CLINICAL ENDOSCOPY

Endoscopic Management of Malignant Colonic Obstruction

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Advanced colorectal cancer can cause acute colonic obstruction, which is a life-threatening condition that requires emergency bowel decompression. Malignant colonic obstruction has traditionally been treated using emergency surgery, including primary resection or stoma formation. However, relatively high rates of complications, such as anastomosis site leakage, have been considered as major concerns for emergency surgery. Endoscopic management of malignant colonic obstruction using a self-expandable metal stent (SEMS) was introduced 20 years ago and it has been used as a first-line palliative treatment. However, endoscopic treatment of malignant colonic obstruction using SEMSs as a bridge to surgery remains controversial owing to short-term complications and long-term oncological outcomes. In this review, the current status of and recommendations for endoscopic management using SEMSs for malignant colonic obstruction will be discussed. **Clin Endosc 2020;53:9-17**

Key Words: Colorectal cancer; Malignant colonic obstruction; Self-expandable metal stent

INTRODUCTION

Malignant colonic obstruction can be caused by colorectal cancer, metastatic cancer, and locally advanced pelvic tumors. Among these conditions, colorectal cancer is one of the most well-known and commonly diagnosed cancers worldwide. Up to 20% of patients with advanced colorectal cancer present with malignant colonic obstruction.[1-5] Advanced colorectal cancer can cause acute colonic obstruction, which is a life-threatening condition that requires emergency decompression. Traditionally, malignant colonic obstruction has been treated using emergency surgery, including primary resection or stoma formation. However, owing to the relatively high rates of complications, such as anastomosis site

leakage, there is a need for alternative treatment strategies aside from emergency surgery.[6-9] Endoscopic management of malignant colonic obstruction using a self-expandable metal stent (SEMS) was introduced approximately 20 years ago, and currently, its use as a palliative tool has yielded sufficient evidence for it to be accepted as a first-line treatment. However, SEMS placement, as a bridge to surgery (BTS), in patients with malignant colonic obstruction, which is potentially curable, remains controversial owing to concerns, such as short-term complications and long-term oncological outcomes. In this review, the current status of and recommendations for endoscopic management using SEMSs for malignant colonic obstruction will be discussed.

MATERIALS AND METHODS

Since the 1990s, many types of colorectal stents have been developed. The majority of stents used for colonic obstruction are SEMSs; these are radiopaque, tube-shaped, metallic meshes, which are self-expandable. Once deployed, the stents expand for 2–3 days and are anchored to a designated site by a self-expandable force opposite to the lumen. SEMS materials can vary and can include the following: stainless steel, elgiloy,

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and nitinol. For a successful stent insertion, an endoscopist should be aware of the characteristics of each stent. Stainless steel stents are relatively stiff and interfere with magnetic resonance images (MRIs). Elgiloy stents are composed of cobalt, chromium, and nickel and have improved elasticity and flexibility compared with stainless steel stents; further, they do not affect MRI assessment. Nitinol stents are composed of nickel-titanium and yield a poor fluoroscopic visualization compared with elgiloy stents. To overcome this limitation, a radiopaque marker, such as a gold or silver marker, is added to both ends of these stents. These stents have more flexibility and can better hold the original shape than stainless steel and elgiloy stents and do not impact MRI assessments; therefore, nitinol stents are used worldwide.

Owing to the lack of research, it is not known whether an enema should be administered before colonic stent placement. Symptomatic colonic obstruction is a known contraindication for an enema; however, an enema can facilitate stent insertion by allowing for clear visualization. Prophylactic antibiotics are not recommended owing to the low incidence of reported bacteremia. Chun et al. reported that 6.3% (4/63) of patients showed positive blood culture test findings after colonic stent placement, and none of them developed infection symptoms within 48 hours.[10] The prolonged procedure time, which was longer than 36 minutes, was the factor associated with bacteremia.[10]

