

Provocative Mesenteric Angiography for Lower Gastrointestinal Hemorrhage: Results from a Single-institution Study

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PURPOSE: To determine the diagnostic capability, complication rate, and potential predictors of success for provocative mesenteric angiography in patients with obscure and recurrent lower gastrointestinal (GI) hemorrhage.

MATERIALS AND METHODS: Thirty-four patients (age, 7–92 years; 22 men) underwent 36 provocative mesenteric angiograms between January 2002 and December 2008. Provocative mesenteric angiography consisted of systemic anticoagulation with heparin followed by selective transcatheter injection of vasodilator and tissue plasminogen activator into the arterial distribution of highest suspicion. Medications were administered incrementally until active extravasation was visualized or until the operator deemed the outcome negative. The pertinent clinical, radiologic, surgical, laboratory, and pathologic notes were retrospectively reviewed.

RESULTS: Among 36 provocative mesenteric angiograms, 11 resulted in angiographically visible extravasation (31%) and an additional procedure resulted in angiographic visualization of an undiagnosed hypervascular mass, resulting in the identification of a source of a hemorrhage in 33% overall. In 10 of the 11 cases with visualized extravasation, transcatheter embolization successfully controlled recurrent hemorrhage, while the hypervascular mass without extravasation was successfully resected. Therefore, a total of 11 of 36 studies (31%) resulted in successful definitive treatment of recurrent hemorrhage. One embolization-related complication occurred, resulting in surgical resection of perforated ischemic bowel. No hemorrhagic complications were identified. Patients with melena and patients admitted for reasons other than acute lower GI hemorrhage were significantly less likely to benefit from provocative mesenteric angiography.

CONCLUSIONS: In this series, provocative mesenteric angiography was safe and effective for eliciting the source of occult lower GI hemorrhage, leading to definitive therapy in about one third of patients.

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Abbreviations: GI = gastrointestinal, IMA = inferior mesenteric artery, RBC = red blood cell, SMA = superior mesenteric artery, TPA = tissue plasminogen activator

ACUTE lower gastrointestinal (GI) hemorrhage is a common cause of hospital admission with an estimated annual incidence rate of 20.5 per 100,000

patients based on survey data (1). These data also demonstrated a greater frequency in male subjects and a rate increase of more than 200 fold from the third to the ninth decades of life. Fortunately, lower GI bleeding ceases spontaneously in approximately 80% of patients (2). However, lower GI bleeding becomes a difficult diagnostic and management dilemma when recurrent and of indeterminate origin by endoscopic and radiologic studies. Patients in this group present as a continuum ranging from cases of chronic intermittent bleeding, which is characterized as slow and sporadic in nature, to those who have

severe, episodic life-threatening hemorrhages (3). Endoscopy is generally the diagnostic modality used in the vast majority of cases, including slow sporadic cases as well as more vigorous hemorrhage, whereas radiologic imaging consisting traditionally of nuclear scintigraphy and angiography is typically used for episodes of acute hemorrhage. However, in both situations, failure to localize a bleeding source or site occurs in approximately 65% of cases (4). These radiologic studies require active hemorrhage during short imaging intervals and may yield negative results as a result of the intermittent nature of

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hemorrhage that ceases before the imaging is performed, or alternatively hemorrhage occurring at a rate too slow to detect. Such patients may be prone to recurrent episodes of hemorrhage, which can be potentially massive, requiring multiple hospitalizations and multiple diagnostic studies incurring significant health and financial risks to the patient (5,6).

Provocative mesenteric angiography is the use of thrombolytic, vasodilating, and anticoagulation medications to elicit active bleeding from a source that may have recently ceased hemorrhaging. This technique was first reported in the literature in 1982 (7). Since then, our review of the literature yielded only six small case series and two case reports totaling 59 patients (8–14). Although reasonably successful and without any reported major hemorrhagic complications, provocative mesenteric angiography is not a commonly used examination. The precise reasons for this are unknown but likely relate to fear of potential hemorrhagic complications and lack of familiarity with this procedure on behalf of referring clinicians and interventional radiologists. Both of these are likely a reflection of the sparse data supporting provocative mesenteric angiography in the literature. This case series includes the largest number of patients described in the literature, allowing for subgroup analysis. Our goal is to review our experience with provocative mesenteric angiography to determine the success and complication rates with currently used medications and to help elucidate the clinical settings in which provocative mesenteric angiography is most appropriate.

