An unexpected presentation of small bowel bleeding from ischaemia, treated with methylene blue-guided surgical resection

Desmond Wei Lun Cheng, MBBS[1], Guo Yuan How, MBBS[1], Huimin Liu, FRCS[2], Martin Weng Chin H'ng, FRCR[1]

[1]Department of Diagnostic Imaging, [2]Department of General Surgery, Tan Tock Seng Hospital, Singapore

SUMMARY

Acute small bowel bleeding has a high morbidity and mortality rate. Computerised tomography (CT) scan is usually performed and angio-embolisation undertaken if acute bleeding is detected. We present a case where acute bleeding was seen on CT and angiography, but as part of an unexpected underlying bowel ischaemia during the latter. Given the decision to defer embolisation in preference of surgical resection, methylene blue was administered during angiography to demarcate the segment of ischaemic bowel. This is in contrast to much of the literature where the dye was injected peri-operatively, and for bleeding from a vascular lesion. During surgery, the affected ileal segment was identified and successfully resected. No recurrence of bleeding occurred during the remainder of the patient's hospital stay.

INTRODUCTION

Gastrointestinal bleeding from the small bowel (SB) is a challenging condition to diagnose and manage. It is difficult to access and it has a long length, which makes localisation of any source of bleeding with scopes challenging. Other pathology, such as ischaemia, can occur concomitantly and can alter treatment course.

CT angiography (CTA), catheter angiography and endoscopic evaluation remain the mainstay of investigation for acute SB bleeding. Once a source of bleeding is identified, treatment options include embolisation of the culprit vessel or surgical resection. Methylene blue has been used since 1978 to aid in intra-operative localisation of bleeding small bowel segments. In this case report, we described how findings on CTA and catheter angiography in a patient with active SB bleeding altered treatment decision which prompted the use of pre-operative methylene blue injection to aid in subsequent intra-operative localisation of the bleeding SB segment.

CASE REPORT

We present a case of a 76-year-old Chinese gentleman with non-ischaemic cardiomyopathy, reduced ejection fraction and atrial fibrillation. He was admitted to hospital for acute limb ischaemia from an acute saddle embolus of the abdominal aorta which was successfully treated with embolectomy of the distal aorta and bilateral iliac arteries. His atrial fibrillation was adequately controlled, and he was adequately anticoagulated post-embolectomy. However, this was complicated by ischaemic colitis 2 days later for which he required a Hartmann's procedure. He was subsequently put on prophylactic subcutaneous enoxaparin for post-operative venous thrombosis prevention. During his stay in the intensive care unit, about 1 month post-operatively, he was diagnosed with acute per-stomal bleeding. On clinical examination, he did not complain of abdominal pain and there were no sign of peritonism. Serological markers showed a haemoglobin drop from 8.7 to 7.8 g/dL, elevated CRP of 68.2 mg/L, and normal lactate level at 1.3 mmol/L. No abdominal radiographs were performed, with patient proceeding straight to a contrast enhanced CT mesenteric angiogram. This showed arterial phase contrast extravasation (Figure 1a) in a distended loop of ileum with pooling of contrast in the venous phase (Figure 1b) which was reported as active intraluminal bleeding.

Conventional angiography was performed with the intention to embolise the bleeding vessel. Digital subtraction angiography images revealed a focal blush near the anti-mesenteric border of the ileum, with a poorly demonstrated feeding vessel (Figure 2). More importantly, it has been recognised that this loop of bowel has remained aperistaltic and had poor contrast improvement signifying ischaemia. Following discussion with the surgical team, a decision was made not to embolise but instead inject methylene blue to better delineate and identify this loop in preparation for emergency laparotomy afterwards. Approximately 1.5 mls of methylene blue was injected via the microcatheter which was then removed before transferring patient for surgery.

During surgery, a segment of the distal ileum stained with methylene blue was identified. The stained bowel loops were dilated with an area of thinned out bowel wall. Intra-operative indocyanine green with fluorescence imaging was performed to assess the line of demarcation between the healthy and ischaemic bowel for potential anastomosis. This showed small bowel wall hypo-enhancement at the same area, which correlated to the area stained by methylene blue. Approximately 20 cm of ischaemic bowel was resected (Figure 3) and a functional end-to-end small bowel anastomosis was performed. Histology of the resected small bowel revealed acute inflammation with acute ischaemic

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Corresponding Author: Desmond Wei Lun Cheng
Email: d3smondcheng@gmail.com

