Original Article

Self-expandable Metallic Stent (SEMS) as an Alternative Utility to Resolve Left Side Colonic Obstruction

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Key Words
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Purpose. Emergent surgery for acute colonic malignant obstruction is associated with high morbidity. Self-expandable metallic stents (SEMS) to relieve obstructions for bridge to surgery (BTS) or palliation have been increasingly used. We conducted a retrospective analysis of the short-term outcomes of SEMS in our hospital.
Materials and Methods. We reviewed the records of patients who received SEMS in our hospital. A standardized procedure combining colonoscopy under fluoroscopic guidance was performed. The stent success rate and complications were analyzed.
Results. From November 2016 to December 2017, fifteen patients underwent SEMS for relieving left-sided colonic obstruction. Seven for BTS (46.7%) and eight for palliation (53.3%). Success was achieved for all BTS group patients, but three patients had anastomosis leakage after subsequent elective laparoscopic surgery. In the palliative group, two (25%) had perforation and one (12.5%) had stent migration.
Conclusion. Our initial experience demonstrated that SEMS was a feasible option to relieve acute colonic obstruction for both BTS and palliation. A larger study to assess long-term results is needed.
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Colonic obstruction remains the most challenging task for colorectal surgeons. Approximately 7%-29% of patients with colorectal cancer present with acute obstruction,[1] especially associated with lesions involving left-sided colon. Acute obstruction causes bacterial translocation, electrolyte imbalance, malnutrition, and intra-abdominal infection or perforation. Emergent operation is the traditional treatment strategy, but it has been associated with higher morbidity and mortality than those of elective surgery. Multistaged resections might be required. Additionally, certain procedures, such as stoma for anastomosis protection or decompression, are often required. Use of self-expandable metallic stent (SEMS) for colonic obstruction is an alternative method either as a bridge to surgery or as palliation alone. Since the first report of SEMS in 1990 by Dohomoto et al., it has been increasingly used worldwide. Colonic stents are associated with the advantage of lower morbidity, option to convert from emergent to elective surgery, and better quality of life. We performed the first colonic stent placement in our hospital since November 2016. In this study, we analyzed the short-term outcomes of SEMS in our hospital and reviewed the published literatures.

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Materials and Methods

We retrospectively reviewed patients with acute colonic obstruction and received SEMS in our Hospital from November 2016 to December 2017. Colonic obstruction was diagnosed by clinical evaluation, abdomen x-ray radiography and computed tomographic scan. Data regarding age, sex, tumor location, underlying diseases, complications, and success rate were analyzed. Technical success was defined as proper placement of the stent, and clinical success was defined as successful decompression and relief of symptoms within 72 hours after the procedure. Our retrospective study was approved by the ethics review board of Mackay Memorial Hospital.

All patients had undergone a procedure combining colonoscopy with fluoroscopic guidance. Intravenous general anesthesia or light sedation was given before the procedure. Colonoscopy was performed and stopped when the obstructed site was reached. We used an over-the-wire technique in which a soft-tipped guidewire (Jagwire™, Boston Scientific) was introduced to pass over the stricture site under direct observation and fluoroscopic guidance. Then, a catheter (Tandem™ XL, Boston Scientific) was inserted via guidewire. Contrast medium (Omnipaque; GE Healthcare) was injected to evaluate characteristics of obstruction and identify the proximal site of the lesion and distal ones. Two types of colonic stents were used: a Bonastent (Standard Sci-Tech Inc.) and a Niti-S™ colonic stent (Taewoong Inc.). The stent was then inserted through an endoscope (Olympus CF-HQ290L) over the guidewire and deployed as a bridge toward both sides of a lesion. The choice of stent depended on the indication of SEMS. In our practice, uncovered stents were used for purpose of bridge to surgery (BTS) and covered stents were mainly for palliation. No balloon dilatation was performed. All patients underwent standing abdominal plain x-ray radiography after the procedure to rule out immediate hollow organ perforation. Followed by serial standing abdominal plain films for three consecutive days to assess successful decompression. Emergent operations such as colectomy were performed when indicated.

