Radiology Case Reports 18 (2023) 3026–3031

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/radcr

Case Report

Successful treatment of multiple microbleeds in a large area of the small bowel by transcatheter arterial embolization using imipenem/cilastatin as embolization material ☆,☆☆

Sakiko Hiraki, MD[a,*], *Fumie Sato, MD*[a], *Ichiro Okada, MD*[b], *Masaya Osugi, MD*[a], *Yoshiya Watanabe, MD*[a], *Yoshiaki Ichinose, MD*[a]

[a] *Department of Radiology, National Hospital Organization Disaster Medical Center, 3256, Midoricho, Tachikawa, Tokyo, 190-0014, Japan*

[b] *Department of Critical Care Medicine and Trauma, National Hospital Organization Disaster Medical Center, Tachikawa, Tokyo, Japan*

ARTICLE INFO

Article history:
Received 24 May 2023
Revised 4 June 2023
Accepted 8 June 2023

Keywords:
Imipenem/cilastatin
IPM/CS
Transcatheter arterial embolization
Multiple small intestine hemorrhages
Nonsteroidal anti-inflammatory drugs
Viable treatment option

ABSTRACT

A 44-year-old man with chronic idiopathic pseudo-intestinal obstruction and lumbar disc herniation presented with orthostatic dizziness, black vomiting, and stools. He was suspected to have an ulcer caused by nonsteroidal anti-inflammatory drugs and treated conservatively but continued to have transfusion-dependent anemia. Trans-arterial contrast-enhanced computed tomography showed multiple microbleeds in the small intestine. We diffusely embolized 7 small intestine branches of the superior mesenteric artery using imipenem/cilastatin on 2 separate occasions. This stopped the bleeding, and the patient progressed well without ischemic complications and was discharged on the 25th postoperative day.

Transcatheter arterial embolization with imipenem/cilastatin may be a viable treatment option for patients with multiple small bowel bleeds in a large area of the small intestine that are unresponsive to conservative treatment or endoscopic methods.

Abbreviations: 4-Fr, 4-French; CT, computed tomography; IPM/CS, imipenem/cilastatin; NSAIDs, nonsteroidal anti-inflammatory drugs; PPI, proton pump inhibitor; SMA, superior mesenteric artery; TAE, transcatheter arterial embolization.

☆ Acknowledgments: The authors would like to thank Editage (www.editage.com) for English language editing.

☆☆ Competing Interests: The authors have declared that no competing interests exist.

* Corresponding author.
E-mail address: hiraki0615@yahoo.co.jp (S. Hiraki).

https://doi.org/10.1016/j.radcr.2023.06.020

Introduction

Small bowel bleeding is a relatively uncommon cause of gastrointestinal bleeding, accounting for approximately 5%-10% of cases [1]. Advances in imaging and endoscopic techniques have significantly improved the diagnosis and treatment of this condition. Endoscopic therapy is often preferred over more invasive treatments, especially when the bleeding lesion is accessible and amenable to such treatment [1–4]. TAE is an alternative option when the patient is hemodynamically unstable and is highly effective in cases involving a single bleeding site [1,2]. Cases with multiple bleeding sites are usually more difficult to treat with TAE. Surgical treatment is generally considered the last resort in cases of small bowel bleeding [1,2].

This study describes a case that was difficult to treat endoscopically or surgically; hence, TAE using IPM/CS as an embolization material was employed to treat multiple microbleeds in a large area of the small bowel. A favorable outcome was obtained in this case.

Case report

A 44-year-old man with a history of chronic idiopathic pseudointestinal obstruction and lumbar disc herniation presented to the emergency department with orthostatic dizziness, black vomiting, and black stools. He was being administered nonsteroidal anti-inflammatory drugs (NSAIDs), without a proton pump inhibitor (PPI), to manage back pain for 2 weeks. Given the initial negative results on contrast-enhanced computed tomography (CT), angiography, and upper gastrointestinal endoscopy, the patient was suspected of having a small intestinal ulcer caused by NSAIDs. He was treated conservatively with the discontinuation of NSAIDs and administration of PPIs, and he did not consume food or water; however, the patient continued to exhibit transfusion-dependent anemia. Eighteen days posthospitalization, the patient developed massive black stools and circulatory failure. Trans-arterial contrast-enhanced CT with a catheter in the superior mesenteric artery (SMA) showed multiple microbleeds in the small intestine (Fig. 1). Due to the patient's preexisting chronic idiopathic bowel obstruction, laparotomy and small intestine endoscopy were not feasible. Therefore, we attempted transcatheter arterial embolization (TAE) as a treatment option.

