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Self-expandable Metallic Stents Contribute to Reducing Perioperative Complications in Colorectal Cancer Patients with Acute Obstruction

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Abstract. *Background/Aim: The self-expandable metallic stent (SEMS) is an excellent non-invasive tool for emergent bowel obstruction. This study was designed to evaluate the clinical usefulness of the SEMS for avoiding perioperative complications. Patients and Methods: We analyzed a total of 47 consecutive patients who had a bowel obstruction due to colorectal cancer at initial diagnosis between 2012 and 2017 from hospital records. Results: Perioperative complications occurred in 30% (14/47) of patients. Univariate and multivariate logistic regression analyses identified an age of more than 75 years [p=0.037, OR=6.84 (95% CI=1.11-41.6)] and the absence of an SEMS treatment [p=0.028, OR=18.5 (95% CI=1.36-250.0)] as independent risk factors for perioperative complications. Pneumonia (12.7% (6/47)) was the most common complication. There were no pneumonia patients (0% (0/15)) who were treated with the SEMS. In contrast to patients with the non-SEMS treatment, 18.7% (6/32) of all patients and 35.7% (5/14) of elderly patients had pneumonia. Conclusion: The SEMS is a safe and effective treatment for avoiding perioperative complications, particularly pneumonia, and may be a crucial strategy in elderly patients with acute obstruction due to colorectal cancer.*

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Colorectal cancer is the fourth most common malignancy worldwide, with an estimated 1,023,000 new cases and 529,000 deaths each year (1). Although colorectal cancer is a common malignancy in Western countries, the incidence of colorectal cancer has been increasing rapidly in Asia and the Eastern countries over the past few decades (2). Despite recent advances in diagnostic techniques that have increased the early detection of colorectal cancer, less invasive treatment techniques, and perioperative management, 7-29% of patients with colorectal cancer still present with bowel obstruction at initial diagnosis (3, 4). Bowel obstruction due to colorectal cancer could cause severe ileus and be an increased risk factor of aspiration pneumonia, bacterial translocation, and electrolyte and fluid imbalance (5). Therefore, a treatment strategy against bowel obstruction due to colorectal cancer is an important clinical issue.

Recently, the self-expandable metallic stent (SEMS) has been widely used for the preoperative bowel management of bowel obstruction due to colorectal cancer (6-8). The SEMS placement seems to be safe and effective in comparison with emergent colostomy under general anesthesia for malignant colorectal obstruction. In this study, we investigated whether the SEMS was useful for avoiding perioperative complications at our institution. The results of our study may provide evidence that the SEMS could be a crucial treatment strategy in patients with bowel obstruction due to colorectal cancer.

Materials and Methods

Patients and samples. A series of 47 consecutive patients diagnosed with bowel obstruction due to colorectal cancer was examined. All the patients were Japanese in Kyoto. All patients underwent ileus release treatment by either the SEMS or colostomy at the Division of Digestive Surgery, Kyoto First Red Cross Hospital, between 2012 and 2017. Patients who were treated with curative colorectal

surgery without release of the ileus, were excluded from this study. Of the 47 patients enrolled, 15 patients were treated with the SEMS, whereas 32 patients were treated with the non-SEMS treatment. The clinicopathological factors of these patients were obtained from hospital records. Colorectal resection was performed according to the tumor location, and radical lymphadenectomy was performed according to the Japanese Colorectal Cancer Treatment Guidelines (9, 10).

Resected specimens were examined by pathologists based on the Japanese Classification of Colorectal Carcinoma (2nd edition) (11) and the 7th Tumor-Node-Metastasis (TNM) (12). Informed consent was obtained from all participants in the study.

Assessment of clinical impact of the self-expandable metallic stent (SEMS). To confirm the clinical feasibility of the SEMS treatment, we first compared the clinical background factors and the incidence of perioperative complications (Table I) between patients with the SEMS and the non-SEMS treatments. Second, to detect clinical and pathological factors for the prediction of perioperative complications, univariate and multivariate logistic regression analyses were performed (Table II). Finally, we evaluated the significance of the SEMS treatment for avoiding perioperative complications in elderly patients (Table III).

Statistical analysis. The Chi-square test or Fisher's exact probability test was used to evaluate correlations between the results of the SEMS and the non-SEMS treatments. A p-value <0.05 was considered statistically significant. Multivariate logistic regression analysis was performed to identify independent risk factors associated with complications. Multivariate odds ratios are presented with 95% confidence intervals.

Results

Distribution of colorectal cancer patients among treatment subgroups. The clinical and pathological features of all 47 patients are shown in Table I. The study group consisted of 30 male and 17 female patients with a median age of 73 years (range=39-98 years). Six patients had primary colorectal cancer tumors in the ascending colon, 4 patients in the transverse colon, 11 patients in the descending colon, 16 patients in the sigmoid colon, and 10 patients in the rectum. Clinically, patients were divided into the following two groups: 15 patients (32 %) with the SEMS treatment and 32 patients (68 %) with the non-SEMS treatment. All patients with the non-SEMS treatment underwent an emergent colostomy.

