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Radiologic diagnosis and management of acute lower gastrointestinal bleeding

ABSTRACT

In patients with acute lower gastrointestinal bleeding, colonoscopy is the initial test of choice. But when colonoscopy gives indeterminate results or cannot be performed, either radionuclide imaging or angiography is indicated.

KEY POINTS

Angiography can locate the site of bleeding and allow for therapeutic intervention. It is indicated as a primary imaging test in patients with brisk bleeding or who are hemodynamically unstable due to hemorrhage.

Radionuclide scanning is noninvasive and, compared with angiography, can detect bleeding that is much slower. Therefore, it is useful in patients who are stable and have suspected low or intermittent rates of hemorrhage.

The roles of computed tomography and magnetic resonance imaging currently are not established. Barium studies are contraindicated in patients with acute gastrointestinal bleeding.

A 73-YEAR-OLD MAN who has had no significant medical problems in the past now presents to the hospital with profuse hematochezia that started several hours ago. He feels slightly light-headed. He has no pain. His vital signs are stable with normal oxygen saturation. A stat hematocrit is 28% (normal range 40–52).

He is appropriately resuscitated with blood products and intravenous fluids. Nasogastric lavage is performed; he has no blood in the stomach. Colonoscopy is then performed, but the colon cannot be properly evaluated because it has a profuse amount of blood within it.

What should be the next diagnostic study?

COLONOSCOPY IS THE FIRST DIAGNOSTIC OPTION

Colonoscopy should always be the first diagnostic test in patients with acute lower gastrointestinal (GI) bleeding. However, in cases of acute bleeding, colonoscopy may be nondiagnostic, especially if there is a large amount of blood within the colon, obscuring visualization. Success rates for locating the source of acute GI bleeding with colonoscopy range from 69% to 80%.[1]

When colonoscopy is negative or indeterminate in a patient with continued bleeding, the next two options for radiographic diagnosis are radionuclide imaging and angiography. In addition, research is being performed to evaluate the utility of computed tomography and magnetic resonance imaging in this setting, but currently these studies have no established role. Barium contrast, given by enema to outline the colon on plain film studies, is con-

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Bleeding at the splenic flexure of the colon: Radionuclide study

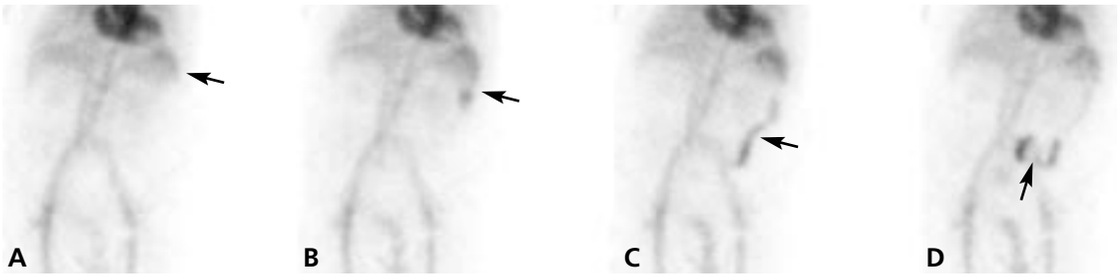

FIGURE 1. Technetium Tc 99m-tagged red blood cell study demonstrates radiotracer extravasation into the colon in the region of the splenic flexure (A, arrow) with antegrade peristalsis (B) into the descending (C) and sigmoid colon (D).

traindicated in patients with acute bleeding because it lacks the ability to locate a bleeding site, and residual barium will cause artifacts on other examinations for several days.

RADIONUCLIDE IMAGING: SENSITIVE BUT SLOW

Radionuclide imaging has the advantages of being safe, noninvasive, and more sensitive than angiography, potentially detecting bleeding rates as low as 0.1 mL/minute.[2] However, both angiography and endoscopy are more specific.

