Factors related to difficult self-expandable metallic stent placement for malignant colonic obstruction: A post-hoc analysis of a multicenter study across Japan

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Background and Aim: Colorectal cancer patients often present with large bowel obstruction. Elective placement of a self-expandable metallic stent (SEMS) can relieve obstruction, but can be challenging. Previous studies have compared cases by outcomes only, but the present study investigated successful cases only to identify factors related to prolonged and difficult SEMS placement in patients with malignant colonic obstruction.

Methods: A post-hoc analysis of a multicenter clinical trial conducted between March 2012 and October 2013 at 46 facilities across Japan (UMIN000007953) was carried out; 511 patients who required SEMS placement for acute colorectal obstruction or symptomatic stricture secondary to malignant neoplasm were enrolled. Technical success rates and procedure times were recorded. Clinical and interventional parameters were investigated for their potential effect on procedure time by univariate and multivariate analyses.

Results: Technical success rate of SEMS placement was 98%. Median procedure time was 30 (range, 4–170) min. In 27% of patients, procedure time exceeded 45 min, indicating technic-ally difficult placement. Multivariate analyses showed significant associations between technically difficult placement and a ColoRectal Obstruction Scoring System (CROSS) score of 0 before SEMS placement (odds ratio [OR], 1.6; \( P < 0.05 \)), tumor site in the right colon (OR, 2.5; \( P < 0.001 \)), stricture length \( \geq 5 \) cm (OR, 2.2; \( P < 0.001 \)), peritoneal carcinomatosis (OR, 1.7; \( P < 0.05 \)), and multiple SEMS placement (OR, 8.0; \( P < 0.01 \)).

Conclusion: Clinicians must anticipate technical challenges in cases with peritoneal carcinomatosis, a CROSS score of 0, or expansive strictures; such cases require experienced clinicians to carry out SEMS placement.

Key words: colonoscopy, colorectal cancer, intestinal obstruction, risk factor, self-expandable metallic stent

INTRODUCTION

Colorectal cancer (CRC) is the most common cancer in Japan and one of the most common cancers worldwide. It has been reported that approximately 10% of patients with CRC present with large bowel obstruction. The conventional treatment for such patients is emergency surgery (colectomy or colostomy), which is associated with poor outcomes and high rates of morbidity and mortality. Currently, elective placement of a self-expandable metallic stent (SEMS) can serve to relieve the obstruction, whether as palliative treatment (PAL) in incurable disease (not amenable to colectomy or colostomy) or as a bridge to surgery (BTS) in patients with potentially resectable CRC.
Elective SEMS placement is credited with fewer stent-related complications, such as perforation, stent migration, and recurrent obstruction, and it results in improved outcomes compared with permanent stoma creation or primary anastomosis.  

In recent years, use of colonic SEMS has been advocated in Japan, with coverage by National Health Insurance beginning in 2012. The Colonic Stent Safe Procedure Research Group, in affiliation with the Japan Gastroenterological Endoscopy Society, was also established to ensure procedural safety and efficacy through mini-guidelines (brief recommendations) for colonic stent placement. In a recent large, prospective, multicenter study, we demonstrated the feasibility of SEMS placement as PAL or BTS for malignant colorectal obstruction.  

Further analysis of this dataset showed that SEMS placement is safe and effective in patients with acute malignant colonic obstruction, similar to stoma creation in terms of outcomes and complication rates. Another pooled analysis of patients (n = 426) from two prospective, multicenter trials of SEMS placement as BTS for malignant colonic obstruction is pending publication. Technical and clinical success rates of two types of stent were 98.1% and 93.8%, respectively, with an 8.5% rate of SEMS-related complications. 

Despite the safety and efficacy amply documented above, adoption of SEMS placement for malignant colorectal obstruction has been slow, primarily as a result of concerns over lengthy and technically difficult procedures in such complex patients. Longer operating time could generally be a predictor of morbidity under such emergency circumstances. The prolonged procedure time required to insert and position the stent under challenging circumstances not only adds to the patient’s surgical burden, but it also increases the risk of intraoperative incidents. Indeed, a large-scale, prospective, observational study from our group reported severe incidents as a result of the procedure, such as cardiopulmonary arrest during the procedure, and sepsis. Moreover, air insufflation during the procedure is considered a risk factor for bowel perforation. Therefore, given these facts, we thought that it is very important to shorten the procedure time and identify the risk factors for such difficult cases. However, previous studies have only compared cases based on outcome. 

