

# Clinicopathologic Characteristics and Outcomes of Patients with Obstructive Colorectal Cancer

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## Abstract

**Purpose** The aim of this retrospective study was to analyze the clinicopathologic characteristics and short-term and long-term outcomes of colorectal cancer patients with obstruction compared to those of non-obstructive colorectal cancer patients.

**Methods** Between January 1998 and December 2005, 1,672 colorectal cancer patients undergoing operation were enrolled in this study. Patients were classified into two groups according to the presentation: patients with complete obstructive colorectal cancer (COC,  $n=215$ ) receiving emergency procedures and patients with non-obstructive colorectal cancer (NOC,  $n=1,457$ ) receiving elective procedures. The data on the clinicopathologic characteristics and short-term and long-term outcomes of patients were analyzed retrospectively.

**Results** Among 1,672 colorectal cancer patients, 215 cases presented with complete obstruction. The distribution of tumor location and size, macroscopic type, depth of invasion, liver metastasis, peritoneal carcinomatosis, and TNM stage were found to be different between the COC and NOC groups. Logistic regression analysis showed that tumor location, depth of invasion, and peritoneal carcinomatosis were independent factors associated with obstruction. Patients with obstruction had an increased risk of death by a factor of 2.251 compared to patients without obstruction. Peritoneal carcinomatosis and TNM stage were independent factors for the survival of the COC group. Obstruction, peritoneal carcinomatosis, tumor macroscopic type, and TNM stage were independent indicators for postoperative recurrence. Postoperative mortality was significantly higher in the COC group than the NOC group. The overall 5- and 10-year survival rates in the COC group were 47.8% and 42.8%, respectively, compared to 67.2% and 59.8% in the NOC group, respectively ( $p<0.05$ ). The

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postoperative recurrence rates were 43.1% in the COC group and 32.8% in the NOC group ( $p<0.05$ ).

**Conclusions** Obstruction is an independent indicator for the survival and postoperative recurrence for patients with colorectal cancer. Patients in the COC group have worse overall survival with high postoperative recurrence rate compared to those in the NOC group.

**Keywords** Colorectal cancer · Obstruction · Prognosis · Recurrence

## Introduction

Colorectal cancer (CRC) is the third and fourth most common cancer in urban and rural districts in China,

respectively, which is difficult to diagnose due to early atypical symptoms and signs. A large number of patients with CRC are not identified until the advanced stage or upon presentation with intestinal obstruction or other emergency situations. The incidence of obstruction has been reported to be about 7% to 47% of among CRC patients and accounts for about 85% of colonic emergencies.<sup>1–5</sup>

It has been reported that CRC patients with obstruction have an advanced stage and worse long-term survival compared to non-obstructive CRC, with a 5-year survival rate ranging from 12% to 31%<sup>6–12</sup> and a higher proportion of liver metastasis.<sup>13</sup> Other differences are also significant between the two groups in clinicopathologic characteristics, postoperative morbidity and mortality, recurrence, and so on. Although the impact of obstruction on postoperative outcomes has been well documented, few data were available for CRC patients with obstruction in China mainland. Therefore, in the present study, clinicopathologic characteristics and short-term and long-term outcomes of patients with obstructing CRC were retrospectively assessed compared to those of patients with non-obstructing CRC.

## Patients and Methods

Between January 1998 and December 2005, 1,672 CRC patients were diagnosed and treated with surgery at our hospital, and all tumors were histologically determined to be adenocarcinoma. Patients were divided into two groups according to the presentation: patients with completely obstructive colorectal cancer (COC,  $n=215$ ) who received emergency procedures and patients with non-obstructive colorectal cancer (NOC,  $n=1,457$ ) who received elective procedures. Complete bowel obstruction was diagnosed by medical history, physical examination, abdominal computed tomography (CT) scan and colonoscopy features, and surgical findings. Emergency surgical operation was performed within 24 h after diagnosis. No CRC patients with obstruction received stent placement in this study during the period of 1998–2005. Postoperative mortality was defined as death occurring within 30 days after the main surgical operation. Overall survival rate at 5 and 10 years were considered the crude survival rate and included all causes of death. Patients who died within 30 days after operation were excluded in the analysis of survival. The patients at TNM stage II with high risk

