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SURGICAL TECHNIQUES AND INNOVATIONS

Super-Selective Mesenteric Embolization as Guide for Surgical Resection in Bleeding Small Bowel Angiodysplasia

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Abstract

We present the case of a 79-year-old woman and of a 43-year-old man with no relevant past medical history. Both patients were admitted to the emergency department for anemia and rectal bleeding. After resuscitation, the two patients underwent colonoscopy and gastroscopy, both negative. Computed tomography angiography revealed active bleeding from the small bowel in both cases. The first patient underwent angiography and mesenteric embolization with surgical glue, obtaining a complete stop of the bleeding. After 2 days, a small bowel resection was performed under the guidance of the segmental bowel ischemia secondary to embolization. In the second patient, the angiography revealed a large jejunal angiodysplasia. Therefore, a mesenteric super-selective embolization was carried out. The intraoperative identification of the coils allowed to guide the following bowel resection. The postoperative course was uneventful in both patients. Small bowel angiodysplasia is a rare cause of lower gastrointestinal bleeding. In most patients, bleeding stops spontaneously. However, patients with ongoing active bleeding non-responding to conservative treatment may need invasive procedures. The use of super-selective mesenteric embolization is highly successful and relatively safe. When surgery is necessary, identification of the bleeding site is troublesome. In this setting, angioembolization could help to identify the correct site of bleeding, thus allowing to perform a segmental small bowel resection.

Keywords Angiodysplasia · Small bowel · Angioembolization · Micro-coil

Introduction

Lower gastrointestinal bleeding (LGB) is defined as an exsanguination from a source below the ligament of Treitz and represents itself 20–24% of all cases of gastrointestinal (GI) bleeding [1, 2].

Lower gastrointestinal bleeding ranges from minor self-limited bleeding to life-threatening hemorrhage with a mortality rate between 2 and 4% [2, 3]. Fifteen percent of patients present with massive bleeding. Surgery is required only in case of unstable patients after the failure of non-operative management [1–4]. Emergency surgery in this kind of patients usually results in significant morbidity and mortality [2, 3]. Approximately 5% of LGB occurs from the small bowel [3].

Angiodysplasia or arteriovenous malformations are defined as an abnormal connection between arteries and veins. Angiodysplasia can appear in any part of the body [4]. Treatment options for gastrointestinal angiodysplasias vary depending on their location. Colonic lesions can be easily detected and consequently treated endoscopically. The diagnostic accuracy of emergency colonoscopy in LGB is 72–86% [3].

Otherwise, gastrointestinal bleeding from the small bowel is extremely difficult to treat endoscopically. Therefore, it remains a therapeutic challenge for emergency surgeons because of the difficulty in identifying the exact source of bleeding [5].

In this paper, we report a novel technique for the management of small bowel bleeding due to angiodysplasia.

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Technical Description/Case Description

We describe the cases of a 79-year-old woman and a 43-year-old man presenting with acute gastrointestinal bleeding due to angiodysplasia.

Case 1

A 79-year-old woman, without relevant past medical history, was admitted to the emergency department for symptomatic anemia and hematochezia. At clinical examination, she appeared pale, sweaty, tachycardic, and hypotensive, requiring immediate medical response. After prompt resuscitation with crystalloids and blood products, a stable hemodynamic status was achieved. Gastroscopy and colonoscopy did not find the source of bleeding; we therefore performed a computed tomography angiography (CT-angio) which revealed a contrast blush in the small bowel highly suspected for angiodysplasia.

Emergency angiography followed by super-selective mesenteric embolization with glue was carried on obtaining a complete stop of the bleeding. A strict clinical and laboratoristic monitoring was planned. Two days later, the patient developed peritonism and was taken to the operating room for an exploratory laparotomy. A segmental small bowel resection was performed under the guidance of the ischemic bowel loop due to the embolization (Fig. 1). The post-operative period was uneventful and the patient was discharged after 8 days. Angiodysplasia was detected at histopathological examination.

