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SHORT COMMUNICATION

The influence of pulmonary comorbidities on treatment choice and short-term surgical outcomes among elderly patients with colorectal cancer

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Abstract

Purpose Most elderly patients with colorectal cancer have comorbidities and reduced functional reserve, which may increase their risks of postoperative morbidity and mortality, and subsequently influence the treatment choice. Therefore, this study aimed to investigate the treatment choice and compare laparoscopic and open surgery in this setting.

Methods This retrospective study evaluated 118 patients with colorectal cancer (≥ 85 years old between January 2007 and February 2018) to determine the influence of comorbidities on treatment choice, as well as the safety and feasibility of laparoscopic surgery for these patients.

Results The patients included 42 men (35.6%) and 106 patients (89.8%) with comorbidities. The treatments were curative resection for 90 patients and palliative surgery for 16 patients, including 5 cases of colostomy/ileostomy because of the difficulty of primary cancer resection, pneumonia, or pulmonary hypertension. Twelve patients received non-surgical treatment, including 7 patients with decreased respiratory function because of chronic obstructive pulmonary disease or pneumonia. Forty-three patients underwent open curative resection and 47 patients underwent laparoscopic curative resection, which was associated with a significantly shorter hospital stay (14 days vs. 19days, $P < 0.01$), a lower morbidity rate (17.0% vs. 37.2%, $P = 0.035$), and less blood loss (10 mL vs. 140 mL, $P < 0.01$). One patient in each group died during the postoperative period because of worsened pre-existing pneumonia.

Conclusion Laparoscopic surgery was safer and less invasive than open surgery for colorectal cancer among ≥ 85-year-old patients. Pulmonary comorbidities affected the choice of non-curative surgery and may be related to the risk of postoperative mortality.

Keywords Elderly patients · Laparoscopic surgery · Open surgery · Colorectal cancer · Pulmonary · Comorbidity

Introduction

The elderly population continues to increase in Japan, with 28% of the population being ≥ 65 years old and 4.5% of the population being ≥ 85 years old in April 2018 [1]. The incidence of colorectal cancer has also gradually increased in Japan to become the fourth most common cancer among men and the second most common cancer among women in 2014 [2]. Surgical resection remains the mainstay of curative treatment for colorectal cancer. Thus, in combination with the aging population, an increasing number of elderly patients have undergone surgical treatment for colorectal cancer. Unfortunately, most elderly patients have comorbidities, such as cardiovascular or pulmonary diseases, and reduced functional reserve, which may increase their risks of postoperative morbidity and mortality and subsequently influence the treatment choice (e.g., avoiding curative resection). Therefore, the present study aimed to investigate the influence of comorbidities on treatment choice among elderly colorectal cancer patients (≥ 85 years old), as well as the safety and feasibility of curative laparoscopic surgery in this setting.

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Methods

Patients and methods

This retrospective study evaluated 118 elderly patients (≥ 85 years old) who were treated for colorectal cancer at our department between January 2007 and February 2018. Patients were excluded if they had undergone endoscopic resection of early colorectal cancer (e.g., polypectomy, endoscopic mucosal resection, and endoscopic submucosal dissection), had recurrent colorectal cancers, or had inflammatory bowel disease. All patients had completed biochemical blood testing, respiratory function testing, electrocardiography, echocardiography, coronary angiography, cerebral computed tomography, and cerebral magnetic resonance imaging if needed to evaluate their comorbidities. Most patients, except those with obstruction, underwent total colonoscopy with a biopsy and were preoperatively evaluated to determine the extent of their disease using thoracic and abdominal computed tomography, pelvic magnetic resonance imaging, and positron emission tomography. Patients with reduced respiratory function received a respiration training device to improve their respiratory function before surgery.

Comorbidities and the reasons for non-treatment or palliative surgery were reviewed. The patients' medical records were also reviewed to determine their clinicopathological features and short-term outcomes (i.e., operative time, amount of blood loss, postoperative hospital stay, morbidity, and mortality) according to curative treatment type (laparoscopic surgery vs. open surgery). Curative resection was defined as macroscopically complete removal of the tumor and regional lymph nodes with microscopically clear margins and no peritoneal spread or distant metastasis. Conversion of laparoscopic surgery to open surgery was defined as any abdominal incision that was different from that planned at the start of surgery. The pathological findings were described according to the TNM classification of the International Union Against Cancer [3]. Patients were discharged when they had sufficient oral intake, no complications or well-controlled complications, and no excessive anxiety about leaving the hospital. The Clavien-Dindo classification was used to identify the 30-day and in-hospital rates of morbidity and mortality. The study's protocol complied with the ethical guidelines of the Declaration of Helsinki and was approved by the University of Tokyo ethics committee [3252-(8)].

