JBUON 2018; 23(6): 1625-1632
ISSN: 1107-0625, online ISSN: 2241-6293 • www.jbuon.com
E-mail: editorial_office@jbuon.com

ORIGINAL ARTICLE

Short- and long-term outcomes of laparoscopic complete mesocolic excision in elderly patients with right colon cancer

Jin Li[1], Lin Yudong[2], Yong Chen[3]

[1]Department of Surgical Oncology, Ningde Municipal Hospital, Fujian Medical University Ningde 352100, Fujian Province, People's Republic of China; [2]Department of General Surgery, the 95th Hospital of People's Liberation Army, Putian, 351100, Fujian Province, People's Republic of China; [3]Department of Laboratory Medicine, Mindong Affiliated Hospital, Fujian Medical University, Fu'an 355000, Fujian Province, People's Republic of China

Summary

Purpose: *This study was designed to compare the short- and long-term outcomes between elderly and middle-aged patients who underwent laparoscopic complete mesocolic excision for right colon cancer.*

Methods: *A retrospective analysis was performed on the clinical and follow-up data of 108 patients undergoing laparoscopic complete mesocolic excision at our institution between January 2012 and January 2018. Patients were grouped according to their age at the time of operation into the elderly group (≥ 70 years old, 46 cases) and the middle-aged group (55 years old ≤ age ≤ 69 years old, 62 cases). Comparisons of short- and long-term outcomes were done between these two groups.*

Results: *When comparing baseline data, the Charlson comorbidity index and American Society of Anesthesiologists (ASA) scores were higher among elderly patients. Comparisons of other baseline data showed no statistically significant differences. With the exception of a higher intraoperative blood loss recorded among elderly patients, comparisons of other short-term outcomes such as operation duration, blood transfusion rate, conversion to open surgery, incidence and severity of complications 30 days after surgery, pathological results, and compliance with chemotherapy showed no statistically significant differences. Long-term follow-up results indicated that recurrences were somewhat similar between these two groups of patients. Multivariate analysis revealed that age was not an independent predictor of overall survival (OS) or disease-free survival (DFS).*

Conclusion: *Similar short- and long-term outcomes can be achieved among elderly and middle-aged patients with right colon cancer who underwent laparoscopic complete mesocolic excision. Age is not a limiting factor in the application of laparoscopic complete mesocolic excision.*

Key words: *complete mesocolic excision, laparoscopic surgery, minimally invasive surgical oncology, prognosis, right colon cancer*

Introduction

Colon cancer is one of the most common malignancies [1-3]. As the average life expectancy rises, the number of old people with colon cancer shows an upward trend [4-6]. The main treatment for colon cancer patients is surgical removal of the tumor [7-9]. Currently, total mesorectal excision (TME) has become a standard technique for the surgical treatment of middle and lower rectal cancer as it can reduce the incidence of local recurrence, making the long-term results of rectal cancer similar to those of colon cancer [10]. In 2009, Hohenberger et al. first mentioned complete mesocolic excision (CME), a procedure similar to TME [11]. Research had shown that CME could reduce the incidence of local recurrence and increase the survival rate of colon cancer patients [12-15]. Ever

Correspondence to: Yong Chen, MD. Mindong Affiliated Hospital, Fujian Medical University, Heshan Rd, Fu'an 355000, Fujian Province, People's Republic of China.
Tel and Fax: +86 593 6336011, E-mail: fjndyc@163.net; 285980355@qq.com
Received: 04/04/2018; Accepted: 29/04/2018

since US surgeon Jacobs first reported on using laparoscopic colectomy to treat colon cancer [16], laparoscopic colectomy became increasingly used as one of the treatments for colon cancer [17-22]. Studies have shown that when using laparoscopic CME as a treatment for colon cancer, this was associated with less blood loss, shorter hospitalization time, faster recovery time after surgery, similar or less complications, and long-term outcomes similar to those of an open CME [23-29]. However, these studies did not include older colon cancer patients. It is noted that there are no English-written papers about laparoscopic CME treatment for older colon cancer patients. This study aimed to compare the short- and long-term outcomes of laparoscopic CME treatment between elderly and middle-aged right colon cancer patients.

