ASTR

ORIGINAL ARTICLE
pISSN 2288-6575 • eISSN 2288-6796
https://doi.org/10.4174/astr.2017.92.6.423
Annals of Surgical Treatment and Research

Laparoscopic surgery for colorectal cancer in patients over 80 years of age: the morbidity outcomes

Sang Woo Lim*, Young Jin Kim, Hyeong Rok Kim

Department of Colon and Rectal Surgery, Chonnam National University Hwasun Hospital, Gwangju, Korea

Purpose: The aim of this study was to compare the outcomes between patients under 60 years of age and older patients over 80 years of age who underwent laparoscopic colorectal surgery with colorectal cancer.
Methods: A retrospective analysis of 519 colorectal patients who underwent laparoscopic colorectal surgery for colorectal adenocarcinoma between January 2007 and December 2012 was collected and categorized into 2 groups of patients, those under 60 years of age (n = 404) and those over 80 years of age (n = 115).
Results: The group of patients over 80 years of age had a significantly higher ASA physical status classification ($P < 0.001$), more preoperative comorbidities ($P < 0.001$), had a tendency towards more tumors in a colonic location ($P = 0.034$), and more advanced American Joint Committee on Cancer TNM stage ($P = 0.001$). A higher proportion of right hemicolectomy and abdominoperineal resection was performed and more transfusions were required in the group of patients over 80 years of age ($P = 0.002$ and $P = 0.001$, respectively). There were no significant differences in operative time, conversion rate, resection margins, and numbers of harvested lymph nodes, hospital stay, and morbidity between the 2 groups. No postoperative mortality was found in the present study. The 3-year DFS for over 80 years age group and under 60 years age group were 73.5% and 73.9%, respectively ($P = 0.770$).
Conclusion: Laparoscopic colorectal surgery was effective and safe for elderly patients over 80 years of age and resulted in postoperative outcomes similar to those in younger patients. The postoperative morbidity after laparoscopic colorectal cancer surgery was not increased in over 80 years of age.
[Ann Surg Treat Res 2017;92(6):423-428]

Key Words: Laparoscopy, Colorectal surgery, Octogenarians, Morbidity

INTRODUCTION

There is a trend toward an increasingly older population as well as a growing tendency in the population towards colorectal cancer. With advances in medicine and improvement in quality of life and screening exams, the number of elderly patients has been increasing over the last decades.

There is a growing trend of octogenarians and nonagenarians who are undergoing colorectal resection for cancer [1-5]. Colorectal surgeon has increasing chance to have perform the operation for colorectal cancer of old aged patients that should have more interest in geriatric colorectal cancer patients, and have the chance of medical and surgical care, However, older age patients with colorectal cancer are somewhat of a burden to the colorectal surgeon in terms of surgical outcome and postoperative morbidity and mortality.

Laparoscopic colorectal surgery has shown many advantages in terms of short term outcomes and recently has been shown to not compromise oncologic outcomes in colorectal carcinoma [6-8]. There were many reports of the advantages of laparoscopic colorectal surgery in elderly patients, and studies show that it can be safely performed in very old patients with colorectal

Received November 10, 2016, **Revised** February 3, 2017,
Accepted February 21, 2017

Corresponding Author: Hyeong Rok Kim
Department of Colon and Rectal Surgery, Chonnam National University Hwasun Hospital, 322 Seoyang-ro, Hwasun 58128, Korea
Tel: +82-61-379-7646, **Fax:** +82-61-379-7661
E-mail: drkhr@jnu.ac.kr

*Current affiliation: Department of Surgery, Hallym University Sacred Heart Hospital, Anyang, Korea

cancer [9-13].

The aim of this study was to compare the outcomes between patients under 60 years of age and older patients over 80 years of age who underwent laparoscopic colorectal surgery and evaluate the safety and feasibility of laparoscopic surgery in older patients with colorectal cancer.

METHODS

A retrospective analysis was performed on the data of 519 cases that underwent laparoscopic colorectal surgery for colorectal adenocarcinoma between January 2007 and December 2012.

In the present study, patients over 80 years of age were defined as the elderly group, and patients less than 60 years of age were defined as the younger group. Patients aged between 60 and 79 years were excluded from the present study for obtaining clear comparative differences.

