REVIEW ARTICLE / PREGLEDNI ČLANAK

ENDOVASCULAR MANAGEMENT OF NON-VARICEAL GASTROINTESTINAL BLEEDING

ENDOVASKULARNO LIJEČENJE NEVARIKOZNOG GASTROINTESTINALNOG KRVARENJA

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Abstract

Gastrointestinal bleeding is a common and potentially life-threatening condition that requires prompt diagnosis and management. Most cases respond well to conservative treatments and endoscopic therapies. However, there is a subset of patients with significant bleeding for whom these methods are ineffective, necessitating endovascular treatment. Endovascular therapy has become the preferred option over open surgery due to its advantages, most importantly reduced morbidity and mortality. This review outlines the indications for endovascular management of gastrointestinal bleeding, with a focus on critical considerations in emergency medicine such as patient selection, hemodynamic instability, and anatomical challenges. It also discusses the role of imaging in identifying candidates for intervention and provides an overview of procedural approaches and outcomes.

Key words: gastrointestinal bleeding; endovascular therapy; embolization

Sažetak

Gastrointestinalno krvarenje je često i potencijalno po život opasno stanje koje zahtijeva brzu dijagnostičku obradu i liječenje. Većina slučajeva dobro odgovara na konzervativno liječenje i endoskopske zahvate. Međutim, kod određene skupine pacijenata sa značajnim krvarenjem ove metode su neučinkovite, te je kod njih potrebno endovaskularno liječenje. Endovaskularno liječenje je bolja opcija od kirurškog zahvata zbog manjeg morbiditeta i mortaliteta. Prikazat ćemo indikacije za endovaskularno liječenje gastrointestinalnog krvarenja, s naglaskom na ključne aspekte u hitnoj medicini, kao što su selekcija pacijenata, hemodinamska nestabilnost i anatomski izazovi. Važna je i uloga slikovne dijagnostike u identificiranju kandidata za endovaskularnu intervenciju.

Ključne riječi: gastrointestinalno krvarenje; endovaskularno liječenje; embolizacija

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Introduction

Non-variceal gastrointestinal bleeding (GIB) is a frequent cause of hospital admission. It can be broadly classified into two groups according to its relationship to the ligament of Treitz: upper and lower GIB.

The clinically apparent GIB as visible blood loss may manifest as hematemesis, melena, or hematochezia. Hematemesis refers to vomiting red blood or coffee-ground emesis and suggests bleeding proximal to the ligament of Treitz. Melena is defined as black, tarry stool that occurs several hours after the bleeding event and results from the degradation of blood to hematin or other hemochromes by gut bacteria and can be seen with variable degrees of blood loss, being visible with as little as 50 mL of blood. Hematochezia refers to red or maroon blood in the stool and suggests active bleeding, usually from the lower GIB. It can also be seen in the massive upper GIB, typically associated with hemodynamic instability (1). Types of GIB's are shown in Table 1.

Differentiating upper and lower GIB based on the clinical presentation of hematemesis, hematochezia, or melena may be difficult and unreliable. Patients with upper GIB commonly present with hematemesis and/or melena, although those with a brisk upper gastrointestinal (GI) source can present with hematochezia. In 70% of cases, GIBs are located in the upper GI tract (2,3). With an incidence of 50 to 100 per 100 000 population, it is a common pathology with a median patient age of 60–70 years (4). In 70–75 % of cases an upper GIB ceases spontaneously. The mortality rate is between 3 and 14% and for intensive care patients between 42 and 64% (2). In approximately 50% of cases, upper GIB results from an ulcer disease such as a gastric ulcer or duodenal ulcer. Other causes include tumour bleeding, Mallory-Weiss syndrome, erosive gastritis or duodenitis, reflux esophagitis, angiodysplasia and iatrogenic or post-traumatic changes. A special cause of upper GIB is acute bleeding of the peripancreatic vessel branches, which is often the result of pancreatitis, surgery, tumours or trauma.

Lower GIB causes approximately 30% of all GIB, with an incidence of about 20 to 30 per 100 000 population and a median age of 65–80 years, increasing dramatically with age (5). In 80–85% of cases lower GIB ceases spontaneously. Recent studies indicate the mortality between 2 and 5% (2). The most common cause of lower GIB is diverticulitis and less frequent are angiodysplasia, polyps, tumours, proctitis or chronic inflammatory bowel disease (6). A separate group is comprised of hemorrhaging from sources outside the digestive tract, such as the biliary tract, the pancreatic duct, arterioenteric fistula, and visceral artery aneurysms or pseudoaneurysms (7).