**Table 1** Demographic and patients characteristics of colorectal cancers with or without obstruction

Indicator	Obstruction		$\chi^2$	<i>p</i> value
	No	Yes		
Age (years)	57.8±13.9 (18–91)	59.3±15.4 (17–99)		0.140
Gender			0.532	0.407
Male	829	128		
Female	628	87		
Age group			1.440	0.487
≤40	191	27		
41–64	731	100		
≥65	535	88		
Hospital stay (days)	14.3±8.4	17.5±9.1		0.216
Site of CRC			45.333	<0.0001
Colon	646	148		
Rectum	813	67		
Site of colon cancer			13.538	<0.0001
Right-sided	357	57		
Left-sided	289	91		
ASA score			0.055	0.815
I/II	1,142	157		
III/IV	315	48		
Surgical procedure			23.499	<0.0001
Curative	1,333	174		
Palliative	99	33		
Others <sup>a</sup>	25	8		
Chemotherapy			0.147	0.701
No	442	68		
Yes	1,015	147		

<sup>a</sup> Colostomy, bypass, or indeterminate procedures

factors and TNM stages III–VI were treated with adjuvant chemotherapy within 1 month after operation. 5-Fu/CF regimes as first-line treatment were administered during 1995–2000, and FOLFOX regimes were administered during 2001–2005.

Clinicopathologic factors of CRC patients were encoded to form a computerized database. The recorded variables included: (1) age, gender, family history, and comorbidity of the patient, (2) location, size, macroscopic type, differentiation, and TNM stage of tumor, and (3) types of operation, postoperative complications, recurrence, and status at last follow-up end point. All the patients were followed up with physical examination, hematological–biochemical examinations, serum carcinoembryonic antigen level assay, chest X-ray, and abdominal and/or pelvic CT scan every 3 months during the first 1 year, every 6 months during the subsequent 2 years, and then once a year. Follow-up was made by clinic appointments, home visits, or letters/phone calls to update information constantly. The follow-up end point was December 2009.

The colon was divided into the left- and right-sided segments, and the junction was defined as the distal third of the transverse colon. Operative procedure was specified as curative, palliative, or bypass/colostomy. Curative procedure was considered a complete resection of the cancer and no residual malignancy, local or distant, was present. Palliative procedure was considered if residual malignancy was present locally or at a distant site after an operation.

Statistical analysis was performed using the program SPSS for Windows Version 10.0 (SPSS, Chicago, IL, USA). Numerical data were compared by *t* test and nominal data by chi-square test or Fisher’s exact test. The variables considered were age, gender, location and size of tumor, pathologic features, curative resection rate, and postoperative outcomes. Significant variables at univariate analysis were included into a multivariate stepwise Cox proportional hazard regression model analysis to identify independent factors related with obstructive CRC and survival. The overall survival was calculated with the Kaplan–Meier method, and the differences in survival were compared by log-rank test. The differences between the two groups were considered statistically significant if the *p* value was  $\leq 0.05$ .

This study was approved by the Ethics Committee of Sun Yat-sen University and consistent with the tenets of the Declaration of Helsinki for biomedical research involving human subjects. All patients included in the study gave their informed consent.

**Results**

**Patients and Tumor Characteristics**

A total of 1,672 patients with known modes of presentation underwent surgery for CRC between 1998 and 2005; of

which, 215 cases were completely obstructive cases that received emergency surgery and represented 13% of the total CRC patients. There were 1,457 elective patients (87%). In the present study, the follow-up time ranged from 6 to 12 years with a median time of 10 years.