Results

From November 2016 to December 2017, 15 patients underwent SEMS at the Department of Colon and Rectal Surgery, Mackay Memorial Hospital. All procedures were performed by a board-certified colorectal surgeon. There were 4 female and 11 male patients, with an average age of 71.06 years (range, 48-89 years old). All of the obstructive sites were left sided with distal to splenic flexure. Two were located in the descending colon (13.3%), 10 (66.7%) in sigmoid colon, and 3 (20%) in the rectosigmoid junction (Table 1). The mean procedural time for SEMS was 50.5 min (range, 22-91 min). Seven (46.7%) patients received SEMS as a bridge to surgery (BTS) for malignant colonic obstruction (Table 2). Six of them underwent curative resection in our hospital, and one had surgery at another institution.

Uncovered colonic stents were applied in all BTS patients. All patients had successful procedures tech-

Table 1. Demographics, diagnosis and indication for SEMS in 15 patients

Gender (male/female)	11/4
Age (mean)	71.06 y/o (48-89)
Indication for SEMS	
Bridge to surgery	7 (46.7%)
Palliation	8 (53.3%)
Diagnosis	
Colorectal cancer	13 (86.7%)
Extracolonic lesions	2 (13.3%)
Tumor location	
Descending colon	2 (13.3%)
Sigmoid colon	10 (67.7%)
RS junction	3 (20%)

Table 2. SEMS as a bridge to surgery (BTS) in 7 patients

Uncovered stent	7
Technical success	7 (100%)
Clinical success	7 (100%)
Procedure time (mins)	57.6
Subsequent operation	6
Operation	
Laparoscopic anterior resection	4
Laparoscopic left hemicolectomy	2
Interval to op (days)	32 (8-48)
Complication (S)	3 (50%)

nically and clinically. No stent-related complications were observed in the BTS group. Followed by laparoscopic colectomy without conversion in variant period of time. The mean interval between SEMS and surgery was 32 days (range, 8-48 days). Three (50%) patients had anastomotic leakage within a week after the surgery, and all of them underwent emergent laparotomy operations with repair or re-do anastomosis. Only 1 patient had a temporary colostomy. No mortality was seen in the BTS patients. Eight (53.3%) patients had SEMS as palliative treatment for colonic obstruction (Table 3). 6 of them were colon cancer obstructions, and the other 2 were caused by extracolonic malignancy obstructions (recurrent gastric cancer and cervical cancer). Palliative SEMS was indicated for these patients because of unresectable metastatic lesions, and covered stents were used in most of the cases. Stent-related complications occurred in 3 patients (37.5%). Two (25%) of them had bowel perforations after stent placement that required emergent surgery. Both of the perforated patients recovered after the operation and received palliative chemotherapy and regular surveillance. One (12.5%) had stent migration after 8 days. A 75% rate of technical and clinical success in the palliation group was achieved. During follow-up, 3 patients died for causes other than colonic obstruction. One patient died of disease progression; the other 2 died of coronary artery disease and sepsis. None of the deaths were related to the stent procedure.

Discussion

The treatment for acute colonic obstruction usually requires emergent surgical intervention, which usually results in a higher mortality or morbidity rate than that of elective surgery. SEMS placement as a BTS or as definite palliation has emerged as a new strategy for acute colonic obstruction. A colonic stent can be placed in any part of colon, but the left side of the colon is usually preferred according to current evidence and guidelines.[2] Prophylactic stenting is not recommended due to its potential risks related to the procedure.[2] There are generally no contraindications except for perforation of the colon[2] and colonic obstruction with systemic toxicity. Placement of colonic SEMS is recommended by using a combination of endoscopy with fluoroscopic guidance. Previous studies have shown a trend toward higher technical success when combined technique is used.[2] Stricture dilatation before or after stent placement is discouraged because of increased risk of perforation.[2] Covered and uncovered stents are equally safe and effective regarding the success and complication rates. It should also be deployed at least 2 cm on each side of the lesion in length.[2]

In patients with acute colonic obstruction, emergent surgery with either primary resection or diverting stoma is associated with high complication rates. SEMS as a BTS can decompress colonic obstructions and converts an emergent condition to an elective one, which should be followed by a complete staging workup, optimization of the patient's condition, and subsequent oncological resection.

