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ABSTRACT BOOK

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However, endoscopic localization may be very precise as the situation when endoscopic clips were placed on a visible vessel or bleeding ulcer. Here, the specific vessel supplying the bleeding pathology can be precisely targeted for embolization.

Some studies (5, 6) have shown comparable rebleeding rates, regardless of whether embolization was performed empirically or to manage demonstrable extravasation. However, a larger study (7) has suggested that the value of empiric embolization depends on which vascular bed this is applied to. For gastric hemorrhage, it was shown that the rate of hemostasis 30 days post-embolization was 67% when embolization was performed to treat an angiographic abnormality in comparison with the rate of 42% after empiric embolization. However, for duodenal bleeding, hemostasis 30 days after angiography was equivalent (60% vs. 58%) for patients undergoing empiric embolization and those undergoing embolization for arterial hemorrhage observed at angiography. Moreover, the rate of hemostasis was significantly worse (33%) for those patients who underwent a diagnostic arteriogram but were not embolized.

In addition to endoscopic guidance, modern CTA angiography can sometimes define the specific arterial branch that is the source of bleeding. This has allowed empiric embolization to be extended to the lower GI tract. Feld et al. (8) described successful super-selective embolization of a sigmoid colon artery, despite a negative arteriogram. The anatomy depicted by CTA perfectly matched the catheter arteriogram; therefore, it was possible to know which vessel was the source of bleeding, despite not visualizing extravasation during the arteriogram.

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304.3

The role of liquid agents

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Learning Objectives

1. When and how to use liquid embolics in LGIB
2. Pros and cons of using liquids in LGIB ,
3. Results and complications of liquid embolics in LGIB

Embolization is currently proposed as the first step in the treatment of severe, acute, and life-threatening lower gastrointestinal bleeding (LGIB) in cases where the endoscopic approach is not possible or not useful. The efficacy of embolization depends on a combination of bleeding site occlusion and clot forming. The main concern with embolic materials is rebleeding and the risk of secondary bowel ischemia. There are no guidelines for the choice of embolic material used, and the final decision is specific to each case. However, liquid embolic materials, including *N*-butyl cyanoacrylate glues (NBCA) and gelling solutions (Onyx, ethylene vinyl alcohol copolymer; Ev3 Endovascular, Inc. Plymouth, MN) have gained acceptance.

NBCA is an effective, rapid, and safe embolic material, which may be lifesaving in emergent situations. NBCA has several advantages. It allows for rapid and permanent embolization due to its fast polymerization when it comes in contact with blood. A single injection may provide complete hemostasis through simultaneous embolization of collateral vessels connected to the bleeding focus. It is useful in patients with coagulopathy as the vessel occlusion is independent of the coagulation process. NBCA glue has other favorable characteristics that make it an effective embolization agent. First, NBCA has a low viscosity that allows for injection through small caliber catheters. Furthermore, the polymerization and injection rates of NBCA can be adjusted to allow for very distal occlusion to the tip of the microcatheter. During the procedure, NBCA is mixed with iodized oil in ratios varying from 1:1 to 1:3 and the microcatheter must be flushed with 5% dextrose solution prior to injection to prevent the premature polymerization of NBCA within the catheter. Injection is stopped when extravasation of the mixture occurs from the bleeding site or when an underlying pseudoaneurysm is completely opacified. In general, coils are preferred for embolization of pseudoaneurysm as they allow precise placement. However, it is often difficult to selectively place the catheter close to and beyond the pseudoaneurysm in small or tortuous vessels. Furthermore, when there are multiple efferent arteries from the pseudoaneurysm or when multiple collaterals from adjacent arteries feed the aneurysm, embolization with coils may be time consuming and technically difficult. Although catheterization may be possible, it may be difficult to deliver the coils because of the tortuosity of the vessels. At such instances, NBCA can be a good choice due to its low viscosity. Embolization with NBCA glue is technically more challenging than embolization with microcoils and requires specific training and expertise. Indeed, relatively few interventional radiologists are experienced in this technique. However, the potential complications of NBCA glue injection, including catheter entrapment, abscess formation, and uncertain control of vascular penetration with nontarget embolization, can be avoided in well-trained hands. In our experience, the following steps can help ensure a successful NBCA embolization procedure: (i) use of a strong supporting catheter to facilitate ease of microcatheter navigation, (ii) awareness of the complex vascular anatomy and use of road mapping, (iii) deep wedging of the microcatheter beyond the margin of the colon to prevent excessive embolization of the vasa recta, (iv) use of contrast imaging to double-check catheter position with respect to the point of bleeding before NBCA injection, (v) use of the appropriate ratio of lipiodol to NBCA, (vi) use of a single column injection technique under continuous fluoroscopic monitoring (with an injection volume as small as

