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Two-Stage Operations in Patients with Acute Right-sided Colonic Obstruction: a 15-year Single Institution Experience

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ABSTRACT

Aim. The aim of the study was to review the characteristics, surgical outcomes, complications, and long-term outcomes of two-stage operations for acute right-sided colonic obstruction (RSCO) in a single institution.
Summary background data. Although patients with acute RSCO can be treated by resection of the tumor with a primary anastomosis, longer procedure times and bigger wounds can result in more mortality and complications. A two-stage operation by diverting loop ileostomy was another surgical option. However, the outcomes of two-stage operations are lacking.
Material and methods. The retrospective study reviewed the patients who underwent emergency surgery for acute RSCO in a tertiary center from 2004-2018. First-stage operations other than diverting loop ileostomy, incomplete obstructions that could be treated medically, or pathologies other than adenocarcinomas were excluded. Perioperative data such as first and second operations, operative times, lengths of stay, harvested lymph nodes, and any complications were included. We assessed overall survival (OS) and disease-free survival (DFS) for the oncologic outcomes.

Results. Sixty-nine patients were included. Seven patients had surgical complications related to ileostomy. Three of them died within 30 days of first admission. Thirty-one patients received a second-stage operation by right hemicolectomy. None had anastomosis leakage or 30-day mortality. Only 9.7% of patients had fewer than 12 harvested lymph nodes. One-year OS was 34% in the patients who received only ileostomy, and 89% in those who received two-stage operations (P < 0.001). Among 26 patients who underwent curative resection of tumor, 3-year DFS was 61.5%.
Conclusions. A two-stage operation is associated with low mortality and morbidity rates in an emergency setting. The subsequent right hemicolectomy can harvest more lymph nodes than emergency resection. Long-term survival benefits can be expected.

Introduction

Colorectal cancer (CRC) is a very common disease. It is the third most commonly diagnosed malignancy worldwide, with 1.8 million new cases and almost 861,000 deaths in 2018 according to the World Health Organization GLOBOCAN database. The incidence of CRC in eastern Asia in 2018 was 3.06%.[1] Although most patients with CRC have no symptoms and are diagnosed as a result of screening, 7–47% present with colonic obstruction as the first diagnosis.[2] Among these cases, about 20–30% patients are of right-sided CRC.[3, 4] For such cases, surgical options include resection of the tumor with a primary anastomosis with or without a temporary proximal diversion, resection without an anastomosis and with an end colostomy, or proximal diversion with a colostomy to stabilize the patient, followed by elective definitive resection at a second operation and, occasionally, self-expandable metallic stent (SEMS) placement.

Because of the lower bacterial counts[5] and better blood supply to the small intestine,[6] most patients with right-sided colonic obstruction can be treated by resection of the tumor with a primary anastomosis.[5, 6] A research compared the surgical interventions and outcomes for patients with right-sided colonic obstruction. Surgical interventions in the research including resection with primary anastomosis, resection with primary anastomosis and loop ileostomy resection without anastomosis, defunctioning ileostomy, and by-pass. Postoperative mortality and morbidity were similar between patients who underwent an ileostomy at initial surgical stage and those who underwent colectomy with primary anastomosis.[7] However, these patients are commonly old, often have some comorbidities and a period of poor nutrient intake. Longer procedure times and bigger wounds can result in more complications. Even the anastomosis itself can have leakage rates of 4.2–10%,[8, 9] which may lead to the need for further surgery and increase patient mortality.[8, 10, 11]

Resection without an anastomosis avoids the risk of anastomotic leakage, but the procedure takes more time than two-stage procedures such as SEMS placement and diverting loop ileostomy. According to ASCO resource-stratified guideline, diverting ostomy was recommended in patients with late-stage colorectal cancer associated with obstruction from primary tumor or from peritoneal metastases.[12] To minimize morbidity and mortality, most patients with a right-sided colonic obstruction receive diverting loop ileostomy as the first-stage emergency operation in our hospital. The aim of this study is to review the characteristics, surgical outcomes, complications, and outcomes of such cases.