Colonic stent insertion can be performed via either an endoscopic or a fluoroscopic method. Most colonic stents are inserted through endoscopy, followed by fluoroscopic guidance. Several studies have shown comparable technical success rates between endoscopic and fluoroscopic methods; however, a combination of both methods showed higher technical success rates.[11-14] Therefore, the European Society of Gastrointestinal Endoscopy (ESGE) and the American Society of Gastrointestinal Endoscopy guidelines for malignant colonic obstruction recommend a combined approach of endoscopy and fluoroscopy. An appropriate learning curve should be anticipated for successful colonic stent placement. Two non-comparative studies suggested that at least 20 colonic stents should be placed to increase the technical success rate and decrease the number of used stents.[15,16] One retrospective study reported that endoscopists with experience in therapeutic endoscopic retrograde cholangiopancreatography (ERCP) achieved lower perforation rates during colonic stent placement.[17] This demonstrates that a therapeutic ERCP endoscopist could have successfully mastered necessary techniques for performing colonic stents. To reduce complications, such as stent migration, a larger body diameter (≥24 mm) and a length of at least 2 cm on each side of the lesion are recommended.[17-21] The overall process of colonic stenting for malignant obstruction is usually followed in this manner. The procedure does not need conscious sedation or general anesthesia. However, sedation with midazolam and analgesia is desirable in patients with excessive anxiety. After insertion of the colonoscope to the distal part of luminal obstruction with the patients in a supine or lateral decubitus position, a catheter loaded with a hydrophilic tip guidewire is inserted through the working channel to the distal part of the obstructive lesion. The catheter should be placed in the orifice of the obstructive lesion and parallelized with the bowel direction as far as possible to facilitate traversion of the obstructive lesion with the guidewire (Fig. 1A, B). Thereafter, cannulation with the guidewire is attempted gently. Endoscopists should be cautious of possible bleeding upon contact, which could be induced by too many cannulation trials or colonic perforation with the guidewire and perforation associated with excessive air inflation during this step.[21] After traversing the obstructive lesion with the guidewire, the correct position of the guidewire should be confirmed via the fluoroscopic view. The catheter is then inserted to the proximal part of the obstructive le-
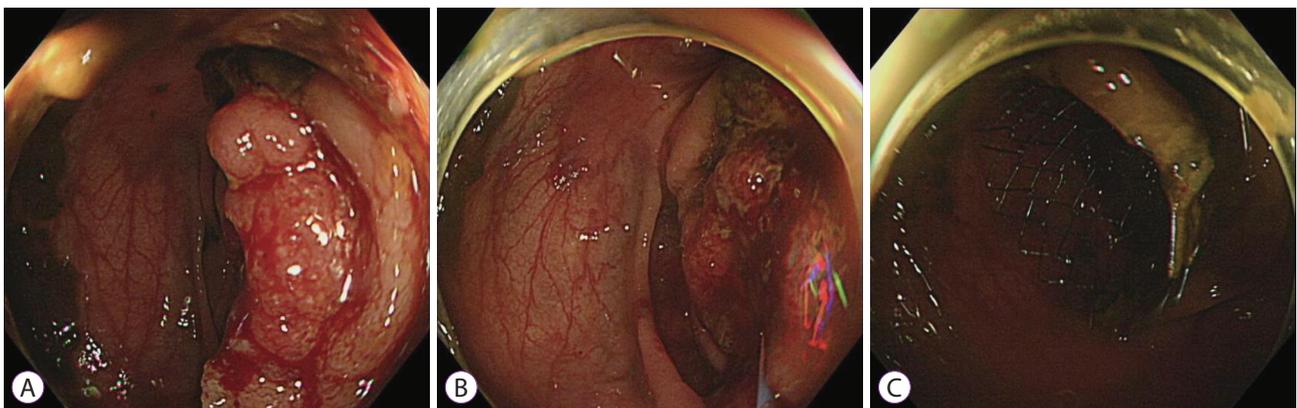

Fig. 1. Endoscopic images of colonic stenting. (A) Malignant obstruction at the splenic flexure, (B) cannulation, and (C) after deployment of the stent.

sion over the guidewire, and a water-soluble contrast medium is injected to identify the length of the obstruction and to rule out the possibility of bowel perforation (Fig. 2A). The catheter is removed, leaving the guidewire tip as far as possible in the colon. A SEMS is inserted over the guidewire, and stent deployment is performed under endoscopic and fluoroscopic guidance (Figs. 1C, 2B). A stent length of at least 2 cm on each side of the lesion is required to prevent stent migration. After stent placement, a water-soluble contrast medium can be in-jected through the working channel to the stent for patency documentation and correct positioning of the stent, although it is not essential (Fig. 2C). Abdominal X-ray follow-up is re-quired to verify bowel decompression and correct positioning of the stent (Fig. 3).

