UW Health
University of Wisconsin Hospital and Clinics

Division of Nuclear Medicine Procedure / Protocol
University Hospital and East Madison Hospital

GI BLEEDING SCAN **CPT CODE: 78728**
UPDATED: December 2021

Indications: The purpose of this exam is to identify the location of active gastrointestinal hemorrhage. The sensitivity in GI bleed scans is significantly greater (>90%) than with angiography for the detection of lower GI bleeding with the added advantage of being noninvasive. This study may also be used as a guide for selective abdominal arteriography and to assess the results of interventional therapy.

Considerations for study protocol include:

- Patients with active hemorrhage, bright red blood per rectum or RBC transfusion requirements are candidates for this examination on an emergency basis.
- Patients with melena are candidates for a more prolonged study with delayed imaging (see below).
- The study is not recommended as an initial test for an *upper GI bleed (versus lower GI bleed)*. In this case, endoscopy is performed.
- Patients with chronic, low-volume blood loss presenting with guaiac-positive stools or chronic anemias seldom benefit from the examination.
- If 99mTc-RBCs are unavailable or if time does not allow for the labeling procedure, 99mTc-sulfur colloid has been used as a GI hemorrhage imaging agent, although this is not as accurate.

Having good communication with referring physicians is critical for success. Their documented history and physical exam can often differentiate upper- from lower-tract bleeding (above or below the ligament of Treitz).

- Upper-tract bleeding typically presents with melena; bright red blood suggests a lower-tract origin. Hemorrhage from the upper tract is often confirmed with gastric intubation and treated with flexible fiberoptic endoscopy.
- Lower tract bleeding is more challenging. Colonoscopy is difficult and of limited value during active hemorrhage.

Patient Prep: None. Fasting is not required for this scan. However, fasting may be required for subsequent procedures such as angiography or surgery. Patients should be instructed to void immediately before imaging, so they are comfortable during a potentially long scan and to facilitate scan interpretation.

Scheduling: Before scheduling patients for this study, a Nuclear Medicine staff or resident physician should be consulted for modifications based on clinical history. A good example is when there is evidence of recurrent GI bleeding with previous unsuccessful attempts at localization of the bleeding site. The study may be started in the morning of a working day, continued out during the routine hours, and additional delayed images can be obtained, as appropriate.

Allow 30 minutes for the labeling process and 90 minutes for image acquisition. Delayed imaging is possible. Schedule a 20-minute dynamic imaging the next morning if the reader requests it.

Radiopharmaceutical & Dose: Tc-99m Pertechnetate (TcO_4-) 20 mCi +/- 20% (16-24 mCi) with Ultratag® RBC kit, adjusted for weight per nomogram or NMIS (pharmacy software).

To ensure the patient receives their own blood, place a label marked with two patient identifiers on the vial. During the blood draw and labeling the patient will stay in their assigned room. No other patient or their blood products will be allowed into the room until the labeling procedure and reinjection is complete.

For the labelling process, refer to the department approved SOP: Immediate Use of Radiopharmaceuticals: UltraTag RBC kit and package insert. Links to both follow.

SOP
https://radiology.wisc.edu/wp-content/uploads/2020/12/Ultratag-Immediate-Use.pdf

Package Insert
https://www.curiumpharma.com/wp-content/uploads/2018/05/Ultratag-RBC-Insert-122018.pdf

Typical labeling efficiency is greater than 95%.

Note: If the patient is receiving a blood transfusion the drawing and reinjection should be in the opposite arm.

Alternative procedure with Tc-99m sulfur colloid: To be used if UltraTag RBC kit is not available.

- Sulfur colloid 10 mCi +/- 20% (8-12 mCi) should be prepared as four separate 2.5 mCi doses each to be injected slowly through IV access with continuous imaging during radiotracer administration and for 10 minutes after each injection.
- Dose will be adjusted for patient weight per nomogram or NMIS.
- The injection site should be as far from the abdomen as possible.
- This procedure will allow 4 opportunities for identifying GI bleeding.

Imaging Device:

Any Gamma camera with LEHR collimator, preferably a large field of view camera to include the entire abdomen from the base of heart to bladder.

