

Gastrointestinal bleeding

Over the past five years, the literature concerning gastrointestinal bleeding shows that glue is the most often employed embolic agent in this kind of indication, especially in Asian countries⁽⁸⁻¹¹⁾. We have recently published a meta-analysis on the subject⁽²⁾.

How distal does Lower Gastrointestinal Bleedings (LGIB) need to be?

– Superselective

- Jejunum, ileum, colon
- Distal embolization of vasa recta (straight artery)
- Beyond the marginal artery
- As close as possible to the site of hemorrhage
- Bowel wall ischemia is unlikely
 - 3 or fewer vasa recta: not risky
 - 4 or more vasa recta: risky

In the discussion as to how to avoid ischemic complications (Fig.36), especially in relation to the lower gastrointestinal part, the factor that needs to be taken into account is the number of vasa recta we embolize. The risk is next to none when we embolize up to three vasa recta. In 2017, JVIR published a notable meta-analysis on the subject⁽³⁾.

The pooled clinical success and major complication rates in the 259 patients with UGIB in whom technical success was achieved were 82.1% and 5.4%, respectively, and those in the 175 patients with LGIB in whom technical success was achieved were 86.1% and 6.1%, respectively (Fig.37).

- 440 patients
- 13 ischemic complications: 2.9%
- Only 3 needed bowel resection (Fig.38)

How to avoid ischemic complications?

- How distal does LGIB need to be?
 - Superselective
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Experimental Study on Acute Ischemic Small Bowel Changes Induced by Superselective Embolization of Superior Mesenteric Artery Branches with N-Butyl Cyanoacrylate

Hyun-Joo Lee, MD, Se-Heon Chung, MD, Hyon-Seok Kim, MD, Young-Ho No, MD, Myung-Cheol Lee, MD, Wook-Ji Lee, MD, Byoung-Kwon Kim, MD, Seok-Jin Kim, MD

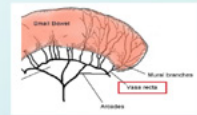


Figure 36 - Avoiding ischemic complications

CLINICAL STUDY

Transcatheter Arterial Embolization of Gastrointestinal Bleeding with N-Butyl Cyanoacrylate: A Systematic Review and Meta-Analysis of Safety and Efficacy

Pyeong Hwa Kim, MD, Jiaywei Tsauo, MD, Ji Hoon Shin, MD, and Sung-Cheol Yun, PhD

440 patients

13 ischemic complications: 2.9%

Only 3 needed bowel resection

| Pt. No./Age (Y)/Sex | Site of Bleeding | Etiology of Bleeding | Embolic Agent | Embolize Artery | Complication | Management | Outcome |
|---------------------|------------------|----------------------|-------------------|-----------------|------------------|------------------------|--------------------------------|
| 155F | Stomach | Ulceration | Histoacryl | LGA | Ulceration | Conservative treatment | Recovered |
| 290F | Stomach | Malignancy | Histoacryl | LGA | Ulceration | Conservative treatment | Recovered |
| 373M | Stomach | Ulceration | Histoacryl | LGA | Ulceration | Conservative treatment | Recovered |
| 477M | Duodenum | Ulceration | Histoacryl, coils | GDA | Liver infarction | Conservative treatment | Recovered |
| 543M | Duodenum | Iatrogenic injury | Histoacryl | APDA | Bowel infarction | Conservative treatment | Died of perforation 6 wk later |
| LGIB | | | | | | | |
| 175F | GJ anastomosis | Iatrogenic injury | Histoacryl | JA | Ulceration | Conservative treatment | Recovered |
| 260M | GJ anastomosis | Iatrogenic injury | Histoacryl | JA | Bowel infarction | Bowel resection | Recovered |
| 356F | Jejunum | Malignancy | Histoacryl | JA | Bowel infarction | Conservative treatment | Recovered |
| 459M | Appendix | - | Histoacryl | AA | Bowel infarction | Bowel resection | Recovered |
| 530M | Appendix | Trauma | Histoacryl | AA | Bowel infarction | Bowel resection | Recovered |
| 652M | Appendix | Diverticulosis | Histoacryl | RCA | Bowel infarction | Conservative treatment | Recovered |
| 779M | Colon | Diverticulosis | Histoacryl | RCA | Ulceration | Conservative treatment | Recovered |
| 866M | Colon | Diverticulosis | Histoacryl | RCA | Ulceration | Conservative treatment | Recovered |