The demographic, patient’s characteristics, and pathologic characteristics of colorectal cancer were summarized in Tables 1 and 2. The mean age was  $59.3 \pm 15.4$  years in

**Table 2** Pathologic characteristics of colorectal cancers with or without obstruction

Indicator	Obstruction		$\chi^2$	<i>p</i> value
	No	Yes		
Tumor size(cm)			6.461	0.011
≤5	1,038	133		
>5	419	82		
Macroscopic type			30.111	<0.0001
Polyploid	595	84		
Ulcerative	685	76		
Infiltrative	177	55		
Depth of invasion			42.278	<0.0001
T1	67	6		
T2	343	11		
T3	912	169		
T4	135	29		
Nodes involvement			0.027	0.868
No	392	59		
Yes	1,065	156	0.328	0.567
N1	380	52		
N2	685	104		
Liver metastasis			10.616	0.001
No	1,354	186		
Yes	103	29		
Histological grade			1.851	0.396
Well differentiated	532	82		
Moderately differentiated	772	105		
Poorly differentiated	153	28		
TNM stage			31.244	<0.0001
I	175	6		
II	617	92		
III	454	61		
IV	211	56		
Histological type			4.197	0.123
Adenocarcinoma	1,302	182		
Mucinous adenocarcinoma	125	27		
Signet ring cell tumor	30	6		
Peritoneal carcinomatosis			25.895	<0.0001
No	1,368	181		
Yes	89	34		
Disease recurrence			11.361	0.001
No	896	99		
Yes	437	75		

**Table 3** Binary logistic regression analysis of pathologic factors associated with obstruction

	$\beta$	$\chi^2$	<i>p</i> value	95% CI
Tumor location	-0.951	31.130	<0.0001	0.378 (0.277–0.540)
Tumor size	0.109	0.394	0.530	1.115 (0.794–1.565)
Depth of invasion	0.449	9.124	0.003	1.567 (1.171–2.097)
Macroscopic type	0.122	2.026	0.155	1.129 (0.955–1.336)
Liver metastasis	0.525	3.533	0.060	1.690 (0.978–2.921)
TNM stage	0.099	0.726	0.394	1.104 (0.880–1.385)
Peritoneal carcinomatosis	0.654	6.516	0.011	1.924 (1.164–3.179)

CI confidence interval

the COC group and  $57.8 \pm 13.9$  years in the NOC group ( $p=0.140$ ). Chemotherapy regimes were similar and no statistical difference was found in the percentage of patients receiving chemotherapy ( $p=0.701$ ) between the two groups. The groups were also compared for gender, ASA score, nodes involvement, histopathologic differentiation and types, and hospital stay ( $p=NS$ ).

The distribution of tumor location was significantly different between the two groups. Of 215 cases with obstruction, 67 had tumor at the rectum, 57 at the right-sided colon, and 91 at the left-sided colon. More colon cancers with obstruction were found in the COC group than in the NOC group (68.8% vs. 44.3%,  $p<0.0001$ ). Further analysis showed that left-sided colon cancer was more common than right-sided colon cancer in the COC group compared to the NOC group (61.5% vs. 44.7%,  $p<0.0001$ ).

There was a significantly higher proportion of advanced TNM stage III/IV cancer in the COC group than in the NOC group (54.4% vs. 45.6%,  $p=0.016$ ). The significant differences by univariate analysis were also found in surgical procedure ( $p<0.0001$ ), tumor size ( $p=0.011$ ), tumor macroscopic type ( $p<0.0001$ ), depth of invasion ( $p<0.0001$ ), liver metastasis ( $p=0.001$ ), peritoneal carcinomatosis ( $p<0.0001$ ), TNM stage ( $p<0.0001$ ), and disease recurrence ( $p=0.001$ ) between the two groups (Tables 1 and 2). Based on binary logistic regression analysis, pathologic factors such as tumor location, depth of invasion, and peritoneal carcinomatosis were independently associated with obstruction after adjusting for differences in tumor size, TNM stage, tumor macroscopic type, and liver metastasis (Table 3). When obstructing CRC patients were divided into two groups by location, colon cancer and rectal cancer groups, no significant difference was found between them in demographic and clinicopathologic features.