Material and methods

Patients

From January 2004 to December 2018, all patients who underwent emergency surgery for acute obstructive right-sided CRC in the Tri-Service General Hospital, Taipei, Taiwan, were reviewed retrospectively. The right colon was defined as including the proximal two-thirds of the transverse colon, the ascending colon, and cecum by abdominal and pelvic computed tomography (CT) scans. Acute obstruction was defined based on clinical findings (abdominal pain, bloating, nausea or vomiting, and absence of flatus and/or bowel movement) and CT findings (tumor obstruction with proximal colon and/or small bowel dilatation). Emergency surgery was defined

as the need to receive surgical intervention within 24 h of admission.

First-stage operations other than diverting loop ileostomy, incomplete obstructions that could be treated medically, or pathologies other than adenocarcinomas were excluded.

This study was reviewed and approved by the Tri-Service General Hospital institutional review board for human subjects (No. 1–108–05–038).

Procedures

Patient characteristics such as age, gender, American Society of Anesthesiologists (ASA) score, body mass index, and comorbidities were recorded. All operations were performed by seven colorectal surgeons in our tertiary referral hospital. Clinical stage was determined by preoperative CT scans.

The surgical approach was a joint decision between the surgeons and the oncologists. Decision making depended on location of the tumor, patient factors, surgeon's expertise, and the available resources.[13] To complicated cases, they would be discussed in Tri-Service General Hospital Cancer Committee, which was composed of multidisciplinary teams.

Surgery of diverting loop ileostomy was performed with steps of making a transverse incision at the right lateral border of rectus abdominis muscle, dividing the anterior rectus sheath, rectus abdominis muscle and posterior sheath, delivering the terminal ileum into the wound outside the peritoneal cavity, forming a small hole at the omentum and the mesenteric border of the terminal ileum, opening the terminal ileum, and matured to the skin.

Another group of patients received a second operation of right hemicolectomy for resection of the tumor. Further right hemicolectomy could be performed as the colon without distension and the patient's general condition keeping stabilized.[14] The optimal time interval between diverting ileostomy and right hemicolectomy was decided by the surgeon.

Pathology stage was reported by pathologists according to the seventh edition of the American Joint Committee on Cancer. Perioperative data included first and second operations, first and second operative times, first and second lengths of stay, and any complications. Overall survival (OS) was determined by the patient's status at the last visit. Disease-free survival (DFS) was defined by the length of time the patient survived after right hemicolectomy without evidence of cancer recurrence at follow-up.

Endpoint

The primary endpoints in the study included mortality, surgical complications, first and second lengths of stay, and the length of time the patient survived after right hemicolectomy without evidence of cancer recurrence.

Statistical analysis

Quantitative data are reported as medians and 25th and 75th percentiles. Categorical data are reported as absolute numbers and percentages. Patients who received only ileostomy and ileostomy plus right hemicolectomy were divided into two groups. For these cases, quantitative data were analyzed using the Mann–Whitney nonparametric *U* test. Categorical data were compared using chi-squared or Fisher's exact tests, as appropriate. OS and DFS were estimated using the Kaplan–Meier method. Log-rank analysis was used to determine statistical significance. A P value < 0.05 was considered statistically significant. All analyses were performed using IBM SPSS Statistics for Windows (Version 25.0; IBM Corp., Armonk, NY, USA).

Results

In total, 69 of 70 patients receiving emergency diverting loop ileostomy over the 15 years of the study were included in the analysis; one patient who underwent exploratory laparotomy with right hemicolectomy was excluded. The median age of the patients was 77 years (25th and 75th percentiles: 64.5 and 83.5 years, respectively). Thirty-nine (56%) patients were male. Forty-six patients had an ASA score of III-V. Fifty of the 69 cases had major comorbidities. The median operation time for diverting ileostomy was 54 min (42.5 and 77.5 min), and the median length of stay was 9 days (7 and 15.5 days; **Table 1**).