Figure 37

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CIRSE

CIRSE STANDARDS OF PRACTICE GUIDELINES

Quality Improvement Guidelines for Transcatheter Embolization for Acute Gastrointestinal Nonvariceal Hemorrhage

Vlastimil Valek · Jakub Husty

- Most frequent
 - Microcoils, 500-700 PVA microspheres, gelatin foam
- In case of massive bleeding:
 - Glue or EVOH may be considered but with increased risk of ischemia??
- Severe ischemic complications requiring surgery:
 - 4-5%

Figure 38

How to avoid ischemic complication

We can certainly say that there is no high risk of ischemic complications in the use of glue for this indication, disregarding the location.

If we look at the Cirse guidelines⁽¹²⁾, microcoils and particles are indicated as the most frequently employed embolic agents. In case of massive bleeding: "Glue or EVOH (copolymers) may be considered but with increased risk of ischemia". We believe this statement to be false, as the game-changing factor is in fact the number of vasa recta we embolize, not the embolic agent we choose. Additionally, severe ischemic complications requiring surgery are indicated as 4-5%, while the meta-analysis indicates in fact 2.9% (Fig.38).

We can conclude that, when compared to other embolic agents, in GI bleedings glue does not pose a higher risk of ischemic complications.

When we perform an empirical embolization, with or without extravasation, we can locate the bleeding ulcera through an endoscopy and then proceed with embolizing the gastroduodenal artery (GDA) (Figs.39-41).