Once the likely location of bleeding (upper, lower, or small bowel) has been determined, the list of diagnostic possibilities may be narrowed down based on the patient's history and risk factors for GIB. Important information includes the type of bleeding (overt, occult, or massive), associated signs and symptoms (e.g., abdominal pain, weight loss), contributing events (e.g., trauma, vomiting, hypotension), and recent procedures (e.g., polypectomy, liver biopsy). Key patient history and risk factors for GI bleeding are listed in Table 2.

Pretreatment imaging

Scintigraphy is the most sensitive imaging method, with the ability to detect bleeding from 0.1 ml/min (8). However, this technique is not able to define precisely the anatomic source of the bleeding. In addition, scintigraphy is too time-consuming to be used in an emergency setting. Hence, it is mainly used for intermittent bleeding.

Conventional digital subtraction angiography (DSA) is able to detect small bleeding amounts (>0.5 ml/min) (9). Its sensitivity ranges from 63 to 90% for upper and 40 to 86%

Table 1. Types of gastrointestinal bleedings

Type of GIB	Description
Upper GIB	GIB originating proximal to the ligament of Treitz
Lower GIB	GIB originating distal to the ligament of Treitz
Suspected small bowel bleeding	GIB in which no bleeding source is identified after performing both upper and lower endoscopy.
Overt GIB	Visible GIB such as hematemesis, hematochezia, or melena.
Massive GIB	GIB associated with hemodynamic instability (blood pressure <90 mmHg, tachycardia, symptoms of shock) or bleeding requiring transfusion of more than 4 units of packed red blood cells per 24 hours.
Obscure GIB	GIB in which no bleeding source is identified after the entire GI tract has been evaluated with advanced endoscopic and imaging techniques. Can be either overt or occult.
Occult GIB	GIB that is not clinically visible (positive fecal occult blood test or iron deficiency anemia when other causes of anemia are excluded).
Occult GIB	GIB that is not clinically visible (positive fecal occult blood test or iron deficiency anemia when other causes of anemia are excluded).

GIB – gastrointestinal bleeding; GI – gastrointestinal

Table 2. Key patient history and risk factors for gastrointestinal bleeding

Angiodysplasia	Advanced age, aortic stenosis, end-stage renal disease, anticoagulant or antiplatelet therapy
Aortoenteric fistula	Massive GIB, infectious aortitis, aortic graft, aortic aneurysm, tumor invasion, radiation injury
Bowel ischemia	Acute abdominal pain, hypotension, advanced age, embolic disease, chronic renal failure, trauma, high-risk surgery
Crohn disease	Risk factors include duration of Crohn's, perianal disease, left colon involvement, steroid use
Delayed postpolypectomy bleeding	Polyp size > 10mm, thick stalk, anticoagulant or antiplatelet therapy
Dieulafoy lesion	Antiplatelet therapy, alcohol abuse, NSAID
Diverticular bleeding	Painless hematochezia, advanced age, hypertension, anticoagulant therapy, NSAID
GI malignancy	Unexplained weight loss, change in bowel habits, anemia
Hemobilia	Liver biopsy, cholecystectomy, endoscopic biliary procedures, trauma, tumors, hepatic artery aneurysm
Hemosuccus pancreaticus	Pancreatitis (chronic or necrotizing), neoplasm, pseudocyst
Mallory-Weiss tear	Vomiting, often related to alcohol abuse
NSAID enteropathy or colopathy	NSAID use
Postsurgical anastomotic bleeding	Gastric bypass surgery, Billroth II, NSAID use, smoking
Peptic ulcer disease	Epigastric pain, nausea, bloating; Helicobacter pylori infection, NSAID, anticoagulant or antiplatelet therapy, stress, Zollinger-Ellison syndrome
Varices and portal hypertensive gastropathy	Massive GIB; cirrhosis, portal hypertension, portal vein thrombosis

GIB – gastrointestinal bleeding; GI – gastrointestinal; NSAID – non-steroidal anti-inflammatory drug

for lower GI tract (10). The localization of bleeding can be improved by previous placement of metal clips at the bleeding source during endoscopy.

Contrast enhanced computerized tomography (CECT) is the imaging method of choice: it is noninvasive, fast, and more sensitive than digital subtraction angiography (DSA).