Among the 69 patients, 31 received a second operation for resection of the tumor (**Fig. 1**). **Table 2** shows the characteristics of the two groups of patients. The median age of the patients who received right hemicolectomy was 68 years (25th

Table 1. Characteristics

	Patients (n = 69) at 1st admission
Age(years)	77(64.5;83.5)
Male(%)	39(56.5)
BMI(kg/m^2) (n = 57*)	22.1(19.6;24.4)
ASA class**	
I-II	23
III-IV	45
V	1
Clinical stage	
I	0
II	12
III	23
IV	34
Comorbidities	50
HCVD	32
DM	17
CAD	6
Renal disease	8
TB	2
COPD	4
Old CVA	10
Arrhythmia	9
Parkinsonism	4
Other cancer	4 (HCC; Sqcc of penis; Prostate Ca; Breast Ca)
Operation time of ileostomy (mins)	54(42.5;77.5)
30-day Mortality	3
Length of stay	9(7;15.5)

* 11 patients' BMI couldn't be counted.
BMI – Body mass index, ASA class – American Society of Anesthesiologists Classification, HCVD – Hypertensive cardiovascular disease, DM – Diabetes mellitus, CVA – Cerebrovascular accident, CAD – Coronary artery disease, HCC – Hepatocellular carcinoma, Sqcc – Squamous cell carcinoma, Ca – Cancer.

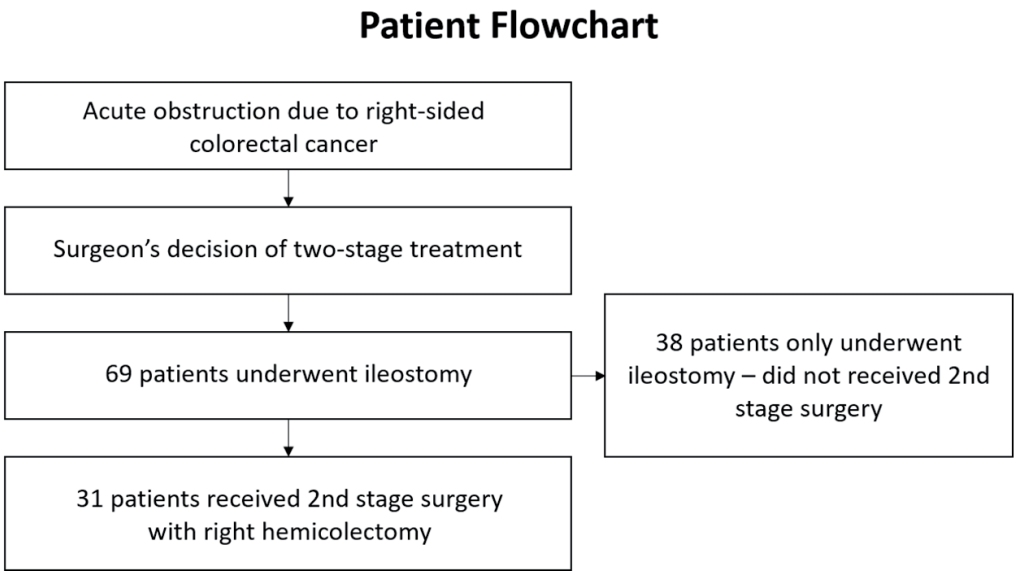

Figure 1. Among the 69 patients, 31 received a second operation for resection of the tumor. The other 38 patients received only ileostomy.

Table 2. Characteristics between two groups of patients.

	Only ileostomy (n = 38)	Ileostomy+right hemicolectomy (n = 31)	*P* value
Age (y)	80.5 (75;88.25)	68 (59;78)	<0.001
Male (%)	20 (52.6)	19 (61.3)	0.470
BMI (kg/m^2)	21.1 (19.3;24.0) (n = 29)	22.9 (20.6;24.9) (n = 28)	0.127
ASA class at 1st admission			0.156
I-II	10	13	
III-IV	28	17	
V	0	1	
Clinical stage			0.017
II	3	9	
III	11	12	
IV	24	10	
Pathologic stage			
II	N/A	8	
III	N/A	13	
IV	N/A	10	
Mean number of harvested LNs	N/A	17 (13;21)	
Comorbidities			
HCVD	16	16	
DM	9	8	
CAD	2	4	
Renal disease	3	5	
TB	1	1	
COPD	0	4	
Old CVA	4	6	
Arrhythmia	4	5	
Parkinsonism	3	1	
Other cancer	2 (Prostate Ca; Breast Ca)	2 (Sqcc of penis; HCC)	0.465
Operation time for ileostomy (mins)	55.5 (43;79.5)	51 (39;77)	
Operation time for right hemicolectomy (mins)	N/A	236 (199.75;274.25)*	0.039
Length of stay(1st) (days)	10.5 (7;21)	8 (6;12)	
Length of stay(2nd) (days)	N/A	9.5 (7;13.25)*	