Methods

Patients

This study complied with the Declaration of Helsinki and was approved by our local ethics committees. The need for informed consent from patients was waived because of its retrospective nature.

A total of 108 cases of primary right colon cancer patients who met the inclusion and exclusion criteria underwent laparoscopic CME at our Institute from January 2012 to January 2018. Inclusion criteria were as follows: (1) pathologically confirmed adenocarcinoma of the colon; (2) cancer at clinical stage T1-3N0-2M0; (3) patients subjected to surgical treatment for the first time without any prior neoadjuvant therapy; (4) no removal of other internal organs; and (5) availability of complete clinical and follow-up information. Exclusion criteria were as follows: (1) emergency surgery had to be performed due to perforation of the colon or intestinal obstruction; (2) combined simultaneous or metachronous colorectal cancer and tumors in other organs; (3) removal of other internal organs during surgery; and (4) recurrent tumors.

Patients were grouped according to their age at the time of operation into the elderly group (≥ 70 years old, 46 cases) and the middle-aged group (55 years ≤ age ≤ 69 years, 62 cases). This study retrospectively compared the baseline information, as well as the short- and long-term outcomes between these two groups of patients. Pretreatment examinations such as colonoscopy, computed tomography (CT) scans on the brain, chest and abdomen, tumor markers, lung function, electrocardiography (ECG), and ultrasonic cardiogram were conducted on all patients to determine their clinical stage, to exclude distant metastasis, and to determine whether patients could tolerate surgery. Examinations such as positron emission tomography–computed tomography (PET-CT) and bone scan were also conducted when necessary.

Patients with pathological stage III were given capecitabine + oxaliplatin (XELOX) or oxaliplatin + calcium folinate/fluorouracil (mFOLFOX6) as chemotherapy. Patients with pathological high-risk stage II were given single-agent capecitabine as chemotherapy [30-32].

Table 1. Baseline characteristics of the two groups

Characteristics	*Middle-aged group (n=62)* *n*	*Elderly group (n=46)* *n*	*p value*
Age (median, years; range)	63 (55-69)	74 (70-77)	0.000
Sex (Male: Female)	38:24	27 :19	0.785
ASA score			0.047
I	47	27	
II	12	13	
III	3	6	
Charlson comorbidity index			0.014
≥ 3	8	15	
< 3	54	31	
BMI (median, kg/m²; range)	21 (18-28)	22 (19-27)	0.548
Clinical stage			0.886
I	9	7	
II	24	29	
III	10	9	
Tumor site			0.943
Cecum	6	5	
Ascending colon	45	32	
Transverse colon	11	9	

Postoperative 30-day complications were graded according to the Clavien-Dindo classification system. Major complications were defined those of grades 3, 4, and 5, while minor complications were defined those of grades 1 and 2 [33-36]. Operative death was defined as mortality occurring intraoperatively or within 30 postoperative days.

Follow-up

Patients were followed-up after being discharged. Follow-up was performed in the form of outpatient visits, house visits, or communications through letters, among other approaches. Following discharge from the hospital, follow-up was once every 3 months in the first year, once every 6 months in the second year, and once every year thereafter. During follow-up, standard examinations such as physical examinations, tumor marker estimations, and chest and abdomen imaging examinations were carried out. Colonoscopy was conducted once a year [37-41]. The last follow-up took place in February 2018.

Statistics

All calculations were performed using IBM SPSS 13.0 software. For variables with normal distribution, data were presented as mean and standard deviations and were analyzed by Student's *t*-test. For variables with non-normal distribution, data were expressed as median and range and were compared by Mann–Whitney *U* test. Differences of semiquantitative results were analyzed by Mann–Whitney *U* test. Differences of qualitative results were analyzed by chi-square test or Fisher's exact test, where appropriate. Survival rates were analyzed using the Kaplan–Meier method, and differences were analyzed with the log-rank test. Results were expressed as odds ratios (OR) with 95% confidence intervals (CI). The Cox proportional hazard model was used to identify significant predictive factors for patient survival outcomes. All analyses were performed using SPSS version 13 for Microsoft Windows version. $p<0.05$ indicated statistical significance.

