Palpation of preoperatively inserted indwelling angiocatheter facilitates intraoperative localization of obscure gastrointestinal bleeding of small intestinal origin

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KEYWORDS
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Summary
Background: Palpation of the indwelling angiographic catheter inserted before operation to localize obscure gastrointestinal bleeding of small intestinal origin during laparotomy has rarely been reported in the literature.

Purpose: The purpose of the study is to investigate the role of palpable indwelling angiocatheter inserted before operation in localizing obscure gastrointestinal bleeding of small intestinal origin during laparotomy.

Methods: Between January 2003 and December 2010, seven patients who had a clinical impression of obscure gastrointestinal bleeding of small intestinal origin and angiographic extravasation from the mesenteric artery had an angiocatheter inserted into the distal mesenteric branch. During laparotomy the catheter was palpated to guide subsequent resection of the intestine. The clinical outcomes of these patients were retrospectively reviewed.

Results: During laparotomy the retained catheter failed to be palpated in one patient. Six patients underwent segmental resection of intestine under guidance of the palpated catheter. All six patients had positive identification of small bowel bleeding. The yield rate of intraoperative localization was 86% (6 out of 7). Two of the six patients ceased bleeding after operation, but died of
1. Introduction

Gastrointestinal bleeding is considered to be obscure when the source of the bleeder cannot be identified after routine radiological and endoscopic studies of upper and lower gastrointestinal tract.1,2 Obscure gastrointestinal bleeding is clinically encountered in about 5% of all cases of gastrointestinal hemorrhage, and the small intestine is the most common source of bleeding.3–5 In many cases the obscure gastrointestinal bleeding of small intestinal origin ceases spontaneously, but may sometimes become recurrent or so massive as to require surgical consultation and intervention. Precise localization during laparotomy, which allows the surgeon to perform appropriate resection of the intestine, remains a great challenge. Among the various modalities for intraoperative localization of obscure gastrointestinal bleeding of small intestinal origin,2,5–11 palpation of the indwelling angiographic catheter which has been selectively left in the distal branch of the mesenteric artery before operation was shown to be a straightforward and practical method for precisely locating small intestinal hemorrhage during laparotomy.11 However, it has rarely been reported in the literature.11

In this study we retrospectively reviewed our experience of using palpation of an indwelling angiographic catheter that was selectively retained before operation to precisely locate small intestinal bleeding during laparotomy.

2. Patients and methods

Between January 2003 and December 2010 in our hospital, the records of eight patients in whom we had a clinical impression of obscure gastrointestinal bleeding and positive angiographic finding of extravasation of contrast medium from a branch of the mesentery artery were retrospectively reviewed. In seven patients, the small indwelling catheter was successfully guided forward to the mesenteric branch quite distally by a radiologist in the angiographic room, but the placement failed in one patient because of the acute angle of the vessel.

After confirmation of extravasation of the contrast medium, a radiologist guided a small angiographic catheter (4.1 French) under fluorescence and advanced it forward to a branch of mesenteric artery as distally as possible. The patient was then sent to the operating room with the retained catheter. During laparotomy, the catheter in the distal branch of mesentery was palpated to guide subsequent resection of intestine in the region of the distal mesentery branch.

The clinical outcomes of the seven patients with preoperatively retained indwelling catheters are reported.

3. Results

Two of the eight patients required a second angiography to detect the extravasation. During exploratory laparotomy, the serosal surface of the intestine revealed no gross abnormal findings in five patients. For the other two patients, the serosal surface of the intestine revealed multiple intestinal diverticula in one patient and multiple intestinal nodules (pathologically proved to be lymphoma) in the other.

However, for one patient in the early period of the study the catheter could not be palpated during laparotomy. Methylene blue dye was injected via the retained catheter during the operation. The patient underwent a subsequent segmental resection of the intestine according to the dye stain and pathology revealed angiodysplasia of the jejunum.