The exclusion criteria were as follows: synchronous multiple cancers, double primary colorectal cancer, familial adenomatous polyposis, and palliative diversionary colostomy. For treating mid to distal rectal cancer, surgery was performed 6 to 8 weeks after neoadjuvant chemoradiation at a dose of 5,040 cGy to the pelvic field and intravenous fluorouracil with leucovorin.

Preoperative demographic data, including age, sex, body mass index (BMI), preoperative comorbidity, American Society of Anesthesiologists (ASA) physical status classification, previous history of abdominal operation, tumor location, histological type, and the American Joint Committee on Cancer (AJCC) TNM staging, were collected and analyzed.

Pre-existing comorbidities were categorized into cardiovascular disease, pulmonary disease, neurovascular accident, diabetes mellitus, chronic renal impairment, and chronic liver disease, and they were expressed as numbers.

Perioperative outcomes, including type of operation, operation time, conversion to open procedure, estimated blood loss, transfusion, stoma creation, tumor size, depth of invasion, distal resection margin, number of harvested lymph nodes, diversion stoma, day of first flatus, postoperative hospital stay, and postoperative morbidity and mortality, were reviewed. Conversion to open laparotomy was defined as any unplanned incision longer than 10 cm during the laparoscopic procedure.

Overall postoperative morbidity was divided into surgical morbidity and medical morbidity. Surgical morbidity included postoperative anastomotic leakage, anastomotic bleeding, intraabdominal bleeding, ileus, pelvic abscess that was apparent on clinical and radiologic examination, surgical site infection, intraoperative iatrogenic injury to the ureter, and small bowel perforation. Medical morbidity included conditions such as myocardial infarction, atrial fibrillation, pneumonia, bronchial asthma, chronic obstructive pulmonary disease, pleural effusion requiring thoracentesis, hepatic function impairment requiring a hepatic protector, renal failure requiring hemodialysis, voiding dysfunction, postoperative peptic ulcer, delirium, depression disorder, and hypoglycemia.

All patients received mechanical bowel preparation with polyethylene glycol one day before the operation and prophylactic antibiotic cefotaxime 1.0 g at induction of anesthesia. Perioperative antiembolic stockings were applied for deep vein thrombosis prophylaxis. During the laparoscopic procedure, a medial to lateral approach for radical operation was applied to all colorectal cancer surgeries.

Extracorporeal side-to-side anastomosis was used for right-sided colon cancer, and intracorporeal double stapling technique was performed for left-sided colon cancer and colorectal anastomosis. For mid to low rectal cancer, total mesorectal excision was performed. A diversionary ileostomy was performed in selected patients with rectal cancer who received preoperative chemoradiation.

Table 1. Demographics and tumor characteristics

Variable	Age < 60 yr (n = 404)	Age ≥ 80 yr (n = 115)	P-value
Age (yr)	51.7 ± 6.6	82.3 ± 2.6	<0.001
Sex			0.022
Male	265 (65.6)	62 (53.9)	
Female	139 (34.4)	53 (46.1)	
Body mass index (kg/m^2)	22.9 ± 3.9	22.8 ± 3.3	0.750
ASA PS classification			<0.001
1	244 (60.4)	3 (2.6)	
2	158 (39.1)	89 (77.4)	
3	2 (0.5)	23 (20.0)	
No. of medical comorbidity			<0.001
0	290 (71.8)	39 (33.9)	
1	86 (21.3)	51 (44.3)	
2	26 (6.4)	23 (20.0)	
≥3	2 (0.5)	2 (1.7)	
Previous abdominal surgery	26 (6.4)	13 (11.3)	0.081
Location of tumor			0.034
Colon	190 (47.0)	67 (58.3)	
Rectum	214 (53.0)	48 (41.7)	
Histological differentiation			0.520
Well	182 (45.0)	49 (42.6)	
Moderate	184 (45.5)	51 (44.3)	
Poorly	38 (9.5)	15 (13.1)	
Preoperative CEA	9.8 ± 1.5	9.6 ± 3.5	0.965
AJCC TNM stage			0.001
I	120 (29.7)	18 (15.7)	
II	128 (31.7)	55 (47.8)	
III	129 (31.9)	31 (27.0)	
IV	27 (6.7)	11 (9.5)	

Values are presented as mean ± standard deviation or number (%).
ASA PS, American Society of Anesthesiologists physical status; AJCC, American Joint Committee on Cancer.