Imaging Procedure:

Use the predefined protocol under UW Gastrointestinal and GI Bleed in the acquisition computer. A dynamic study will be acquired using 10 seconds per frame with a 128x128 matrix for three separate datasets of 20 minutes. The protocol also includes

- A fourth data set if needed with 10 seconds per frame, a 128x128 matrix for 30 minutes.
- SPECT/CT (parameters listed below)

Additional images at longer intervals (at discretion of NM physician) may be acquired.

Lateral pelvic view, to include the rectum, will be obtained at the end of dynamic imaging series to differentiate bladder activity. Acquire the lateral pelvic view for 3 minutes with a 128x128 matrix.

Delayed imaging:

- Delayed images may be performed within the next 18 hours following the start of the GI bleed scintigraphy, as needed if the patient experiences a repeat GI bleed without re-administration of the radiotracer.
- 12-hour delayed imaging from the start of GI bleed study. If there is good image count rate, then acquire delayed images as 1min/frame for 30 minutes with additional lateral pelvic view.
- If between 12–18-hours delayed imaging and the count rate is poor, then a 10min Anterior static view will be acquired, with additional views as needed. SPECT/CT of the suspected GI bleed can be obtained as needed to further localize the GI bleeding site as needed by the NM physician, preferably using the highest resolution CT with SPECT/CT.

Excessive gastric, thyroid, and soft tissue background activity suggests poor labeling. If the stomach is visualized, image the neck to document free pertechnetate in the thyroid gland.

If the scan is abnormal and the physician is coming or has been called to review, keep acquiring a new set of images in 10-second/frame format until told to discontinue imaging.

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SPECT/CT Acquisition Parameters:

	INFINIA 1	INFINIA 2 & 3	OPTIMA 640
Tomo Key Parameters			
Mode	H	H	H
Start Angle	0	0	0
Patient Location	Feet First Supine	Feet First Supine	Feet First Supine
Use Body Contour	Check	Check	Check
Acquire CT/AC	Check	Check	Check
Select	Table In	Table In	Table In
Select	Emission First	Emission First	Emission First
CT/AC range	Full	Full	Full
Select On	Emission	Emission	Emission
Zoom	1.5	1.5	1.5
Matrix	128 x 128	128 x 128	128 x 128
Pan Y	0	0	0
Select	Step & Shoot	Step & Shoot	Step & Shoot
Seconds	20	20	20
Scan on extender Optima640			No
Tomo Corrections			
Energy session	Tc99m	Tc99m	Tc99m
Collimator	LEHR	LEHR	LEHR
COR Correction	Check	Check	Check
Tomo CT/AC Parameters			
Select	Slice Step 10 mm	Helical	Helical
Pitch		1.9	1.25
Voltage	140.0	140.0	120.0
Current	2.5	2.5	Absolute
Velocity	2.6	2.6	2.5
Matrix	256 x 256	512 x 512	512 X 512
Filter	Hann	Soft	N/A
Extended FOV		Check	N/A
CT/AC Reconstruction			
Tomo Location Parameters			
Slice Thickness (cm)			2.5
Slice Spacing (mm)			2.5
Kernel			Standard
Matrix			512x512
Tomo Location Parameters			
Mode	H	H	H
Start Angle	0	0	0
Patient Location	Feet First Supine	Feet First Supine	Feet First Supine
Use Body Contour	Check	Check	Check
Detectors 1 and 2	Check	Check	Check
Absolute (table height)	73	73	90
Total Angular Range	360	360	360
View Angle	6	6	6
Direction	CW	CW	CW
Number of FOVs	1	1	1
FOV time multiplier	1.0	1.0	1.0
Rough Overlap	4	4	4
Direction	Table In	Table In	Table In
Select	Default	Default	Default
Motorized Pallet Support	Check	Check	Check
Tomo Admin Parameters			
Auto Apply	No	No	No
Release at end of scan		Check	Check
NM	None	None	None
CT/AC		None	None
FOV		None	None
Body Part	Chest	Chest	Chest
Acquisition Context	Unknown	Unknown	Unknown
Body Side	Other	Other	Other

Alternative procedure with Tc-99m sulfur colloid: Begin imaging immediately upon injection of the radiopharmaceutical, obtaining 1-minute images with a 128x128 matrix for 10 minutes. Cranial tilt of the gamma camera may be required to better view the infrahepatic region. If no bleeding is identified then, then repeat injections of the divided radiopharmaceutical can be administered (up to 4 separate injections).