Radionuclide scans can find the source of slow bleeding, but can delay therapy for rapid bleeding

Since radionuclide scanning may be able to locate the site of bleeding, it is a useful adjunct to angiography or surgery. For example, if a bleeding site is detected within the ascending colon on a radionuclide scan, the angiographer can selectively catheterize the superior mesenteric artery and evaluate the territory supplied by this artery.

This study is useful when the suspected rate of bleeding is low or intermittent and the patient is hemodynamically stable. However, in cases in which the suspected hemorrhage rate is brisk or the patient is hemodynamically unstable due to bleeding, a radionuclide study may not be of significant benefit, since it may delay the time to therapy.

Either technetium Tc 99m-tagged red blood cells or technetium Tc 99m-sulfur colloid can be used to detect the source of GI bleeding. Tagged red blood cells remain in the circulation for up to 48 hours, allowing intermittent bleeding to be detected. Sulfur colloid rapidly clears from the circulation and is taken up by the reticuloendothelial system, providing excellent contrast between background and extravasated isotope at the bleeding site.

Of the two, the red blood cell study is more commonly used and is more sensitive and specific for detecting GI bleeding than the sulfur colloid study. An in vitro technique is used: a 1- 3-mL sample of the patient's blood is withdrawn, labeled with technetium Tc 99m (a process that takes only a few minutes), and then reinjected into the patient. The patient is then imaged continuously for 60 to 90 minutes. A typical positive result is shown in FIGURE 1. If the scan is initially negative, the patient can be rescanned for up to 24 hours.

Once the radiotracer extravasates into the colon, it can move either forward or backward, making the site of bleeding difficult to locate precisely. Since a positive tagged red blood cell scan makes an angiogram more likely to be positive, and a negative scan makes an angiogram more likely to be negative, a red blood cell study is indicated in selecting patients in whom an invasive procedure is likely to be beneficial.

Because of the radiation dose involved, this study is relatively contraindicated in pregnant women.

In children with GI bleeding, Meckel diverticulum should be considered. In this case, a nuclear Meckel scan with technetium Tc 99m pertechnetate is preferred to identify ectopic gastric mucosa.

ANGIOGRAPHY: SPECIFIC, BUT SENSITIVITY VARIES

Angiography is the second option for the radiographic diagnosis of lower GI bleeding. This test requires higher rates of blood loss to

be positive, at least 1.0 mL/minute. Its specificity is essentially 100%, but its sensitivity has a wide range depending on the hemorrhage rate. The diagnostic yield of angiography ranges from 41% to 78%.[1]

When positive, an angiogram can precisely locate the bleeding site. Most importantly, it has the added advantage of allowing for therapeutic intervention.

This study is particularly useful in patients who have active bleeding or who are hemodynamically unstable because of hemorrhage. Hypotension and hemodynamic instability do not preclude angiography, which may be a life-saving choice under these circumstances. Indeed, rapid bleeding increases the likelihood that the bleeding site will be identified angiographically. Full intensive care monitoring and supportive transfusion therapy can continue in the angiographic suite while the bleeding site is identified and treated. For these reasons, angiography should be the next study for the patient described at the beginning of this article.

However, in patients who are hemodynamically stable and in whom the suspected rate of hemorrhage is very slow or intermittent, angiography may be of limited benefit. In these cases, a radionuclide study is warranted.

If the site of bleeding is unknown, the superior mesenteric artery is catheterized first, since most lower GI bleeding from diverticulosis and angiodysplasia occurs in regions of the intestine supplied by this artery, ie, the ascending and transverse colon. If this does not reveal the source of bleeding, then the celiac trunk and inferior mesenteric artery (supplying the descending and sigmoid colon) are evaluated. The source of bleeding is found when contrast can be seen extravasating into the bowel lumen (**FIGURE 2**).

Angiography can be used for therapy

The two major options for angiographic therapy of lower GI bleeding are vasopressin infusion and transcatheter embolization.[3]

Vasopressin now is rarely used in modern angiographic practice, since it requires monitoring in an intensive care unit, the catheter position must be maintained for several hours, and it occasionally causes significant complications, including arrhythmias, cardiac ischemia, intestinal ischemia, and cerebral edema.