The procedure was performed using an angiographic system (Azurion 7 M20; Philips Healthcare, Best, Netherlands) under local anesthesia administered via the femoral artery using a 4-French (Fr) sheath (Medikit Super Sheath; Medikit, Tokyo, Japan). A 4-Fr Cobra-type angiographic catheter (C1; Medikit, Tokyo, Japan) was placed into the SMA, and diagnostic angiography was performed to identify the bleeding site. Angiography revealed no active bleeding. Given the difficulty in identifying lesions via angiography, we planned to embolize the vessels using TAE, based on the findings of trans-arterial contrast-enhanced CT. Microbleeds were scattered over a wide area of the small intestine, and the responsible vessels appeared to be 7 small intestine branches of the SMA. Due to the extensive lesions and numerous vessels involved, we decided to perform TAE using an imipenem/cilastatin (IPM/CS) mixture as an embolic agent. We performed diffuse embolization of the 7 small intestinal branches of the SMA on 2 separate days in light of the risk of ischemic complications (Figs. 2 and 3).

The use of IPM/CS as an embolic agent is not typically covered by insurance in Japan. Therefore, we obtained approval from an institutional review board prior to this treatment. The IPM/CS mixture was prepared using 0.5 g (1V) of IPM/CS in 5 mL of nonionic contrast medium. The mixture was then drawn into a syringe and gently dispensed approximately 10 times to ensure proper mixing. A high-flow microcatheter (BISHOP HF, PIOLAX, Kanagawa, Japan; LEONIS Mova HF, Sumitomo Bakelite, Tokyo, Japan) placed on the proximal side of the small intestine branches of the SMA was used to inject the mixture until the blood flow of the vasa recta slowed. The total amount of IPM/CS used in the procedure was 3.5 g.

After the procedure, the patient's bleeding and transfusion-dependent anemia ceased, and he progressed well without any ischemic complications. The patient was discharged on the 25th postoperative day. Thus, this TAE treatment approach using the IPM/CS mixture successfully stopped the bleeding and resolved the patient's symptoms.

Discussion

IPM/CS was used as an embolic agent for chemoembolization in a study on animals in 1999 [5]. IPM/CS has been shown to possess several unique characteristics, including the production of particles predominantly <60 μm in size, a relatively short embolic effect of <48 hours, and its effectiveness in embolizing small blood vessels but not large vessels, making it a useful embolic agent [5,6]. It has also been safely used for proximal embolization in the human intestine and in the treatment of tendinopathy and enthesopathy [7–9,11]. Few safety reports also describe the use of IPM/CS for treating small bowel bleeding [10,11].

In this case, there were 2 points to consider for embolization using IPM/CS: the extent and endpoint of embolization. The extent of embolization refers to the number and size of the embolized blood vessels. In general, TAE with conventional embolic materials, such as metallic coils and N-butyl cyanoacrylate, has been reported to potentially cause ischemic damage, if the embolization is performed on >3 vasa recta [12–15]. However, in this case, it was impossible to embolize in a super selective manner due to the presence of multiple microbleeds and the difficulty in identifying the lesions on angiography. Therefore, embolization was performed from the proximal side of the 7 branches of the SMA. This area was considerably larger than that typically embolized using conventional materials, with a high risk of ischemia.