The other six patients had a palpable angiographic catheter during laparotomy and underwent subsequent segmental resection of the small intestine under guidance of the palpable catheter (Fig. 1). One of the six patients had a palpable and even visible angiocatheter close to the margin of the intestine during laparotomy (Fig. 2). The clinical profiles of the six patients with palpable retained angiographic catheter during laparotomy are shown in Table 1. The surgicopathological results and outcomes are shown in Table 2. After segmental resection of the intestine following guidance of the palpable retained catheter, the bleeding lesions in the small intestine interior were positively identified in all the six patients.

Four of the six patients ceased bleeding and ran an uneventful postoperative clinical course. The identified lesions in the four patients included angiodysplasia, diverticulum, ulcer of the jejunum, and ulcer of the ileum. The four patients were followed up until March 2011 without recurrent bleeding after a median follow-up period of 25 months (range 6–98 months).

The other two patients also ceased bleeding after operation. One of them had bleeding due to multiple intestinal lymphomas and died of septicemia. The other one had a bleeding ulcer in the jejunum and died of pulmonary bleeding due to complications related to underlying systemic lupus erythematosus.

Overall, among the seven patients who had preoperatively retained an indwelling catheter to localize the lesion, the retained catheter was palpable during laparotomy in 6. After segmental resection of the intestine following guidance of the palpated catheter, all of the six patients had positive identification of the small bowel bleeding and pathological confirmation. The yield rate of intraoperative localization was 86% (6 out of 7 patients).
4. Discussion

Obscure gastrointestinal bleeding of intestinal origin remains a diagnostic dilemma and a therapeutic challenge. The small intestine is quite long and folded in the peritoneal cavity, and makes identification of the genuine bleeders in the small intestine particularly difficult by conventional endoscopic or radiological studies. While multiple diagnostic procedures may confirm the source of small intestinal bleeding before operation,\textsuperscript{12–16} the diagnostic yield may vary and preoperative investigation does not guarantee successful intraoperative localization. Precise localization during laparotomy to allow appropriate surgical resection of the intestine may still be problematic, especially for intermittent small intestinal bleeders or for minute vascular lesions confined to the mucosa of the intestine that are neither visible nor palpable from the serosal surface.

There are various novel modalities for intraoperative localization of intestinal bleeders, including intraoperative enteroscopy,\textsuperscript{2,5,9,10} injection of methylene blue dye via the retained angiographic catheter,\textsuperscript{2,6–8} and identification of the retained angiographic catheter by palpation.\textsuperscript{11} Intraoperative double-balloon enteroscopy is a promising modality for concomitant treatment of bleeders. However, the method is typically time-consuming and the total small-bowel exploration rate may vary considerably.\textsuperscript{9,15} Injection of methylene blue dye during operation through a retained catheter to a branch of the mesentery artery was reported to be helpful, but it stained a long segment of the demarcated intestine and the surgeon found it distracting as the infusion of dye was too rapid and widespread.\textsuperscript{2,11} The development of the angiographic micro-catheter allows for

Figure 1  An 84-year-old male with obscure gastrointestinal bleeding of intestinal origin. (A) Angiogram showing extravasation of contrast medium (arrow) from a branch of mesentery. (B) A 4.1-French angiographic catheter (arrow) guided forward to a mesenteric branch as distally as possible. (C) Retained angiographic catheter (arrows) palpable during laparotomy to guide appropriate resection of the intestine. (D) After segmental resection of the intestine, multiple small ulcers (arrows) were found within the lumen. Pathology proved to be angiodysplasia.

Figure 2  Palpable and even visible angiocatheter (arrows) placed close to the margin of the intestine during laparotomy in a 68-year-old female patient with lymphoma.
insertion of the catheter into a distal branch of the vascular arcade\textsuperscript{17} so that injection of dye during laparotomy may no longer be necessary when the micro-catheter can already be identified by palpation. Therefore, the authors recommend performing intra-operative palpation of an indwelling catheter that has been selectively retained before operation to guide subsequent resection of the intestine in the vicinity of the distal mesentery branch. Reed et al reported successful intraoperative identification of arteriovenous malformation of the intestine by palpation of a catheter preoperatively placed in the feeding artery\textsuperscript{11}. Surgeons may find this approach to be practical, straightforward and time-saving during laparotomy for precise localization of the bleeding site, which thus allows for appropriate resection of the intestine.

