TAE GI bleeding
Interventional Radiology for Gastro-intestinal Hemorrhage.
- Basic Overview -

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Objective

To describe fundamental methods for identifying the bleeding source and effective IR treatment.

Introduction

Acute gastrointestinal hemorrhage is a major cause of morbidity and mortality despite numerous advances in diagnosis and treatment. Accurate diagnosis followed by prompt and appropriate intervention is imperative in the management of GI bleeding. Angiography and subsequent transarterial embolization (TAE) has become a useful diagnostic and therapeutic tool in selected populations. The typical candidate patient presents with massive bleeding or hemodynamic instability, who have failed to respond to conservative medical therapy consisting of volume replacement, antacids, H2 receptor blocking agents, or proton pump inhibitors, and have failed at least one, and sometimes two, attempts for endoscopic intervention to control bleeding. Preoperative evaluation by endoscopy or contrast-enhanced CT (CE-CT) is required before IR procedure. The results of these preoperative evaluations and patient condition define the process of IR treatment.

Identifying GI bleeding point

Endoscopy assists to define GI bleeding site and cause. Thereupon, the diagnostic process is immediately followed by endoscopic treatment. When a patient is hemodynamically stable, CT scans with and without contrast enhancement (NE-CT and CE-CT) can be applied. Dual phasic CE-CT with arterial and parenchymal phases is usually performed. NE-CT image visualizes high density fluid collection, which enables identifying the area of bleeding point, CECT visualizes extravasation or pseudoaneurysm, and it also visualizes ulcers or exposed blood vessels that can be the cause of the bleeding. Computed tomography angiography (CTA) has been used accurately (sensitivity up to 86%) in the diagnosis of acute gastrointestinal bleeding and can show the precise location and etiology of bleeding, thereby directing further management[1). Angiographic findings suggesting GI bleeding are extravasation, pseudoaneurysm, or irregularity of vascular wall. However, a bleeding sauce (target vessel) cannot be defined if extravasation or pseudoaneurysm is not identified on angiography. Hence, preparative evaluation - endoscopy marking with clip and CE-CT- are effective method to achieve successful IR treatment.

Effectiveness and complications of trans-arterial embolization for GI bleeding

Many published studies of TAE for upper GI bleeding have confirmed the efficacy of this approach and its high technical and clinical success rates, which range from 69 to 100% and from 63 to 97%, respectively, with using various embolic materials including coils, gelatin sponge, and the other material[2). Clinical outcome was adversely affected by shock, multi-organ failure, transfusion, and coagulopathy. The anatomical source of hemorrhage and IR technique did not affect the outcome.

TAE for lower GI bleeding is most effective for the treatment of diverticular bleeding. Embolization for diverticular bleeding was successful in 85% of patients. In contrast, re-bleeding after embolization for non-diverticular bleeding occurred in greater than 40% of patients and over a more protracted period. Currently, microcatheters allow super-selective embolization of GI bleeding vessels, a technique that minimizes potential ischemic complications[3)].

Indication of IR treatment

As described before, the first-line treatment option for GI bleeding is the endoscopic techniques. IR is the second-line option only when endoscopic hemostasis cannot be achieved or applied. IR is a fast, safe, and effective minimally invasive alternative to surgery.

IR techniques

The bleeding at a rate of at least 0.5ml per minutes is successfully identified on angiography. We must know intermittent nature of GI bleeding. Angiography can result in negative study if the bleeding has temporarily stopped at the time of the injection. Super-selective angiography and/or repeated angiography are often required to detect the bleeding point. We must use microcatheters for super-selective embolization of GI bleeding to obtain reliable hemostasis without ischemic complications.

The techniques of trans-arterial embolization (TAE) for GI bleeding requires the following 3 considerations: target organs and its characteristic, type of embolization materials, alternative method to stop bleeding for the cases of unidentified bleeding or failure of catheterization. Firstly, embolization method should be selected depending on its organ characteristic: (i) stomach, (ii) duodenum, and (iii) lower GI tract. Stomach is ischemia- resistant organ, hence, only 1 artery such as short gastric artery or right gastric artery is required to avoid necrosis. Given that duodenum is under dual supply by pancreaticoduodenal arcades, embolization of both sides distal and proximal to the bleeding point is essential for successful hemostasis[4)]. The key factor for lower GI tract TAE is selection of an adequate embolic material and the area of treatment, as it's non-resistant for ischemia. The risk of intestinal necrosis increases if the larger area is embolized. Secondly, gelatin sponge and coils are the standard embolic materials for GI bleeding: gelatin sponge is suitable for ischemia-resistant stomach, and it is used when embolizing target vessel from proximal side toward bleeding site. Coils are appropriate for embolizing specific area of pancreaticoduodenal arteries (PDAs) or GDA for duodenal bleeding, and proper for embolizing exact site of lower GI bleeding which is not resistant for ischemia. Another decision factor for the embolic materials - gelatin sponge or coil- is the position of the catheter tip at embolization. Coil is the first-line embolic material when the catheter tip could be positioned at the bleeding point of the target artery in duodenal or lower GI bleeding[5)]. Injection of gelatin sponge from the proximal branches is the second-line option when the catheter tip could not be selectively advanced into the target artery. It should be reminded that excessive injection of gelatin sponge from the proximal branch has a risk of ischemic complication. Use of small size gelatin sponge increase the risk of tissue ischemia[4)].