Results

Short-term outcomes

The Charlson comorbidity index and ASA score were higher among elderly patients when comparing the baseline data of these two groups of patients. Comparisons of the remaining baseline data, such as sex, body mass index (BMI), clinical stage, and tumor site, showed no statistically significant differences (Table 1).

Table 2 shows the short-term outcomes of these two groups, which indicate that blood loss during surgery was higher in the elderly group.

Table 2. Short-term outcomes of the two groups

Outcomes	*Middle-aged group (n=62)* *n*	*Elderly group (n=46)* *n*	*p value*
Conversion to open surgery			1.000
Tumor reasons	4	3	
Technical reasons	1	1	
Operative time (median, min; range)	140 (110-200)	130 (100-210)	0.247
Blood loss (median, ml; range)	80 (50-300)	120 (100-280)	0.040
Blood transfusion	1	1	1.000
Time to pass first flatus (median, d; range)	3 (1-5)	3 (2-6)	0.254
Time to resume liquid diet (median, d; range)	4 (2-6)	4 (3-5)	0.587
Hospitalization (median, d; range)	11 (8-19)	12 (8-29)	0.158
Patients with postoperative complications	9	7	0.919
Anastomotic leakage	2	1	
Ileus	1	0	
Wound infection	1	2	
Chylous leakage	2	2	
Gastroplegia	1	1	
Intra-abdominal sepsis	2	1	
Patients with major complications	1	2	0.792
Intraoperative mortality	0	0	-
Postoperative 30-day mortality	0	0	-
First chemotherapy after surgery (median, weeks; range)	7 (6-9)	8 (7-10)	0.208

There were no statistically significant differences when comparing the operation duration, blood transfusion rate during and after surgery, number of days in hospital, and incidence and severity of complications 30 days after surgery between these two groups. The rate of conversion to open surgery was similar between the two groups of patients, and the cause of conversion to open surgery among these two groups was mainly due to the disease itself. None of the patients died at the operating table. A comparison of the pathological results between the two groups showed no statistically significant differences (Table 3).

Long-term outcomes

The median follow-up period of the elderly and middle-aged groups were 41 and 45 months respectively, without statistical significance. During follow-up, 9 patients from the elderly group passed away, of which 7 cases were due to recurrence of cancer while the other 2 deaths were not caused by cancer (one was due to ischemic stroke while the other was due to a hemorrhagic stroke). Nine patients from the middle-aged group passed away, of which 8 cases were due to recurrence of cancer while the other death was not related to cancer (sudden cardiac death) (Table 4). Comparisons of the sites of recurrent disease, treatment of recurrence, etc. between the two groups of patients showed no statistically significant differences (Table 4).

The 5-year OS rate of the elderly and middle-aged groups was 71 and 75% respectively, without statistical significance (p=0.411, Figure 1). Multivariate analysis revealed that the T-stage and

Table 3. Pathological outcomes of the two groups

Outcomes	*Middle-aged group (n=62) n*	*Elderly group (n=46) n*	*p value*
Pathological TNM stage			0.415
I	5	4	
II	22	20	
III	35	22	
Tumor differentiation			0.711
Well differentiated	19	14	
Moderately differentiated	29	24	
Poorly differentiated	9	6	
Mucinous	5	2	
Harvested lymph nodes (median, range)	19 (13-42)	18 (12-29)	0.107
Lymphovascular invasion			0.681
Yes	45	35	
No	17	11	
Residual tumor (R0/R1/R2)	62/0/0	46/0/0	1.000

Table 4. Tumor recurrence data of the two groups

Recurrences	*Middle-aged group (n=62) n*	*Elderly group (n=46) n*	*p value*
Tumor recurrence	12	9	0.978
Recurrence site			
Locoregional	2	1	
Distant	9	7	
Mixed	1	1	0.300
Time to first recurrence (median, months, range)	19 (11-48)	17 (8-43)	0.486
Mortality	9	9	
Died of cancer recurrence	8	7	
Died of non-cancer-related causes	1	2	

