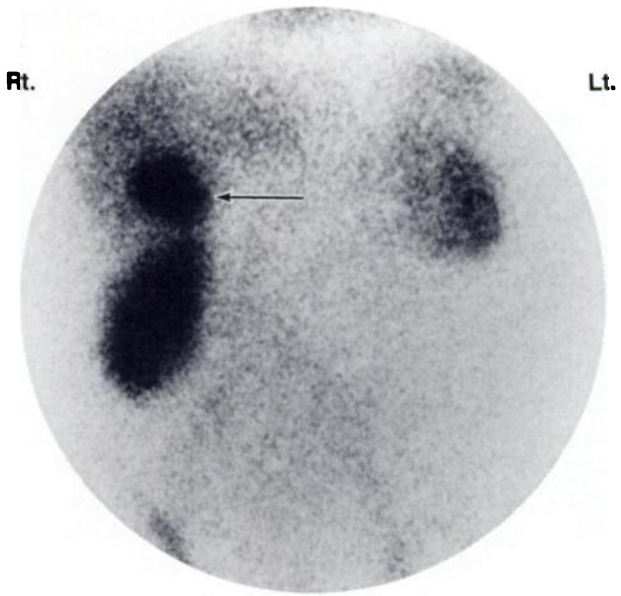

FIGURE 3
Case 3: 5.5-hr anterior image showing concentration in gallbladder (arrow) and right kidney

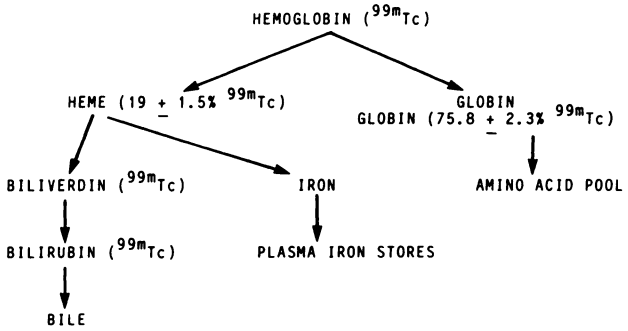

FIGURE 4
Proposed mechanism of concentration of ^{99m}Tc in gallbladder after labeling red blood cells

DISCUSSION

Review of numerous large series of cases (*1-9*) yields no mention of gallbladder visualization during red cell imaging for gastrointestinal bleeding. In fact, there is only one case report of this finding, that of Wood and Hennigan (*12*). Like four of the patients reported here, their patient had chronic renal disease and multiple transfusions, and showed gallbladder concentration on delayed views. Because of the poor condition of our patients, we elected not to stimulate gallbladder contraction, but Wood and Hennigan did, proving that the gallbladder discharged the radioactivity.

The mechanism of bile labeling is probably through the breakdown of hemoglobin to bilirubin (Fig. 4). Dewanjee (*13*) and Rehani and Sharma (*14*) have demonstrated that most of the labeling of hemoglobin occurs on the B globin chains, a portion of hemoglobin that does not contribute to the formation of bilirubin. However, the latter group points out that 75.8 ± 2.3% of the label is on globin, and that 19 ± 1.5% occurs on heme. It is this activity which enters the biliary system, since heme is the biochemical precursor of bilirubin (*15*).

Wood and Hennigan postulate a role for renal disease in this process. Their patient and four of our five patients with this condition had chronic renal failure, but one did not. Another possible explanation is that the five patients presented here and the one reported by Wood and Hennigan had had prior transfusions, raising the question as to whether the fragility of those transfused cells might have caused abnormally accelerated breakdown with unusual concentration of labeled bilirubin in the bile.

To determine the role of renal disease and prior transfusions in gallbladder visualization with labeled heme, we reviewed all prior red cell scans performed in our department for gastrointestinal bleeding. Excluding the five reported here, 65 examinations were performed on 61 patients between 1981-1985. Of these 65 studies, 54 were preceded between 1 day and 3 mo by blood transfusions. It thus seems likely that prior administration of bank blood plays a minor role, if any, in gallbladder visualization of this type.

Twelve of 61 patients not showing gallbladder activity were mildly to severely azotemic, with BUNs ranging between 28-150 mg/dl (avg = 64 mg/dl), and creatinines ranging between 1.6-9.2 mg/dl (avg = 3.7 mg/dl). The average BUN of our five patients exhibiting gallbladder concentration was 111 mg/dl. The average creatinine was 5.2 mg/dl. The difference in average BUN between the two groups was significant ($p < 0.05$), but that of the average creatinine was not. Thus, although Wood and Hennigan's contention that gallbladder visualization during red cell scintigraphy is related to renal disease is very probably correct, the present data do not support a conclusion that this finding is a function of the severity of azotemia. In any case, its presence in a patient with normal renal function (Case 3) suggests that other factors may be involved. Those using the technique of ^{99m}Tc-labeled red blood cells for study of acute gastrointestinal hemorrhage should be aware that radioactivity can be excreted in bile thus gallbladder activity may not represent hematobilia.

FOOTNOTE

*Technicare series 438.

ACKNOWLEDGMENT

The author thanks Messrs. J. Korol, L. Reed, D. Tomaschik, S. Edmeads, R. Beyler, T. Hummel, and Ms. S. Griffith for their technical support in doing the studies, and Ms. J. Blake for typing the manuscript.

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