MATERIALS AND METHODS

This retrospective study was approved by the institutional review board, and a waiver of the informed consent requirement was obtained for this Health Insurance Portability and Accountability Act-compliant study.

Patient Selection and Data Collection

From January 2002 through December 2008, a total of 251 mesenteric angiograms were performed at our institution for suspected lower GI hemorrhage, of which 74 studies were positive for localization of the source of hemorrhage.

Within this time period, 34 consecutive patients underwent 36 provocative mesenteric angiograms. No patients were excluded. The age range was 7–92 years, with a median of 71 y and mean of 66 y. Twenty-two patients were male and 12 were female. All patients had clinical evidence of recurrent lower GI hemorrhage without a definite source identified. Provocative mesenteric angiography was performed on patients with recurrent lower GI hemorrhage when requested by the primary clinical team, but only after consultation with the gastroenterology and general surgery services. All patients were first screened for contraindications to thrombolytic therapy, consisting of major surgery or biopsy within 7 days, major trauma within 10 days, recent stroke, transient ischemic attacks, craniocerebral trauma, or neurologic surgery within 6 months (15).

At our institution, an algorithm for the workup of patients with acute lower GI bleeding is generally followed. Patients with acute massive lower GI bleeding and hemodynamic instability undergo urgent angiography, whereas those in stable condition undergo tagged red blood cell (RBC) scintigraphy. Patients with a positive scintigraphic result undergo urgent angiography, whereas patients with a negative scintigraphic result undergo nonurgent endoscopic examination. Similarly, patients with nonmassive GI bleeding undergo elective endoscopic examination. Surgery is generally reserved for patients in whom the source of hemorrhage could not be definitively treated endovascularly. Patients with persistently negative study results may undergo continued observation and conservative management, repeat diagnostic studies, and in some cases, provocative mesenteric angiography, based on referring physician preference.

The majority of patients who underwent provocative mesenteric angiography ($n = 29$) had undergone at least one previous tagged RBC scintigraphy examination to evaluate GI hemorrhage (mean, 1.9 examinations per patient; range, 1–7). A total of 25 patients had undergone recent scintigraphy, defined as within 5 days of provocative mesenteric angiography. Twenty-four patients had undergone at least one previous mesenteric angiogram (mean, 1.2 angiograms per patient; range, 1–4), all of which were negative for identification of bleeding source. Thirty-two patients

had undergone an endoscopic procedure, with an average of 4.1 endoscopic procedures (range, 1–12) performed for the indication of GI bleeding. Endoscopic studies included flexible sigmoidoscopy ($n = 5$), colonoscopy ($n = 30$), capsule endoscopy ($n = 17$), small bowel enteroscopy ($n = 12$), and upper endoscopy ($n = 24$). An endoscopic study was considered to have a positive result if blood was visualized.

Clinic notes, admission notes, and discharge summaries were reviewed for stool character as related to lower GI hemorrhage episodes. Stool color was categorized as “bright red blood,” “maroon-colored stool,” or melena. Hematochezia was comprised of either bright red blood or maroon-colored stool. All patients were inpatients at the time of the procedure. The reason for admission was determined based on emergency room notes and discharge summaries: acute lower GI hemorrhage ($n = 19$), nonacute lower GI hemorrhage ($n = 13$), and other reasons ($n = 4$), which included sepsis, urinary tract infection, coronary artery bypass graft surgery, and splenic rupture. The laboratory records were reviewed for the hematocrit level at admission and immediately before the procedure, and the lowest level between admission and performance of provocative mesenteric angiography. The electronic records were also reviewed to ascertain whether packed RBC transfusions were administered, and if so, the quantity was ascertained. All additional pertinent clinical, radiologic, surgical, laboratory, and pathologic notes were reviewed. Procedural details and medication dosages were obtained from the procedure reports (Table 1). All subsequent clinical notes were reviewed for procedure-related complications.

Provocative Mesenteric Angiography Technique

All studies were performed in the interventional radiology unit. Surgical consultation was always obtained before the procedure in case of the need for urgent surgery for uncontrollable hemorrhage.

Procedures were performed in the manner we previously described (11). Briefly, all were performed via a common femoral artery access and a 5-F catheter-based system. Diagnostic angiography of the celiac artery, superior

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