The Role of Transcatheter Arterial Embolization in the Management of Nonvariceal Upper Gastrointestinal Bleeding

Dan E. Orron, MD[a], Allan I. Bloom, MD, FSIR[b], Ziv Neeman, MD[c,*]

KEYWORDS

• Arterial • Embolization • Embolic agents
• Nonvariceal upper gastrointestinal bleeding • Hemorrhage • Interventional radiology

KEY POINTS

- Current technology advances have introduced microcatheters that are capable of selecting third-order branches and of delivering a wide array of embolic agents.
- The majority of cases of nonvariceal upper gastrointestinal bleeding are managed conservatively or by endoscopy, which has also benefited from significant technological advances.
- With the advancement of endoscopic bleeding control hemostatic techniques, patients with nonvariceal upper gastrointestinal bleeding are generally referred to the interventional radiologist for therapeutic management.
- This paper reviews the clinical, technical, and angiographic variables that guide appropriate embolization strategies aiming to optimize the anticipated outcome of transcatheter arterial embolization.

INTRODUCTION

The usefulness of diagnostic angiography in localizing GI hemorrhage was described by Margulis and colleagues[1] and Baum and associates[2] in the 1960s. Before this breakthrough, barium studies of the gastrointestinal (GI) tract were the only imaging adjunct to plain abdominal radiography. Transcatheter infusion of the constricting agent vasopressin was the first endovascular means of hemostasis applied to GI bleeding (GIB),[3,4] after which transcatheter arterial embolization (TAE), as it was described initially, using autologous blood clot.[5] In the ensuing years, continued innovation and technological advancements have resulted in TAE becoming an effective

Disclosure Statement: No disclosures for all 3 authors.
[a] Department of Radiology, Carmel Medical Center, Michal Street, Haifa 34362, Israel; [b] Department of Radiology, Hadassah University Medical Center, Ein Karem, Jerusalem 91120, Israel; [c] Medical Imaging Institute, Haemek Medical Center, Izhak Rabin Boulevard, Afula 1834111, Israel
* Corresponding author.
E-mail address: ziv_ne@clalit.org.il

Gastrointest Endoscopy Clin N Am 28 (2018) 331–349
https://doi.org/10.1016/j.giec.2018.02.006
giendo.theclinics.com

and rapid means of achieving hemostasis, particularly in hemodynamically unstable patients with acute, massive nonvariceal upper GIB (NVUGIB) that could not be accessed or controlled endoscopically. Angiography is also used to identify and treat causes of chronic bleeding in which endoscopy failed to identify a source.

IMAGING DIAGNOSIS OF GASTROINTESTINAL BLEEDING

Before the development of multidetector computed tomography (MDCT) scanning techniques, radionuclide scanning with tagged red blood cells/sulfur colloid was the primary noninvasive imaging modality for detection and localization of GIB, owing to its high sensitivity. Scintigraphy can detect bleeding rates as low as 0.1 mL/s, whereas angiographic detection requires a bleeding rate of 0.5 to 1.0 mL/s.[6–11]

Nuclear scanning is useful for differentiating between upper and lower GIB (LGIB) and detecting multiple sites of bleeding, although it provides no etiologic information. Limitations in UGIB include activity in the heart, lung and spleen, secretion of free technetium pertechnate into the stomach and antegrade movement of the tracer from the stomach to bowel owing to peristalsis. In current practice, radionuclide scanning has occasional usefulness in LGIB but no role in UGIB.

MDCT has largely replaced radionuclide scanning for the assessment of LGIB in stable patients, and has demonstrated a bleeding rate sensitivity intermediate to that of isotope scanning and catheter angiography. In an animal model reported by Kuhle and Sheiman,[10] bleeding rates as low as 0.3 mL/min were identified. Current imaging technology allows the demonstration of small bleeding arteries. Best results are obtained with the triphasic technique (precontrast, arterial, and portal phases). MDCT is most suitable to, and has been most studied in, acute LGIB.[11–15] The overall sensitivity and specificity have been reported at 79% to 89% and 85% to 95%, respectively.[11,16,17] Importantly, for the scenarios in which endoscopy either did not identify a bleed, or identified a bleed but could not determine the source, the American College of Radiology considers MDCT to be a diagnostic modality equivalent to angiography.[18] For cases in which a small bowel bleeding source is suspected, the addition of neutral (water density) oral contrast agent (CT enterography) improves the detection of small bowel pathology.

CT is also useful for detecting related pathology such as tumors and aneurysms/pseudoaneurysms. Treatment planning (access and catheter selection) is facilitated by its demonstration of relevant anatomy, particularly patency/tortuosity of the access arteries and presence of aortic visceral branch anomalies or origin narrowing/angulation.

Cone beam CT, a standard feature in current angiographic units, allows catheterization guidance by overlay of the CT angiography image upon live fluoroscopy (fusion road map). In addition, Cone beam CT is superior to digital subtraction angiography for detection of residual untreated tumor after embolization.[19]

MDCT is rarely required for the assessment of NVUGIB, except in rare cases in which endoscopy cannot be performed completely. Exceptions include patients with a history of pancreatitis, and recent percutaneous or endoscopic biliary procedures. MDCT may also be useful in patients with concomitant portal hypertension.

DIAGNOSTIC ANGIOGRAPHY

In current practice, patients with NVUGIB are referred for angiography with a therapeutic rather than a diagnostic intention. The typical patient is hemodynamically unstable with massive bleeding resistant to medical management and endoscopic intervention. Less common indications include failure to identify a bleeding source by endoscopy or CT, chronic bleeding, and postoperative hemorrhage. Preprocedural