Tc-99m Sulfur Colloid Scanning in Blunt Trauma: Detection of Abdominal Bleeding

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Tc-99m sulfur colloid scintigraphy can detect and locate active lower gastrointestinal bleeding. The same principles apply to the detection and location of active intra-abdominal or pelvic hemorrhage following blunt abdominal trauma. We report two patients with abdominal bleeding who were correctly diagnosed by this method. As part of the routine examination of all patients having Tc-99m sulfur colloid liver-spleen scans for trauma, 500,000-count images should be made of the rest of the abdomen and pelvis.


Patients who are clinically stable following blunt abdominal trauma are often scintigraphed in the immediate postimpact period. Radionuclide scanning with Tc-99m sulfur colloid is an effective initial method for the detection of significant splenic or hepatic injury (1–4). Radionuclide angiography may precede static imaging for the detection of perfusion abnormalities elsewhere in the abdomen or in the chest (5). In practice, however, imaging with Tc-99m sulfur colloid is usually confined to the upper abdomen.

Sulfur colloid scintigraphy also has been used to detect gastrointestinal bleeding in experimental animals and humans (6–8). If the patient with blunt trauma is actively bleeding at the time the tracer is injected, the potential exists to detect and locate an intra-abdominal or pelvic hemorrhage.

We report two cases in which stable patients with clinically unsuspected intra-abdominal hemorrhage were correctly diagnosed by Tc-99m sulfur colloid scanning of the abdomen.

CASE REPORTS

Case 1. A 47-yr-old man was involved in an automobile accident, striking his chest and upper abdomen on the steering wheel. Examination showed contusions over the left anterior chest and upper abdomen. Vital signs were good (BP 118/80, P 88), and the hematocrit was 45%. A Tc-99m sulfur colloid scan was ordered to exclude injury to the liver and spleen.

Routine multiview images of the liver and spleen were normal (Fig. 1A), but on a 500,000-count anterior image of the abdomen and pelvis there was an abnormal collection of tracer in the central abdomen near the umbilicus (Fig. 1B). This pool of activity appeared confined to the peritoneal cavity on a left lateral image (Fig.

FIG. 1. 47-yr-old man suffered steering-wheel injury to abdomen. A: Tc-99m sulfur colloid liver-spleen scan, anterior view. Arrows point to location of hematoma. Here no activity is seen between arrows. B: 500,000-count anterior image of mid-abdomen and pelvis with higher intensity setting. The bleeding site is easily identified (arrow). C: Left lateral image shows anterior location of bleeding (arrow). Open arrowhead points to technetium marker on anterior abdominal wall.
The surgeon was informed of the intraperitoneal bleeding and the patient was admitted to the intensive care unit. Over the next 18 hr, the patient's hematocrit dropped to 30%, and he was taken to surgery. Upon opening the peritoneal cavity, a large collection of clotted blood, estimated between 2500–3000 cc, was found in the upper abdomen. The liver and spleen were normal. A four-inch tear in the omentum near the distal transverse colon was repaired. Recovery was uneventful.

Case 2. A 20-yr-old man sustained a steering-wheel injury to the upper abdomen. Vital signs on admission to the emergency room were good (BP 138/90, P 60), and the hematocrit was 48%. Because of severe upper abdominal pain, a Tc-99m sulfur colloid scan was ordered to exclude injury to the liver and spleen. The injection was given 90 min after the accident.

The liver and spleen were normal (Fig. 2A). Scans of the abdomen and pelvis revealed a small collection of ectopic tracer in the mid-abdomen just anterior and to the right of the spine (Figs. 2B, 2C, and 2D). This was interpreted as showing retroperitoneal hemorrhage in the area of the duodenum, pancreas, and right kidney.

Over the next hour, the patient's clinical status deteriorated; he became hypotensive, his hemoglobin dropped 7 g, and his abdomen became distended.

At surgery, a massive retroperitoneal hematoma was found to extend from the diaphragm to the coccyx. The pancreas and duodenum were bruised, and there was a large tear in the small-bowel mesentery. Eight large, actively bleeding arteries, behind the ligament of Treitz, were ligated.

The patient was discharged on the tenth postoperative day.

**DISCUSSION**

Rapid transportation of the injured patient and well-coordinated triage have resulted in a shortening of the time between injury and imaging. A certain number of vascular injuries of the abdomen go clinically undetected in the first few hours after blunt trauma, and injuries to the retroperitoneal area often have delayed clinical expression (9). Signs and symptoms of abdominal injury may be absent in 16% of the patients with nonpenetrating abdominal trauma. With injuries to both the abdomen and head, the percentage rises to as high as 43% (10). In some of these patients, Tc-99m sulfur colloid scanning can detect occult bleeding.

When labeled sulfur colloid is injected intravenously, the particles are rapidly cleared by the reticuloendothelial cells of the liver, spleen, and marrow. In the actively hemorrhaging patient, the colloidal particles that extravasate at the bleeding site are no longer available to target organs. In a short time, a contrast is reached between the bleeding site and the surrounding background. This mechanism applies to the detection of bleeding anywhere—chest, abdomen, or pelvis—and is not limited to the gastrointestinal tract.

We advocate scanning the abdomen and pelvis in all trauma patients having Tc-99m sulfur colloid liver-spleen scans. If the patient is stable, the extra time spent for the scans adds little additional risk and offers great potential benefit. Increasing the dose of Tc-99m sulfur colloid to 10 mCi will shorten the scanning time and aid in the detection of bleeding sites.

The amount of blood lost may be markedly underestimated on the scan. The size of a hematoma depends on the rate of blood loss and the duration of bleeding. Only a fraction of the total blood loss extravasates during the time between injection and clearance of the colloid. Therefore, in the event of incomplete mixing of blood within the hematoma space, the activity seen on the scan will not be representative of the true size of the hematoma. Any ectopic tracer collection in a traumatized patient may merely represent the "tip of the iceberg." As in Case 2. Appraised of this possibility, the surgeon can take appropriate action—admission to the intensive care unit for close observation, interventional angiography, or surgery.

The frequent combination of chest and abdominal trauma, as with steering-wheel injuries, may warrant scanning of the chest in search of mediastinal bleeding.

A potential source of confusion in detecting hematomas is accessory splenic tissue. Once an accessory spleen is recognized as such on the initial static images, then that activity should not be misinterpreted on the 500,000-count image. Also, bladder activity is occasionally seen with Tc-99m sulfur colloid preparations, and this should be recognized in cases of suspected pelvic hematoma.

In summary, hematomas can be detected on Tc-99m sulfur colloid scans of actively bleeding patients. In addition to liver and spleen scintigrams, 500,000-count images of the abdomen and pelvis should be included as part of the workup of all patients with acute abdominal injury.

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**REFERENCES**


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**12th ANNUAL MEETING MIDEASTERN CHAPTER SOCIETY OF NUCLEAR MEDICINE**

*April 2–3, 1982, Bethesda, Maryland*

**Announcement and Call for Abstracts**

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The program will be approved for Category 1 credit toward the AMA Physicians Recognition Award through the Society of Nuclear Medicine.

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