Case 2

A 43-year-old man was admitted to the emergency department for symptomatic anemia and melena. After admission, he became hemodynamically unstable and required resuscitation with crystalloid and blood products. Once stabilized, both gastroscopy and colonoscopy did not reveal the source of bleeding. A CT-angio was then performed, showing contrast extravasation into the small bowel. The subsequent angiography detected an active bleeding from a jejunal vascular malformation. An angioembolization with micro-coil was attempted with just reduction of the contrast extravasation (Fig. 2). Therefore, the patient was brought directly to theater. The micro-coils used for the angioembolization were used as guidance to identify the involved bowel segment to guarantee a targeted resection (Fig. 3). No complications affected the post-operative course. The patient was discharged after 5 days and the histopathological report confirmed angiodysplasia as the cause of hemorrhage (Fig. 3).

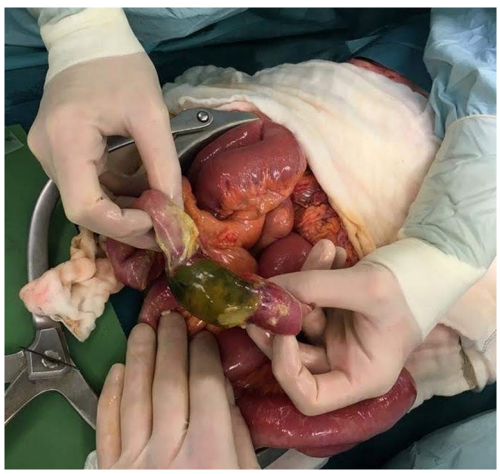

Fig. 1 The ischemic small bowel loop after the angioembolization with Glubran®

Discussion

Small bowel angiodysplasia is a rare cause of lower gastrointestinal bleeding in young people (< 40 years). It becomes more frequent in middle age people (41–65 years) and one of the most frequent cause of small bowel bleeding in the elderly (> 65 years). The most frequent cause of bleeding in young people is cancer followed by Crohn's disease, Meckel's diverticulum, Dieulafoy's lesion, vascular abnormalities, and celiac disease. On the contrary, patients older than 40 are most likely to have bleeding from vascular anomalies, erosions, or NSAID-related ulcerations. Overall, vascular lesions comprise 40% of all causes [1, 3, 5]. In Asia, Africa, and South America, a frequent cause of LGB is infectious colitis due to *Entamoeba histolytica* and bacteria like *E. coli*, Shigella, Salmonella, and tuberculosis [1].

Lower gastrointestinal bleeding ranges from minor self-limited bleeding to life-threatening hemorrhage[2]. In most patients, bleeding stops spontaneously. However, patients with ongoing active bleeding non-responding to conservative therapy may need more invasive procedures. In this setting, surgery is required in 5% of cases [1, 3].

Small bowel bleeding can be conservative, endoscopic, radiological, and/or surgical depending upon the clinical presentation, indications, expertise, and availability.

In case of massive bleeding, resuscitation is mandatory to restore volume and maintain oxygen delivery [3]. Once the patient is hemodynamically stable, finding the bleeding source is mandatory to plan the following invasive procedures.

In the management of acute gastrointestinal bleeding, angiography is both a diagnostic and a therapeutic tool. Its sensitivity ranges between 30 and 78%; the specificity is 100%. However, this radiological procedure needs a bleeding rate higher than 1 mL/min to detect the source. Finally, angiography allows performing the embolization also in super-selective fashion, using glue, micro-coil, or other materials. This technique can be used on vessels as small as 1 mm [3]. Following angiographic treatment, the potential complications