Covered and uncovered stents

Colorectal stents can be divided into two types: covered and

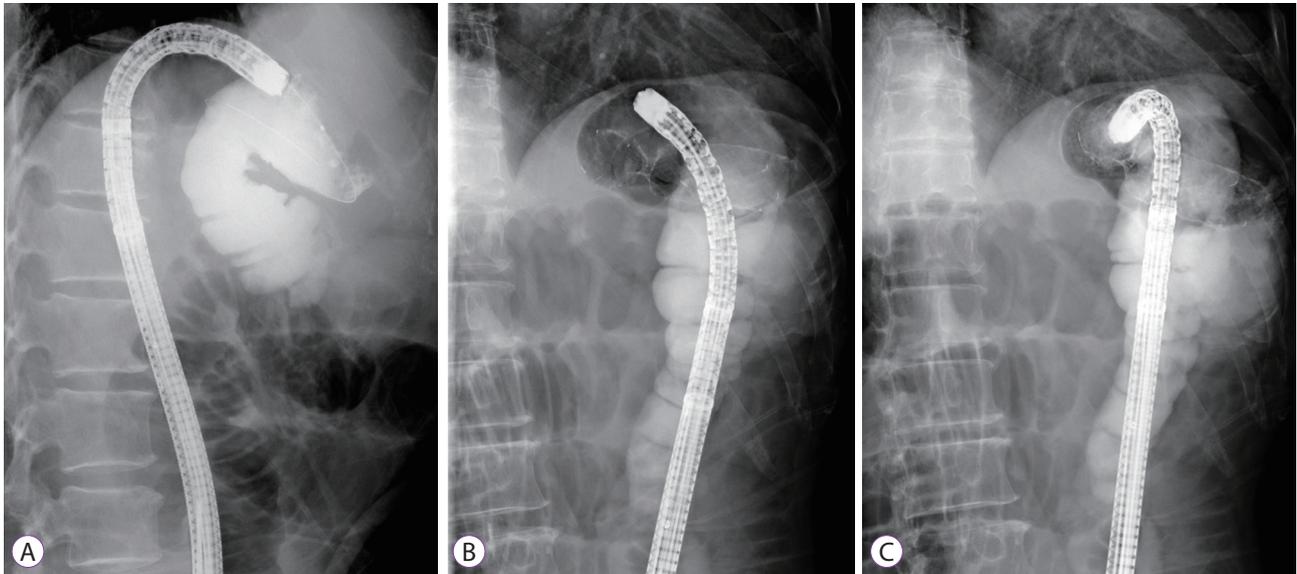**Fig. 2.** Fluoroscopic images of colonic stenting. (A) Contrast medium injection after cannulation, (B) after deployment of the stent, and (C) documentation of stent patency and correct positioning.
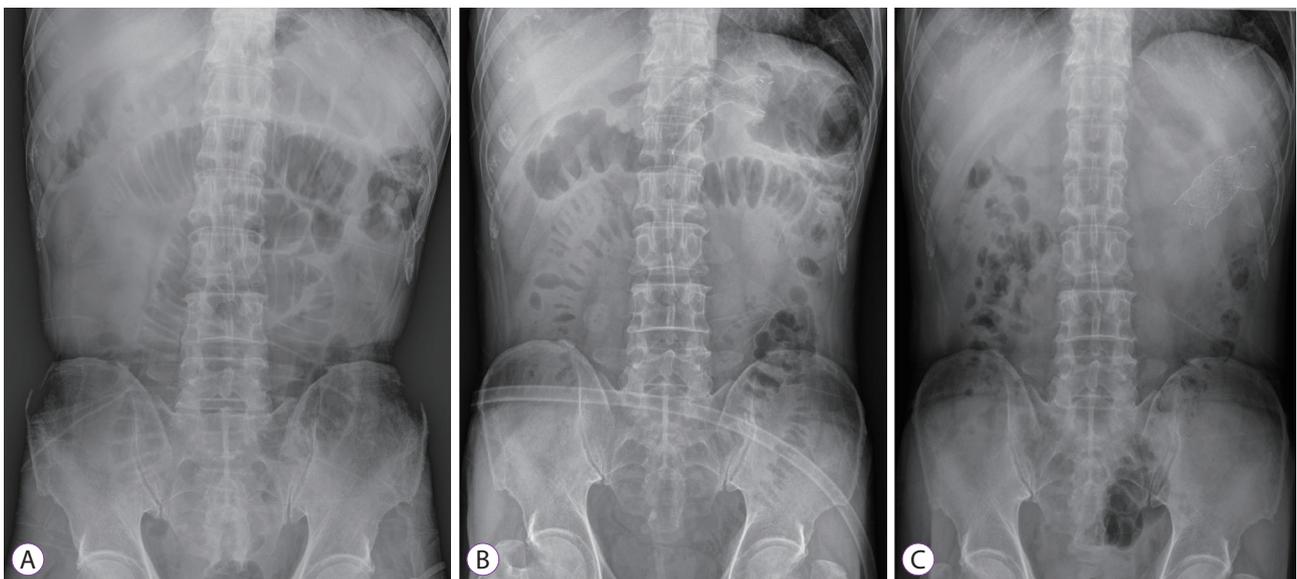

