Introduction

In upper gastrointestinal (GI) bleeding, endoscopic diagnosis and therapy is the initial treatment of choice as it is imperative to determine whether bleeding is variceal or arterial, and endoscopic treatments usually achieve primary hemostasis in the majority of patients. However, 10-30% of these patients have repeat bleeding.\(^1\)

After the first report of selective arterial embolization of gastroepiploic artery for the control of acute gastric bleeding,\(^2\) improvements in interventional devices and embolic materials and wider availability of skilled interventional radiologists have increased the utility of embolization procedures in the management of GI bleeding.\(^3\)

Arterial embolization seems now accepted as the salvage treatment of choice over surgery for acute bleeding from the upper GI tract despite endoscopic treatment.

Decision making to choose transcatheter arterial embolization (TAE) or surgery depends on the condition of the patients or their availability.

Indications / Contraindications

1. Indications

The typical candidate patient presents with the following: 1) endoscopy-refractory acute upper GI bleeding. In previous studies, endoscopy had been performed and failed in average 99% of the patients: significant amount of blood in the stomach, large ulcer size, location of lesion at posterior bulbar duodenum, multiple lesions, and lesser curve were identified as causes for endoscopic failure.\(^4\) High risk patients tend to be directed toward TAE rather than surgery,\(^4\) 2) massive bleeding (transfusion requirement of at least 4 U blood over 24 hours) or hemodynamic compromise (systolic blood pressure < 100 mm Hg and heart rate > 100 beats per minute or clinical shock), and 3) recurrent bleeding after surgery.

2. Contraindications

There are no absolute contraindications because angiography and TAE may be needed as lifesaving procedures. Relative contraindications include renal insufficiency, contrast allergy, and uncorrectable coagulopathy. There is increased risk of gastric or duodenal infarction after TAE in patients with previous ex-
tensive upper GI surgery or radiotherapy. If the rate of bleeding is massive, surgery may be preferable to angiography, since angiography may not be able to control the bleeding as quickly as surgery.3

Techniques of Angiography and Embolization

1. General rules

Digital subtraction arteriography seems to be equivalent to detection rates of scintigraphic images. The major limitation of angiography relates to the intermittent nature of bleeding, which can result in a negative study if the bleeding has temporarily stopped at the time of contrast injection.3

For upper GI bleeding, angiography is centered on the anatomy of the celiac artery; left gastric artery supplies superior lesser curvature and cardiac region, right gastric artery supplies inferior lesser curvature, short gastric artery from splenic artery supplies superior greater curvature and the fundus, and gastroduodenal artery supplies remainder of the stomach and duodenum. The superior mesenteric artery (SMA) may supply portions of the duodenum, mostly by way of pancreaticoduodenal anastomoses, which are important as a rich collateral supply, but it also may be responsible for rebleeding after TAE. Selective catheterization for upper GI bleeding includes the celiac and superior mesenteric arteries. Aortograms are usually not performed, since visualization of contrast extravasation into the GI tract requires more selective injection.

2. Methods to enhance bleeding detection

1) Glucagon and Buscopan may be given before the procedure to decrease bowel motility and motion artifacts during digital subtraction angiography.
2) Provocative angiography such as infusion of tolazoline (vasodilator), heparin, or even thrombolitics (tissue plasminogen activator), can stimulate bleeding.
3) Longer injection durations or use of carbon dioxide for contrast medium can also improve sensitivity for small bleeds [4].
4) Refer to clips placed around the area of bleeding during pre-embolization endoscopy. If no extravasation is seen despite the injection of contrast, then the branches terminating at the clip are superselected using microcatheter techniques and embolized.

3. Angiographic findings and embolization

The only direct angiographic sign of UGI bleeding is extravasation of contrast medium into the bowel lumen. Indirect signs include aneurysms/pseudoaneurysms, vessel irregularity, vessel cutoff and arteriovenous/arterio-portal shunting, neovascularity, and increased vascularity from dilated arterioles (as seen in angiodysplasia).3 It is very important to correlate the angiographic findings with the endoscopic and image findings.