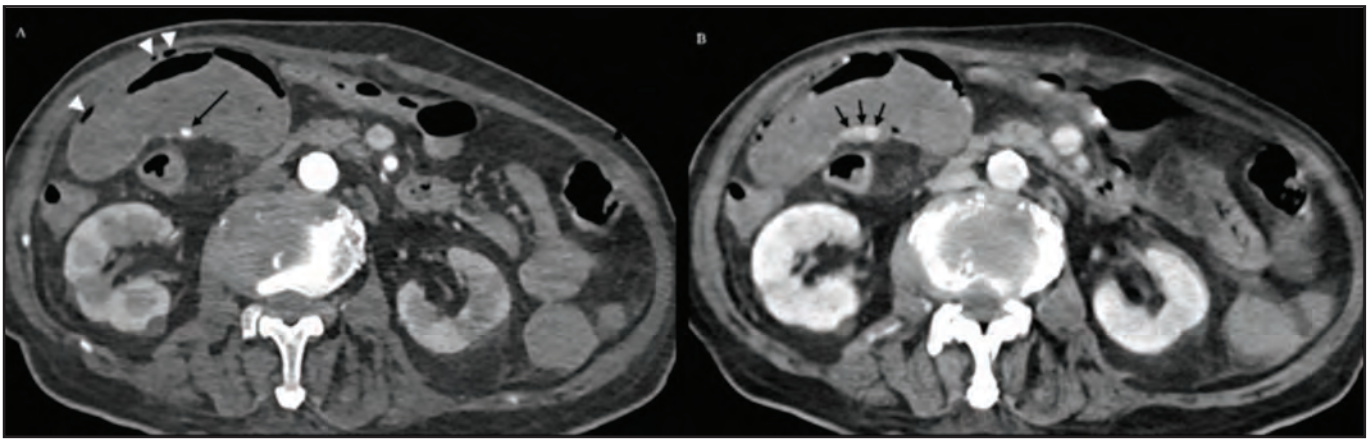

Fig. 1: CT mesenteric angiogram of a 76-year-old patient showing (a) focal contrast extravasation within a distended loop of ileum in the arterial phase (arrow) and intra-mural gas (white arrowheads) as well as (b) pooling of contrast by the venous phase (black arrows).

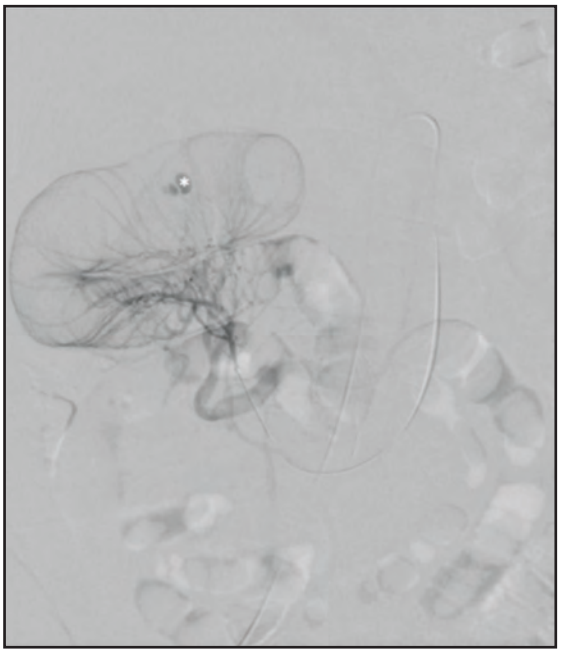

Fig. 2: Digital subtraction angiography image reveals an aperistaltic loop of ileum with focal blush near the anti-mesenteric border (asterix).

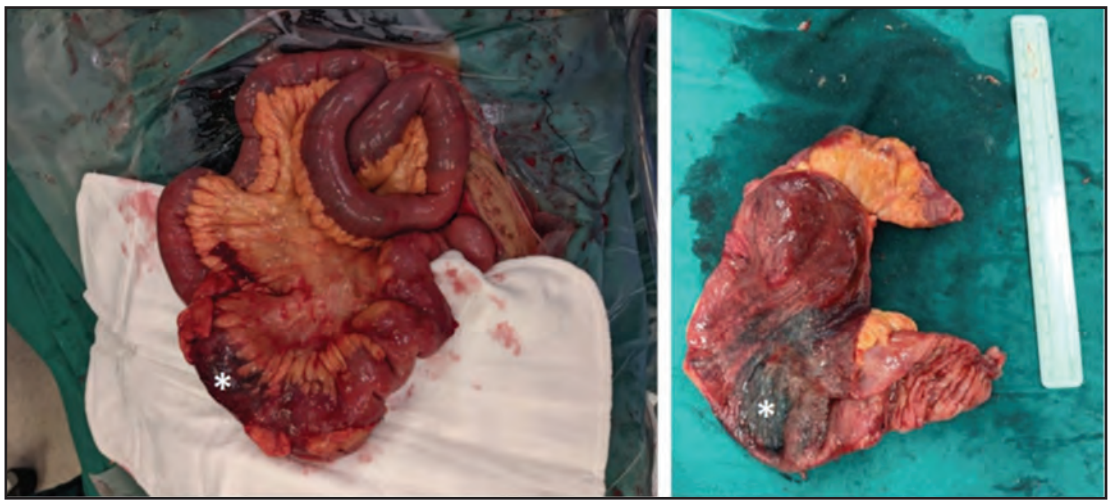

Fig. 3: (a) Intra-operative appearance and (b) resected specimen showing necrotic bowel with areas stained with methylene blue (asterixes).

changes. No recurrence of intestinal bleeding occurred throughout the remainder of the patient's hospital stay. In view of his poor functional status, he kept his colostomy permanently.