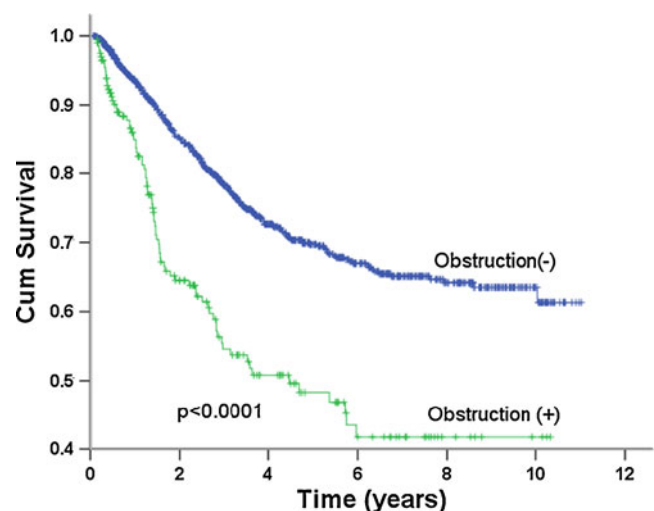
Several concomitant diseases were found in 109 patients in the COC group and 585 patients in the NOC group (51.2% vs. 40.4%,  $p=0.002$ ). Chronic pulmonary diseases, cardiovascular disorders, hypertension, insulin-dependent diabetes, and renal dysfunction were common concomitant diseases.

### Short-Term Outcomes

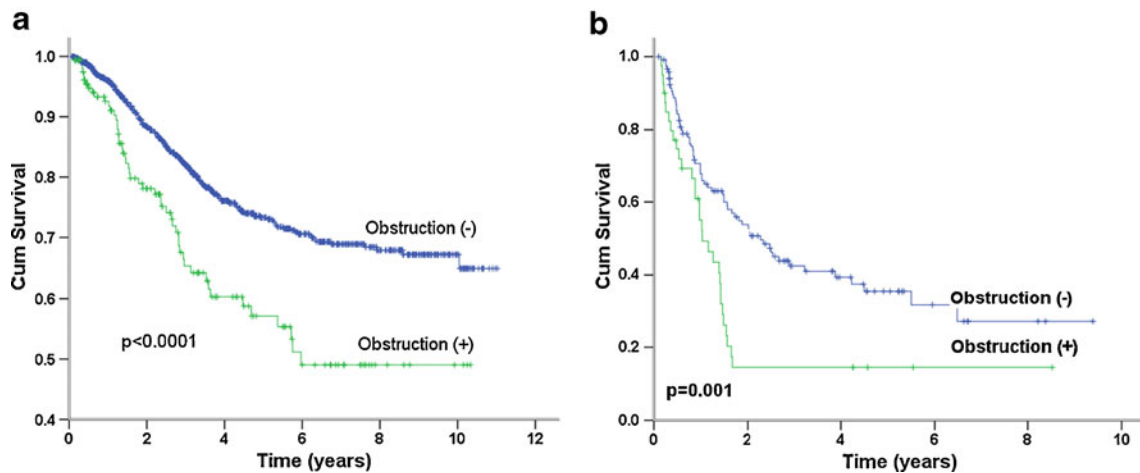
The average length of hospitalization in the cohort was  $15 \pm 4.3$  days with a range from 12 to 45 days. The mean hospital stay in the COC group ( $14.3 \pm 8.4$  days) and in the NOC group ( $17.5 \pm 9.1$  days) was not significantly different ( $p=0.216$ ). The overall curative resection rate was 89.2% for the two groups. A relatively lower curative resection rate was found in the COC group than in the NOC group (82.2% vs. 92.3%,  $p<0.0001$ ).

The overall postoperative mortality within 30 days of surgery was 5.1% ( $n=85$ ) for all patients, and the postoperative mortality was high in the COC group compared to the NOC group (7.9%,  $n=17$  vs. 4.7%,  $n=68$ ;  $p=0.044$ ). Eleven cases with colon cancer and 6 cases with rectal cancer died within 30 days after operation in the COC group, while 42 cases with colon cancer and 26 cases with rectal cancer died in the NOC group.