* One of the patients underwent right hemicolectomy at other hospital.
BMI – Body mass index, ASA class – American Society of Anesthesiologists Classification, LNs – Lymph nodes, HCVD – Hypertensive cardiovascular disease, DM – Diabetes mellitus, CAD – Coronary artery disease, TB – Tuberculosis, COPD – Chronic obstructive pulmonary disease, CVA – Cerebrovascular accident, Ca – Cancer, Sqcc – Squamous cell carcinoma, HCC – Hepatocellular carcinoma.

and 75th percentiles: 59 and 78 years, respectively), which was significantly younger than those who received only ileostomy (P < 0.001). The patients who received only ileostomy had more advanced clinical cancer stages (P < 0.017) and longer hospital stays for ileostomy (medians: 10.5 vs. 8 days; P < 0.039). However, no significant difference was found in the operation time for ileostomy between the two groups (55.5 vs. 51 mins). Most patients in both groups had major comorbidities.

Seven patients had surgical complications related to ileostomy, including ileostomy prolapse, parastomal hernia, pneumonia, and 30-day Mortality. Six of these received only ileostomy. The other patient who suffered an ileostomy prolapse subsequently received right hemicolectomy. Three of the patients died within 30 days of first admission. All of these patients had clinical stage IV colon cancer. Two of the patients died from nosocomial pneumonia, and the other one died from acute myocardial infarction (**Table 3**).

For patients who received a second operation, only three of them had surgical complications related to right hemicolectomy; none had anastomosis leakage or 30-day mortality (**Table 4**).

The mean follow-up time was 8.37 ± 1.14 months in the patients who received only diverting loop ileostomy, and 109.11 ± 13.42 months in those who received two-stage operations. Dur-

Table 3. Surgical complications of ileostomy.

	Only ileostomy (38)	Ileostomy+right hemicolectomy (31)
Parastomal hernia	1	0
Ileostomy prolapse	1	1
Pneumonia	1	0
30-day Mortality	3	0

Table 4. Surgical complications of right hemicolectomy (n = 31).

Pneumonia	1
Wound infection	1
Hernia	1
Anastomosis leakage	0
30-day Mortality	0

ing follow-up, 19 of 38 patients who received only diverting ileostomy and seven of 31 who received two-stage operations died. The median survival time was 7.51 months for patients who received only ileostomy; this end point was not reached for the other group of patients. One-year OS was 34% vs. 89%, respectively, between the two groups (P < 0.001; **Figure 2**).

Thirty-one patients received a second-stage operation by right hemicolectomy (four by laparoscopic surgery). In three of the patients, fewer than 12 lymph nodes were harvested. The mean number of harvested lymph nodes was 17 (13 and 21, respectively). Comparing tumor stages II, III, and IV, the 1-year OS rates were 100%, 90.9%, and 87.5%, respectively, and the 3-year OS rates were 100%, 70.1%, and 62.5%, respectively. No significant difference was seen in OS between the two groups (P = 0.211); however, a trend was observed (**Figure 3**). Among the patients, 26 underwent curative resection of tumor and nine had a tumor recurrence. Three-year DFS was 61.5%. The median DFS was not reached during the follow-up period (**Figure 4**). Comparing tumor stages II, III, and IV, the 3-year DFS rates were 100%, 57.8%, and 20%, respectively. DFS was significantly different between patients with stage II and IV tumors (P = 0.017; **Figure 5**).