Table 5. Univariate and multivariate analysis for predictive factors of overall survival

Factors	*Univariate Favorable vs unfavorable*	*p value*	*OR*	*Multivariate 95% CI*	*p value*
Age	<70 vs ≥ 70 years	0.411	-	-	-
Sex	Male vs female	0.284	-	-	-
ASA score	I-II vs ≥ III	0.085	1.584	0.557 – 1.874	0.284
T stage	T1-T2 vs ≥T3-T4	0.021	2.254	1.680 – 3.014	0.001
N stage	N0-N1 vs ≥ N2	0.033	2.584	1.541 – 2.987	0.018

OR:odds ratio, 95% CI:95% confidence interval

Table 6. Univariate and multivariate analysis for predictive factors of disease-free survival

Factors	*Univariate Favorable vs unfavorable*	*p value*	*OR*	*Multivariate 95% CI*	*p value*
Age	<70 vs ≥ 70 years	0.318	-	-	-
Sex	Male vs female	0.254	-	-	-
ASA score	I-II vs ≥ III	0.047	1.214	0.487 – 1.547	0.128
T stage	T1-T2 vs ≥T3-T4	0.025	2.238	1.541 – 3.258	0.021
N stage	N0-N1 vs ≥ N2	0.021	2.008	1.321 – 2.357	0.028

OR: odds ratio, 95% CI: 95% confidence interval

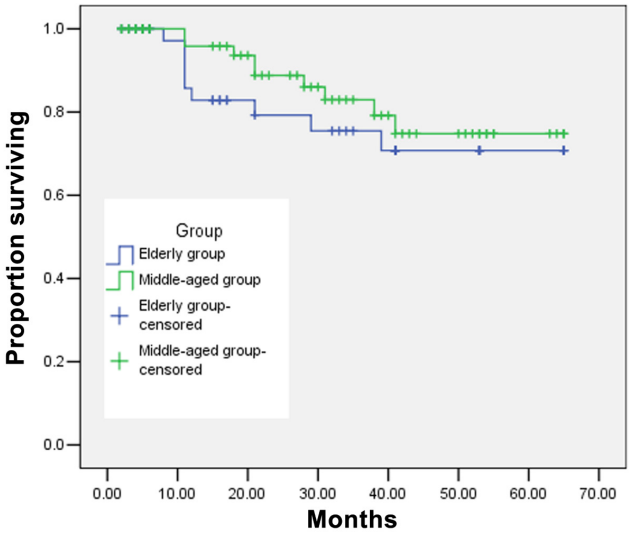

Figure 1. Comparison of overall survival rate between elderly group (≥ 70 years old, 46 cases) and the middle-aged group (55 years ≤ age ≤ 69 years, 62 cases). There was no significant difference between the two groups (p=0.411).

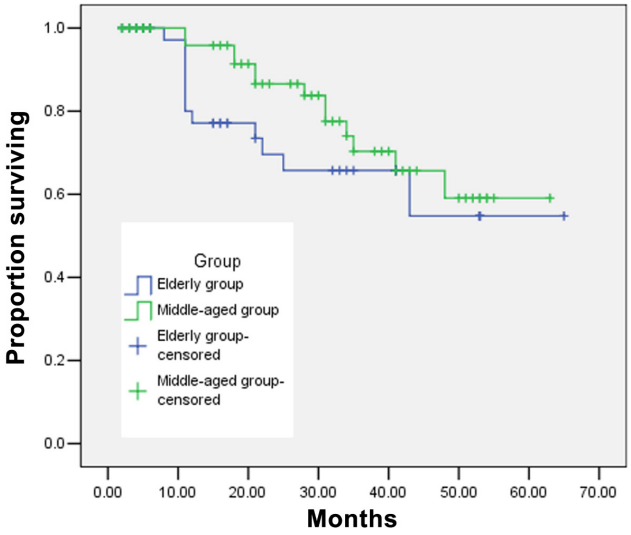

Figure 2. Comparison of disease-free survival rate between elderly group (≥ 70 years old, 46 cases) and the middle-aged group (55 years old ≤ age ≤ 69 years old, 62 cases). There was no significant difference between the two groups (p=0.318).