Gastric bleeding

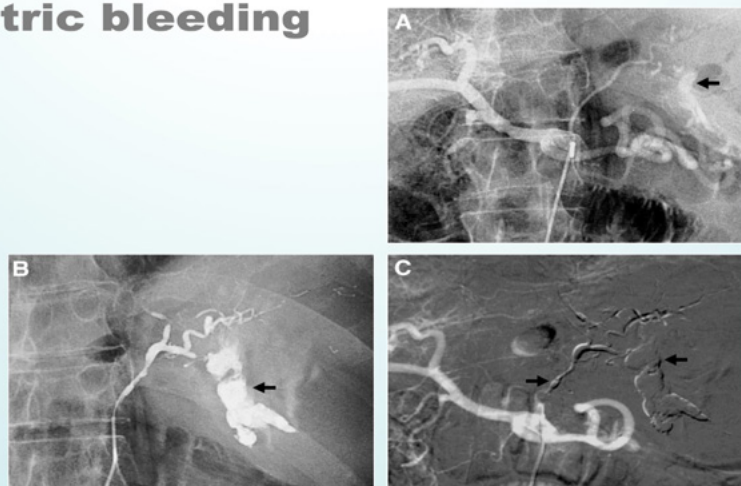


Figure 39

Duodenal bleeding

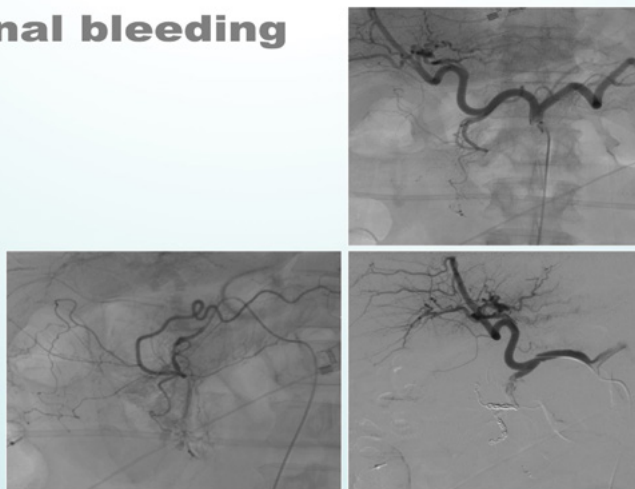


Figure 40

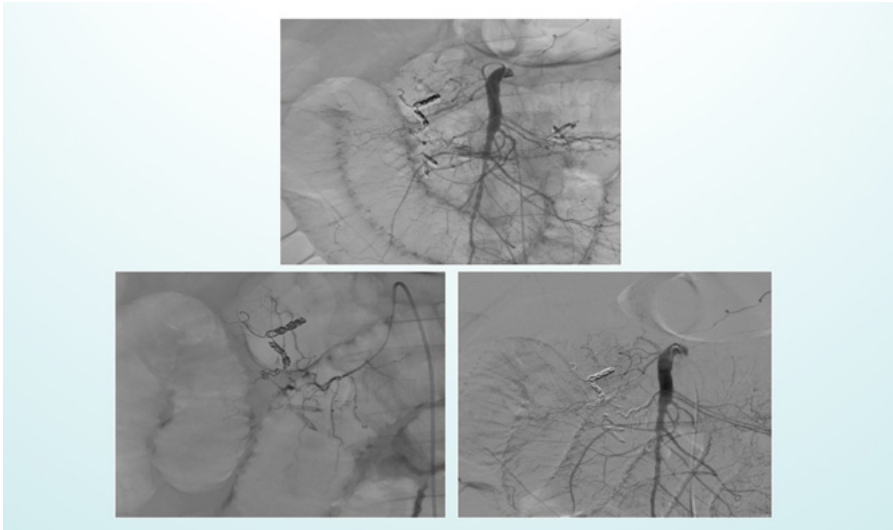


Figure 41

We usually put coils in the right gastroepiploic artery (GEA) to protect it and prevent distal embolization by liquids. It is now safe to inject the glue in the rest of the trunk and the branches. Because we need to avoid migration in case of reflux, we use a 1:1 dilution ratio and start to form the cast by slowly injecting the mixture while removing the microcatheter. We published many papers on GDA bleeding, showing that it is always preferable to use a combination of agents, however, when only one embolic agent is employed, glue gives the best results.

Extravasation control

It is important to always check the superior mesenteric artery for extravasation. With so many collaterals, there is no danger of ischemic complications, however, an incomplete embolization may pose serious risk of rebleeding, as most of these patients have comorbidities or take anticoagulants. For this reason, we perform a very aggressive embolization in these cases, to ensure

we will not need to intervene a second time at a later stage.

Whether we were dealing with recanalization or with a known event previously shown by the initial angiography, the extravasation was evident and made it difficult to approach more distally. We used a 1:3/1:4 ratio and achieve great results. Regarding a left colon extravasation from the inferior mesenteric artery, the risk of recanalization is high, as it is impossible to reach behind the extravasation to perform a sandwich embolization with the aid of coils. This is what we call a blocked flow embolization, where glue is the perfect choice as it allows for total control.

The mixture will advance when we push and it will stop when we stop injecting. By using hyperpressure, we can easily push the glue beyond the extravasation point and reach the two vasa recta we need to embolize. The feeling is that of a microcatheter with an occlusive balloon: we want to avoid reflux so we push slowly and distally. We do not actually need a balloon, the microcatheter is enough to block the flow, as you can see in this case of diverticular bleeding (Fig.42). This is another example of extravasation from trauma, in a spastic patient (Fig. 43)⁽¹³⁾. The artery is small and the extravasation quite large, however, we can sacrifice the branch without concern. Two drops of glue are enough here and the the dilution ratio is not important. Due to the spasticity and the bleeding, it is easy to underestimate the size of the coils and cause the artery to reopen at a later time. Figures 44 A-F show a complicated case of hepatocellular carcinoma (HCC) bleeding with occlusion of the celiac trunk involving the superior mesenteric artery and the pancreatic duodenal arcades. Chemoembolization would appear the perfect step to follow such a procedure, however, it is not necessary. The patient can be fully treated through a simple embolization performed by using a 1:6 dilution ratio, and closing the access for any future chemoembolization will not be an issue. At follow-up, we observed perfect necrosis and the patient was admitted for surgery. After five years, the patient is alive and doing well. In this particular indication, the chemotherapeutic agent in chemoembolization is only accessory to the embolization itself, and you can sacrifice the branch with-

