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Short-term Postoperative Outcomes of Colorectal Cancer Patients With Chronic Renal Failure on Dialysis

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Abstract. *Background/Aim: Surgery for dialysis patients requires special attention because of their physical characteristics. This study aimed to investigate the short-term postoperative outcomes of colorectal cancer patients with chronic renal failure (CRF) on dialysis and aimed to investigate safer treatment options for these patients. Patients and Methods: A total of 1,504 colorectal cancer patients who underwent primary resection between January 2008 and December 2018 were included. A retrospective analysis of clinical data, preoperative tumor markers (carcinoembryonic antigen and carbohydrate antigen 19-9), and the Clavien-Dindo (CD) classification was performed. Patients were stratified into Groups A and B based on their need for dialysis or not, respectively. Results: There were 20 and 1,484 patients in Groups A and B, respectively. No differences were observed regarding age, body mass index, and preoperative tumor markers. The rate of laparoscopic surgery was significantly lower in Group A than in Group B. There was one mortality in Group A due to pulmonary disease. Group A had a significantly higher rate of complications. Conclusion: CRF patients on dialysis who underwent colorectal cancer surgery tended to be ruled out of laparoscopic surgery, and their rates of postoperative complications were higher.*

Almost 400,000 Japanese annually undergo dialysis for chronic renal failure (CRF), and this number is steadily increasing as dialysis technology continuously improving (1). It is only natural that the number of patients with colorectal cancer with CRF on dialysis will increase. In general, the rate of postoperative complications and mortality of dialysis-dependent CRF patients is higher than the general population because their overall health status and metabolic and physiological derangements are poor. Most of them tend to have simultaneous diseases such as cardiovascular disease, hypertension, metabolic disease, diabetes mellitus and so on (2). Therefore, colorectal surgery for patients with dialysis-dependent CRF is considered highly challenging. There are few reports of this important issue, especially in the setting of colorectal surgery for dialysis-dependent CRF patients in a single hospital. In this study, we aimed to identify the risk factors for morbidity and mortality after elective colorectal surgeries for patients with dialysis-dependent CRF.

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Key Words: Colorectal cancer, dialysis, chronic renal failure.

Patients and Methods

This study included 1,572 patients with colorectal cancer who underwent primary colorectal cancer resection between January 2008 and December 2018 at the Department of Surgery of the Jikei University Hospital, Tokyo, Japan. Of the 1,572 patients, 68 who underwent simultaneous other-site surgeries were excluded. Consequently, the study included 1,504 patients in the final analysis, and we retrospectively retrieved data regarding their clinical characteristics, treatments, and clinical outcomes from their medical records. Patients were classified into Group A, who were comprised of dialysis-dependent CRF patients, and Group B, who were comprised of colorectal cancer patients not needing dialysis. Univariate analysis was conducted for each of the following patient background factors: patient demographics, preoperative tumor markers for colorectal cancer [carcinoembryonic antigen (CEA) and carbohydrate antigen 19-9 (CA 19-9)], intraoperative findings, postoperative outcomes, and mortality rate. Postoperative complications were classified using the Clavien-Dindo (CD) classification. Univariate analysis was performed using Pearson's Chi-square test (for categorical variables) and one-way analysis of variance (for scale variables). All *p*-values were considered statistically significant when the associated probability was less than 0.05. IBM SPSS Statistics version 25 for Windows (IBM, Inc., Armonk, NY, USA) was used for the statistical analysis. The study protocol was reviewed and approved by the Ethics Committee and the Institutional Review Board (27-283 8168).

Results

A total of 1,504 patients comprising of 937 men (62.3%) and 567 women (37.7%) were enrolled in the study. The patient ages ranged from 24 to 97 years, with a median age of 67 years. Laparoscopic surgery was performed on 73.1% (1,099/1,504) of patients. As to their colon cancer stage, 57 patients (3.8%) were stage 0, 491 patients (32.6%) were stage I, 361 patients (24.0%) were stage II, 451 patients (30.0%) were stage III, and 144 patients (9.6%) were stage IV. The patient's characteristics are shown in Table I.

There were 20 patients in group A (16 men and 3 patients with peritoneal dialysis), while group B included 1,484 patients (921 men). No differences were observed with regard to age (p=0.475), body mass index (p=0.080), and preoperative tumor markers (CEA, p=0.607 and CA 19-9 (p=0.687). Regarding the American Society of Anesthesiologists Physical Status, there was a significant difference between Groups A and B (p<0.001). Table II shows the characteristics of patients in both groups. Table III shows operative findings separated by each group. Group A had significantly fewer laparoscopic surgeries than Group B [9/20 (45.0%) *vs.* 1,090/1,484 (73.5%), p=0.004]. There was no significant difference in 'Operative time', 'Blood loss' and 'Length of stay after operation'. The results on postoperative complications and mortality are shown in Table IV. There was one death recorded in Group A due to pulmonary disease (p=0.013). Group A had a significantly higher number of complications [CD 1-2: 10/20 (50.0%) *vs.* 347/1,484 (23.4%), p=0.009; CD 3-4: 4/20 (20.0%) *vs.* 86/1,484 (5.8%), p=0.028). Table V shows the details of complications for Group A. Those included 5 superficial incisional infections, chylothorax ascites, intraperitoneal abscess, anastomosis leakage, heart failure, and transfusion-related acute lung injury.

Table I. *Characteristics of all patients.*

		Patients n=1,504	Rate %
Sex	Male	937	62.3
	Female	567	37.7
Approach	Laparoscopic	1,099	73.1
	Open	405	26.9
Stage	Stage I	491	32
	Stage II	361	24
	Stage III	451	30
	Stage IV	144	9.6
Dialysis	Yes (Group A)	20	1.3
	No (Group B)	1,484	98.7

Discussion

Since the introduction of dialysis for CRF patients in 1945, the dialysis process has steadily improved. Current dialysis regimens and active medical management by nephrologists have given dialysis-dependent CRF patients a longevity and convalescence that was previously unimaginable (3). Since dialysis-dependent CRF patients live longer than those in the past, the role of surgeons has been increasing due to increasing rate of oncological diseases related to their longevity.