Statistical analysis

Categorical variables were reported as number and percentage and were analyzed using Fisher's exact test. Continuous variables were reported as median or mean ± standard deviation and were analyzed using the Mann-Whitney *U* test or *t* test. Differences were considered statistically significant at *P* values of < 0.05.

Results

The patients included 42 men and 76 women, with the oldest patient being 98 years old. Comorbidities were present for 106 patients (89.8%) and pulmonary comorbidities were common (39.0%). Curative resection was performed for 90 patients, palliative operation was performed for 16 patients, and non-surgical treatment was performed for 12 patients. Seven of these 12 patients had reduced respiratory function because of moderate-to-severe COPD (5 patients) and pneumonia (2 patients). Three patients had decreased heart function, 1 patient had multiple primary cancers with distant metastasis, 1 patient had a poor general condition after preoperative chemoradiotherapy, and 1 patient refused treatment. Among the 16 patients who underwent palliative surgery, 11 patients underwent resection for symptomatic colorectal cancer with unresected distant metastasis (9 patients had stenosis, 1 patient had bleeding, and 1 patient had an abscess) and 5 patients underwent colostomy/ileostomy (adjacent organ invasion in 3 patients, pneumonia in 1 patient, and pulmonary hypertension in 1 patient).

Among the 90 patients who underwent curative resection, 43 patients underwent open surgery and 47 patients underwent laparoscopic surgery. These patients' background characteristics, operative data, pathological findings, and the postoperative events are shown in Table 1. The two groups had similar comorbidities, although chronic liver disease was only found in the open surgery group ($P = 0.0483$). Conversion to open surgery was required in 2 cases (4.3%) because of extensive adhesion (1 patient) or repeated air leakage after anastomosis (1 patient). All three emergency surgeries were performed using an open approach. The operative time was slightly longer for laparoscopic surgery than for open surgery, although the difference was not statistically significant (249 min vs. 212 min, $P = 0.252$). Laparoscopic surgery was associated with significantly less blood loss (10 mL vs. 140 mL, $P < 0.01$). None of the patients experienced intraoperative complications. There were no significant inter-group differences in tumor location ($P = 0.49$), histology ($P = 0.15$), tumor size ($P = 0.22$), pT stage ($P = 0.64$), or the number of harvested lymph nodes ($P = 0.51$). Laparoscopic surgery was associated with a significantly shorter hospital stay (14 days vs. 19 days, $P < 0.01$) and a significantly lower morbidity rate (17.0% vs. 37.2%, $P = 0.035$). Death during the postoperative period was detected for 1 patient who underwent laparoscopic surgery and 1 patient who underwent open surgery. Both patients had pneumonia before surgery and died because of subsequent deterioration of the pneumonia. Most other postoperative complications were similar between the two groups,

Table 1 Clinicopathological characteristics and operative data

	Open surgery ($n = 43$)	Laparoscopic surgery ($n = 47$)	P value
Gender			0.2761
Male	13	20	
Female	30	27	
Age range	85–95	85–94	
Comorbidities			
Overall	37 (86.0)	43 (91.5)	0.51
Cardiovascular	10 (23.3)	12 (25.5)	0.812
Hypertension	17 (39.5)	24 (51.1)	0.2967
Pulmonary	15 (34.9)	18 (38.3)	0.8278
Liver	4 (9.3)	0 (0)	0.0483
Renal	8 (18.6)	7 (14.9)	0.7787
Cerebrovascular	12 (27.9)	15 (31.9)	0.8184
Diabetes mellitus	6 (14.0)	11 (23.4)	0.2912
Conversion	–	2 (4.3)	
Emergency surgery	3	0	0.105
Operative time (min)			0.0252
Median	212	249	
Range	93–441	119–680	
Blood loss (mL)			< 0.01
Median	140	10	
Range	0–2800	0–570	
Tumor location			0.4934
Colon	29	35	
Rectum	14	12	
Histology			0.1454
Well/moderately differentiated	37	45	
Others	6	2	
Tumor size (mm)			0.2249
Mean ± S.D.	47.5 ± 25.0	41.8 ± 18.0	
pT stage			0.6446
T1	7	8	
T2	6	5	
T3	21	21	
T4a	5	9	
T4b	4	4	
Number of harvested lymph nodes			0.51
Mean ± S.D.	18.6 ± 10.2	20.0 ± 10.6	
Postoperative hospital stay (days)			< 0.01
Median	19	14	
Range	11–111	7–63	
Morbidity			
Overall	16 (37.2)	8 (17.0)	0.035
Wound infection	3 (7.0)	1 (2.1)	0.3451
Intraabdominal abscess	1 (2.3)	0	0.4778
Anastomotic leakage	0	1 (2.1)	1.0
Infection via catheter	3 (7.0)	1 (2.1)	0.3451
Urinary tract infection	4 (9.3)	0	0.0483
Pneumonia	2 (4.7)	1 (2.1)	0.6043