Diverticular bleeding

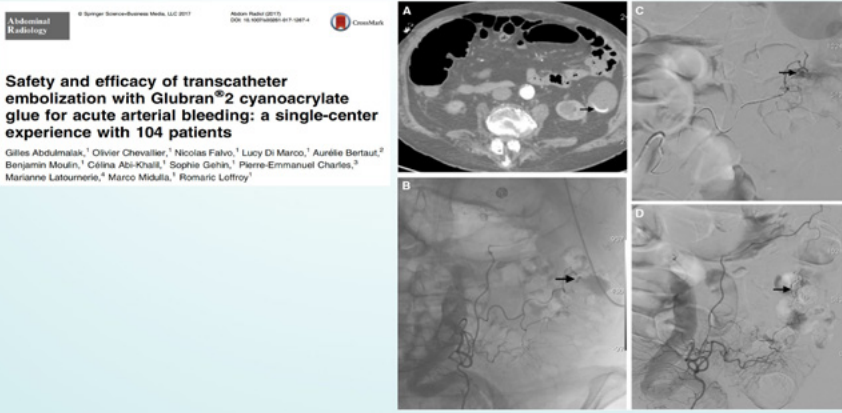


Figure 42 - Diverticular bleeding

20 year-old woman, trauma

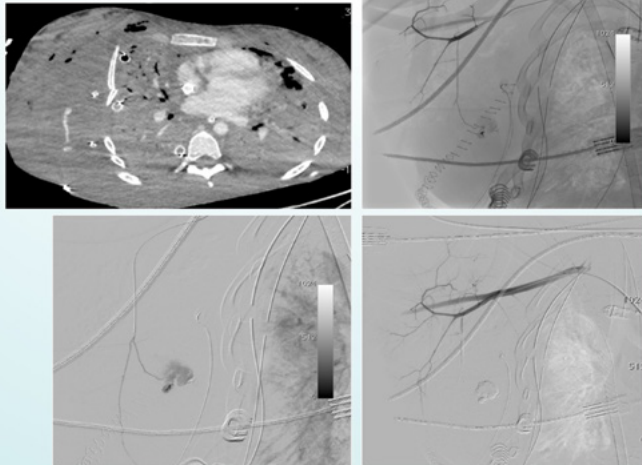
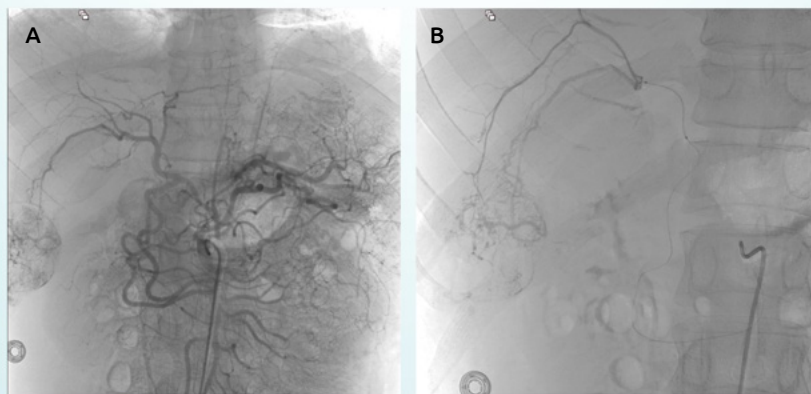