Transcatheter embolization of an arterial bleeding site is accomplished by placing a microcatheter in the arterial branch leading to the site of extravasation. High-technology steerable guidewires have made it possible, in most cases, to place a microcatheter tip almost out to the vasa recta level in the mesenteric artery branches. Platinum microcoils then are deployed from the catheter tip, blocking the feeding artery branch and reducing blood pressure at the site of bleeding.

When a bleeding source is found, success at initial hemostasis ranges from 73% to 100%, but rebleeding has been reported in 1% to 14% of cases.[4]

Potential complications of angiography

Angiography is invasive, and although the technique itself is relatively safe, complica-

Angiography of the mesenteric artery to locate and treat lower GI bleeding

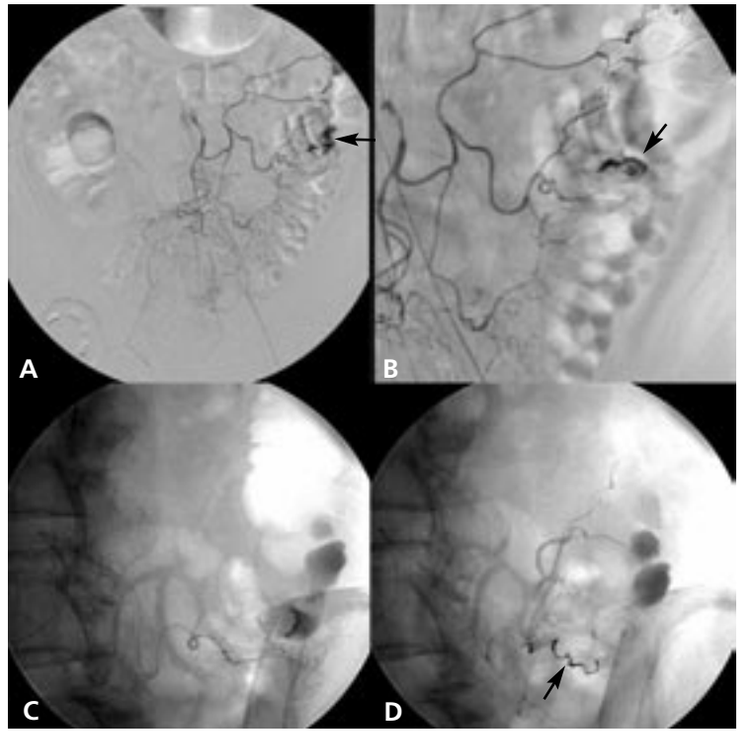

FIGURE 2. Angiograms demonstrate contrast opacification of the inferior mesenteric artery and its branches. A and B show contrast extravasation into the colonic lumen. The distal branches were superselectively catheterized (C), with microcoil embolization (dark lines) (D).

tions have been reported.

Bowel ischemia. Despite concerns about inducing focal bowel ischemia with angiographic embolization, 90% of patients have no ischemic sequelae and can avoid surgery. Patients should be carefully observed after embolization for signs of ischemia or obstruction.

Other complications include trauma to the vessels at the access site resulting in hemorrhage or thrombosis, reaction to contrast, or injury to the distal celiac or mesenteric vessels. In patients with compromised renal function, the use of iodinated intravenous contrast can be associated with further worsening of renal function. In these cases, the risks of contrast-induced nephropathy must be weighed against the potential benefits of the procedure.

SURGERY IS THE FINAL OPTION

In cases in which bleeding is refractory or angiography is unsuccessful in providing hemostasis, surgery may be the final option. In these cases, pinpointing the source of bleeding by preoperative angiography or radionuclide scanning provides the opportunity for a limited, strategic resection of the bowel. This less-aggressive procedure allows for markedly lower rates of perioperative complications and death.

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