The survivors and the non-survivors in the COC group were compared regarding demographic and clinicopathologic characteristics, concomitant diseases, and compli-



**Fig. 1** Cumulative survival probability according to the presence or absence of obstruction at presentation,  $p<0.0001$



**Fig. 2** Cumulative survival probability according to obstruction by procedure. **a** Comparison in patients undergoing radical resection between the two groups,  $p < 0.0001$ ; **b** comparison in patients undergoing incurable resection between the two groups,  $p = 0.001$

cations, and the results were as follows: mean age,  $47.1 \pm 12.3$  vs.  $63.4 \pm 14.2$  years,  $p = 0.018$ ; ASA score III/IV, 18.2% ( $n = 36$ ) vs. 70.6% ( $n = 12$ ),  $p = 0.003$ ; infiltrative tumor, 23.7% ( $n = 47$ ) vs. 47.1% ( $n = 8$ ),  $p = 0.034$ ; concomitant diseases, 47.5% ( $n = 94$ ) vs. 88.2% ( $n = 15$ ),  $p = 0.001$ ; and complications, 32.3% ( $n = 64$ ) vs. 76.5% ( $n = 13$ ),  $p < 0.0001$ . No significant difference was found in other pathologic factors between survivors and non-survivors. Mortality was independently related to concomitant diseases ( $p < 0.0001$ ), obstruction ( $p = 0.001$ ), and complication ( $p < 0.0001$ ). The postoperative complications in the COC group (35.8%,  $n = 77$ ) and in the NOC group (40.6%,  $n = 591$ ) were not significantly different ( $p = 0.184$ ).

Long-Term Outcomes

The overall 5- and 10-year survival rates of all CRC patients were 64% and 57%, respectively, with a median survival time of 11 years. The overall 5- and 10-year survival rates were 43% and 36% in the COC group, respectively, compared to 67% and 60% in the NOC group, respectively. The median survival time was 4.6 years in the COC group and 11 years in the NOC group. Comparison of survival curves between the COC and the NOC groups was presented in Fig. 1. Obstructive CRC patients receiving

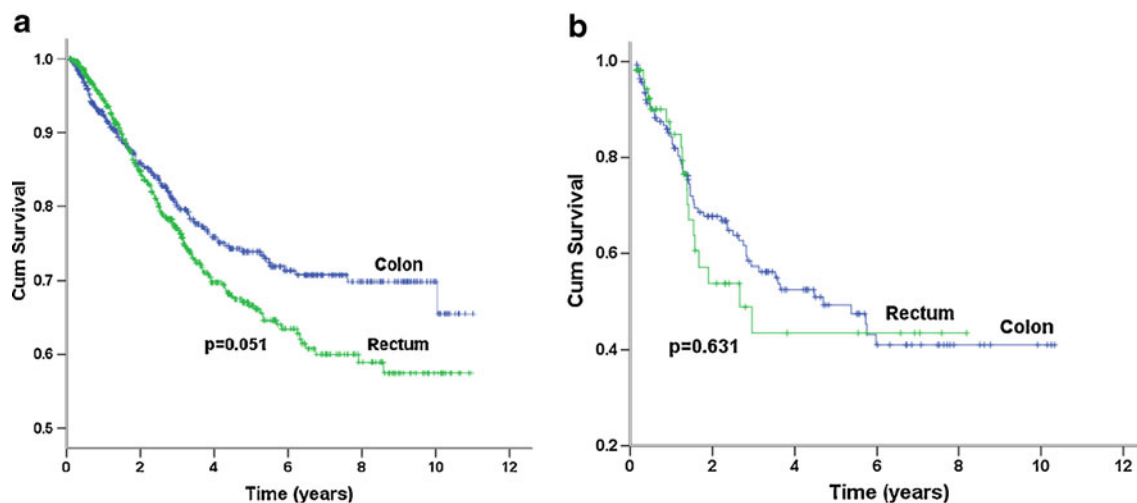
emergency procedures did have significantly worse overall 5-year survival than non-obstructive CRC patients receiving elective procedures (43% vs. 67%,  $p < 0.0001$ ).