Current evidence has failed to demonstrate an advantage of SEMS over emergent operation regarding the overall complication rate and 30-day post-operative mortality rate, with no statistically significant difference between these two groups. The anastomotic leakage rate was found to be 9% for BTS and 3.7% for emergent surgery ($p = 0.35$) in a previous study. Intra-abdominal abscess complication was observed in 5.1% of patients in the BTS group and in 4.9% of the patients in the emergent surgery groups ($p = 0.97$).[4] Nevertheless, a higher rate of primary anastomosis (64.9% vs. 55 %, $p = 0.003$) and lower overall stoma rate (45.3% vs. 62%, $p = 0.02$) in the BTS group was observed.[4] Another study reported less incisional hernia (6.3% vs. 22%, $p = 0.04$) and permanent stoma creation (6.3% vs. 26%, $p = 0.01$) during long-term fol-

Table 3. SEMS as a palliation in 8 patients

SEMS type	
Covered	6 (75%)
Uncovered	2 (25%)
Technical success	6 (75%)
Clinical success	6 (75%)
Procedure time (min)	44.38
Perforation	2 (25%)
Migration	1 (12.5%)

low-up for both groups.[5] Moreover, elective laparoscopic surgery after colonic stenting has been proven to be a safe and feasible strategy.[6] In this study, all patients in the BTS group received elective laparoscopic surgery without conversion. However, a 50% leakage rate was observed in the BTS group. One patient had vascular stenting for an infra-renal abdominal aortic aneurysm prior to colectomy; a compromised colonic blood supply might have been responsible for anastomosis leakage. Another possible reason for our high leakage rate may be the time interval to elective surgery. An optimal interval of 5-10 days between stenting and surgery is suggested by the European Society of Gastrointestinal Endoscopy guideline.[2] This interval allows colonic decompression and nutrition status optimization. A longer interval may compromise surgery because of fibrosis and tumor infiltration causing re-obstruction.[7] In our series, the mean time interval to surgery was 32 days, which is longer than the recommended interval. Especially in our three leakage patients, the time interval was 28, 43, 48 days, respectively. Prolonged interval might play a role in affecting our surgical outcome.

Despite the advantages of SEMS in a BTS setting, concerns regarding compromised long-term oncological outcomes following colonic stent placement have been documented in some reports. Particularly in patients with potentially curable cancer experienced stent related colonic perforation.[3] Several randomized control trials have demonstrated a higher recurrence rate in the BTS group than in the emergent surgery group, although the small sample size in those trials may make their results less reliable. These results are further supported by a larger scale cohort study showing higher local recurrence rates in stented patients aged < 75 years old.[2,3] Therefore, the use of SEMS as a BTS is not recommended as a standard treatment for potentially curable left-sided malignant colonic obstruction.[2] Further long-term study for oncological results is warranted in the future. With better patient selection and more experienced endoscopists or colorectal surgeons, the incidence of stent perforation can be reduced. To sum up, SEMS is still considered to be an alternative to emergent surgery in in patients with higher surgical risks.[2] In our BTS experience, promising results with 100% of technical and clinical success has been achieved. No SEMS-related complications occurred. However, the surgical outcomes in our BTS group were not satisfactory because of a higher leakage rate. Further adjustment regarding the interval to surgery is necessary. Moreover, advanced techniques to examine anastomosis during the operation, such as indocyanine green fluorescence imaging, might be helpful in our future practice.

For palliation group, SEMS has the clear advantages of shorter hospital stay, lower postoperative mortality, and earlier start of chemotherapy.[1,2] Several trials have demonstrated its advantage of better quality of life and faster resumption of enteral feeding.[8,9] In our series, we achieved a 75% of stent success rate. Complications, such as perforation or migration, were encountered in this group. Early stent related complications are perforation and bleeding, and late complications include migration and re-obstruction have been addressed in previous articles.[10] The perforation rate was approximately 4.8%-7.4% in several meta-analyses.[10,11] In this study, our perforation rate was 25% in the palliative group, and all of these patients received emergent surgical intervention without mortality.