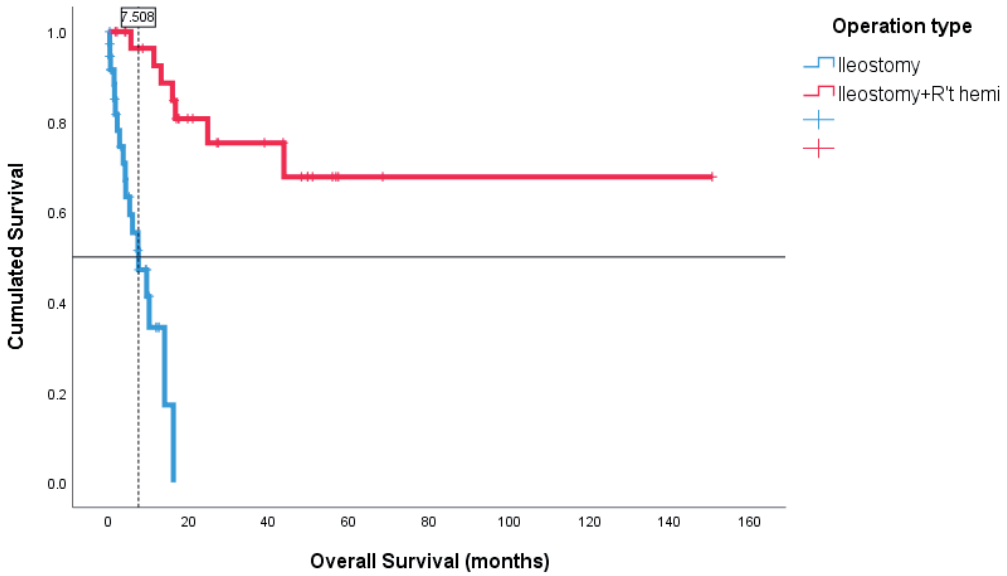

Figure 2 The median survival time was 7.51 months for patients who received only ileostomy; One-year OS was 34% in the patients who received only ileostomy, and 89% in those who received two-stage operations (P < 0.001). R't hemi – right hemicolectomy.

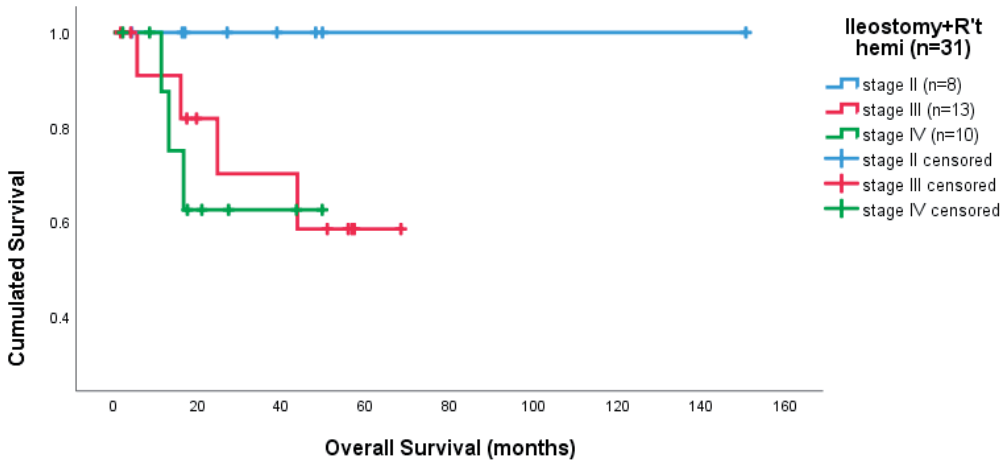

Figure 3. Comparing tumor stages II, III, and IV, no significant difference was seen in OS between the two groups (*P* = 0.211). R't hemi – right hemicolectomy.