In the present study, a post-hoc analysis using the dataset from the previous multicenter clinical trial was conducted, and only successful cases were investigated to identify factors that help predict technically difficult SEMS placement in cases of malignant colorectal obstruction by analyzing factors that accounted for prolonged procedure time.

**METHODS**

**Patient enrolment**

A POST-hoc analysis of a prospective, observational, multicenter clinical trial conducted at 46 facilities (14 academic centers and 32 community hospitals) across Japan between March 2012 and October 2013 was carried out. The clinical trial was registered with the University Hospital Medical Information Network Clinical Trial Registry (UMIN000007953) and has been described in detail in previous reports. Methods of SEMS placement were standardized based on previously published data, posting the protocols on a website and disseminating the specifics among participating endoscopists in a prestudy workshop on SEMS placement. Institutional review boards of participating facilities granted approval prior to study initiation, and informed consent was obtained from all patients agreeing to SEMS placement and clinical data registration. All patients were treated for acute colorectal obstruction and had registered at participating facilities through the study website before or immediately after each procedure. 

Patients were managed in accordance with the standard medical practices of each participating facility. Patients undergoing SEMS placement prior to scheduled elective resection of primary tumors were classified as BTS, whereas those without scheduled surgeries were considered PAL.

**Inclusion and exclusion criteria**

The registry included patients requiring BTS or PAL decompression for obstructive CRC or extracolonic cancer. Diagnosis was based on abdominal radiography, computed tomography (CT), or colonoscopy. Subjects with a history of prior colonic stent placement, disease-related complications (enteral ischemia, perforation [suspected or impending], intra-abdominal abscess or perforation, or severe peri-neoplastic inflammation), contraindications to endoscopic procedures, or any off-label use of stents were excluded.

**Stent device and procedure**

All procedures involved placement of an uncovered enteral colonic stent (WallFlex colonic stent; Boston Scientific Corp., Natick, MA, USA) with mid-body and proximal flange diameters of 22 or 27 mm and 25 or 30 mm, respectively, and lengths of 6, 9, or 12 cm. Procedural details were presented in the pre-introduction publicity announcement and posted on the study website. Guidewires were used to traverse the strictures, inserting a contrast tube into the proximal lumen to fluoroscopically determine stricture length and establish the
number of stents required. Stricture location was tagged intraor extraluminally by endoscopic clips, lipiodol, or radiopaque markers at the discretion of the endoscopist.

**Outcome measures**

Procedure times were recorded, considering those beyond the 75th percentile as technically difficult placement. Technical success was defined as accurate SEMS placement, conferring adequate stricture coverage on the first attempt, free of procedure-related adverse events, such as perforation, re-obstruction, stent migration, infection/fever, abdominal pain, and tenesmus. Perforation was diagnosed based on clinical, radiological, or intraoperative evidence.

Patients were monitored until hospital discharge. As previously stipulated, clinical success corresponded with resolution of symptoms and radiological relief of obstruction within 24 h, confirmed by a water-soluble contrast enema study or radiographic improvement.

**Candidate risk factors (clinical and interventional)**

Effects of various clinical and interventional factors were investigated in terms of prolonging procedure time, thus reflecting technically difficult SEMS placement. These included the following: (i) patient parameters, including age, gender, Eastern Cooperative Oncology Group (ECOG) performance status (PS), ColoRectal Obstruction Scoring System (CROSS) score, and time from diagnosis to SEMS placement; (ii) therapeutic parameters, including treatment intent and history, and use of chemotherapy or radiation therapy; (iii) tumor characteristics, including tumor site and origin, completeness of obstruction (defined as inability to pass flatus, lack of water-soluble contrast passing proximal to the lesion, or lack of an endoscopically visible lumen), stricture count and length(s), local or distant spread, and presence or absence of ascites; and (iv) interventional practices, including bowel preparation, length and caliber of first-placed SEMS, number of SEMS used, digestive tract decompression before SEMS placement, biopsy before SEMS placement, stricture marking, and balloon dilation before SEMS placement.

**Statistical analysis**

All computations were carried out using standard software (JMP v13; SAS Institute, Cary, NC, USA), with significance set at $P < 0.05$. Univariate and multivariate logistic regression analyses were undertaken, using stepwise variable selection (patient parameters, therapeutic parameters, tumor characteristics, interventional practices) to identify those associated with technically difficult SEMS placement, expressed as odds ratios (OR) and 95% confidence intervals (CI). Variables reaching a 0.25 level of significance in each step of the stepwise procedure were included in the multivariate logistic regression analysis. To exclude the effect of multicollinearity, if the correlation coefficient between pairs of covariates was greater than 0.4, one of the pair of covariates was excluded from the multivariate analysis.