Data were expressed as mean and standard deviation. Differences between the 2 groups were evaluated by Student t-test and chi-square test or Fisher exact test.

Univariate analysis was employed as appropriate to determine the factors that correlated with surgical and medical morbidities. A 2-tailed P-value <0.05 was considered statistically significant. Statistical analysis was performed using SPSS ver. 17.0 (SPSS Inc., Chicago, IL, USA).

RESULTS

From January 2007 to December 2012, 2,365 patients with colorectal adenocarcinoma underwent surgery at Chonnam National University Hwasun Hospital. A total of 519 patients were included and categorized into 2 groups; those under 60 years of age and those over 80 years of age.

Males were predominant in the group of patients under 60 years of age (P = 0.022). The group of patients over 80 years of age had a significantly higher ASA physical status classification (P < 0.001), more preoperative comorbidities (P < 0.001), tendency towards more tumors in a colonic location (P = 0.034) compared to the rectum, and more advanced AJCC TNM stage (P = 0.001).

There were no statistically significant differences in BMI, previous abdominal operation history, histological differentiation, and preoperative CEA level between the 2 groups. Patients' demographics are shown in Table 1.

In terms of operative details, a higher proportion of right hemicolectomy and abdominoperineal resection was performed and more transfusions were required in the group of patients over 80 years of age (P = 0.002 and P = 0.001, respectively). There were no significant differences in operative time, estimated blood loss, conversion rate, and number of harvested lymph nodes between the 2 groups. The day of first flatus was later in the elderly group (P < 0.001). Fifteen patients (2.9%) were converted to open procedures, and the conversion rate was similar between the 2 groups. The reasons for conversion to open surgery were as follows: bulky tumors in 3 cases, technical difficulties with a narrow male pelvis in 4 cases, adhesions to the abdominal and pelvic walls in 3 cases, obesity with high BMI in 2 cases, intraoperative bleeding in 1 case, and tumor perforation during manipulation in 2 cases. There were no significant differences in postoperative length of hospital stay or postoperative surgical and medical morbidities between the two groups. Operative outcomes are shown in Table 2, and details of surgical and medical morbidities are listed in Table 3.

Twenty patients (3.9%) had anastomotic leakage, and 18 of these 20 patients underwent laparoscopic ileostomy and

Table 2. Operative results

Variable	Age < 60 yr (n = 404)	Age ≥ 80 yr (n = 115)	P-value
Type of operation			0.002
Right hemicolectomy	79 (19.6)	33 (28.7)	
Sigmoidectomy	100 (24.8)	36 (31.3)	
Low anterior resection	209 (51.7)	37 (32.2)	
Abdominoperineal resection	16 (4.0)	9 (7.8)	
Operation time (min)	188.6 ± 59.3	184.1 ± 57.0	0.471
Conversion	11 (2.7)	4 (3.5)	0.434
Estimated blood loss (mL)	160.8 ± 11.3	186.7 ± 19.6	0.276
Transfusion	52 (12.9)	29 (25.2)	0.001
Diverting stoma	61 (15.1)	9 (7.8)	0.045
Depth of invasion			0.012
T1	71 (17.6)	10 (8.7)	
T2	62 (15.3)	10 (8.7)	
T3	234 (57.9)	83 (72.2)	
T4	37 (9.2)	12 (10.4)	
Tumor size (cm)	4.2 ± 2.2	4.9 ± 2.1	0.001
Distal resection margin (cm)	5.9 ± 0.2	6.0 ± 0.6	0.210
No. of harvested lymph nodes	24.9 ± 15.8	22.6 ± 12.6	0.108
1st flatus (day)	2.0 ± 1.1	2.5 ± 1.3	0.000
Postoperative hospital stay (day)	9.5 ± 3.9	9.3 ± 3.7	0.584
Postoperative morbidity	66 (16.3)	19 (16.5)	0.752
Surgical morbidity	46 (11.4)	10 (8.7)	0.412
Medical morbidity	20 (5.0)	9 (7.8)	0.236

Values are presented as number (%) or mean ± standard deviation.