The most common embolic agents are metallic coils and polyvinyl alcohol (PVA) particles (usually 300-500 or 500-700 μm). Use of coils as the only embolic agent is significantly associated with early rebleeding, compared with the use of PVA or gelatin sponge with coils. Use of N-butyl cyanoacrylate (NBCA) is advantageous for massive bleeding that requires urgent hemostasis, especially in patients with coagulopathy because of rapid embolization.
Types of embolization can be classified into localized, proximal, and segmental embolizations (Fig. 1). Localized embolization is an ideal type of embolization, while proximal embolization may potentially be related to recurrent bleeding attributable to the backflow of blood from the distal, un-embolized side of the bleeding site. It is imperative to avoid extensive segmental embolization to prevent potential bowel infarction.

Outcomes

1. Summary of previous results

Six recent representative studies of embolization for nonvariceal UGI bleeding in 331 patients showed technical success rates of 92-100% and clinical success rates of 51-94%. Rebleeding rates were 9-47%, rates for surgery were 0-35%, and 30-day mortality rates were 3-27%. A wide range of clinical success and rebleeding rates, rates for surgery, as well as 30-day mortality rates seem to have originated from different etiologies and clinical severities.

Predictors of rebleeding were reported to be coagulopathy, longer time to angiography, massive transfusion, previous surgery, bleeding secondary to trauma, cancer bleeding, use of coils as the only embolic agent, or multiorgan failure.3,4

2. Is prophylactic embolization necessary?

Because of the intermittent nature of many incidents of upper GI bleeding, the incidence of a normal angiogram in a patient with acute upper and lower GI bleeding was 52% (75 out of 143 patients) in one recent report.11 In the latter study, the incidence of an angiographically negative outcome was significantly higher in patients with a stable hemodynamic status, or in patients with lower GI bleeding.

If no evidence of bleeding is found on pre-TAE arteriogram, then prophylactic embolization (usually with gelatin sponge and/or coils), defined as embolization without angiographic evidence of active bleeding, could be an alternative and is typically guided by endoscopic information regarding the location of the bleeding vessel.4 Angiographic confirmation of a bleeding site seems not a prerequisite for TAE in the upper GI bleeding. Several studies showed no difference in clinical outcomes between patients with negative and patients with positive angiography results treated with TAE.9,12-14
3. TAE vs. surgery

The wide array of alternatives for the treatment of upper GI bleeding after endoscopic failure make the decision of when to resort to emergency surgery more difficult, especially in patients with risk factors for recurrent bleeding and death, which are also related to high surgical risk. Nonetheless, TAE could not replace surgery. Although continuing bleeding demands for emergency TAE, especially in high-operative-risk patients, surgery is preferred in young and healthy patients, especially with large and/or multiple peptic ulcers, without having proved the inferiority of TAE in such a setting.

4. Complications

TAE in the upper GI tract above the ligament of Treitz is generally considered very safe because of the rich collateral supply to the stomach and duodenum. However, the risk of significant ischemia or stricture could be increased when potential collateral vessels are damaged from previous upper abdominal surgery, radiotherapy, or severe atherosclerosis, or when liquid agents such as NBCA, or very small particles advance far into the vascular bed.

Lang et al. reported a 16% (9/57 patients) incidence rate of duodenal strictures following TAE. If true bowel infarction occurs, surgical resection is generally required. For more chronic ischemic complications such as bowel stricture, balloon dilation may be possible, but surgical resection should be considered if the stricture is resistant to balloon dilation.

Conclusions

The safety and efficacy of TAE for the treatment of acute nonvariceal upper GI bleeding refractory to endoscopy is now widely accepted. TAE may be effective for even high-operative-risk patients, even when active bleeding is not visualized by angiography.

References