**RESULTS**

A schematic of the study design and results is presented in Figure 1. Although 518 consecutive patients were enrolled, seven failing to meet the study criteria (loose stricture in 3, benign stricture in 3, and nonconforming SEMS device in 1) were excluded. The remaining 511 patients were stratified by treatment intent (per protocol) as BTS (310/511, 60.7%) or PAL (201/511, 39.3%). There were no patient dropouts during the 7-day follow up, but 10 technical failures occurred because of inability to pass a guidewire through the tumor stricture ($n = 5$), perforation by the guidewire ($n = 4$), and inability to endoscopically visualize the tumor ($n = 1$), resulting in a technical success rate of 98.0% (Figure 1).

**Baseline characteristics**

Baseline patient demographic and tumor characteristics in the technical success subset ($n = 501$) are presented in Table 1. Patients’ average age was 70.6 years, and 56.3% of...
patients were men. PS and CROSS scores were 0 or 1 in the majority of patients. Tumors were commonly located in the left colon (72.7%), and 87.2% of tumors were primary CRC. Clinical success was achieved in 97.6% of patients.

**Procedure times**

Median procedure time was 30 min (range, 4–170 min). Given that procedure times beyond the 75th percentile qualified as technically difficult placement, 27.1% of procedures were deemed technically difficult, requiring ≥45 min to complete (Figure 2).

**Univariate analysis**

Results of univariate analysis are presented in Tables 2–5. In terms of patient parameters, a CROSS score of 0 and technically difficult SEMS placement trended strongly toward a significant association (OR, 1.5; P = 0.07) (Table 2). However, no significant associations were evident between therapeutic parameters and technically difficult SEMS placement (Table 3). In contrast, significant relationships did emerge between technically difficult SEMS placement and tumor characteristics, including tumor site in the right colon (OR, 2.6; P < 0.001), multifocal strictures (OR, 11.0; P < 0.01), stricture length ≥5 cm (OR, 2.1; P < 0.001), and peritoneal carcinomatosis (OR, 2.1; P < 0.001) (Table 4). Similarly, significant associations were identified between technically difficult SEMS placement and first-placed SEMS length >6 cm (OR, 2.6; P < 0.0001), placement of multiple SEMS (OR, 6.4; P < 0.001), use of a nasointestinal tube (OR, 2.3; P < 0.05), and use of a transanal tube (OR, 0.4; P < 0.01) (Table 5).

**Multivariate analysis**

Results of multivariate analysis (Table 6) aligned with those of univariate analysis, showing significant associations between technically difficult SEMS placement and placement of multiple SEMS (OR, 8.8; P < 0.01), CROSS score of 0 before SEMS placement (OR, 1.6; P < 0.05), tumor site in the right colon (OR, 2.5; P < 0.0001), stricture length ≥5 cm (OR, 2.2; P < 0.001), and peritoneal carcinomatosis (OR, 1.7; P < 0.05). Multifocal strictures, use of a nasointestinal tube, and biopsy before SEMS placement had no significant relationships with technically difficult placement. Furthermore, significant inverse relationships were observed between technically difficult SEMS placement and digestive tract decompression by a transanal tube before SEMS placement (OR, 0.3; P < 0.05), larger caliber (25 mm) of first-placed SEMS (OR, 0.3; P < 0.05), and cleansing enema (OR, 0.5; P < 0.01) (Table 6).

**DISCUSSION**

RESULTS OF THE present study showed that, despite the complexities of malignant colorectal obstruction (as baseline patient demographic and tumor characteristics attest), technical (98%) and clinical (97.6%) success rates of SEMS placement are high. In nearly 27% of patients, however, procedure time exceeded 45 min, thus qualifying as a technically difficult placement. Furthermore, parameters such as a CROSS score of 0 before SEMS placement, peritoneal carcinomatosis, tumor site in the right colon, stricture length ≥5 cm, and placement of multiple SEMS were significantly associated with or predisposed to technically difficult SEMS placement.