N-stage were identified as independent predictors for the patient OS (Table 5).

The 5-year DFS rate of the elderly and middle-aged groups was 55 and 59% respectively, showing no statistically significant difference (p=0.318, Figure 2). Multivariate analysis revealed that the T-stage and N-stage of disease were identified as independent predictors for DFS (Table 6). Age was not an independent predictor for OS or DFS.

Discussion

Based on similar principles of embryo anatomy for TME procedures [10], Hohenberger et al. introduced the concept of CME in 2009 in which sharp dissection is carried out in the fascial gap between the colon and the wall of the colon [11], preserving the intactness of colon visceral fascia, clearing as much regional lymph nodes as possible through

ligation of the corresponding blood vessels in the mesangial root [11], reducing the chances of abdominal tumor spreading, and thereby improving the prognosis of colon cancer patients [11]. Since 2011, the National Comprehensive Cancer Network (NCCN) began recommending CME as a standard procedure for locally advanced colon cancer [42]. However, doubts exist over the suitability of performing CME on elderly patients as the excision area is larger in CME than in non-CME, coupled with the physiological degeneration of this group of patients. Based on information retrieved from retrieval databases such as MEDLINE, Embase, Web of Science, Google Scholar and Chemical Abstracts, there are currently no studies written in English on the use of CME for treating elderly colon cancer patients. This study is the first paper to indicate that similar short- and long-term outcomes can be achieved among elderly and middle-aged right colon cancer patients who underwent laparoscopic CME treatment. Hence, laparoscopic CME can be used effectively and safely on elderly right colon cancer patients.

It has been found in our study that the amount of blood loss during surgery is higher among elderly patients than the middle-aged group. The cause of this is the physiological degeneration of elderly patients, which results in the corresponding degeneration of the coagulative function [1-5]. In addition, vascular elasticity is weaker in elderly patients [1-4]. As such, their blood loss during surgery is comparatively higher. Even though their platelet count and coagulation tests prior to surgery showed no obvious abnormalities, coagulation is, however, a very complicated process. At present, the platelet count and coagulation tests, which are routinely used in the clinic, can only give a rough indication of the body's coagulation state. Notwithstanding, the blood transfusion ratio of these two groups was similar, and when compared with previous reports on laparoscopic colectomy, the blood transfusion ratio was also similar [23-29]. This showed that even though elderly right colon cancer patients have higher blood loss when subjected to laparoscopic CME, as long as the perioperative period is properly managed, the blood transfusion ratio will be similar to that of middle-aged patients.

Conversion to open surgery during laparoscopic CME for colon cancer is unavoidable in some cases, as it is in other laparoscopic procedures (such as laparoscopic gastrectomy and laparoscopic liver resection). Previous studies showed that the conversion rate during laparoscopic CME is 2-14% [23-29] and the reasons for the conversion can be classified into cancer-related reasons (such as bulky tumors and T4 stage cancers) and technical-related reasons (such as hemorrhage and adhesions) [23-29]. Our research showed that the difference in conversion rate of both elderly and middle-aged groups, at 9 and 8% respectively, was not significantly different between these two groups of patients and these rates were also similar to conversion rates in past reports. Most of the conversion cases in these two groups were mainly due to tumor reasons.

Relevant guidelines for treating colorectal cancer recommend the commencement of adjuvant chemotherapy 4-8 weeks after surgery for high-risk stage II and stage III cancer patients [30-32]. This showed that similar chemotherapy compliance can be achieved for elderly right colon cancer patients who underwent laparoscopic CME. Our study showed that the OS and DFS rates were similar between the two groups, which is related to their similarity in chemotherapy compliance.