As a result of the efforts of nephrologists, the condition of dialysis-dependent CRF patients has significantly improved. However, dialysis-dependent CRF patients are still at increased risk for nephrogenic diabetes insipidus, hypernitrogenemia, acidosis, anemia, cardiovascular disease, arteriosclerosis, infections, and wound healing disorder (4, 5). Organized and planned preoperative dialysis can contribute to address these issues and their morbidity and mortality rates could be decreased in these patients (6).

The number of patients undergoing dialysis in Japan is 2,732 per 1,000,000 (7). The number of CRF patients with maintenance dialysis in our study was 20/1,504 (1.3%). The patients in Group A tended to undergo more open surgeries than those in group B. This may be attributed to CRF patients having other issues. In general, during laparoscopic surgery for colon cancer, the patient position needs to be adjusted (8). As positional adjustments require the patient's blood pressure to be stable regardless of their body position, open surgery is usually chosen for dialysis-dependent CRF patients who have difficulty maintaining their blood pressure.

Similar to previous studies reporting that the rate of morbidity and mortality related to CRF was higher, our study showed the same result: the rate of complications of CRF patients on dialysis were higher (9-19). In previous studies investigating laparoscopic colon surgery for dialysis patients, Higashino *et al.* and Obara *et al.* reported that there were no significant differences in operative outcomes and postoperative short-term outcomes between dialysis patients and other patients (20, 21). In our study, the fact of that the rate of open surgery in Group A was higher may have had a strong impact on the result. Postoperative superficial incisional infections, such as wound infections, were the most frequent complications in Group A (5/20). Similarly, there are previous reports documenting those postoperative wound complications in CRF patients on dialysis at high incidences (11, 18-19, 22). This complication, as well as anastomosis leakage, are related to delayed wound healing in patients on dialysis (6). In addition, postoperative complications, including intraperitoneal abscess, are more common in dialysis patients (22). Abe *et al.* reported that uremia had a strong effect on delaying infection healing and wound healing. High blood urea nitrogen levels in dialysis patients can make them more susceptible to infection (23). Finally, cardiopulmonary complications might be caused by systemic vascular atherosclerosis, which is one of the most common complications in patients on maintenance dialysis (24).

Table II. *Characteristics of patients distributed in each group.*

		Group A (n=20)	Group B (n=1484)	*p*-Value
Sex	Male	16	921	0.1
	Female	4	563	
Age	Median (y)	67 (49-87)	66 (24-97)	0.475
BMI	Median (ng/ml)	20.8 (16.2-31.3)	22.6 (12.5-51.9)	0.08
ASA-PS	Class I	0	428	<0.001
	Class II	7	949	
	Class III	13	69	
	Class IV	0	2	
	Class V, VI	0	0	
	Unknown	0	36	
CEA	Median (ng/ml)	4.4 (0.0-13.9)	4.3 (0.0-12,839.0)	0.607
CA19-9	Median (ng/ml)	20.0 (0.0-104.0)	16.0 (0.0-17,741.0)	0.687

Group A: Dialysis, Group B: no dialysis. BMI: Body mass index; ASA-PS: American Society of Anthologists Physical Status; CEA: carcinoembryonic antigen; CA19-9: carbohydrate antigen 19-9.

Table III. *Operative findings according to group.*

	Group A (n=20)	Group B (n=1,504)	*p*-Value
Approach			
Open	11	1,090	0.004
Laparoscopic	9	394	
Operative time (min)			
Median	194	234	0.016
Blood loss (ml)			
Median	5	0	0.19
LOS (day)			
Median	17	11	0.013

Group A: Dialysis, Group B: no dialysis. LOS: Length of stay.

Table IV. *Postoperative complications and mortality according to group.*

		Group A (n=20)	Group B (n=1,504)	*p*-Value
Clavien-Dindo	0	10	1,137	0.006
Classification	1,2	6	261	
	3,4,5	4	86	
Mortality	Yes	1	0	0.013
	No	19	1,484	

Group A: Dialysis, Group B: no dialysis.

In conclusion, our study asserts that the morbidity and mortality rates might be high in patients with CRF on dialysis following colorectal surgery. More serious perioperative care and greater rate of informed consent may be required for patients undergoing dialysis.

Finally, the study pointed out that more careful and strict postoperative management is required for colorectal cancer patients with CRF on dialysis. There are possible limitations in this study, these include its retrospective nature and it being a single-center study. In the future, we plan to increase the number of the cases and clarify not only short-term postoperative outcomes but also long-term postoperative outcomes.

Conclusion

In our study, patients undergoing dialysis tended not to be fit for laparoscopic surgery, thus the observed complication rates were higher. It is overall necessary to plan a more careful and meticulous treatment strategy for surgery on patients with colorectal cancer who are undergoing dialysis.

Table V. *Details of complications for Group A patients.*

Superficial incisional infections	5
Chylothorax ascites	1
Intraperitoneal abscess	1
Anastomosis leakage	1
Heart failure	1
Transfusion-related acute lung injury	1

Group A: Patients on dialysis.

Conflicts of Interest

The Authors have no conflicts of interest to declare regarding this study.

Authors' Contributions

Kai Neki designed the study, wrote the initial draft of the manuscript, and analyzed and interpreted the data. All other Authors have contributed to data collection and interpretation, and critically reviewed the manuscript. All Authors approved the final version of the manuscript.

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