The increased technical difficulty of SEMS placement in the presence of the above factors may be explained in several ways. For example, it is apparent that extreme degrees of distention are the key problem in patients with a CROSS score of 0. Such individuals typically present with severe symptoms, even if continuous decompression is applied.14,16 Inevitably, distention at the mouth of an
obstruction creates an impediment to guidewire insertion, but post-stenosis breakthrough examination of the mouth also becomes extremely difficult. Superimposed images of blocked intestinal gas, amidst obstructive enterocolitis, readily impede accurate appraisal of the stenotic segment. As the need for intervention is often urgent, assessing the potential for technical difficulty and, hence, the prospect of a prolonged procedure time, is warranted. It is thus advisable that, under challenging circumstances, SEMS placement be conducted early (obviating the need for gastric tube insertion) and by experienced endoscopists. CROSS scores may be derived from patient symptoms, proving especially

Table 2

| Parameter                        | Technical difficulty, n (%) | Odds ratio (95% CI) | P-value |
|---------------------------------|----------------------------|---------------------|---------|
| Age, y                          |                            |                     |         |
| <70                             | 58/215 (27.0)              | 1                   |         |
| ≥70                             | 78/286 (27.3)              | 1.0 (0.68–1.51)     | 0.94    |
| Gender                          |                            |                     |         |
| Male                            | 74/282 (26.2)              | 1                   |         |
| Female                          | 62/219 (28.3)              | 1.1 (0.75–1.65)     | 0.61    |
| Performance status              |                            |                     |         |
| 0/1                             | 94/349 (26.9)              | 1                   |         |
| 2–4                             | 42/152 (27.6)              | 1.0 (0.68–1.59)     | 1.04    |
| CROSS score before SEMS placement |                        |                     |         |
| 0                               | 57/178 (32.0)              | 1.5 (0.97–2.20)     | 0.07    |
| 1–4                             | 79/323 (24.5)              | 1                   |         |
| Time from diagnosis to SEMS placement, days |            |                     |         |
| ≤3                              | 70/259 (27.0)              | 1                   |         |
| >3                              | 66/242 (27.3)              | 1.0 (0.68–1.50)     | 0.95    |

Cl, confidence interval; CROSS, ColoRectal Obstruction Scoring System; SEMS, self-expandable metallic stent.

Table 3

| Parameter                              | Technical difficulty, n (%) | Odds ratio (95% CI) | P-value |
|----------------------------------------|----------------------------|---------------------|---------|
| Therapeutic intent                     |                            |                     |         |
| Bridge to surgery                      | 78/303 (25.7)              | 1                   |         |
| Palliation                             | 58/198 (29.3)              | 1.2 (0.80–1.78)     | 0.38    |
| Treatment history                      |                            |                     |         |
| Colon surgery                          |                            |                     |         |
| Yes                                    | 10/48 (20.8)               | 0.68 (0.33–1.41)    | 0.30    |
| No                                     | 126/453 (27.8)             | 1                   |         |
| Other abdominal surgery                |                            |                     |         |
| Yes                                    | 30/107 (28.0)              | 1.1 (0.66–1.71)     | 0.82    |
| No                                     | 106/394 (26.9)             | 1                   |         |
| Chemotherapy                           |                            |                     |         |
| Yes                                    | 21/71 (29.6)               | 1.2 (0.66–2.00)     | 0.62    |
| No                                     | 115/430 (26.7)             | 1                   |         |
| Radiation                              |                            |                     |         |
| Yes                                    | 1/5 (20.0)                 | 0.7 (0.07–6.03)     | 0.72    |
| No                                     | 135/496 (27.2)             | 1                   |         |

Cl, confidence interval; SEMS, self-expandable metallic stent.
useful in anticipating difficulties prior to actual stent placement.

Malignant colorectal obstruction in conjunction with peritoneal carcinomatosis is especially notorious for prolonging SEMS placement procedures. The increased mobility of the bowel in such instances encumbers endoscopic insertion and operation. It may also be difficult to access or accurately identify sites of stenosis secondary to tumor invasion from the serosal surface. Nonetheless, the lower morbidity and mortality rates achieved through endoscopic stenting in such patients make it preferable to surgery. Thus, SEMS placement should be considered in this context, particularly by an expert endoscopist.

Tumors of the right colon are prone to technical difficulty, no doubt as a result of the greater time required for endoscopic access to obstructive lesions. At a deeper insertion depth, endoscopic maneuverability also suffers, perhaps contributing equally to the overall technical difficulty. It should be noted that obstruction occurring despite the high water content and relatively soft consistency of feces in the right colon suggests a severe degree of luminal stenosis, promising a longer and technically difficult procedure under compromised conditions.