Risk factors for perforation included longer strictures, sharper angulation distal to the obstruction,[12] and patients previously treated with bevacizumab.[11] The use of soft-tipped guidewires may help reduce perforation.[10] SEMS is not recommended as a palliative treatment for patients currently under or planning to receive treatment with antiangiogenic therapy (e.g., bevacizumab) because of an increased risk of perforation.[2]

Several studies have reported the rate of migration to be approximately 4%-10%.[10] We observed a rate of 12.5% for stent migration. The reason for early stent migration may be an inappropriate stent diameter and length. Furthermore, migration more frequently occurs after chemotherapy or radiotherapy because of tumor shrinkage.[10]

Re-obstruction due to tumor ingrowth is another late complication, with an incidence of approximately 30% according to a previous study.[10] A covered stent is recommended to reduce tumor ingrowth.[10] Endoscopic re-intervention by stent-in-stent placement or

stent re-placement has been suggested when obstruction occurs.[2] No re-obstruction was encountered in our series because of the short follow-up period.

SEMS is also a valid alternative to surgery for palliation of malignant extracolonic obstruction,[2] and it is more time consuming and technically demanding than for colorectal cancer obstruction, with lower technical and clinical success rate.[2] Some retrospective studies have also reported a higher rate of stent-related complications. In our cases, two patients received SEMS for extracolonic malignancy obstruction. One because of recurrent gastric cancer and another possibly because of recurrent cervical cancer. Technical and clinical success following SEMS placement was achieved in both patients. The cervical cancer patient demonstrated slow improvement on X-ray radiography despite flatus and stool passage. Stool characteristics might have a role in affecting the outcome of SEMS placement. Which roentgenological changes might not be able to reflect the actual clinical response. There are no difference regarding success rate or complications between covered and uncovered stents. However, a higher chance of stent migration but a lower rate of tumor ingrowth with covered stent has been observed in previous study.[10] Aside from BTS and definitive palliation for colonic obstruction, SEMS can also be indicated in the management of anastomotic leakage,[13] and of colo-vesical, colo-enteric, or colo-vaginal fistula.[14]

The limitations of this study on the short-term outcomes of SEMS in our hospital within one year were the small sample size and short follow-up period. Measurements to improve surgical outcomes and enhance the SEMS success rate should be performed. With more experience, we hope to refine our SEMS results so that it can be used in various indications

Conclusion

Treatment of colonic obstruction remains challenging. Previous articles demonstrated that SEMS maybe an alternative approach to relieve left-sided obstruction with less morbidity and better quality of life. Our initial experience suggested that SEMS is feasible for both BTS and palliation. Although the postoperative and stent-related complication rates need to be improved. SEMS remains a promising and practical technique. Further well-designed larger studies are needed to better evaluate this procedure.

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原　著

金屬自動撐開支架作為緩解左側結腸阻塞的替代治療

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目的　面對由於腫瘤造成的急性大腸阻塞，緊急手術往往造成較多的併發症。以大腸支架來緩解阻塞症狀，已經越來越被廣泛的使用。大腸支架可以做為橋接至根治性手術的過渡手段或是緩和治療。本研究將回溯性的分析本院置放大腸支架之成果。

方法　本研究分析了在本院接受大腸支架放置的病人。透過大腸鏡以及 X 光透視下的合併運用，所有病人都接受一致的支架放置流程。我們進一步分析了支架放置成功率以及相關併發症。

結果　自 2016 年 11 月至 2017 年 12 月，共 15 位病人因為左側大腸阻塞而接受支架放置。7 位病人作為過渡至手術的目的，8 位病人作為緩和治療目的。在過渡至手術組的支架放置成功率是 100%，但後續 3 位病人在接受腹腔鏡結腸切除手術後產生了吻合處滲漏情形。在緩和組中，2 位病人因支架置放而合併大腸破裂 (25%)，1 位病人有支架位移的併發症 (12.5%)。

結論　本院的初步經驗顯示，大腸支架的放置在對於緩解腫瘤造成的急性阻塞上，是一個可行的治療選項。未來需要更大型的長期研究來評估成效。

關鍵詞　結腸阻塞、金屬自動撐開支架、過渡至手術、緩和治療。