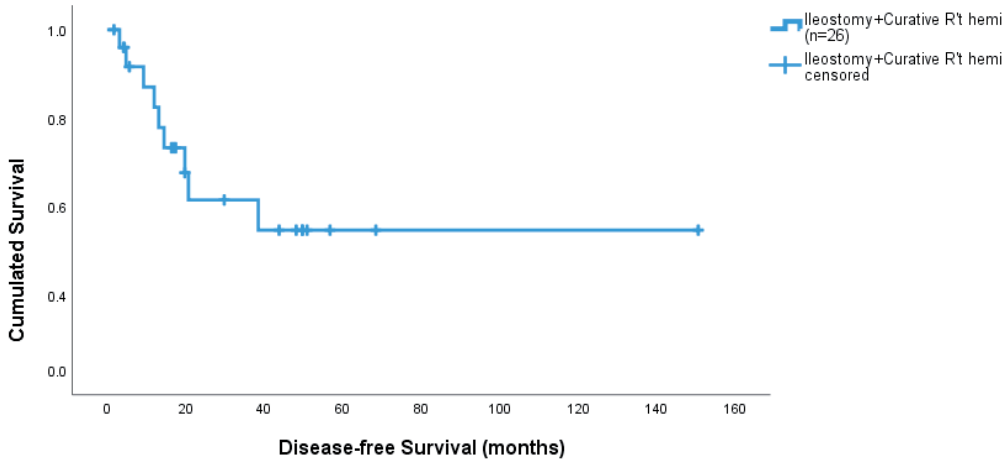

Figure 4. Three-year DFS of ileostomy and curative right hemicolectomy group patients was 61.5%, n = 26. R't hemi – right hemicolectomy.

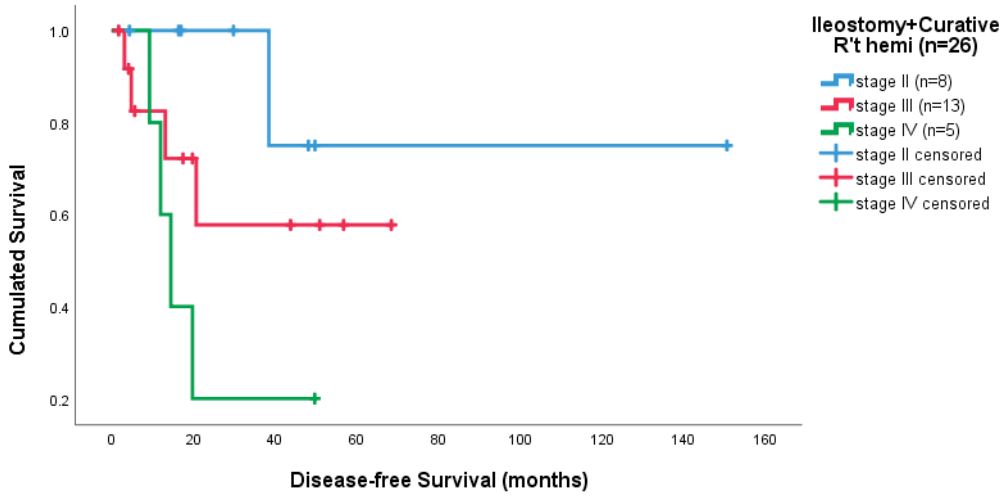

Figure 5. Comparing tumor stages II, III, and IV, DFS was significantly different between patients with stage II and IV tumors (*P* = 0.017). R't hemi – right hemicolectomy.

Discussion

Elderly patients are known to have high rates of emergency colorectal surgery for tumor obstructions or perforations.[15] The median age of the patients in our study was 77 years, consistent with the literature. Patients who have obstructive CRCs also have more comorbidities and higher ASA tumor scores than those who have non-obstructive CRCs.[2, 16] In the present study, 46 of the 69 patients had ASA tumor scores of III-V at first admission, and 50 had major comorbidities. These data indicate the fragility of our patients.

Although some reports have advocated the benefits of palliative resection of the primary colon tumor for patients with unresectable metastatic CRCs, this remains controversial.[17–19] In the present study, 38 of the 69 patients received only ileostomy. It is not surprising that most of these patients had an unresectable metastatic CRC. Fourteen patients in this series had clinical stage II or III CRCs and did not receive curative treatment. The reasons for this included major comorbidities, poor performance status, incurable second cancers, and old age.