Table 4 Univariate analysis of relationships between tumor characteristics and technically difficult SEMS placement

| Characteristic                           | Technical difficulty, n (%) | Odds ratio (95% CI) | P-value |
|-----------------------------------------|----------------------------|---------------------|---------|
| Tumor site                              |                            |                     |         |
| Left colon                              | 79/364 (21.7)              | 1                   | <0.001  |
| Right colon                             | 57/137 (41.6)              | 2.6 (1.69–3.92)     |         |
| Complete obstruction                    |                            |                     |         |
| Yes                                     | 118/425 (27.8)             | 1.2 (0.70–2.19)     | 0.46    |
| No                                      | 18/76 (23.7)               | 1                   |         |
| Tumor origin                            |                            |                     |         |
| Colorectal cancer                       | 115/446 (25.8)             | 1                   | 0.05    |
| Other                                   | 21/556 (32.8)              | 1.8 (0.99–3.19)     |         |
| No. of strictures                       |                            |                     |         |
| 1                                       | 132/496 (26.6)             | 1                   | <0.01   |
| >1                                      | 4/5 (80.0)                 | 11.0 (1.22–99.60)   |         |
| Stricture length, cm                    |                            |                     |         |
| <5                                      | 69/320 (21.6)              | 1                   | <0.001  |
| ≥5                                      | 67/181 (37.0)              | 2.1 (1.43–3.20)     |         |
| Tumor with local invasion only          |                            |                     |         |
| Yes                                     | 65/269 (24.2)              | 0.7 (0.49–1.07)     | 0.72    |
| No                                      | 71/232 (30.6)              | 1                   |         |
| Distant metastasis                      |                            |                     |         |
| Liver                                   |                            |                     |         |
| Yes                                     | 34/135 (25.2)              | 0.9 (0.56–1.37)     | 0.55    |
| No                                      | 102/366 (27.9)             | 1                   |         |
| Lung                                    |                            |                     |         |
| Yes                                     | 14/55 (25.5)               | 0.9 (0.48–1.72)     | 0.77    |
| No                                      | 122/446 (27.4)             | 1                   |         |
| Peritoneal carcinomatosis                |                            |                     |         |
| Yes                                     | 49/127 (38.6)              | 2.1 (1.35–3.19)     | <0.001  |
| No                                      | 87/374 (23.3)              | 1                   |         |
| Ascites                                 |                            |                     |         |
| Yes                                     | 48/156 (30.8)              | 1.3 (0.86–1.97)     | 0.22    |
| No                                      | 88/345 (25.5)              | 1                   |         |

CI, confidence interval; SEMS, self-expandable metallic stent.

Table 5 Univariate analysis of relationships between interventional practices and technically difficult SEMS placement

| Practice                                | Technical difficulty, n (%) | Odds ratio (95% CI) | P-value |
|-----------------------------------------|----------------------------|---------------------|---------|
| Preparation                             |                            |                     |         |
| Cleansing enema                         |                            |                     |         |
| Yes                                     | 41/172 (23.8)              | 0.8 (0.50–1.18)     | 0.23    |
| No                                      | 95/329 (28.9)              | 1                   |         |
| Oral bowel cleaning                     |                            |                     |         |
| Yes                                     | 8/37 (21.6)                | 0.7 (0.32–1.62)     | 0.43    |
| No                                      | 128/464 (27.6)             | 1                   |         |
| Length of first-placed SEMS, cm         |                            |                     |         |
| ≤6                                      | 60/305 (19.7)              | 1                   | <0.0001 |
| >6                                      | 76/196 (38.8)              | 2.6 (1.73–3.87)     |         |
| Caliber of first-placed SEMS, mm        |                            |                     |         |
| 22                                      | 128/457 (28.0)             | 1                   | 0.16    |
| 25                                      | 8/44 (18.2)                | 0.6 (0.26–1.26)     |         |
| No. of SEMS                             |                            |                     |         |
| 1                                       | 127/488 (26.0)             | 1                   | <0.001  |
| >1                                      | 9/13 (9.2)                 | 6.4 (1.94–21.1)     |         |
| Digestive tract decompression before SEMS placement |             |                     |         |
| Nasogastric tube                        |                            |                     |         |
| Yes                                     | 9/32 (28.1)                | 1.1 (0.47–2.34)     | 0.90    |
| No                                      | 127/469 (27.1)             | 1                   |         |
| Nasointestinal tube                     |                            |                     |         |
| Yes                                     | 18/41 (43.9)               | 2.3 (1.18–4.35)     | <0.05   |
| No                                      | 118/460 (25.7)             | 1                   |         |
| Transanal tube                          |                            |                     |         |
| Yes                                     | 8/62 (12.9)                | 0.4 (0.17–0.78)     | <0.01   |
| No                                      | 128/439 (29.2)             | 1                   |         |
| Biopsy before SEMS placement            |                            |                     |         |
| Yes                                     | 83/292 (28.4)              | 1 (0.78–1.75)       | 0.45    |
| No                                      | 53/209 (25.4)              | 1                   |         |
| Stricture marking                       |                            |                     |         |
| Yes                                     | 76/312 (24.4)              | 0.7 (0.46–1.03)     | 0.07    |
| No                                      | 60/189 (31.8)              | 1                   |         |
| Balloon dilation before SEMS placement  |                            |                     |         |
| Yes                                     | 2/7 (28.6)                 | 1.1 (0.21–5.61)     | 0.93    |
| No                                      | 134/494 (27.1)             | 1                   |         |