With respect to patients who underwent curative resection, the overall 5- and 10-year survival rates were 57% and 48% in the COC group, respectively, and 71% and 63% in the NOC group, respectively ( $p < 0.0001$ ; Fig. 2a). Similar results were found in the overall 5- and 10-year survival rates of patients who underwent non-curative resection ( $p = 0.001$ ; Fig. 2b). On stage-for-stage analysis for survival, the overall 5- and 10-year survival rates were 92% and 74%, respectively, in the COC group and 95% and 80%, respectively, in the NOC group for patients at TNM stage I; 60% and 60%, respectively, in the COC group and 79% and 76%, respectively, in the NOC group at TNM stage II; 38% and 38%, respectively, in the COC group and 62% and 60%, respectively, in the NOC group at TNM stage III; and 18% and 0%, respectively, in the COC group and 19% and 0%, respectively, in the NOC group at TNM stage IV (Table 4). Compared to the NOC group, the COC group had a worse 5-year overall survival rate for TNM stage II patients (79% vs. 60%,  $p = 0.001$ ) or stage III patients (62% vs. 38%,  $p < 0.0001$ ), but not for the TNM stage I patients (95% vs. 92%,  $p = 0.266$ ) or stage IV patients (19% vs. 18%,  $p = 0.077$ ). When patients were divided into two

**Table 4** Stage-specific overall survival of CRC patients by presentation

TNM stage	Obstruction	5-year OS (%)	10-year OS (%)	p value
I	No	95	80	0.266
	Yes	92	74	
II	No	79	76	0.001
	Yes	60	60	
III	No	62	60	<0.0001
	Yes	38	38	
IV	No	19	0	0.077
	Yes	18	0	

OS overall survival



**Fig. 3** Cumulative survival probability according to obstruction by tumor location. Both in the COC group and in the NOC group, no significant difference was found in the overall 5-year survival rate

between the colon cancer group and rectal cancer group (a NOC group,  $p=0.051$ ; b COC group,  $p=0.631$ )

groups by location, no significant difference was found in the overall 5-year survival rate between the colon cancer group and rectal cancer group both in the COC group and in the NOC group (Fig. 3).

Univariate and multivariate analyses demonstrated that obstruction was an independent predictor for the survival of CRC patients. Patients with obstructive CRC had an increased risk of death by a factor of 2.251 compared to non-obstructive CRC patients (Table 5). With regard to demographic and pathologic factors affecting the survival of obstructive CRC patients, univariate analysis showed that survival was significantly affected by nodes involvement ( $p=0.039$ ), liver metastasis ( $p<0.0001$ ), peritoneal carcinomatosis ( $p<0.0001$ ), and TNM stage ( $p<0.0001$ ), while other factors including gender, age, ASA score, histological grade and histological type, tumor location and size, tumor macroscopic type, and depth of invasion did not affect survival. In addition, multivariate analysis demonstrated that peritoneal carcinomatosis and TNM stage were independent factors for the survival of obstructive CRC patients (Table 6).

In the present study, the overall recurrence rate was 34% (512 out of 1,507) for CRC patients who underwent curative resection. Median intervals from radical surgery to recurrence were  $18.3\pm 5.4$  months in the COC group and  $21.5\pm 8.1$  months in the NOC group ( $p=0.501$ ). During

follow-up, 75 patients in the COC group and 437 patients in the NOC group were diagnosed as local and/or distant recurrence ( $p=0.001$ ). In the COC group, 51 local and 17 distant recurrences were recorded, while in the NOC group, 260 local and 133 distant recurrences were recorded. In addition, 7 patients in the COC group and 44 patients in the NOC group were diagnosed as local associated with distant recurrence. Univariate analysis demonstrated that postoperative recurrence was associated with obstruction ( $p<0.0001$ ), peritoneal carcinomatosis ( $p<0.0001$ ), tumor macroscopic type ( $p=0.001$ ), depth of invasion ( $p<0.0001$ ), and TNM stage ( $p<0.0001$ ). However, multivariate analysis showed that obstruction, tumor macroscopic type, and TNM stage were independent indicators for postoperative recurrence (Table 7).