possible to avoid reflux), and (vii) rapid removal of the catheter after glue injection. Only two glues are currently and officially available in the market worldwide for endovascular use: Glubran2 (GEM) and Trufill (Cordis); these glues have a European Conformity marking and U.S. Food and Drug Administration approval, respectively. Histoacryl (B. Braun), which has been used in many previous series, is normally not allowed for endovascular procedures because of the absence of European Conformity marking or U.S. Food and Drug Administration approval. Its use is considered off-label in such a setting. In addition, Histoacryl polymerizes faster and provides higher exothermic reaction (90°C) than other glues, resulting in more challenges associated with its use and the development of more inflammation and histotoxicity. High clinical success rates with the use of glue are reported in the literature (85%–96%), suggesting that this embolic agent has gained acceptance. Recurrent bleeding ranges from 4% to 15%).

On the other hand, selective arterial embolization with Onyx is a very interesting and promising treatment option for lower GI bleeding. Onyx seems to provide controlled embolization due to slow polymerization that enables deep penetration with less risk of catheter gluing due to its non-adhesive nature. The main disadvantage of Onyx is its relatively high cost compared with other embolic agents. The 6% concentration of ethylene-vinyl alcohol copolymer (Onyx18) is mostly used to ensure more fluidity and to permit greater penetration in the thin vasa recta. This property is particularly useful in tortuous or rigid vessels, where it is occasionally impossible to deploy microcoils as selectively as would be desirable. This liquid embolic material can also be delivered through a 0.010-inch microcatheter, which may be useful in small or spastic vessels. Onyx produces a plug in the eroded artery and simultaneously blocks the primary site of bleeding. The slow real-time injection under fluoroscopic guidance provides greater control over the distribution of the embolization agent, avoiding nontargeted embolization. Because this product is non adhesive and its solidification time is long, the microcatheter is not entrapped, even though its tip is surrounded by the Onyx. Distal migration of Onyx is rare because of its adhesive nature and slow, controlled real-time injection; however, retrograde reflux into a nontargeted vessel is possible if the injection technique is incorrect and if it is performed at a greater velocity than recommended. Another disadvantage is that if the operator does not have enough experience with the use of Onyx, the time, radiation dose, and complexity of the procedure may be excessively increased. Some authors have reported severe vasospasm in cases of rapid injection. This is especially important during the early stages of the embolization procedure when the dimethyl sulfoxide (DMSO) is being replaced by Onyx in the catheter dead space. Therefore, the first 1 mL of embolic agent must be injected very slowly. DMSO is volatile and is excreted via respiration and sweat. This has a typical smell, unlike that of diabetic ketoacidosis, and may last for a few days. The patient and ward staff should be warned to expect this. In addition, chemical irritation caused by DMSO is usually painful. It is advisable to start stirring Onyx as soon as it is suspected that its use may be necessary. If microcatheter repositioning is needed when Onyx is being used for embolization, the microcatheter will no longer accept a microguide when it is filled with Onyx, and a new microcatheter will be required. Another drawback is that Onyx creates streak artifacts that hinder future multi-detector CT evaluation; however, in cases of LGIB, this problem is minor because of the small amount of Onyx employed. Free flow is necessary for particles or cyanoacrylate embolization; however, Onyx works equally well with or without flow, and this is an advantage in cases where vasospasm is present. Recently, Onyx has exhibited nice results in terms of LGIB control, with a clinical success rate that approaches 100% and no major complications or procedure-related deaths. The 30-day rebleeding rate is reported to be about 10%.

All advantages and drawbacks of liquid embolic materials for the treatment of LGIB will be presented in detail in this review.

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304.4

The role of particles

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Learning Objectives

1. When and how to use particles in LGIB
2. Pros and cons of using particles in LGIB
3. Results and complications of particles in LGIB

Because microcoils are both effective and forgiving, they are the author's primary embolic for treatment of non-variceal lower gastrointestinal hemorrhage. However, particles have been reported to be equally effective and continue to be the agents of choice in some centers. Interventional radiologists who use particles argue that particles flow along the path of least resistance toward the bleeding vessel. Additionally, at least theoretically, particles may be superior to microcoils in patients with coagulopathies as they can result in a more complete vessel occlusion. Particles are preferable over microcoils for tumoral hemorrhage or in some cases where vasospasm precludes distal catheterization. Compared with microcoils, the drawbacks of particles include the inability to directly visualize particles and the lack of any effective means to mollify non-target