Fig. 3. Abdominal X-ray images showing bowel decompression and correct positioning of the stent. (A) Pre-colonic stenting, (B) 2 days after colonic stenting, and (C) 5 days after colonic stenting.

uncovered. A covered stent is subdivided into two groups—fully and partially covered—and each type of this stent has specific advantages and disadvantages. Covered stents have a lower tumor ingrowth into the stent, which can be used for sealing fistulas. However, the risk of stent migration is higher than that for uncovered stents because of the low anchoring power. In contrast, uncovered stents have a lower risk for stent migration; however, they have a higher associated tumor ingrowth rate. To overcome this limitation, a partially covered stent that consists of an uncovered segment at both ends of the stent was developed. Two meta-analyses that compared between covered and uncovered stents have shown that covered stents are associated with a higher risk of migration than uncovered stents but have a lower tumor ingrowth. However, there was no significant difference in the technical and clinical success and complication rates between the stent groups.[22,23] Appropriate stent selection for patients with consideration of clinical situations is very important; however, currently, there is no established approach for selecting the type of stent. To date, the efficacy and safety have been reported to be similar for covered and uncovered stents. Therefore, an endoscopist must be aware of the unique features of each stent type and select the appropriate stent based on patient conditions.

STENT INDICATION

Two main indications for malignant colonic obstruction are applied in clinical practice: the first approach is palliative stenting for patients with malignant colonic obstruction who are not able to undergo curative surgery and the second approach is preoperative stenting for bowel decompression until the condition is suitable for elective surgical resection, which is also called colonic stenting for BTS. Although a colonic stent can be inserted in any part of the colon, many studies on colonic stenting have focused on left-sided colonic obstruction. This is probably attributable to the relatively lesser severity of right-sided colonic obstruction than of left-sided colonic obstruction. Some retrospective studies have reported successful insertions for proximal colonic obstruction[11,24-27]; however, conflicting results have also been reported.[17,28-31] Recently, a retrospective multicenter trial reported on the advantages of colonic stents for right-sided colonic obstruction. Sixty-nine patients with a colonic stent and 36 patients who had undergone surgery were included. The technical and clinical success rates of surgery were higher than those of colonic stenting (100% vs. 89.8%, p=0.09 and 100% vs. 78%, p<0.001). However, the surgery group had longer hospital stays (8 days vs. 4 days, p<0.01) and higher early adverse event rates (30.5% vs. 7.5%, p=0.003), while the stenting group had higher rates

of late complications, although this result was not statistically significant.[32] In general, emergency surgery without bowel preparation is considered for patients with right-sided colonic obstruction. However, it should be noted that palliative stenting can be considered as an alternative to surgery for patients who are not able to undergo surgery.