DISCUSSION

Small bowel haemorrhage accounts for approximately 5% of gastrointestinal bleeding and has high morbidity and mortality with the inpatient mortality as high as 17%.[1,2] Common aetiologies in the elderly population include vascular abnormalities, ulcers and tumours.[1] Acute bleeding is usually diagnosed using CTA, catheter angiography or endoscopically (oesophago-gastro-duodenoscopy, colonoscopy and more recently, deep enteroscopy) and usually requires active bleeding at the time of investigation for the best chance at detection.[1,3] However, localisation of the acute bleeding source, particularly in the small bowel, is still a challenge as the cause of bleed can be obscure and difficult to locate. The long length of the small bowel, its intraperitoneal location and high motility results in challenging access and inspection with scopes.[1] Furthermore, poor visualisation from suboptimal bowel preparation and slow intermittent bleeding results in delayed presentation and investigation.[4,5] Acute bleeds are usually treated by radiolologic-guided embolisation using coils or glue, endoscopically (e.g. haemoclip application) or surgical resection.[1] The choice of treatment hinges on both patient and clinician factors as well as hospital resources.[1] In general, radiologically-guided angioembolisation is used for regions of haemorrhage beyond the reach of endoscopy, while surgical resection is reserved for recurrent bleeds not amendable to endoscopic or endovascular techniques.[1] Occasionally, radiological and surgical means can be combined as in our case.

Methylene blue dye injection for localisation of the site of intestinal bleeding was first described in 1978 by Fogler and Golembe.[6] A syringe with a 22-gauge needle was inserted directly into the superior mesenteric artery intra-operatively and 10 mls methylene blue was injected. A 10 cm segment of bowel was then stained which guided resection.

A literature review by Gifford et al. in 2012 and Pai et al. in 2013 showed that most authors used the following technique where a microcatheter is left in the culprit vessel during angiography before patient was transferred to the operating theatre.[7,8] Majority were undertaken for bleeding from a vascular lesion. Methylene blue was then injected intra-operatively, usually after the small bowel had been exposed at the time of laparoscopy or laparotomy.[9] Gifford et al. advanced on this method by administering methylene blue peri-operatively.[7]

There have been refinements to this localisation technique. Smaller microcatheters and more super-selective cannulation has resulted in more targeted resection, with the resected bowel length to be as low as 5 to 9 cm.[7,8] The amount of methylene blue required for staining has also decreased, with only 0.5 mls needed in some reported cases.[7] There are however some drawbacks to this technique. One of the risks as described by Gifford et al. is the theoretical risk of catheter migration or dislodgement during patient transfer.[7] This technique may also not be feasible if there is more than one bleeding focus. In addition, there are also some side effects associated with methylene blue. Doses of 500 mg or more (i.e 50 mls) is associated with chest and abdominal pain, nausea, vomiting and altered mental status.[8] There is also a risk of haemolytic anaemia in patients with glucose-6-phosphate dehydrogenase deficiency.[8]

Pre-operative injection of methylene blue during conventional angiography is a viable consideration and has been described in literature. We only found one case where in 2003, Remzi et al. described injection of methylene blue during angiography after identification of the bleeding culprit vessel. This still resulted in accurate identification of the bleeding segment and only 5 cm of small bowel was eventually resected.[10] We employed a similar method where injection of methylene blue during angiography was performed by the interventional radiologist to guide imminent surgery after realisation that embolization was not feasible. There are advantages with this method. The catheter was removed in the angiography suite prior to our patient's transfer to surgery, eliminating the risk of dislodgement.[7,10] Methylene blue injection has been showed to have bowel staining up to six hours in animal models.[7] Hence, in the event of any delay in transfer to surgery, the affected segment will still remain stained. Finally, the process of methylene dye injection during surgery is removed which results in better efficiency and potential time saving.[10]

CTA may be equal or better to catheter angiography in its sensitivity of detecting a bleed.[3] However, the latter is dynamic and has the benefit of providing information regarding bowel peristalsis and perfusion. A pertinent point in our case was that despite performing angiography with embolisation in mind, and detecting the bleeding source, it was crucial to recognise the aperistaltic and poorly enhancing segment of small bowel suggesting ischaemia. This was an unusual presentation given the lack of abdominal pain or peritonism and was an unexpected and subtle finding at the time of angiography. Embolising may have resulted in a satisfying imaging outcome but would have been detrimental to the patient. Hence, we instinctively combined catheter-directed injection of methylene blue to guide surgery. This resulted successful intra-operative localisation and subsequent resection of the affected segment of ischaemic bowel.

CONCLUSION

Recognising potential concomitant pathology in SB bleeding is important. In our case, recognising the concurrent bowel ischaemia changed the treatment course for the patient which resulted in a better outcome. Injection of methylene blue during catheter angiography prior to surgery is a viable alternative technique compared to the conventional technique. Based on our literature review this technique has not been widely used and reported on. We suggest this method be considered as benefits include eliminating the risk of catheter dislodgement and potential time saving.

DECLARATION

The authors declare no conflict of interest.

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