Perioperative complications occurred in 30% (14/47) of patients. In particular, pneumonia (12.7% (6/47)) was the most common perioperative complication in patients with a bowel obstruction due to colorectal cancer.

Comparison of clinicopathological factors between the SEMS and the non-SEMS treatments for patients with bowel obstruction in colorectal cancer. There were no significant differences of background factors in age, sex, tumor location, T-factor, and N-factor, excluding the presence of M-factor between patients with the SEMS and the non-SEMS treatments. Regarding perioperative complications, the incidence was significantly lower in patients treated with the SEMS than with the non-SEMS treatment (p=0.019). Pneumonia (12.7% (6/47)) was the most common complication. There were no patients (0%) treated with the SEMS, compared to 18.7% (6/32) of patients with the non-SEMS treatment, who had pneumonia (Table I).

Univariate and multivariate logistic regression analyses for preoperative complications in patients with bowel obstruction due to colorectal cancer. Univariate and multivariate logistic regression analyses identified an age of more than 75 years (p=0.037, odds ratio (OR)=6.84 (95% confidence interval (CI)=1.11-41.6)) and the absence of the

Table I. *Comparison of clinical factors and complications between patients with the SEMS and the non-SEMS treatments.*

	n=47	SEMS n=15	Non-SEMS n=32	p-Value
Age				
≥75	22	8 (53%)	14 (43%)	0.764
<75	25	7 (47%)	18 (57%)	
Gender				
Male	30	10 (66%)	20 (62%)	0.961
Female	17	5 (34%)	12 (38%)	
Tumor location				
Ascending	6	2 (13%)	4 (12%)	0.874
Transverse	4	1 (6%)	3 (9%)	
Descending	11	2 (13%)	9 (28%)	
Sigmoid	16	7 (46%)	9 (28%)	
Rectum	10	3 (2%)	7 (21%)	
T-factor				
T1	0	0 (0%)	0 (0%)	0.355
T2	1	1 (7%)	0 (0%)	
T3	19	9 (60%)	10 (31%)	
T4	27	5 (33%)	22 (69%)	
N-factor				
N0	23	8 (53%)	15 (48%)	0.946
N1	10	3 (20%)	7 (21%)	
N2	11	4 (27%)	7 (21%)	
N3	3	0 (0%)	3 (9%)	
M-factor				
M0	32	15 (100%)	17 (53%)	0.001
M1	15	0 (0%)	15 (47%)	
Perioperative complication				
Present	14	1 (7%)	13 (41%)	0.019
Absent	34	14 (93%)	19 (59%)	
Complications				
Perforation	3	1 (7%)	2 (6%)	1.000
Pneumonia	6	0 (0%)	6 (19%)	0.161
Ileus	2	0 (0%)	2 (6%)	1.000
Delayed gastric emptying	1	0 (0%)	1 (3%)	1.000
Other	2	0 (0%)	2 (6%)	1.000

Table II. *Univariate and multivariate logistic regression analyses for perioperative complications in patients with bowel obstruction due to colorectal cancer.*

	Perioperative complication		Univariate[a]	Multivarate[b]		
Clinical factor	Present (n=14)	Absent (n=33)	*p*-Value	OR[c]	95% CI[d]	*p*-Value
Age						
<75	5 (36%)	20 (61%)	0.213	1	1.11-41.6	0.037
≥75	9 (64%)	13 (39%)		6.84		
Gender						
Female	4 (29%)	13 (39%)	0.528	1	0.57-18.6	0.184
Male	10 (71%)	20 (61%)		3.26		
Tumor location						
Right	3 (21%)	7 (21%)	1.000	1	0.36-24.8	0.304
Left	11 (79%)	26 (79%)		3.01		
T factor						
T1-T3	5 (36%)	15 (45%)	0.767	1	0.13-4.78	0.812
T4	9 (64%)	18 (55%)		0.80		
N factor						
N0	7 (50%)	15 (45%)	0.972	1	0.14-4.59	0.806
N1-N3	7 (50%)	18 (55%)		0.80		
M factor						
M0	8 (57%)	24 (73%)	0.480	1	0.28-9.36	0.574
M1	6 (43%)	9 (27%)		1.64		
SEMS treatment						
Present	1 (7%)	14 (42%)	0.019	1	1.36-250	0.028
Absent	13 (93%)	19 (58%)		18.5		

[a]Univariate analysis was assessed using Chi-square test and Fisher's exact probability test; [b]Multivariable logistic regression was used to assess the risk factors for lymph node involvement; [c]OR: Odds ratio; [d]CI: confidence interval.

SEMS treatment [p=0.028, OR=18.5 (95%CI=1.36-250.0)] as independent risk factors for perioperative complications, although there was no significant difference between patients with and without perioperative complications in gender, tumor location, T-factor, N-factor, and M-factor (Table II).