A perforated colon is the only absolute contraindication for colonic stenting. Lower rectal stenting (≤5 cm from the anal verge) was also considered as a contraindication because of complications, including anal pain, tenesmus, and incontinence.[33,34] However, a recent Korean retrospective study showed that lower rectal stenting can be an alternative treatment option for obstructive decompression in patients who are not able to undergo surgery. Patients with malignant rectal obstruction underwent lower rectal stenting for palliation or BTS, and the technical and clinical success rates were 87.1% (34/39) and 69.2% (27/39), respectively. Only 4 of 27 patients with clinical success reported anal pain, and the pain was well controlled with analgesics.[35] However, there were several limitations to the study, including the retrospective design and selection bias, because patients with lower rectal obstruction were more likely to undergo palliative surgery rather than stenting. Malignant colonic obstruction can also be caused by extracolonic tumors. However, clinical outcomes of colonic stenting in patients with extracolonic tumors were less favorable than those of colonic stenting in patients with colorectal cancer.[36] Therefore, stent placement for colonic obstruction by extracolonic tumors should be considered in selective patients who are not suitable for surgery. The indications, clinical advantages, and contraindications of colonic stenting are summarized in Table 1.

Colonic stenting for palliation

Palliative colonic stenting for malignant obstruction has been demonstrated to be successful enough to be accepted as a first-line treatment. Two recently published meta-analyses that included randomized and non-randomized studies compared the efficacy and safety of colonic stents and emergency surgery in the palliative setting.[37,38] Clinical relief of obstruction in the surgery group was significantly higher than that of the stent group (99.8% vs. 93.1%, p<0.001). However, a meta-analysis showed that the 30-day mortality was lower in the stenting group than in the surgery group (4.2% vs. 10.5%, p=0.01).[38] In addition, colonic stenting was associated with a shorter hospital stay (9.6 days vs. 18.8 days), lower intensive care unit admission rate (0.8% vs. 18.0%), and lower stoma formation rate (12.7% vs. 54.0%).[38] The overall complication rates were not significantly different between the groups. The surgery group showed a higher early complication rate, whereas the stenting group had more frequent late compli-

cations; these findings are consistent with recently published data.[32,38] Reported colonic stenting-related complications include perforation (12.7%), stent migration (9.2%), and stent obstruction (18.3%).[38] Another advantage of colonic stenting over surgery for treating malignant obstruction is an earlier start of palliative chemotherapy (15.5 days vs. 33.4 days).[38] For patients with colonic stents, palliative chemotherapy is associated with better survival rates.[36,39] Considering these findings, colonic stenting for malignant obstruction can be the preferred treatment option in palliative settings. However, when palliative colonic stenting and bevacizumab treatment are considered for patients with malignant obstructions, careful approaches are needed because of a high risk of stenting-related perforation. Several retrospective studies reported a high risk of stenting-related perforation in patients receiving palliative chemotherapy, especially bevacizumab treatment.[17,19,40] A meta-analysis that assessed risk factors for stenting-related colonic perforation was recently published. Bevacizumab-based chemotherapy increased the risk of stenting-related perforation (12.5%) compared with chemotherapy without bevacizumab (7.0%) or no chemotherapy (9.0%).[41] Based on these findings, colonic stenting is not recommended as a first-line treatment option in patients being treated with, or who are candidates for, palliative bevacizumab-based chemotherapy. Another concern related to colonic stenting in patients receiving palliative chemotherapy is that stent migration is associated with tumor shrinkage.[42-44] Despite these concerns, in patients with malignant obstruction, palliative colonic stenting should be considered as a first-line treatment because of the associated lower short-term mortality rate and earlier start of chemotherapy.