In our series, the six patients who had a palpable retained catheter during laparotomy all had positive gross identification of a small bowel bleeding lesion and pathological confirmation in the resected intestine. The yield rate of intraoperative localization by this method was 86\% (6 out of 7) for patients with a retained catheter. Furthermore, for patients with grossly multiple lesions such as multiple

<table>
<thead>
<tr>
<th>Table 1</th>
<th>The clinical profiles of the six patients who had obscure gastrointestinal bleeding of small intestinal origin with a palpable retained angiographic catheter during laparotomy.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient</td>
<td>1</td>
</tr>
<tr>
<td>Final diagnosis</td>
<td>Ulcer</td>
</tr>
<tr>
<td>Gender</td>
<td>Female</td>
</tr>
<tr>
<td>Age</td>
<td>42</td>
</tr>
<tr>
<td>Underlying disease</td>
<td>Crohn’s disease</td>
</tr>
<tr>
<td>Symptom</td>
<td>Melena</td>
</tr>
<tr>
<td>History</td>
<td>1 wk</td>
</tr>
<tr>
<td>Hemoglobin (g/L)</td>
<td>70</td>
</tr>
<tr>
<td>Preoperative diagnostic procedure</td>
<td>Upper GI scope</td>
</tr>
<tr>
<td>Site of bleeder</td>
<td>Jejunum, 10 cm distal to Treitz</td>
</tr>
<tr>
<td>Length of resected intestine</td>
<td>5 cm</td>
</tr>
<tr>
<td>Gross findings from interior of resected intestine</td>
<td>Single stigma with active oozing</td>
</tr>
<tr>
<td>Pathology</td>
<td>Ulcer with hemorrhage</td>
</tr>
<tr>
<td>Cessation of bleeding after operation</td>
<td>Yes</td>
</tr>
<tr>
<td>Follow-up (mo)</td>
<td>No recurrence of intestinal bleeding (98 mo)</td>
</tr>
</tbody>
</table>

* Between placement and removal of the catheter during laparotomy.
digestive diverticula or ulcers, this method proved effective for confirming the actual bleeding site among the multiple lesions and it ensured cessation of postoperative bleeding.

This method, however, did have some shortcomings and limitations. Only active bleeding detected by angiography can be localized. Repeated angiography may be necessary because of the intermittent nature of intestinal bleeding. In our experience the timing of angiography was important to catch the lesion upon the clinical manifestation of active bleeding. Two lesions in our series were detected by a second angiography. The technique of the radiologist is also critical both in identifying the bleeding site and in advancing the catheter via a small branch of the mesentery artery as distally as possible.

In one patient in our series, the lesion could not be catheterized on account of the acute angle of the vessel. In another patient in the early period of the study the catheter could not be palpated during laparotomy, probably due to embedding of the catheter in the fat surrounding the mesentery root. In this situation the injection of methylene blue dye via the retained catheter can be applied to complement intraoperative localization of obscure intestinal bleeding lesions. However, the development of angiographic micro-catheter enables a skilled and experienced radiologist to advance the indwelled catheter to the very distal branch of the mesenteric arcade close to the margin of the intestine, so that during laparotomy it can be identified by palpation or even by direct vision. Good communication and cooperation with the radiologist are crucial for success of this modality. Nevertheless, despite the above shortcomings, intraoperative palpation of an indwelling catheter that has been selectively left before operation was found to be a practical, straightforward, and time-saving procedure with a high yield rate of localization of obscure gastrointestinal bleeding of small intestinal origin during laparotomy. It remains a good option for surgeons to facilitate intraoperative localization of obscure gastrointestinal bleeding of small intestinal origin.

In conclusion, palpation of an indwelling angiographic catheter that has been selectively retained before operation was found to be effective for precisely locating obscure gastrointestinal bleeding of small intestinal origin during laparotomy. It is a good option for surgeons to facilitate intraoperative localization of obscure gastrointestinal bleeding of small intestinal origin.

References