Table 1 (continued)

	Open surgery ($n = 43$)	Laparoscopic surgery ($n = 47$)	P value
Cholecystitis	1 (2.3)	0	0.4778
Delirium	1 (2.3)	1 (2.1)	1.0
Bowel obstruction	1 (2.3)	1 (2.1)	1.0
Bleeding	0	1 (2.1)	1.0
Cerebral infarction	1 (2.3)	0	0.4778
Angina	1 (2.3)	0	0.4778
Urinary retention	0	1 (2.1)	1.0
Disuse syndrome	1 (2.3)	0	0.4778
Mortality	1 (2.3)	1 (2.1)	1.0

Values in parentheses are percentages

S.D. standard deviation

although urinary tract infections were only detected in the open surgery group ($P = 0.0483$).

Excluding three emergency surgery cases, laparoscopic surgery was associated with a significantly shorter hospital stay (14 days vs. 18 days, $P < 0.01$) and less blood loss (10 mL vs. 135 mL, $P < 0.01$). Overall morbidity rate was not significantly different between the two groups (17.0% vs. 35%, $P = 0.0824$). Death during the postoperative period occurred in 1 patient. In the multivariate analysis, histology, but not laparoscopic surgery, was found to be the only independent predictive factor of postoperative morbidity.

Discussion

The present study included 7 patients who did not receive surgical treatment because of impaired respiratory function (COPD in 5 patients and pneumonia in 2 patients), and two patients underwent colostomy/ileostomy (1 patient with pneumonia and 1 patient with COPD). Moreover, two patients who underwent curative resection had pre-existing pneumonia and subsequently died from its aggravation during the postoperative period. In this context, postoperative pneumonia is a common postoperative complication that requires prolonged hospital stays and is associated with higher costs, increased morbidity, and mortality [4]. Our findings also indicated that respiratory comorbidities were associated with mortality. Similarly, Bare et al. have demonstrated that COPD was associated with increased rates of postoperative complications, intensive care unit admission, antibiotic treatment, reintervention, and in-hospital mortality [5]. Another American study also revealed that COPD clearly increased the rates of postoperative morbidity and mortality, as well as the length of hospital stay, among patients undergoing all types of abdominal surgery [6]. In addition, Kochi et al. reported that the incidence of postoperative pneumonia was 1.8% among colorectal cancer patients who were ≥ 80 years old, and that restrictive respiratory impairment, obstructive respiratory impairment, history of cerebrovascular events, and open surgery were risk factors for postoperative pneumonia [7]. Therefore, we believe that it is important to carefully assess pulmonary comorbidities among elderly colorectal cancer patients before selecting treatment.

Miki et al. have evaluated the efficacy of swallowing function screening to reduce the incidence of postoperative pneumonia among elderly gastric cancer patients, although they reported that the risk of postoperative aspiration pneumonia could not be accurately identified using a symptom questionnaire, the modified water swallow test, or the repetitive saliva swallowing test [8]. However, Boden et al. have reported that preoperative physiotherapy education and breathing exercise that was overseen by physiotherapists could reduce the incidence of postoperative pneumonia [9]. Based on those findings, as well as our findings, intensive perioperative chest physiotherapy may be useful for preventing pulmonary-related morbidity and mortality after surgery for elderly patients with colorectal cancer and comorbidities.

The present study revealed that, among ≥ 85-year-old patients with colorectal cancer, laparoscopic surgery was associated with significantly lower values for the postoperative hospital stay ($P < 0.01$), morbidity rate ($P = 0.035$), and blood loss amount ($P < 0.01$). Thus, it appears that this minimally invasive type of surgery may be an effective treatment in this setting. However, most large-scale randomized trials that investigated laparoscopic surgery have excluded patients who were > 80 years old [10, 11], and very few studies have defined elderly patients as being ≥ 85 years old. Moreover, the safety and effectiveness of laparoscopic surgery is not clear among elderly patients with colorectal cancer, who are likely to have other comorbidities, such as cardiovascular or pulmonary disease. A recent systematic review has indicated that elective laparoscopic resection was safe and feasible for

colorectal cancer among patients who were > 85 years old, and that it offered the same advantages over open surgery as those observed among younger patients [12].

In conclusion, laparoscopic surgery was a safe and less invasive alternative to open surgery for treating colorectal cancer among patients who were ≥ 85 years old, based on the association of laparoscopic surgery with less blood loss and a shorter postoperative hospital stay. However, pulmonary comorbidities influenced the treatment approach and may be related to the risk of postoperative mortality.

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