Colonic stenting for bridge to surgery

Although colonic stents can be inserted in any part of the colon, many studies on colonic stenting have investigated patients with left-sided colonic obstruction. Similarly, most studies on colonic stenting for elective surgery have focused on left-sided malignant obstruction. Symptomatic left-sided malignant colonic obstruction requires bowel decompression via emergency surgery or colonic stenting. Considering the relatively high mortality and morbidity of emergency surgery, colonic stenting appears to be the preferred treatment option for malignant colonic obstruction in patients with potentially curable and resectable cases.[45,46] Moreover, colonic stenting as a BTS can provide time for staging work-up and optimizing the patients' condition for elective surgery. However, recent studies have not shown a clear superiority of colonic stenting for BTS over emergency surgery. Nine systematic reviews with meta-analyses[47-55] and eight randomized controlled trials[56-63] that compared the efficacy and safety of colonic stenting for BTS with those of emergency surgery have been published in the last decade. Interestingly, three of the randomized controlled trials were closed prematurely because of contrasting reasons and one was discontinued owing to a high incidence of anastomosis site leakage in the emergency surgery group[60] and the other two owing to higher rates of adverse events, such as stenting-related perforation in the stenting group.[61,62]

The most recently published systematic review with meta-analysis compared the efficacy and safety of colonic stenting for BTS with those of emergency surgery, and only randomized controlled trials were considered for inclusion.[47] A total of 497 patients were included (251 in the stenting group vs. 246 in the emergency surgery group). The overall short-term mortality (within 60 days after surgery) was not significantly different between these groups (9.6% in the stenting group vs. 9.9% in the emergency surgery group).[47] However, the overall short-term morbidity was significantly lower in the stenting group than in the emergency surgery group (33.9%

Table 1. Indication of Colonic Stent and Each Clinical Advantages over Surgery

Indication	Advantage	Disadvantage
Colonic stent for palliation	Lower short term motality	High stent related perforation risk
	Shorter hospital day	(especially Bevacizumab)
	Lower stoma rate	
	Earlier start of chemotherapy	
Colonic stent for bridge to surgery	Lower short term morbidity	Concern about oncological outcomes
	Lower stoma rate	Possibility of surgical failure
	High primary anastomosis rate	
Contraindication		
Perforated colon (absolute)		
Lower rectal stenting (<5 cm from anal verge, relative)		
Extrinsic compression by extracolonic tumors (relative)		

vs. 51.2%, *p*=0.023).[47] In addition to morbidity, the meta-analysis showed that the stenting group had a lower temporary stoma rate (33.9% vs. 51.4%, *p*<0.001), lower permanent stoma rate (22.2% vs. 35.2%, *p*=0.003), and higher primary anastomosis rate (70.0% vs. 54.1%, *p*=0.043).[47] These findings are consistent with those of a previous meta-analysis.[48] Based on these results, colonic stenting for BTS in patients with malignant obstruction, which is potentially curable and resectable, may be more advantageous than emergency surgery in regard to short-term outcomes. However, currently, there are conflicting data on colonic stenting for BTS. One study reported that the use of multiple colonic stents for BTS is associated with surgical failure.[61] Long-term outcomes, especially oncological outcomes of colonic stenting for BTS, are another major concern. One comparative prospective study showed that the local recurrence rate was significantly higher in the stenting group than in the primary surgery group.[64] In the Dutch Stent-In 2 trial, colonic stenting for BTS and stenting-related perforation were associated with a higher overall recurrence rate.[65] Recently, a systematic review with meta-analysis that included 21 comparative studies was published; this study evaluated the oncological safety of colonic stenting for BTS in patients with malignant left-sided obstruction.[66] A total of 1,919 patients were included (938 in the stenting group vs. 981 in the emergency surgery group). There were no significant differences in the 3- and 5-year overall survival rates between the two groups (69.7% vs. 67.9% and 63.5% vs. 57.9%, respectively).[66] The disease-free survival and overall and local recurrence rates were not significantly different.[66] The permanent stoma rate was significantly lower in the stenting group than in the emergency surgery group (14.7% vs. 26.5%; odds ratio [OR], 0.49; 95% confidence interval [CI], 0.32–0.74).[66] These results may indicate that colonic stenting for BTS in patients with malignant left-sided obstruction yields favorable oncological safety profiles and lower permanent stoma rates than does emergency surgery. However, careful interpretation of these results is necessary because of conflicting data on survival in the stenting groups based on subgroup analyses that included only randomized controlled trials (all four trials). In the subgroup analysis, the stenting group had worse survival outcomes (OR, 1.18; 95% CI, 0.66–2.11), although this result was not statistically significant. The meta-analysis was mainly based on non-randomized studies; therefore, there is still a need for more randomized studies to assess the oncological outcomes of colonic stenting for BTS clearly in patients with malignant obstructions. However, despite the current uncertainty on oncological outcomes, colonic stenting for BTS is advantageous compared with emergency surgery because of the lower short-term morbidity and temporary or permanent stoma rates and higher primary anastomosis rates.[47]