For GI bleeding, both the arterial distribution and the level of occlusion of particles are critical because nontarget embolization of the normal bowel can result in ischemic damage. In experimental studies using animal models, super-selective embolization of three or fewer vasa recta of the superior and inferior mesenteric arteries was relatively tolerable, whereas embolization involving four or more vasa recta carried an increased risk of significant ischemic bowel damage[6, 7)]. Therefore, maximum number of Vasa recta embolized should be limited to be three.

N-butyl cyanoacrylate (NBCA) has been used for TAE of uncontrolled GI bleeding in place of gelatin sponge particles or coils. TAE using NBCA for GI bleeding is a therapeutic method of choice for patients with a coagulation disorder because the efficacy of NBCA does not depend on the coagulation process. NBCA using TAE is controversial for acute LGIB because it has a potential risk of ischemic complications [8, 9)]. Some investigators have recommended more distal embolization at the level of or just proximal to the vasa recta to minimize the area of potential ischemia [8)].

Lastly, another alternative to embolization is the use of vasospastic agent, when the embolization is not applicable or failed. This method is applicable for lower GI bleeding, and it is continuous injection of Vasopressin via the catheter placed at the root of superior mesenteric artery (SMA) or inferior mesenteric artery (IMA). A review of four of the recent studies consisting of 267 patients demonstrated an initial 70 to 80% success rate. They observed approximately 20% rate of rebleeding with hemorrhage refractory to infusion in up to 40% of patients[10, 11)].

Conclusion

TAE is the second-line option for GI bleeding in the case of endoscopic failure. However, it is an effective procedure to stop bleeding when the bleeding area is identified on endoscopy or CT especially for the cases with single and definitive bleeding point.

References

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Fig.1 CE-CT

CE-CT shows high density fluid in the gastric fundus (annotated with circle) which represent hematoma. An ulcer with exposed blood vessels is seen at the duodenal bulb (annotated with arrow). The CT findings suggest the bleeding from duodenal ulcer.

Fig.2 Celiac Arteriography

Celiac angiography shows an extravasation from the gastroduodenal artery into the duodenal lumen (annotated with arrow).

Fig.3 Celiac Arteriography after selective embolization

Coil embolization of the gastroduodenal artery from distal to proximal of the bleeding point was performed. Celiac angiography after embolization shows occlusion of the gastroduodenal artery and disappearance of extravasation.

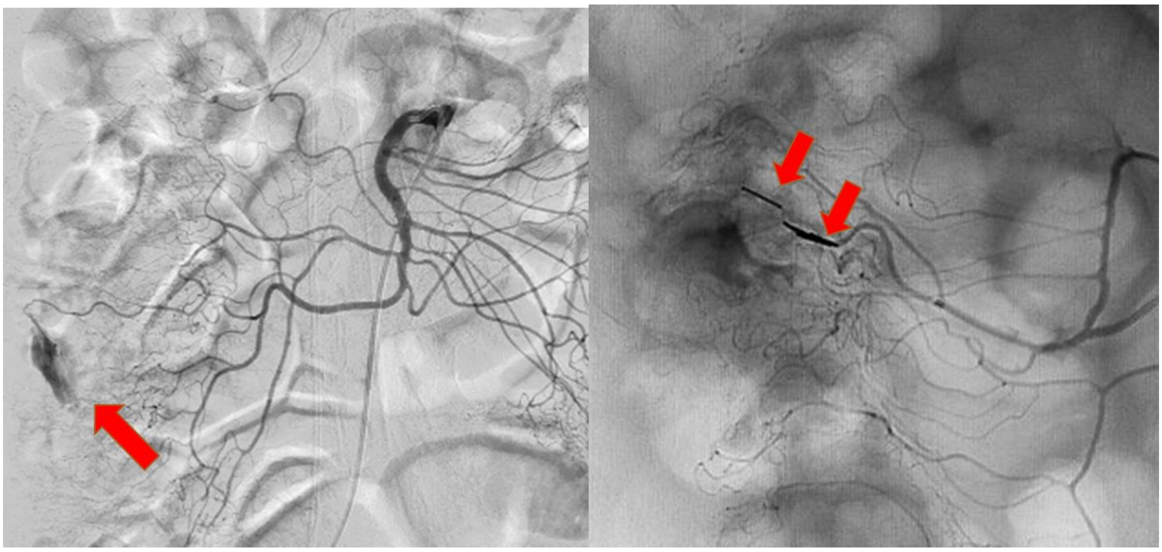

Fig.4 Hemorrhage from ascending colon diverticulum

a. Superior mesenteric arteriography shows extravasation into ascending colon. b. Coil embolization of two branches toward vasa recta is performed.