Table 3. Postoperative morbidity

Postoperative morbidity	Age < 60 yr (n = 404)	Age ≥ 80 yr (n = 115)	Total
Surgical morbidity	46 (11.4)	10 (8.7)	56 (10.8)
Anastomotic leakage	16 (4.0)	4 (3.5)	
Anastomotic bleeding	2 (0.5)	0 (0)	
Intraabdominal bleeding	2 (0.5)	1 (0.9)	
Prolonged ileus	9 (2.2)	2 (1.7)	
Pelvic abscess	2 (0.5)	1 (0.9)	
Surgical site infection	11 (2.7)	2 (1.7)	
Ureteral injury	3 (0.7)	0 (0)	
Small bowel perforation	1 (0.2)	0 (0)	
Medical morbidity	20 (5.0)	9 (7.8)	29 (5.6)
Cardiovascular	2 (0.5)	1 (0.9)	
Pulmonary, deep vein thrombus	3 (0.7)	1 (0.9)	
Hepatic	3 (0.7)	0 (0)	
Renal dysfunction	2 (0.5)	0 (0)	
Voiding difficulty	5 (1.2)	4 (3.5)	
Peptic ulcer	1 (0.2)	0 (0)	
Delirium	0 (0)	3 (2.6)	
Depression disorder	1 (0.2)	0 (0)	
Hypoglycemia	3 (0.7)	0 (0)	

Values are presented as number (%).

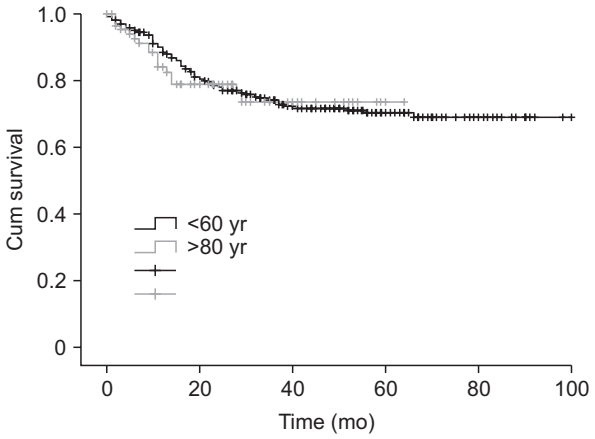

Fig. 1. Disease-free survival (DFS) after laparoscopic surgery for colorectal cancer did not differ between young aged and octogenarians (P = 0.770).

drainage. Two patients were managed with conservative therapy. Two patients (0.4%) with anastomotic bleeding were identified.

Three patients (0.6%) with intraabdominal bleeding were identified, and 2 of these 3 patients underwent reoperation, while 1 patient was managed conservatively with transfusion. Among 11 patients (1.3%) with prolonged postoperative ileus, 2 patients underwent exploratory laparotomy, and the other patients were managed conservatively. No postoperative mortality was found in the present study.

The disease-free survival (DFS) did not differ significantly between the 2 groups (P = 0.770), as shown in Fig. 1. The 3-year DFS for the over 80 years age group and the under 60 years age group was 73.5% and 73.9%, respectively.

DISCUSSION

Combined with minimally invasive surgery, advances in perioperative anesthetic techniques and improvement in perioperative monitoring have enabled the application of laparoscopic colorectal surgery in the geriatric population. Indeed, better outcomes in high risk cancer patients, including the elderly, have been reported for laparoscopic colorectal surgery [2-4,10,14,15].

Mortality and morbidity after colorectal surgery in the elderly are known to be high with increasing age, male sex, increasing comorbidity, advanced disease, and postoperative medical and surgical complications [5,13,16-20]. As a result, many colorectal surgeons are reluctant to perform laparoscopic surgery in older patients, given the vulnerable cardiopulmonary compliance for ventilation, unstable perioperative hemodynamics, risk of arrhythmia, hypercapnia during longer operation times with exposure to the risk of CO_2 pneumoperitoneum, and the steep Trendelenburg position.