Contrast enhanced computerized tomography (CECT) can detect even smaller amounts of bleeding (<0.3 ml/min), and is more sensitive than DSA (10). In addition, compared to DSA, it is able to depict surrounding anatomical structures and to determine not only the place, but also a possible cause of bleeding. Since GIBs are usually intermittent in nature, it is important to scan the patients during the actual bleeding in order to determine the bleeding localization. CECT also displays the complete vascular anatomy and allows planning of subsequent endovascular intervention. Oral contrast should not be administered, because it will mask the intraluminal contrast material, which is a radiological sign of bleeding. Even in hemodynamically unstable patients with acute significant bleeding of obscure localization, CECT should be considered the imaging method of choice due to its non-invasiveness, speed, and sensitivity. Since the CECT is more sensitive than DSA, DSA and embolization should be considered only in cases when bleeding is identified on CECT.

Indications for endovascular treatment

The indication for endovascular treatment is usually based on a multidisciplinary consensus between the gastroenterologist, radiologist, and surgeon. In the event of acute significant gastrointestinal bleeding and after the failure of conservative treatment, endoscopy is the method of choice. Acute significant bleeding is generally considered as bleeding requiring transfusion of at least 4 units of blood within 24h or causing signs of hemodynamic instability and shock (systolic blood pressure <100, tachycardia >100) (11). Endovascular treatment is indicated for patients with significant acute GIB with endoscopically untreatable or unrevealed source of bleeding or with excessive bleeding that obscures the endoscopic view (7). It is recommended to perform CECT before the intervention. In the case of a negative CECT, the probability of detection of the bleeding site in DSA is low. Surgical treatment is generally considered in operable patients, especially those with a bleeding gastroduodenal peptic ulcer (12) or recurrent bleeding from colonic diverticula (13) and after endoscopy and embolization therapy failure.

Contraindications

Contraindications for embolization in significant GIB are only relative. These include general contraindications for iodine-contrast examinations (allergy and renal insufficiency), and those of coagulopathy and residues of barium sulphate contrast agent after the previous examination.

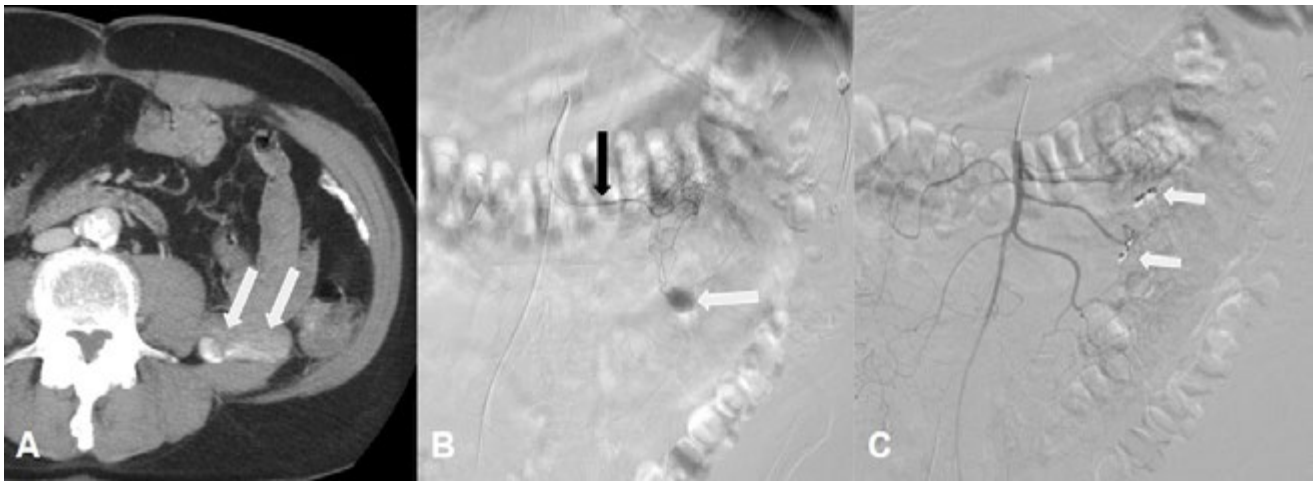

Figure 1. 1Lower gastrointestinal bleeding (GIB) (hematochezia) with unidentified genesis in a 74-year-old male. **A.** An axial contrast enhanced computerized tomography (CECT) shows an intraluminal contrast extravasation within a jejunal loop in the left hemiabdomen (white arrows). **B.** Superselective digital subtraction angiography (DSA) with the tip of the microcatheter in the left colic artery (black arrow) shows active bleeding (white arrow). **C.** Selective superior mesenteric artery DSA after the embolization shows two coils (white arrows) with complete cessation of the bleeding.