**Discussion**

The survival of obstructive CRC patients is poor even in those undergoing potentially curative surgery. Moreover, the poor outcomes for obstructive CRC patients persist from initial hospital stay to long-term follow-up.<sup>1–5</sup>

In the present study, the incidence of complete obstruction in CRC patients was 13%, similar to the results in a previous report.<sup>6</sup> Moreover, the percentages of obstructive

**Table 5** Five-year overall survival by presentation for CRC patients

Obstruction	No. of patients	Overall survival			$\chi^2$	p value
		5-year OS (%)	HR	95% CI		
No	1,457	67	1	Reference	42.22	<0.0001
Yes	215	43	2.251	1.762–2.875		

OS overall survival, CI confidence interval, HR hazard ratio

**Table 6** Univariate and multivariate analysis of the prognostic factors for 5-year overall survival of 215 CRC patients with obstruction

Indicator	Univariate analysis		Multivariate analysis		
	5-year OS (%)	<i>p</i> value	HR	95% CI	<i>p</i> value
Gender		0.550			NS
Male	41				
Female	45				
Age group (years)		0.07			NS
≤40	38				
41–64	56				
≥65	34				
Location of CRC		0.631			NS
Colon	42				
Rectum	47				
Blood transfusion		0.299			NS
No	52				
Yes	40				
Family history		0.8			NS
No	43				
Yes	47				
Tumor size(cm)		0.238			NS
≤5	45				
>5	43				
Macroscopic type		0.868			NS
Polyploid	46				
Ulcerative	43				
Infiltrative	37				
Nodes involvement		0.039			0.062
No	49		1	Reference	
Yes	38		1.444	0.193–10.823	
Depth of invasion		0.403			NS
T1	75				
T2	54				
T3	44				
T4	33				
Liver metastasis		0.000			0.192
No	47		1	Reference	
Yes	15		1.551	0.802–2.997	
Histological grade		0.514			NS
Well differentiated	49				
Moderately differentiated	43				
Poorly differentiated	39				
Peritoneal carcinomatosis		0.000			0.032
No	46		1		
Yes	25		1.828	1.052–3.175	
TNM stage		0.000			0.001
I	100		1	Reference	
II	60		1.387	0.185–10.393	
III	38		3.396	0.459–25.142	
IV	18		4.793	0.622–36.918	
Histological type		0.901			NS
Adenocarcinoma	58				
Mucinous	43				
Signet ring					

OS overall survival, CI confidence interval, HR hazard ratio

**Table 7** Multivariate analysis of postoperative recurrence

Variable	HR	95% CI	<i>p</i> value
Obstruction	1.502	1.147–2.126	0.032
Macroscopic type	1.724	1.557–2.174	0.008
TNM stage	2.80	2.593–3.048	<0.0001

CI confidence interval

CRC patients and advanced cancer in different age groups were not statistically different, although previous studies suggest that patients aged <40 or >80 years were more likely to have large bowel obstruction and advanced Duke-staged cancer.<sup>7–10</sup> Malignant obstruction can occur at any part of the colon and rectum; however, the risk varies with different locations. In this study, 42.3% of the obstructions occurred at the left-sided colon and most of them occurred at the sigmoid colon; this tumor distribution is similar to what has been reported by other investigators.<sup>11–13</sup> Although recent studies demonstrate similar radical resection rates for CRC patients receiving emergency and elective surgery,<sup>14</sup> the curative resection rate was significantly higher in the NOC group than in the COC group in the present study.

Emergency surgery for obstructive CRC has been documented to carry high rates of mortality and morbidity.<sup>15,16</sup> In terms of postoperative mortality, the overall postoperative mortality in the present study was 5.1%, including those patients with advanced unresectable tumors. Concomitant diseases and obstructions were so strongly associated with postoperative mortality that the mortality rate in the COC group is significantly higher than that in the NOC group. The result obtained from the study is consistent with other reports.<sup>17,18</sup> Although ASA score was associated with obstruction,<sup>19</sup> no significant difference was found between the COC and NOC groups. In terms of postoperative morbidity, the complications in the immediate postoperative period in the COC group (35.8%) and in the NOC group (40.6%) were not significantly different.