The definition of the elderly was not clearly established in studies; patients older than 65 years [17], 70 years [21,22], 75 years [11,13,23,24], octogenarians [5,12,19,25], and nonagenarians [5] were defined as the elderly groups in the previously published reports.

We analyzed the traditional younger age group of patients under 60 years of age with a group of patients over 80 years of age for a clear comparison. In the present study, the mean age of the patients in the elderly group was 82 years. Compared to the younger group, the elderly group was female predominant, had a higher ASA physical status classification and more comorbidities, and the location of tumor and subsequent operations were more in the colon than in the rectum.

Although the elderly group had a higher ASA physical status classification and more comorbidities, postoperative morbidities were similar. Seventy-six of the 115 patients (66.1%) in the elderly group had one or more preoperative concomitant medical comorbidities, but the perioperative data and morbidity were comparable to those in the younger age group.

The rate of overall morbidity in the present study was 16.4% (85 of 519 patients) and it is comparable with other series in the literature [11,12,15,21,23]. Surgical morbidity and medical morbidity were similar in both the young and elderly groups.

With respect to operative outcomes, there were no significant differences in operation time, estimated blood loss, number of harvested lymph nodes, and postoperative surgical complications between the 2 groups, although more transfusions and delayed return of bowel movement defined as passage of first flatus were found in the elderly group. In the present study, the depth of invasion was more advanced as T3 lesion and larger tumor size were identified in the elderly group than in the younger group. The operation type was more frequently left-sided, and diverting stoma formation was more frequent. The short-term outcomes of laparoscopic approach were comparable in both groups.

The conversion rate in the present study was 2.9%, comparable to the rate in the other series of laparoscopic colorectal surgery [11,13,15,21,23]. Although conversion to an open procedure was not relevant to morbidity, transfusion was found to be a risk factor for postoperative complication. Thus, an early decision to convert to an open procedure and not struggle with laparoscopy would be helpful to decrease the operation time and blood loss and to ensure oncologic radicality and safety of patients in complicated situations.

Multivariate analysis of risk factors for postoperative surgical and medical complications showed that rectal location, transfusion, male sex, previous abdominal surgery, T4 lesion, and distant metastasis were independent factors for postoperative complications in the present study (data not shown).

Rectal cancer, male sex, and distant metastasis as the risk factors for complications are well-known concepts considering

that surgeries for low rectal cancer, in a narrow male pelvis, and under circumstances of distant metastasis are very technically demanding procedures. Previous abdominal surgery, T4 invasion induced abdominal adhesions, and subsequent adhesiolysis or *en bloc* resection including the adjacent organs would make the operation more aggressive and complicated.

Thus, thorough preoperative physiologic and oncologic assessment and preparation are warranted for safe laparoscopic surgery in the elderly.

In the present study, medical morbidity was similar between the young and older groups, but generally, elderly patients are known to have more medical comorbidities that need be managed by tailored preoperative preparation [22,23]. Good operative technique used by an experienced surgeon and communication between the colorectal surgeon and the anesthetist are essential in preparation for surgery in elderly patients to minimize any adverse anesthesia events [15]. Optimized perioperative care may improve the postoperative outcomes.

The results of the present study suggest that a standardized laparoscopic colorectal procedure can be performed, regardless of age, without compromising the oncologic principle. In addition, long-term colorectal cancer-related outcomes in the elderly group were reported to be similar to those in the younger groups; therefore, the decision to operate should not be based on age alone [24].

The present study assessed the generation difference in the same laparoscopic procedure to compare laparoscopic surgery with open approach as follows:

Li et al. [1] reported a systematic review and meta-analysis comparing laparoscopy versus open surgery for octogenarians and they showed that laparoscopic surgery could reduce the length of hospital stay, intraoperative blood loss, time to return to normal bowel function, and incidence of postoperative pneumonia, wound infection, and postoperative ileus. Xie et al. [2] reported similar results of laparoscopic colorectal resection in octogenarian patients and stated that it is as safe as the open approach and short-term outcomes appeared to be more favorable in their systematic review and meta-analysis. Vallribera et al. [3] stratified 545 colorectal cancer patients into 3 subgroups by age: <75 years, between 75–84 years, and ≥85 years and they reported that laparoscopic colectomy is as safe and well tolerated as open surgery in patients over 85 years of age. Antoniou et al. [4], in their meta-analysis of 66,483 patients, reported a substantial benefit for elderly patients undergoing laparoscopic surgery in comparison with open colorectal surgery, and stated that laparoscopic colorectal surgery confers lower mortality. Hinoi et al. [9] conducted a propensity score matched case-control study of colon and rectal cancer patients aged over 80 years using data from 41 hospitals, and they concluded that laparoscopic colorectal cancer surgery is an acceptable alternative to open surgery.