In addition, colonic stenting for BTS can facilitate elective laparoscopic resection. A population-based study showed that the postoperative mortality in laparoscopic colorectal cancer surgery is lower than that in open surgery.[67] Considering these advantages, colonic stenting for BTS could be performed as an alternative treatment option for patients with high surgical risks, such as those with advanced age, multiple co-morbidities, and high American Society of Anesthesiologists (ASA) classification.[68-73] This is consistent with the current ESGE guidelines for malignant colonic obstruction. The guidelines suggest that colonic stenting for BTS could be an alternative treatment in patients who have an increased risk of postoperative mortality, especially those with an ASA classification of ≥III or an age of >70 years.

COMPLICATIONS

Colonic stenting for malignant obstruction is a relatively low-risk procedure with a mortality rate of <4%.[28,38,74] However, it is associated with various complications, such as perforation, migration, re-obstruction, pain, and bleeding. Colonic stenting-related complications are usually divided into early (≤30 days) and late (>30 days) complications. Perforation is the most serious colonic stenting-related complication, with a mortality rate of 16%, although the overall risk is relatively low.[75,76] Guidewire or catheter misplacements are frequently associated with early perforation, while stent quality can be a cause of late perforation.[21] As mentioned above, colonic stenting in patients who will receive bevacizumab treatment should be avoided as much as possible because of the high risk of perforation.[17,19,40] When perforation is documented, emergency surgery is usually required. However, some patients with microperforation can be treated with antibiotics and bowel rest.[77] Stent migration can also be an early or a late complication. Use of covered stents, small stent diameter of 17–21 cm (<24 cm), too short in length to obstructive lesion, and chemotherapy-induced tumor shrinkage are factors that might affect stent migration.[17-23,42-44] Stent re-obstruction by

Table 2. Complications of Colonic Stent and Proper Management

Complications	Management
Major	
Perforation	Emergency surgery except microperforation
Migration	Replacement of SEMS
Re-obstruction	Additional SEMS
Minor	
Pain, bleeding	Conservative

SEMS, self-expandable metal stent.

tumor in- or overgrowth is a late complication of colonic stenting, especially in the palliative setting. Previous studies have reported a median stent patency duration of 106 days and that the use of uncovered stents is a risk factor for tumor ingrowth.[22,76] Stent migration and re-obstruction can be managed with stent replacement and additional stenting.[39,78,79] Post-stenting bleeding and pain are minor complications and can be managed conservatively in the majority of patients.[11] The complications of colonic stenting and their proper management are summarized in Table 2.

CONCLUSIONS

Endoscopic management of malignant colonic obstruction using SEMSs can be performed as a palliative therapy or BTS. Since palliative colonic stenting for malignant obstruction is associated with lower morbidity and mortality rates and an earlier implementation of palliative chemotherapy, it may be accepted as a first-line treatment. Colonic stenting for BTS also yielded better outcomes than emergency surgery, although using SEMSs for patients with resectable malignant colonic obstructions, especially in cases with uncertain oncological outcomes, remains controversial. Colonic stenting for BTS can be an alternative treatment option for patients with high surgical risks, such as those with advanced age, multiple co-morbidities, and high ASA classification.

Conflicts of Interest

The authors have no financial conflicts of interest.

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