Image Reframe and Display:

1. Reframe the three 20-minute raw datasets should be reframed into 1 minute per frame, label as noted below and send these reframed datasets to PACS.
   a. Label 1st image set Ant 0-20 min 1 min/frame – send to PACS for immediate review
   b. Label 2nd image set Ant 21-40 min 1 min/frame – send to PACS for immediate review
   c. Label 3rd image set Ant 41-60 min 1 min/frame – send to PACS for immediate review
   d. If acquired: Label 4th image set Ant 61-90 min 1 min/frame – send to PACS for immediate review
   e. Repeat for any subsequent dynamic image sets and name them in the same style as above.
2. Make separate save screens of each 1 min/frame reframed image set, 20 images total with 4 rows of 5 images and send to PACS with the same labeling as the reframed images above.
3. Add reframed images together to make a 0-60 min dynamic (1min/frame)
   a. Label image set Ant 0-60 min 1 min/frame.
   b. Screen cap
4. Make a save screen of lateral images.
5. 12 hour delayed images:
   a. Screen capture delayed dynamic (5 rows x 6 images) indicating the amount of time since injection.
   b. Combine/add delayed dynamic images into 1 image and save screen indicating amount of time since injection.

Alternative Procedure with Tc-99m sulfur colloid: Screen cap the 1 min/fame images. Repeat for each of the injections/imaging sets. Adjust the intensity to demonstrate background abdomen activity best.

Note: Bone marrow activity should be seen in every image.

PACS:

1. Send the reframed image sets, raw static delays and screen caps
   a. Ant 0-20 min 1 min/frame (already sent)
   b. Ant 21-40 min 1 min/frame (already sent)
   c. Ant 41-60 min 1 min/frame (already sent)
   d. Ant 61-90 min 1 min/frame (if acquired) (already sent)
   e. Ant 0-60 (90) min 0-60 (90) min 1 min/frame
2. When the **study is complete** delete the dynamic image sets from a, b, c and d. The final image sets in PACS will be the screen caps and dynamic image set from e.

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Interpretation:

The purpose of the radionuclide bleeding study is:
1. To determine whether hemorrhage is active.
2. To estimate the approximate rate of bleeding.
3. To determinate the site of bleeding.

Specific diagnostic criteria should be used to diagnose active bleeding and its site of origin.

The radiotracer activity must
1. First appear where there was none before.
2. Then increase over time.
3. Move in a pattern consistent with intestinal anatomy, antegrade and/or retrograde.

Angiography may be negative in patients with intermittent bleeding or bleeding rates below 1.0 mL/min. With radionuclide techniques, bleeding rates on the order of 0.2 mL/min are reliably detected, and the sensitivity has been reported to be good even for bleeding rates as low as 0.04 mL/min, although a total volume of 2 to 3 mL of blood is necessary.

The study establishes the presence of GI bleeding during the period from tracer injection to image acquisition. Because the main purpose of the exam is to localize the site of bleeding, the study should be continued for a sufficient length of time to follow the progress of the labeled blood and permit mapping of bowel anatomy, which may vary somewhat from patient to patient. Because of the frequent retrograde and/or anterograde passage of tracer the bleeding site is optimally viewed in 10 second or 1 minute frames in cine format. Enough time must be allowed to see the passage of tracer and identify whether the bleed is of small or large bowel origin. Multiple sequential images aid greatly in establishing its origin by recording the pattern of progression of the radionuclide within the bowel.

With RBCs, most bleeding sites show an initial focus of activity, which increases and changes position and/or configuration with time. Because blood is an irritant to the intestine, movement of activity is often rapid and can be bidirectional. If the activity remains in the same location, this should raise the suspicion of causes other than intraluminal bleeding, such as static vascular abnormalities (e.g., aneurysm or angiodysplasia). Occasional confusion of bladder activity with a rectosigmoid bleed can usually be resolved on postvoid views or lateral pelvic images. Interfering genital activity is usually identified by its location on anterior oblique or lateral pelvic views.

Alternative procedure with Tc-99m sulfur colloid: Abnormal scans are characterized by activity foci away from the liver, spleen and bone marrow. This technique actually detects lesser bleeding rates (0.1 – 0.2 ml/min) but because the circulating tracer is present for shorter time periods (half plasma disappearance time of radiopharmaceutical is 2 ½ minutes), the sensitivity for bleeding detection is less than the labeled RBC method.

Comments: A nuclear medicine staff or resident physician should be consulted to determine if additional views are indicated.

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