CI, confidence interval; SEMS, self-expandable metallic stent.

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Table 6  Multivariate analysis of relationships between candidate parameters and technically difficult SEMS placement

| Parameter                                                      | Technical difficulty, n (%) | Odds ratio (95% CI) | P-value |
|---------------------------------------------------------------|-----------------------------|---------------------|---------|
| Cleansing enema                                               | 41/172 (23.8)               | 0.5 (0.33–0.86)     | <0.01   |
| Larger caliber first-placed SEMS (25 mm)                     | 8/44 (18.2)                 | 0.3 (0.14–0.82)     | <0.05   |
| No. of SEMS placed >1                                         | 9/13 (69.2)                 | 8.0 (2.07–31.2)     | <0.01   |
| digestive tract decompression via transanal tube before SEMS placement | 8/62 (12.9)                 | 0.3 (0.15–0.78)     | <0.05   |
| Biopsy before SEMS placement                                  | 83/292 (28.4)               | 1.4 (0.88–2.19)     | 0.15    |
| CROSS score of 0 before SEMS placement                        | 57/178 (32.0)               | 1.6 (1.03–2.59)     | <0.05   |
| Tumor site in right colon                                     | 57/137 (41.6)               | 2.5 (1.61–4.01)     | <0.0001 |
| Stricture length ≥5 cm                                        | 67/181 (37.0)               | 2.2 (1.38–3.37)     | <0.001  |
| Peritoneal carcinomatosis                                      | 49/127 (38.6)               | 1.7 (1.06–2.83)     | <0.05   |

CI, confidence interval; CROSS, ColoRectal Obstruction Scoring System; SEMS, self-expandable metallic stent.

Lengthy and technically demanding procedures are also expected in patients with stenotic segments ≥5 cm. Passage of guidewires and devices through extended obstructions poses technical problems, requiring particular caution. Similarly, patients requiring more than one SEMS for adequate coverage of expansive stenoses are at a clear disadvantage. Endoscopic operability problems in this setting and efforts to locate points of subsequent SEMS placement carry the risk of stent displacement and heighten the overall complexities of such procedures.

Remarkably, SEMS placement was facilitated by transanal insertion of an ileus tube for preoperative colonic lavage and digestive tract decompression. Upon tube removal, a guidewire is more readily advanced, moving past the point of obstruction with greater ease. Still, we are not endorsing this approach as preparation for SEMS placement, considering the added time, effort, and inherent risk involved.27

Several studies compared cases based on outcomes and reported the failure factor of the technical failure cases. Yoon et al. retrospectively reported that peritoneal carcinomatosis, extrinsic origin, and tumor site in the right colon were associated with technical failure of stent procedures,28 consistent with the present findings. According to our previous prospective study, stricture marking only trended toward a negative association with technical failure, but it was not significant (P = 0.09).16 Moreover, stricture marking and factors related to technically difficult SEMS placement in this study were few correlated (all correlation coefficients <0.2) and they could be considered completely independent. Therefore, in addition to the present findings, clinicians must also pay attention to these things before SEMS placement.

Limitation of the present study is that it was a post-hoc analysis with a single-arm design using only one SEMS device exclusively. Meanwhile, this prospective, multicenter investigation involved a record number of patients, with a high rate of technical success. A fair number of procedures (~25%), however, required a longer amount of time to complete as a result of technical difficulty.

In conclusion, before attempting SEMS placement for obstructive CRC, clinicians must anticipate technical challenges that can occur in patients with peritoneal carcinomatosis, a CROSS score of 0, or expansive strictures. The present findings underscore the need for SEMS placement to be carried out by experienced clinicians in cases with anticipated challenges.

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CONFLICTS OF INTEREST

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