The endpoint of embolization refers to the degree of embolization or the amount of blood flow blocked by the embolic material. Determining the endpoint, in this case, was difficult because of the difficulty in recognizing the lesions on angiography. Therefore, we stopped the embolization at a point milder than that usually performed with IPM/CS to avoid ischemic complications, as the bleeding was not vigorous, and the embolization area was extensive. The ability to adjust the degree of embolization according to the level

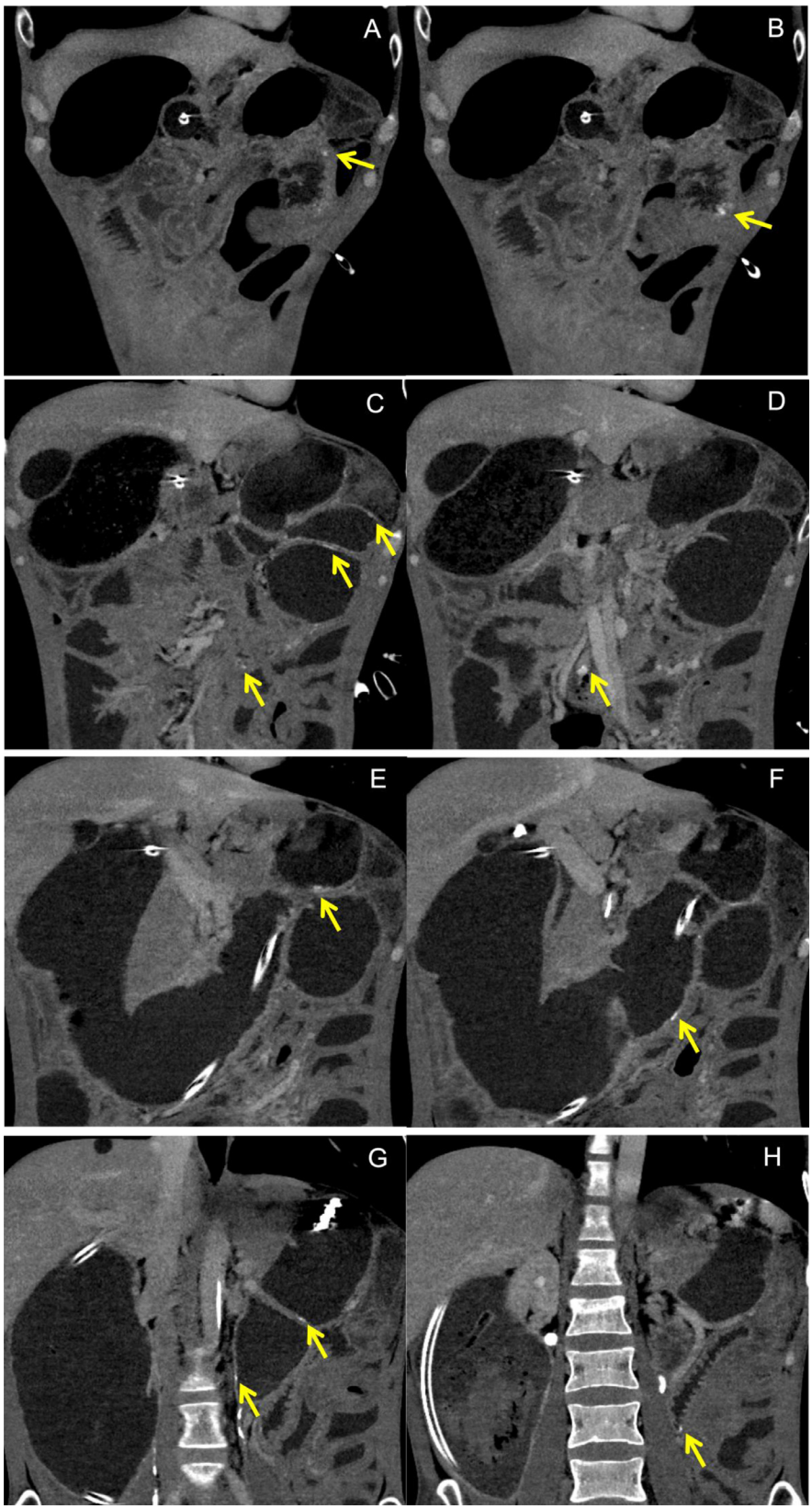

Fig. 1 – Trans-arterial contrast-enhanced computed tomography (CT) of the superior mesenteric artery (SMA). Trans-arterial contrast-enhanced CT with a catheter placed into the SMA was performed, and it showed multiple microbleeds in the small intestine (yellow arrow).