There is currently no consensus on the definition of elderly colon cancer patients. Different studies set different standards with defined age groups ranging from those above 65 years old to those above 80 years old [43-49]. However, most of the clinical studies, both locally and overseas, defined this age group to be between 65 and 75 years old. Our study has defined this age group as those who are 70 years old and above.

It was noted that presently there are no studies written in English on the long-term outcomes of elderly colon cancer patients who underwent CME. Our study is the first to report on the long-term outcomes of elderly colon cancer patients who underwent laparoscopic CME. Based on previous studies, the 5-year OS and 5-year DFS rates of right colon cancer patients who underwent laparoscopic CME is 70-90% and 51-59%, respectively. The 5-year OS and 5-year DFS rates of right colon cancer patients in our study were similar to past papers and between the two groups. In our study, the cause of death among elderly patients was mainly due to the recurrence of cancer while a handful of them passed away due to non-cancer-related causes. This showed that as long as an elderly right colon cancer patient is deemed suitable for laparoscopic CME, such treatment ought to be given to the elderly patient so as to achieve a similar long-term survival rate to that of middle-aged patients. For colon cancer treatments, non-surgical treatments have limited effects and their 5-year OS is 0%. Currently in China, the expected life expectancy among the older population shows a rising trend. Therefore, old age is not a limiting factor in the application of laparoscopic CME.

However, we acknowledge that this study has several limitations. First, it was a retrospective study based on a single center and not a pro-

spective randomized analysis. Second, the sample size was small and the follow-up period was not very long. These limitations should be considered when interpreting our study results. In the future, a multicenter prospective randomized controlled study with longer follow-up period is necessary to validate the safety of laparoscopic CME for elderly patients with right colon cancer.

Conclusion

In conclusion, our study shows that the application of laparoscopic CME in elderly right colon cancer patients did not increase the incidence of complications and death, and it is possible to achieve similar long-term outcomes comparable to that of middle-aged patients. Old age is not a limiting factor for elderly right colon cancer patients to undergo laparoscopic CME.

Acknowledgements

We sincerely thank our hospital colleagues who participated in this research.

Conflict of interests

The authors declare no conflict of interests.