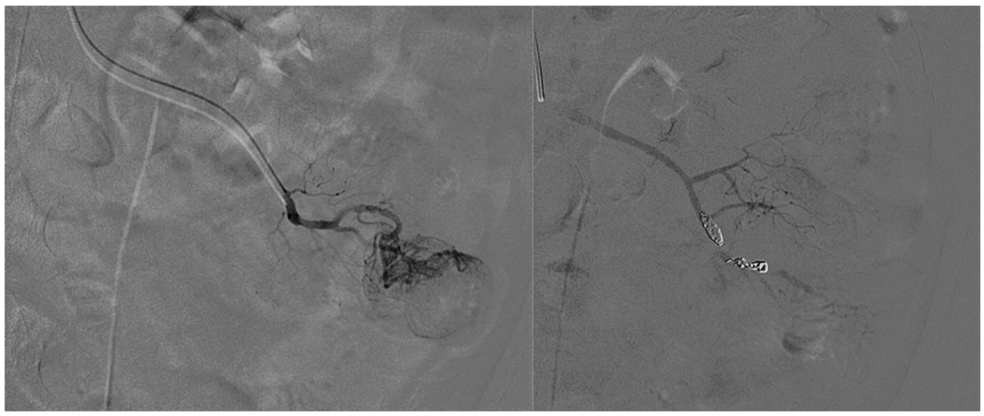

Fig. 2 Super-selective angioembolization with coils of the jejunal angiodysplasia

include bowel infarction, re-bleeding, and stricture because of ischemia [2]. Bowel ischemia caused by this technique occurs in about the 3–5% of cases. Moreover, re-bleeding rates after micro-coil super-selective embolization are up to 33–40% [2, 3]. Nowadays, in expert hands, the use of super-selective mesenteric embolization is highly successful and relatively safe, with low complication rate [2, 3]. Anyhow, angioembolization is not death-free. Tan el al. reported a mortality rate of about 7–9% [2].

Currently, angiographic treatment has become widely available and accepted, leaving to surgery a minor role in case of more conservative treatment failure or complications. When surgery is mandatory, identification of the bleeding site is always challenging.

In the last decade, several techniques were described showing the usefulness of the association between angiography and surgery. The use of methylene blue dye to identify GI bleeding sources is well described by *Frydman* et al. He showed how methylene blue injection via a super-selective angiographic micro-catheter resulted in a focused small bowel resection [5].

So et al. reported the effectiveness of the combination of metallic coil embolization and laparoscopic surgery with intraoperative fluoroscopy in patients with recurrent jejunal bleeding [4].

In this setting, angioembolization alone may be helpful in the identification of the precise bleeding site, in reducing the bleeding rate and even in stopping the hemorrhage completely. In this last event, a careful and strict monitoring of the patient is mandatory in order to avoid early complications (e.g. bowel ischemia, re-bleeding). In case of an adverse event, the previous angiographic procedure may guide the surgeon during surgery. In fact, the operator may be able to feel the micro-coils, the angiographic catheter left in place, or to see the ischemic changes of the small bowel segment involved. This allows the surgeon to perform a targeted segmental small bowel resection instead of a blind, complex, and sometimes extended procedure.

In both our patients, we were able to find immediately the loops involved in the bleeding thanks to the previous angioembolization, allowing us to perform a quick segmental small bowel resection instead of a blind and complex procedure.

Since angioembolization may be unsuccessful and/or lead to complications and even death, we believe that proceeding with the surgical operation right after the radiological