Our present study had several limitations. One of the limitations is that we excluded patients aged between 60 and 79 years for making a clear comparison. In the present study, 24 patients (4.6%) were under 40 years of age, 380 patients (73.2%) were aged 40–60 years, and 115 patients (22.2%) were over 80 years of age. Patients aged between 60 and 79 years comprised most of the colorectal cancer data registry in our institution; therefore, the number of patients enrolled in the study and data distribution may have a selection bias. Among 2,365 patients within the analysis period, approximately 1,500 patients were aged between 60 and 79 years.

Secondly, in analysis of preoperative comorbidities in the cohort, we used only the number of comorbidities as variables and did not qualify the nature of the preoperative comorbidity as the risk factor for postoperative complication. Thirdly, the long-term survival data of DFS comparing the elderly group to the younger group did not differ significantly between the 2 groups; however, the impact of postoperative adjuvant chemotherapy was not evaluated.

We compared the age factor in the young and elderly groups of patients who underwent laparoscopic surgery. Compared to an open approach, laparoscopic surgery in the elderly has been reported to have favorable outcomes, including hospital stay and morbidity [12,15,21]. A randomized, large sample-size study is warranted. We are collecting the prospective data and will report the data as soon we obtain reasonable data.

In conclusion, laparoscopic surgery could be considered a safe and feasible method for colorectal cancer in geriatric patients and it provides comparable and favorable outcomes without increasing the postoperative morbidity and mortality rates. Laparoscopic colorectal cancer surgery was effective and safe in very elderly patients over 80 years of age and it resulted in postoperative outcomes similar to those in younger patients. Postoperative morbidity after laparoscopic colorectal cancer surgery was not increased in patients over 80 years of age.

CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

ACKNOWLEDGEMENTS

This research was supported by Hallym University Research Fund (HURF-2015-03 and HURF-2016-40).