References

1. Choi Y, Sateia HF, Peairs KS, Stewart RW. Screening for colorectal cancer. Semin Oncol 2017;44:34-44.
2. Wakeman C, Keenan J, Eteuati J et al. Chemoprevention of colorectal neoplasia. ANZ J Surg 2017;87:E228-32.
3. Haywood M, Molyneux C, Mahadevan V, Srinivasaiah N. Right colic artery anatomy: a systematic review of cadaveric studies. Tech Coloproctol 2017;21:937-43.
4. Merchant SJ, Nanji S, Brennan K et al. Management of stage III colon cancer in the elderly: Practice patterns and outcomes in the general population. Cancer 2017;123:2840-9.
5. Egenvall M, Schubert Samuelsson K, Klarin I et al. Management of colon cancer in the elderly: a population-based study. Colorectal Dis 2014;16:433-41.
6. Kim GM, Ahn JB, Rha SY et al. Changing treatment patterns in elderly patients with resectable colon cancer. Asia Pac J Clin Oncol 2013;9:265-72.
7. Buczacki SJ, Davies RJ. Colon resection: is standard technique adequate? Surg Oncol Clin N Am 2014;23:25-34.
8. Emile SH. Laparoscopic intersphincteric resection for low rectal cancer: technique, oncologic, and functional outcomes. Minim Invasive Surg Oncol 2017;1:74 -84.
9. Tran V, Lyon M, Ha SC, Warncke J, Cost N, Wilson S. Review of management options for localized renal cell carcinoma. Minim Invasive Surg Oncol 2017;1:85 -102.
10. Heald RJ, Husband EM, Ryall RD. The mesorectum in rectal cancer surgery--the clue to pelvic recurrence? Br J Surg 1982;69:613-16.
11. Hohenberger W, Weber K, Matzel K, Papadopoulos T, Merkel S. Standardized surgery for colonic cancer: complete mesocolic excision and central ligation-technical notes and outcome. Colorectal Dis 2009;11:354-64; discussion 364-65.
12. Bertelsen CA, Neuenschwander AU, Jansen JE et al. Disease-free survival after complete mesocolic excision compared with conventional colon cancer surgery: a retrospective, population-based study. Lancet Oncol 2015;16:161-8.
13. Bertelsen CA, Neuenschwander AU, Jansen JE et al. Short-term outcomes after complete mesocolic excision compared with 'conventional' colonic cancer surgery. Br J Surg 2016;103:581-9.
14. Storli KE, Søndenaa K, Furnes B et al. Short term results of complete (D3) vs. standard (D2) mesenteric excision in colon cancer shows improved outcome of complete mesenteric excision in patients with TNM stages I-II. Tech Coloproctol 2014;18:557-64.
15. Merkel S, Weber K, Matzel KE et al. Prognosis of patients with colonic carcinoma before, during and after implementation of complete mesocolic excision. Br J Surg 2016;103:1220-9.
16. Jacobs M, Verdeja JC, Goldstein HS. Minimally invasive colon resection (laparoscopic colectomy). Surg Laparosc Endosc 1991;1:144-50.
17. Clinical Outcomes of Surgical Therapy Study Group. A comparison of laparoscopically assisted and open colectomy for colon cancer. N Engl J Med 2004;350:2050-9.
18. Fleshman J, Sargent DJ, Green E et al. Laparoscopic colectomy for cancer is not inferior to open surgery based on 5-year data from the COST Study Group trial. Ann Surg 2007;246:655-62; discussion 662-4.
19. Colon Cancer Laparoscopic or Open Resection Study Group, Buunen M, Veldkamp R et al. Survival after laparoscopic surgery versus open surgery for colon cancer: long-term outcome of a randomised clinical trial. Lancet Oncol 2009;10:44-52.
20. Jayne DG, Thorpe HC, Copeland J et al. Five-year follow-up of the Medical Research Council CLASICC trial of laparoscopically assisted versus open surgery for colorectal cancer. Br J Surg 2010;97:1638-45.
21. Bagshaw PF, Allardyce RA, Frampton CM et al. Long-term outcomes of the australasian randomized clinical trial comparing laparoscopic and conventional open surgical treatments for colon cancer: the Australasian Laparoscopic Colon Cancer Study trial. Ann Surg 2012;256:915-9.