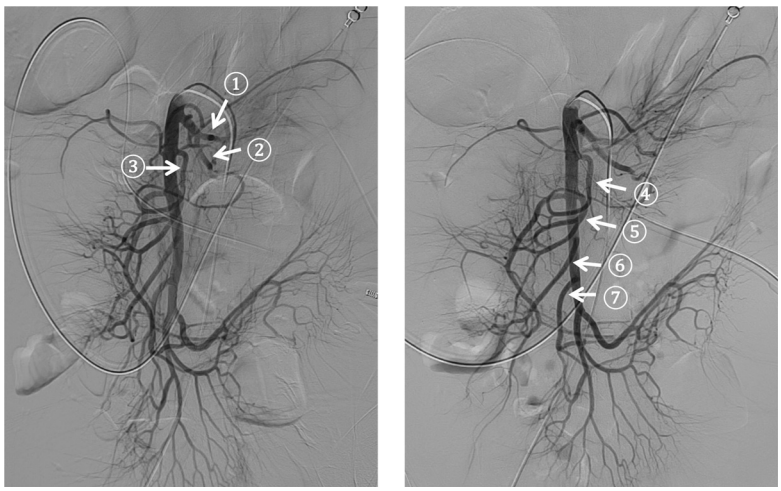

Fig. 2 – Angiography of the computed tomography (CT) of the superior mesenteric artery (SMA). SMA angiography did not reveal any active bleeding. Therefore, we planned the embolization of the vessels based on the findings of the trans-arterial contrast-enhanced CT. The microbleeds are scattered over a wide area, and the responsible vessels appear to be the 7 small intestinal branches of the SMA (white arrow).

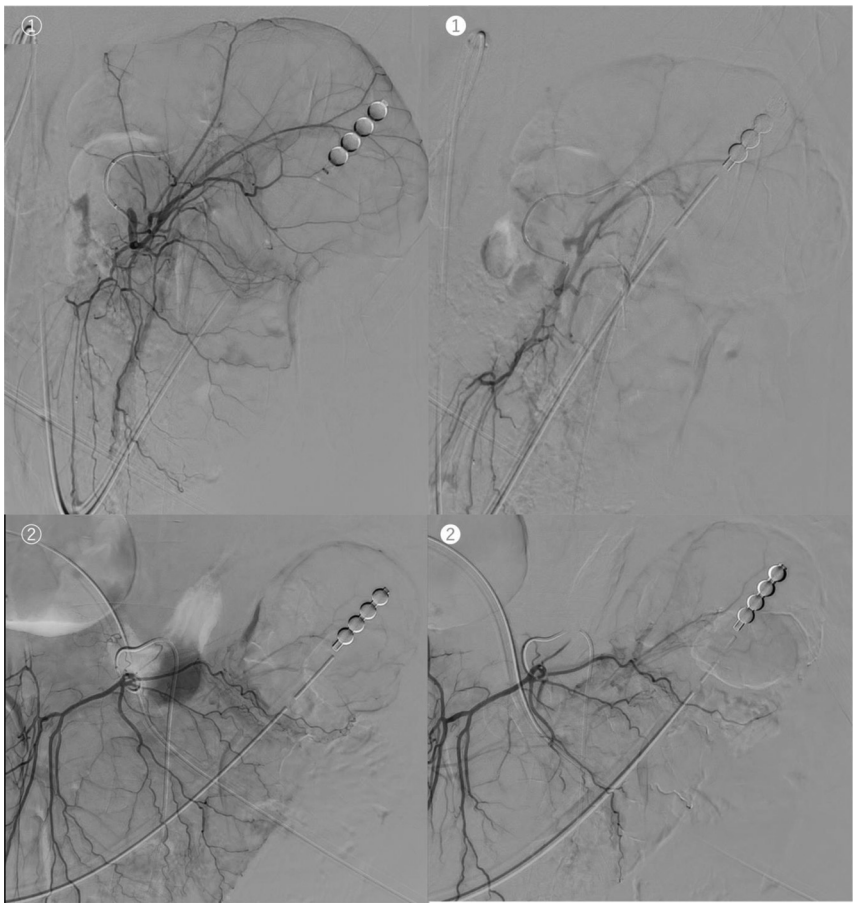

Fig 3 – Embolization of the small intestine branches of the superior mesenteric artery (SMA) using IPM/CS. We performed diffuse embolization of the 7 small intestinal branches of the SMA (4 of the 7 branches are shown in the photograph) using the IPM/CS mixture as an embolic agent. The mixture was injected via a microcatheter placed on the proximal side of the small intestine branches until the blood flow in the vasa recta slowed. The numbers in the photographs correspond to the numbers of the vessels in Fig. 2. The photograph to the right of each number shows the contrast before embolization, while the photograph to the left shows the contrast after embolization.