Procedure

Transarterial embolization (TAE) is an endovascular procedure in which embolic agents such as coils, microparticles, or liquid embolic are intentionally introduced in the vessel in order to achieve haemostasis (Figure 1).

Transarterial embolization (TAE) is an effective procedure in the treatment of gastrointestinal bleeding (GIB) in patients with bleeding source not detected on endoscopy or who cannot undergo endoscopy.

The patient's preparation before the procedure includes supportive therapy (volume therapy, etc.) and correction of coagulopathy. Bladder catheter insertion is desirable. In patients with GI bleeding, it is necessary to have anaesthesia or intensive care physician support, particularly in unstable patients. During the procedure, blood pressure, heart rate, saturation, and ECG are monitored.

The most common access used for TAE is the common femoral artery, therefore both groins must be shaved before the procedure. The procedure is usually performed under local anesthesia with analgosedation. It is recommended that arterial puncture should be done under ultrasound guidance in order to avoid local complications. Use of spasmolytics (e.g., Buscopan) can be helpful in avoiding motion image artefacts.

The procedure begins with selective angiography to localize the source of bleeding. After verifying the source, a microcatheter is introduced coaxially through the diagnostic catheter. The most commonly used embolic materials are microcoils, PVA (polyvinyl alcohol) microspheres (500-700 um), gelatin foam, and tissue glue (Histoacryl™). Selective intraarterial infusion of vasoconstrictor agent (vasopressin) is rarely used due to the high frequency of rebleeding (>50 %) and occurrence of systemic side effects (14). It could be considered for diffuse mucosal haemorrhage, or lesions inaccessible to a microcatheter.

Due to differences in blood supply of the upper and lower GI tract, the technique of embolization also differs. The upper gastrointestinal tract is characterized by a rich network of collateral supply with a lower risk of ischemia. Before the embolization itself, it is necessary to map all the possible sources of collateral supply, especially in the region of gastroduodenal artery and pancreaticoduodenal arcades. Because of the risk of rebleeding via collaterals, it is necessary to perform embolization proximally and distally from the site of bleeding (the so-called sandwich technique). In the lower gastrointestinal tract, particularly in the colon, there is a higher portion of terminal branches. Therefore, the ischemia risk is higher, and embolization should be as selective as possible (15).

Outcomes

Generally, the morbidity and mortality associated with endovascular intervention for GIB is lower or comparable than for surgical procedure (16,17).Therefore, endovascular therapy is considered the treatment of choice for GIB following failed medical and endoscopic therapy. Predictive factors for recurrent bleeding and mortality are uncorrectable coagulopathy, older age, cirrhosis, oncologic diseases, multiple organ failure, and current corticosteroid treatment (18).

Digital subtraction angiography (DSA) and embolization should be considered only in cases when bleeding is identified on contrast enhanced computerized tomography (CECT).

Complications

In addition to the standard rate of nonspecific complications associated with any angiographic procedure (such as reactions to the contrast agent, renal failure, local complications in the groin, dissection, and vasospasm), the most common and specific complication of GI embolization is ischemia. The risk of ischemia is low in the upper GI tract due to the rich collateral supply. Duodenal stenosis as a result of duodenal ischemia following embolization is rare and reported to be less than 7 %. Patients are at increased risk of ischemia if they have a previous history of surgery or radiotherapy and after embolization with glue or microparticles (11). The overall average complication rate is approximately 9% (19). In the lower GI tract, the most common specific complication is intestinal ischemia. The mild form presented with transient abdominal pain and asymptomatic stenosis occurs in 10 % of patients. Severe ischemic complications requiring surgical treatment (symptomatic ischemic stenosis, intestinal infarction) occur in 2 % (20).

Conclusion

TAE is an effective procedure in the treatment of GIB in patients with a bleeding source not detected on endoscopy or who cannot undergo endoscopy. The clinical success and complications of this approach in upper GIB makes preventive TAE useful in selected patients due to the high risk of rebleeding, also in consideration of the generally limited complications in empirical embolization of the upper gastrointestinal tract. Patient selection should be more prudent in the treatment of lower GIB: due to poor collateral supply lower GI tract is at higher risk of ischemia, hence the treatment should be as selective as possible.

Emergency physicians must recognize the indications for endovascular intervention, prioritize rapid imaging, and facilitate timely multidisciplinary coordination to optimize patient outcomes.

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