22. Ng SS, Lee JF, Yiu RY et al. Long-term oncologic outcomes of laparoscopic versus open surgery for rectal cancer: a pooled analysis of 3 randomized controlled trials. Ann Surg 2014;259:139-47.
23. Bae SU, Saklani AP, Lim DR et al. Laparoscopic-assisted versus open complete mesocolic excision and central vascular ligation for right-sided colon cancer. Ann Surg Oncol 2014;21:2288-94.
24. Shin JK, Kim HC, Lee WY et al. Laparoscopic modified mesocolic excision with central vascular ligation in right-sided colon cancer shows better short- and long-term outcomes compared with the open approach in propensity score analysis. Surg Endosc 2017 Nov 3. [Epub ahead of print]
25. Han DP, Lu AG, Feng H et al. Long-term outcome of laparoscopic-assisted right-hemicolectomy with D3 lymphadenectomy versus open surgery for colon carcinoma. Surg Today 2014;44:868-74.
26. Sheng QS, Pan Z, Chai J et al. Complete mesocolic excision in right hemicolectomy: comparison between hand-assisted laparoscopic and open approaches. Ann Surg Treat Res 2017;92:90-6.
27. Kim IY, Kim BR, Choi EH, Kim YW. Short-term and oncologic outcomes of laparoscopic and open complete mesocolic excision and central ligation. Int J Surg 2016;27:151-7.
28. Gouvas N, Pechlivanides G, Zervakis N, Kafousi M, Xynos E. Complete mesocolic excision in colon cancer surgery: a comparison between open and laparoscopic approach. Colorectal Dis 2012;14:1357-64.
29. Storli KE, Søndenaa K, Furnes B, Eide GE. Outcome after introduction of complete mesocolic excision for colon cancer is similar for open and laparoscopic surgical treatments. Dig Surg 2013;30:317-27.
30. Kannarkatt J, Joseph J, Kurniali PC, Al-Janadi A, Hrinczenko B. Adjuvant Chemotherapy for Stage II Colon Cancer: A Clinical Dilemma. J Oncol Pract 2017;13:233-41.
31. Wu C. Systemic Therapy for Colon Cancer. Surg Oncol Clin N Am 2018;27:235-42.
32. Iqbal A, George TJ. Randomized Clinical Trials in Colon and Rectal Cancer. Surg Oncol Clin N Am 2017;26:689-704.
33. Clavien PA, Barkun J, de Oliveira ML et al. The Clavien-Dindo classification of surgical complications: five-year experience. Ann Surg 2009;250:187-96.
34. Zhou X, Wang L, Shen W. Laparoscopic surgery as a treatment option for elderly patients with colon cancer. J BUON 2017;22:424-30.
35. Guo S, Tang D, Chen X, Chen M, Xiang Y. Laparoscopic colectomy for serosa-positive colon cancer (pT4a) in patients with preoperative diagnosis of cancer without serosal invasion. JBUON 2017;22:679-85.
36. Dong J, Wang W, Yu K et al. Outcomes of laparoscopic surgery for rectal cancer in elderly patients. JBUON 2016;21:80-6.
37. Sekiguchi M, Matsuda T, Saito Y. Surveillance after endoscopic and surgical resection of colorectal cancer. Best Pract Res Clin Gastroenterol 2016;30:959-70.
38. Emile SH. Evolution and clinical relevance of different staging systems for colorectal cancer. Minim Invasive Surg Oncol 2017;1:43-52.
39. Emile SH. Advances in laparoscopic surgery for colorectal cancer: fluorescence- guided surgery. Minim Invasive Surg Oncol 2017;1:53-65.
40. Ielpo B, Duran H, Diaz E et al. Colorectal robotic surgery: overview and personal experience. Minim Invasive Surg Oncol 2017;1:66-73.
41. Kahi CJ, Boland CR, Dominitz JA et al. Colonoscopy Surveillance After Colorectal Cancer Resection: Recommendations of the US Multi-Society Task Force on Colorectal Cancer. Gastroenterology 2016;150:758-68.
42. Benson AB 3rd, Venook AP, Cederquist L et al. Colon Cancer, Version 1.2017, NCCN Clinical Practice Guidelines in Oncology. J Natl Compr Canc Netw 2017;15:370-98.
43. Otsuka K, Kimura T, Hakozaki M et al. Comparative benefits of laparoscopic surgery for colorectal cancer in octogenarians: a case-matched comparison of short- and long-term outcomes with middle-aged patients. Surg Today 2017;47:587-94.
44. Koh FH, Wong J, Tan JK et al. Laparoscopic colorectal surgery is safe and benefits octogenarian patients with malignant disease: a matched case-control study comparing laparoscopic and open colorectal surgery. Int J Colorectal Dis 2015;30:963-8.
45. Lim SW, Kim YJ, Kim HR. Laparoscopic surgery for colorectal cancer in patients over 80 years of age: the morbidity outcomes. Ann Surg Treat Res 2017;92:423-8.
46. Niitsu H, Hinoi T, Kawaguchi Y et al. Laparoscopic surgery for colorectal cancer is safe and has survival outcomes similar to those of open surgery in elderly patients with a poor performance status: subanalysis of a large multicenter case-control study in Japan. J Gastroenterol 2016;51:43-54.
47. Moon SY, Kim S, Lee SY et al. Laparoscopic surgery for patients with colorectal cancer produces better short-term outcomes with similar survival outcomes in elderly patients compared to open surgery. Cancer Med 2016; 5:1047-54.
48. Hinoi T, Kawaguchi Y, Hattori M 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.
49. Robinson CN, Balentine CJ, Marshall CL et al. Minimally invasive surgery improves short-term outcomes in elderly colorectal cancer patients. J Surg Res 2011;166:182-8.