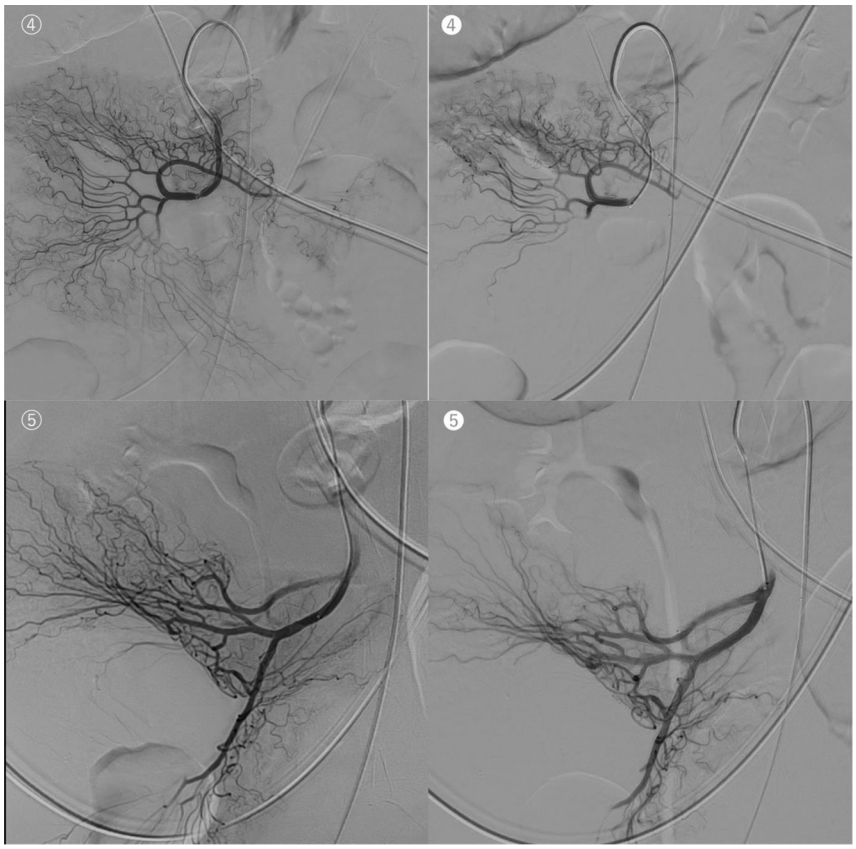

Fig 3 – Continued

of bleeding facilitated increased flexibility in the treatment of multiple small intestinal bleeding while minimizing the risk of complications.

Based on our findings, we believe that one of the strengths of IPM/CS as an embolic agent might be the relatively short duration of the embolic effect (<48 hours), which can be advantageous for avoiding ischemic complications. Another advantage of IPM/CS is the ability to adjust the degree of embolization according to bleeding momentum. These characteristics ensure increased flexibility in the procedure while minimizing the risk of complications, even in the treatment of multiple small intestinal bleeds. Therefore, it may be a useful alternative when super-selective embolization is not possible.

It is important to note that the use of IPM/CS as an embolization material for small bowel bleeding is still considered off-label in Japan, and further research is needed to determine its safety and efficacy in this setting. Therefore, embolization with microcoils or other conventional embolic materials is typically preferred. Nonetheless, this case report provides valuable information on a potential new approach for treating small bowel bleeding and highlights the importance of ongoing research and innovation in the management of this condition.

Conclusion

To the best of our knowledge, this is the first report of successful treatment with TAE using IPM/CS as an embolization material for multiple small intestine microbleeds. TAE using IPM/CS as an embolization material may be a viable treatment option for patients with diffuse multiple small intestine microbleeds that are not responsive to conservative treatment or endoscopic methods.

Authors' contributions

SH was the primary author of this study. All authors were deeply involved in the actual medical practice. YI contributed significantly to this study's conception and design. All authors read and approved the final manuscript.