Unlike left-sided tumor obstructions, acute tumor obstructions in the right colon are usually treated by resection with a primary ileocolic anastomosis. However, the reported leakage rate is 4.3–16.4%, which could lead to death in some patients.[2, 3, 20, 21] In the literature, the mortality rate for emergency surgery for proximal colon tumor obstruction ranges from 10.1 to 14.7%.[3, 21, 22] Although our patients had higher ASA tumor grades and more comorbidities compared with those in other reports,[3, 22] the surgical complications rate, including the mortality rate for first-stage operations, was extremely low. There are some possible reasons for this. First, we avoided prolonged operation times in emergency settings. The median operation time for an ileostomy was < 1 h, which is shorter than that needed for resection of the obstructed tumor. Second, to make an ileostomy, we only need to create a small incision. Compared with the long midline incisions needed for laparotomy, an incision at the lower right quadrant of the abdomen is less painful. Third, we did not perform an anastomosis, meaning that we avoided the risk of anastomotic leakage, which could lead to the need for another operation, prolong the length of hospital stay, and increase the mortality rate.

The surgical complications of the second operation in this study were minor. No anastomotic leakage or 30-day mortality was found, even though 18 of 31 tumors had ASA scores of III or IV at the first operation. The patients could build up their nutrition, stabilize vital signs, and have better circulation during the interval between operations. All of these factors probably improved the outcomes of the second operations.

Emergency resection for an obstructing CRC can make it difficult to harvest a sufficient number of lymph nodes because of the dilated proximal bowel and limited surgical field. In the literature, 19.3–19.8% of patients had inadequate numbers of harvested lymph nodes.[2, 23] This could lead to tumor understaging and poorer prognosis, especially among elderly patients.[24, 25] In our study, 31 patients received two-stage operations. Less than 10% of patients had fewer than 12 harvested lymph nodes, and 74% had lymph node invasion, which is higher than that in previous reports.[2, 26] Although the case number was small, four patients received laparoscopic right hemicolectomy with D3 lymphadenectomy at the second operation. Better oncological and cosmetic outcomes can be expected compared with emergency laparotomy.

It is not surprising that the patients who received only diverting loop ileostomy had significantly shorter OS. Even though 24 of 38 patients had a clinical stage IV CRC, their OS was shorter than that reported previously.[27] This result could be explained by the old age and multiple comorbidities of these patients. The patients who received two-stage operations had longer OS. Although five patients who had unresectable metastatic CRCs received a right hemicolectomy, the OS showed no significant difference among patients with stage II, III, or IV tumors. This result may imply the benefit of resecting primary tumors, even though the case number was small.[17]

The patients who received curative two-stage operations had better DFS than that reported in the literature.[28] This may be explained by our use of elective curative surgery and adequate numbers of harvested lymph nodes. However, some patients who were too weak to undergo further surgery were excluded. Thus, the long-term sur-

vival benefit of two-stage operations remains to be proven by further prospective studies.

Self-expandable metal stent (SEMS) used for obstructive CRCs as a bridge to surgery help avoid the need for emergency surgery and reduce the risk of postoperative complications and mortality. It seems to have the same benefits as diverting loop ileostomy and avoids the creation of a stoma. However, SEMS insertion for right-sided tumor obstruction is associated with a higher technical failure rate than that for left-sided tumor obstruction.29, 30 Once perforation occurs, the patients' oncologic outcome will be significantly worse.31 It must be noted that the stent procedure can increase the numbers of circulating tumor cells by compressing the tumor, and this is related to worse oncologic outcomes.32, 33

Our study had several limitations. First, it was a retrospective cohort analysis, and all cases were from a single tertiary center, which could have introduced bias in this 15-year series. Second, most of the patients with an acute right-sided colonic obstruction in our hospital received two-stage operations. Thus, we could not compare the outcomes between emergency resection and two-stage operations in our institute. Third, only 69 patients were included in our study, and this small sample size might have caused some bias.

Conclusions

Although a two-stage operation by diverting loop ileostomy is not usually the first procedure considered for acute right-sided colonic obstruction because of the need to create a temporary stoma, it is associated with low mortality and morbidity rates in an emergency setting. Diverting loop ileostomy associates with few oncologic adverse outcomes, and moreover, the subsequent right hemicolectomy harvests a large number of lymph nodes. Long-term survival benefits can be expected from this approach.

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Conflict of interest statement
The authors declare no conflict of interest.

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