REFERENCES

1. Li Y, Wang S, Gao S, Yang C, Yang W, Guo S. Laparoscopic colorectal resection versus open colorectal resection in octogenarians: a systematic review and meta-analysis of safety and efficacy. Tech Coloproctol 2016;20:153-62.
2. Xie M, Qin H, Luo Q, He X, Lan P, Lian L. Laparoscopic colorectal resection in octogenarian patients: is it safe? A systematic review and meta-analysis. Medicine (Baltimore) 2015;94:e1765.
3. Vallribera Valls F, Landi F, Espin Basany E, Sanchez Garcia JL, Jimenez Gomez LM, Marti Gallostra M, et al. Laparoscopy-assisted versus open colectomy for treatment of colon cancer in the elderly: morbidity and mortality outcomes in 545 patients. Surg Endosc 2014;28:3373-8.
4. Antoniou SA, Antoniou GA, Koch OO, Pointner R, Granderath FA. Laparoscopic colorectal surgery confers lower mortality in the elderly: a systematic review and meta-analysis of 66,483 patients. Surg Endosc 2015;29:322-33.
5. Kunitake H, Zingmond DS, Ryoo J, Ko CY. Caring for octogenarian and nonagenarian patients with colorectal cancer: what should our standards and expectations be? Dis Colon Rectum 2010;53:735-43.
6. Lacy AM, Garcia-Valdecasas JC, Delgado S, Castells A, Taura P, Pique JM, et al. Laparoscopy-assisted colectomy versus open colectomy for treatment of non-metastatic colon cancer: a randomised trial. Lancet 2002;359:2224-9.
7. Kang SB, Park JW, Jeong SY, Nam BH, Choi HS, Kim DW, et al. Open versus laparoscopic surgery for mid or low rectal cancer after neoadjuvant chemoradiotherapy (COREAN trial): short-term outcomes of an open-label randomised controlled trial. Lancet Oncol 2010;11:637-45.
8. Baek JH, Lee GJ, Lee WS. Comparison of long-term oncologic outcomes of stage III colorectal cancer following laparoscopic versus open surgery. Ann Surg Treat Res 2015;88:8-14.
9. Hinoi T, Kawaguchi Y, Hattori M, Okajima M, Ohdan H, Yamamoto S, et al. Laparoscopic versus open surgery for colorectal cancer in elderly patients: a multicenter matched case-control study. Ann Surg Oncol 2015;22:2040-50.
10. Tominaga T, Takeshita H, Arai J, Takagi K, Kunizaki M, To K, et al. Short-term outcomes of laparoscopic surgery for colorectal cancer in oldest-old patients. Dig Surg 2015;32:32-8.
11. Tan KY, Konishi F, Kawamura YJ, Maeda T, Sasaki J, Tsujinaka S, et al. Laparoscopic colorectal surgery in elderly patients: a case-control study of 15 years of experience. Am J Surg 2011;201:531-6.
12. Pinto RA, Ruiz D, Edden Y, Weiss EG, Nogueras JJ, Wexner SD. How reliable is laparoscopic colorectal surgery compared with laparotomy for octogenarians? Surg Endosc 2011;25:2692-8.
13. Fiscon V, Portale G, Frigo F, Migliorini G. Laparoscopic resection of colorectal cancer: matched comparison in elderly and younger patients. Tech Coloproctol 2010;14:323-7.
14. Hemandas AK, Abdelrahman T, Flashman KG, Skull AJ, Senapati A, O'Leary DP, et al. Laparoscopic colorectal surgery produces better outcomes for high risk cancer patients compared to open surgery. Ann Surg 2010;252:84-9.
15. Poon JT, Law WL, Chow LC, Fan JK, Lo SH. Outcome of laparoscopic resection for colorectal cancer in patients with high operative risk. Ann Surg Oncol 2011;18:1884-90.
16. Plocek MD, Geisler DP, Glennon EJ, Kondylis P, Reilly JC. Laparoscopic colorectal surgery in the complicated patient. Am J Surg 2005;190:882-5.
17. Duron JJ, Duron E, Dugue T, Pujol J, Muscari F, Collet D, et al. Risk factors for mortality in major digestive surgery in the elderly: a multicenter prospective study. Ann Surg 2011;254:375-82.
18. Senagore AJ, Stulberg JJ, Byrnes J, Delaney CP. A national comparison of laparoscopic vs. open colectomy using the National Surgical Quality Improvement Project data. Dis Colon Rectum 2009;52:183-6.
19. Al-Refaie WB, Parsons HM, Habermann EB, Kwaan M, Spencer MP, Henderson WG, et al. Operative outcomes beyond 30-day mortality: colorectal cancer surgery in oldest old. Ann Surg 2011;253:947-52.
20. Kennedy GD, Rajamanickam V, O'connor ES, Loconte NK, Foley EF, Leverson G, et al. Optimizing surgical care of colon cancer in the older adult population. Ann Surg 2011;253:508-14.
21. Law WL, Chu KW, Tung PH. Laparoscopic colorectal resection: a safe option for elderly patients. J Am Coll Surg 2002;195:768-73.
22. Chautard J, Alves A, Zalinski S, Bretagnol F, Valleur P, Panis Y. Laparoscopic colorectal surgery in elderly patients: a matched case-control study in 178 patients. J Am Coll Surg 2008;206:255-60.
23. Fiscon V, Portale G, Migliorini G, Frigo F. Laparoscopic resection of colorectal cancer in elderly patients. Tumori 2010;96:704-8.
24. Devon KM, Vergara-Fernandez O, Victor JC, McLeod RS. Colorectal cancer surgery in elderly patients: presentation, treatment, and outcomes. Dis Colon Rectum 2009;52:1272-7.
25. Cheung HY, Chung CC, Fung JT, Wong JC, Yau KK, Li MK. Laparoscopic resection for colorectal cancer in octogenarians: results in a decade. Dis Colon Rectum 2007;50:1905-10.