Figure 43 - 20 year-old woman, trauma



HCC rupture

Figure 44 AB - HCC rupture

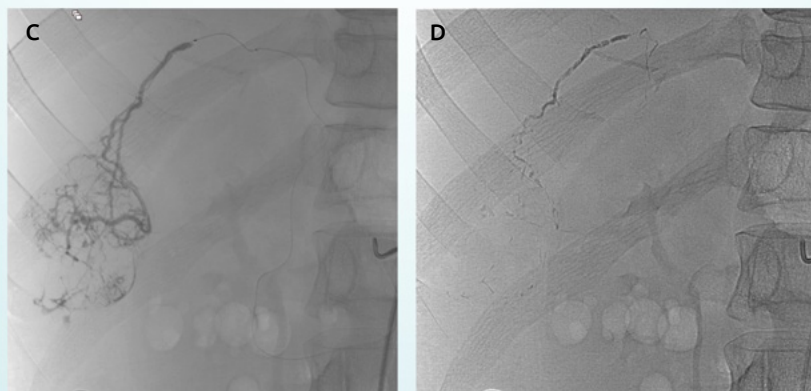


Figure 44 CD

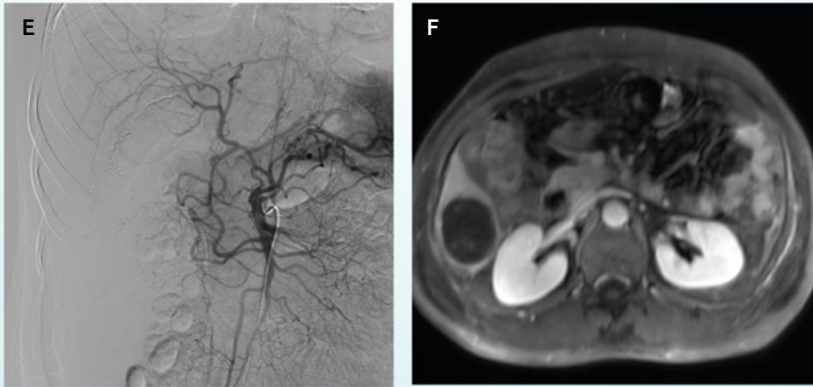


Figure 44 EF

out concern and achieve the best possible outcome. In case of pseudoaneurysm in the splenic artery, we know we can expect an infarction as a likely consequence, disregarding the embolic agent of choice. Nevertheless, the size of the infarction may be affected by the number of microcoils employed to complete the embolization. Once again, liquids appear to be the safest solution. Recently, patients on anticoagulants who arrive in our practice with spontaneous bleeding have been more and more frequent; this is a complicated indication, as we cannot treat the patient directly, but we have to rely on images⁽¹⁴⁾. Sometimes, we can only detect a small hematoma and the patient seems to be recovering well, however, the size of the hematoma represents a prognostic factor in itself. In case of internal extravasation, we find that the best choice is to perform a preventive embolization, as the hematoma is likely to grow, causing both venous and arterial bleeding that are not easy to control when it is too late. By using a 1:3/1:4 dilution ratio we can perform a quick embolization and sacrifice the entire branch to prevent complications that can take

as little as one hour to arise. Undoubtedly, age is an important factor in the rate of the growth and we are aware that this is more likely to happen in patients who are over 70 years old. Nonetheless, if the CT scan detects an active bleeding with extravasation, we do not foresee it is likely to stop spontaneously. Even when we decide to administer antagonists, for example, we know they take several hours to work, so we proceed with embolizing at the same time, to prevent the hematoma from growing. In 50 patients who underwent Glubran[®] 2 embolization, we observed a 40% mortality rate at one month: clinicians are possibly unaware of such outcome and often put patients on anti-coagulant even when they are not strictly necessary. While these medications can save lives, they can also cause death. In patients who are being treated with antiplatelet or anticoagulant, we see spontaneous bleeding in absence of trauma, and the hematoma grows bigger every time. At least in case of extravasation, preventive embolization is, in our opinion, the safest choice, even when the patient conditions seem to be improving (Fig. 45)⁽¹³⁾.

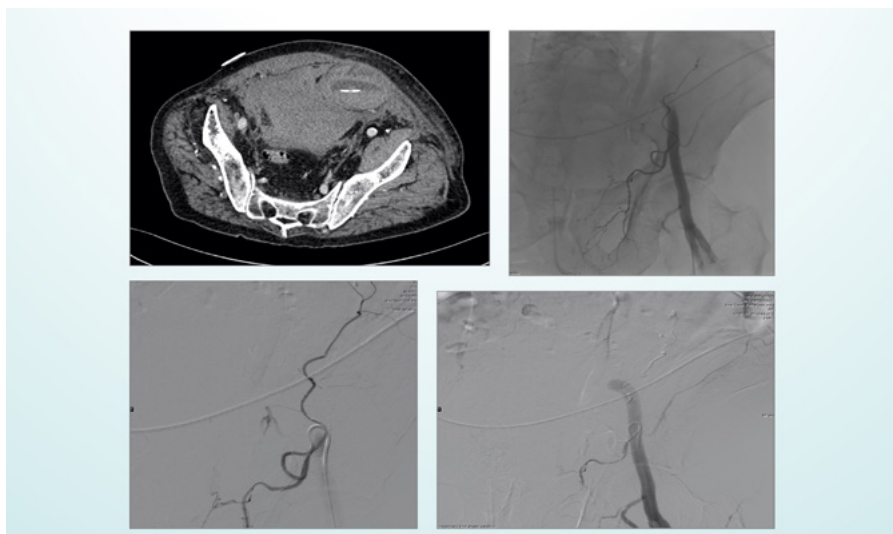


Figure 45