Although some reports have demonstrated that even T1 carcinoma may be the cause of obstruction, many studies show that obstructing colorectal cancers are either locally advanced or associated with distant metastasis. In the present study, the distribution of TNM stage III/IV was more common than TNM stage I/II in the COC group (15% vs. 11%,  $p=0.026$ ). Previous studies revealed that the survival of CRC patients with obstruction is significantly related to tumor stage, histological type, and clinical and operative variables and that obstruction is not a significant indicator for survival.<sup>20,21</sup> However, in the present study, we found that obstruction is associated with survival based on both univariate analysis and multivariate Cox regression model. Patients with obstructive CRC had an increased risk

of death by a factor of 2.251 compared to non-obstructive CRC patients.

Long-term prognosis of obstructive CRC patients undergoing emergency procedure has been reported to be worse compared to that of non-obstructive CRC patients receiving elective surgery.<sup>22</sup> Although a recent study reported that the negative effect of obstruction on colorectal cancer may be limited to the perioperative period and that long-term survival would depend on the tumor stage not on the presentation,<sup>23</sup> in the present study, apart from mortality, the overall 5- and 10-year survival rates were still worse in the COC group than in the NOC group. When patients were stratified according to tumor stage and stage-for-stage analysis on survival was performed, significant difference was found at TNM stage II or III, but not at TNM stage I or IV between the COC and the NOC group, which is different from previous studies.<sup>14,24</sup>

In our study, the overall recurrence rate was 34% consisting of 20.6% local recurrence, 10.0% distant recurrence alone, and 3.4% local and distant recurrences in the same patient. Local recurrence rate is significantly higher in the COC group than in the NOC group (29.3% vs. 17.3%,  $p<0.0001$ ); however, no statistical difference was found in metastasis between the groups (10.8% vs. 8.8%,  $p=0.679$ ). Our results show that obstruction is an independent indicator for postoperative recurrence, although some reports suggest that obstruction is not associated with local recurrence.<sup>14,25</sup> We postulate that the extent of tumor excision and lymph node dissection would have been limited because of the dilated bowel filled with a large amount of fecal material, edematous conditions of the bowel, and manipulation of the surgeons, which facilitated the spreading of the tumor cells into the lymphatic vessels, vasculature, and peritoneal cavity to cause recurrence. Therefore, for CRC patients with obstruction, one important measure is to decompress the dilated bowel by surgical procedure or non-surgical measures; on the other hand, much more attention should be paid to the patient with obstructing CRC receiving curative resection in order to detect early local and/or distant recurrence in future practice.

Compared to CRC patients undergoing elective surgery, patients undergoing emergency surgery have high morbidity and mortality rates, which was confirmed again in our study. Stent placement is a mini-invasive alternative to decompress an obstructed colon, which is widely used for the treatment of obstructing CRC. For patients with potentially curable obstructing CRC, stent insertion offers immediate and effective colon decompression and acts as a bridge to elective oncologic resection, which transfers about 90% obstructive CRC patients from emergency surgery to elective surgery with lower mortality and shorter hospital stay.<sup>26–28</sup> Even for patients with incurable obstruc-



tive CRC, stent insertion also provides the opportunity of chemotherapy to improve oncological outcomes.

As most retrospective studies, there were several limitations in the present study. First, the relatively small number of patients in our study may overlook some important factors which may predict the postoperative outcomes. Second, such pathologic factors as lymphovascular and perineural invasion were not investigated in this study. In addition, patients who were managed by non-operative options, such as the using of stents as a bridge to surgery, were not included in this study.

## Conclusion

CRC patients with obstruction have significant differences in clinicopathologic features compared to those CRC patients without obstruction. Obstruction is an independent indicator for survival and postoperative recurrence for patients with colorectal cancer. Patients in the COC group have worse survival with higher postoperative recurrence rate compared to those in the NOC group.

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**Conflict of Interest** The authors declare no conflict of interest.

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