Ethics approval

All procedures were performed in accordance with the ethical standards of the institution and the 1964 Helsinki Declaration.

Patient consent

Written informed consent was obtained from the patient for the publication of this case report and any accompanying images.

REFERENCES

[1] Gerson LB, Fidler JL, Cave DR, Leighton JA. ACG clinical guideline: diagnosis and management of small bowel bleeding. Am J Gastroenterol 2015;110:1265–87 quiz 88.

[2] Murphy B, Winter DC, Kavanagh DO. Small bowel gastrointestinal bleeding diagnosis and management-a narrative review. Front Surg 2019;6:25.

[3] Pennazio M, Spada C, Eliakim R, Keuchel M, May A, Mulder CJ, et al. Small-bowel capsule endoscopy and device-assisted enteroscopy for diagnosis and treatment of small-bowel disorders: European Society of Gastrointestinal Endoscopy (ESGE) clinical guideline. Endoscopy 2015;47:352–76.

[4] Yamamoto H, Ogata H, Matsumoto T, Ohmiya N, Ohtsuka K, Watanabe K, et al. Clinical practice guideline for enteroscopy. Dig Endosc 2017;29:519–46.

[5] Aihara T. A basic Study of superselective transcatheter arterial chemotherapy and chemoembolization (2) -expermental study- IVR. J Interv Radiol 1999;14:466–73.

[6] Yamada K, Jahangiri Y, Li J, Gabr A, Anoushiravani A, Kumagai K, et al. Embolic characteristics of imipenem-cilastatin particles in vitro and in vivo: implications for transarterial embolization in joint arthropathies. J Vasc Interv Radiol 2021;32:1031–9 e2.

[7] Woodhams R, Nishimaki H, Ogasawara G, Fujii K, Yamane T, Ishida K, et al. Imipenem/cilastatin sodium (IPM/CS) as an embolic agent for transcatheter arterial embolisation: a preliminary clinical study of gastrointestinal bleeding from neoplasms. Springerplus 2013;2:344.

[8] Okuno Y, Matsumura N, Oguro S. Transcatheter arterial embolization using imipenem/cilastatin sodium for tendinopathy and enthesopathy refractory to nonsurgical management. J Vasc Interv Radiol 2013;24:787–92.

[9] Fujiwara K, Inui S, Shibuya M, Sugihara E, Miyazaki K, Sakugawa T, et al. Transcatheter arterial embolization Using imipenem/cilastatin sodium for chronic low back pain resistant to conservative treatment: a pilot study with 2-year follow-up. Cardiovasc Intervent Radiol 2021;44:1964–70.

[10] Arima T, Morimoto K, Terai K, Kawamoto K, Muroya K, Koba Y, et al. Small bowel bleeding treated successfully with transcatheter arterial embolization with imipenem/cilastatin. Acute Med Surg 2022;9:e733.

[11] Hiraki S, Sato F, Osugi M, Watanabe Y, Ichinose Y. Transcatheter arterial embolization for acute lower gastrointestinal bleeding using imipenem/cilastatin: a single-center retrospective study. CVIR Endovasc 2023;6:12.

[12] Funaki B, Kostelic JK, Lorenz J, Ha TV, Yip DL, Rosenblum JD, et al. Superselective microcoil embolization of colonic hemorrhage. AJR Am J Roentgenol 2001;177:829–36.

[13] Kinoshita M, Kondo H, Hitomi S, Hara T, Zako R, Yamamoto M, et al. Ultraselective transcatheter arterial embolization with small-sized microcoils for acute lower gastrointestinal bleeding. CVIR Endovasc 2021;4:28.

[14] Ikoma A, Kawai N, Sato M, Sonomura T, Minamiguchi H, Nakai M, et al. Ischemic effects of transcatheter arterial embolization with N-butyl cyanoacrylate-lipiodol on the colon in a Swine model. Cardiovasc Intervent Radiol 2010;33:1009–15.

[15] Kodani M, Yata S, Ohuchi Y, Ihaya T, Kaminou T, Ogawa T. Safety and risk of superselective transcatheter arterial embolization for acute lower gastrointestinal hemorrhage with N-butyl cyanoacrylate: angiographic and colonoscopic evaluation. J Vasc Interv Radiol 2016;27:824–30.