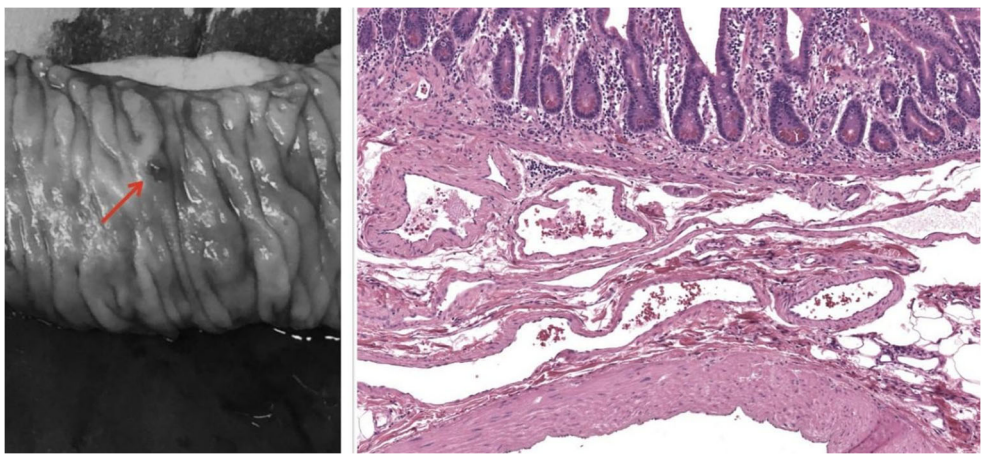

Fig. 3 The angiodysplasia on the resected small bowel loop and the respective histopathological analysis

procedure may decrease its morbidity and mortality rates. We think that the main goal of angioembolization should not be to solve the bleeding itself, but, at first, (1) stop the bleeding to stabilize the patient, and then (2) help detecting the precise bleeding site allowing surgeons to identify the bowel loop involved.

In conclusion, the combination between angiography and surgery may avoid the long and difficult search for the source of bleeding and the use of intraoperative enteroscopy. Furthermore, this combined technique allows the surgical team to reduce the operating time in a patient often critical, in shock, needing inotropes, and prompt intensive care management.

Even if we reported only a small number of cases, we believe that this technique can be useful in case of small bowel angiodysplasia to reduce the extension of bowel resections and morbidity and mortality rates.

Authors' Contribution All authors contributed to the study. More specifically:

Conceptualization: Paola Germani and Alan Biloslavo

Study design: Paola Germani, Alan Biloslavo, and Stefano Martinolli

Project writing and management: Paola Germani

Defining the study: Paola Germani and Alan Biloslavo

Extensive literature search: Paola Germani

Actually performing the study viz: Paola Germani and Gabriele Bellio

Experiments: n.a.

Practical work: Paola Germani, Gabriele Bellio, Laura Bernardi, and Jacopo Galvanin

Operative work: Paola Germani and Gabriele Bellio

Data acquisition: Gabriele Bellio

Data analysis: n.a.

Statistical inferences: n.a.

Manuscript writing: Paola Germani, Laura Bernardi, and Marina Troian

Repeated editing and reviewing of the manuscript: Paola Germani, Alan Biloslavo, Hayato Kurihara, and Nicolò de Manzini

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Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Ethical Approval All procedures performed in this study were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in this study.

References

1. Hawks MK, Svarverud JE (2020) Acute lower gastrointestinal bleeding: evaluation and management. Am Fam Physician 101(4):206–212
2. Tan KK, Wong D, Sim R (2008) Superselective embolization for lower gastrointestinal hemorrhage: an institutional review over 7 years. World J Surg 32(12):2707–2715. https://doi.org/10.1007/s00268-008-9759-6
3. Andrei GN, Popa B, Gulie L, Diaconescu BI, Martian BV, Bejenaru M, Beuran M (2016) Highlighted steps of the management algorithm in acute lower gastrointestinal bleeding - case reports and literature review. *Chirurgia* (Bucur) 111(1):74–79
4. So M, Itatani Y, Obama K, Tsunoda S, Hisamori S, Hashimoto K, Sakai Y (2018) Laparoscopic resection of idiopathic jejunal arteriovenous malformation after metallic coil embolization. Surg Case Rep 4(1):78–74. https://doi.org/10.1186/s40792-018-0486-4
5. Frydman J, Bahouth H, Leiderman M, Ofer A, Kluger Y (2014) Methylene Blue injection via superior mesenteric artery microcatheter for focused enterectomy in the treatment of a bleeding small intestinal arteriovenous malformation. World J Emerg Surg 9(1):1–4. https://doi.org/10.1186/1749-7922-9-17