Comparison of perioperative complications between the elderly and the non-elderly patients with bowel obstruction in colorectal cancer. In this study, 47% (22/47) of patients with acute malignant colorectal obstruction were elderly patients (Table I). The incidence of perioperative complications was higher in elderly patients (41%: 9/22) than in non-elderly patients (20%: 5/25) (Table III). Pneumonia [23% (5/22)] tended to be higher in elderly patients than in non-elderly patients [4% (1/25)) (p=0.084].

Specifically, there was no pneumonia (0% (0/8)) in elderly patients treated with the SEMS, whereas 36% (5/14) of elderly patients with the non-SEMS treatment had pneumonia.

Regarding perforation, it tended to be more frequent in elderly patients (p=0.094). However, there was no significant difference in perioperative complications between the SEMS (4.5% (1/22)) and the non-SEMS (8.0% (2/25)) treatments in elderly patients.

Table III. *Comparison of perioperative coplications between elderly and non-elderly patients with bowel obstruction in colorectal cancer.*

	Elderly n=22	Non-elderly n=25	*p*-Value
Periopearive complications			
Present	9 (41%)	5 (20%)	0.213
Absent	13 (59%)	20 (80%)	
Complications			
Perforation	3 (14%)	0 (0%)	0.094
Pneumonia	5 (23%)	1 (4%)	0.084
Ileus	0 (0%)	2 (8%)	0.491
Delayed gastric empting	1 (4.5%)	0 (0%)	0.468
Other	0 (0%)	2 (8%)	0.491

Discussion

Acute malignant colorectal obstruction, which is a major oncologic emergency of colorectal cancer at the initial diagnosis, occurs in 7%-29% of patients (13). It is a life-threatening condition that may cause severe ileus leading to aspiration pneumonia, bacterial translocation, electrolyte and fluid imbalance, and malnutrition (5, 14, 15).

Nevertheless, emergent colostomy under general anesthesia has been a prevalent treatment strategy for malignant colonic obstruction. In this study, we clearly demonstrated that the SEMS treatment strategy could be an independent factor to reduce perioperative complications, particularly pneumonia.

In this study, 30% (14/47) of patients with acute malignant colorectal obstruction had perioperative complications. In particular, pneumonia [13% (6/47)] was the most common complication in all patients with malignant colorectal obstruction. Although the release of ileus is an important strategy to avoid aspiration pneumonia, emergency colostomy may be also associated with high morbidity and mortality rates (16, 17) because emergency colostomy normally requires general anesthesia, which may reduce respiratory function. Therefore, we also hypothesized that the SEMS might be a safe and effective tool to avoid pneumonia in comparison with emergent colostomy for malignant colorectal obstruction. As a result, there were no patients (0%) treated with the SEMS, compared to 19% (6/32) of patients with the non-SEMS treatment, who had pneumonia. The SEMS might be useful strategy for avoiding pneumonia following bowel obstruction due to colorectal cancer.

Regarding elderly patients, it is well known that the respiratory and deglutition functions of elderly patients may be lower than those of non-elderly patients (18, 19, 20). In this study, 47% (22/47) of patients with acute malignant colorectal obstruction were elderly patients. The incidence of perioperative complications was higher in elderly patients (41%: 9/22) than in non-elderly patients (20%: 5/25) (Table III). Moreover, an age ≥75 years was identified as an independent risk factor for perioperative complications by the multivariate analysis (p=0.037, OR=6.84 (95%CI=1.11-41.6)) (Table II). Of note, pneumonia (23% (5/22)) was also a more common complication in elderly patients than in non-elderly patients (0% (0/25)). However, there was no pneumonia in elderly patients (0%) treated with the SEMS, whereas 36% (5/14) of patients with the non-SEMS treatment had pneumonia. Presumably, emergent colostomy itself under general anesthesia may be a risk factor of aspiration pneumonia in patients with subileus status due to colonic obstruction. The incisional pain of colostomy and possible impairment of the abdominal rectus muscle may influence abdominal breathing, thereby decreasing pulmonary volume and increasing the risk of pulmonary complications (21).

Therefore, the SEMS may be a crucial strategy for avoiding emergent colostomy, which might be one possible cause of pneumonia, in elderly patients. The number of patients of extreme old age has been increasing in Japan and other countries. Special care and preventive treatment strategies such as the SEMS against perioperative complications are important for elderly patients.

This study had the limitation of being a retrospective analysis of a single institute. Therefore, a prospective observational study using several larger cohorts may be needed to validate the significance of the SEMS treatment, especially in elderly patients. In conclusion, the SEMS treatment is a less invasive and safe strategy for avoiding perioperative complications, particularly pneumonia. Moreover, the SEMS treatment may be a crucial strategy in elderly patients for acute obstruction due to colorectal cancer.

Conflicts of Interest

There are no conflicts of interest to disclose.

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