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Outcomes of Laparoscopic Surgery for Colorectal Cancer in Elderly Patients

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ABSTRACT

Objective: To evaluate the short-term outcomes of laparoscopic colorectal surgery for cancer in the elderly compared with younger patients.

Methods: We retrospectively considered a consecutive unselected series of 159 patients who underwent elective laparoscopic procedures for colorectal cancer at our institution between January 2007 and December 2009. Of these patients, 101 (63.5%) were ≤70 years of age (Group A), and 58 (36.5%) were >70 (Group B). Operative steps and instrumentation were standardized. Demographics, disease-related, operative, and short-term data were analyzed for each group, and an appropriate statistical comparison was made. Comorbidity was quantified by using the Charlson Comorbidity Index.

Results: We reviewed right colectomies (29.5%), left colectomies (44.7%), rectal resections (19.5%), and other procedures (6.3%). There was no significant difference in sex ratio, body mass index, American Society of Anesthesiology score, type of surgical procedures, and tumor stage between Group A and Group B. A statistically higher comorbidity according to the Charlson index characterized Group B (2.2 vs 3.8; P=.034). Median operative time (228±78.1min vs 224.3±97.6min; NS), estimated blood loss (50.0±94.8mL vs 31.2±72.7mL; NS), conversion rate (2.0% vs 1.7%; NS), and timing to canalization (4.5±1.7dd vs 4.4±1.3dd; NS) were statistically comparable in both Groups. Group B was associated with a significantly longer length of hospital stay compared with Group A (8.1±2.8dd vs 10.8±6.6dd; P<.01) There was no statistically significant difference in major postoperative complications (3.8% vs 3.4%; NS), reoperations (0.9% vs 1.7%; NS), and 30-day mortality (0% vs 1.7%; NS).

Conclusions: Laparoscopic colorectal surgery appears feasible and safe in elderly patients with increased comorbidity.

Key Words: Laparoscopic surgery, Colorectal cancer, Elderly patients.

INTRODUCTION

The constant improvements in healthcare and technology have increased life expectancy, particularly in Western countries. Globally, the World Health Organization reports that 2 billion people (23% of the population worldwide) will be older than 60 in the year 2050. In Italy, the last National Institute of Statistics (ISTAT) census in 2001 estimated that 18% of the country's population was over 65 years of age. Colorectal cancer (CRC) is a major cause of morbidity and mortality in the elderly, because >70% of cases occur in people over 65 years of age.[1]

It is felt that, because of an aging population, surgeons will be operating on an increasing amount of CRC in elderly patients. Compared to conventional procedures, laparoscopic colorectal surgery (LCS) is associated with less postoperative pain, better pulmonary function, reduced ileus, and a shorter hospital stay.[2-3] Moreover, randomized clinical trials and a metaanalysis have recognized that the long-term oncologic outcome of LCS procedures is at least comparable to that of open surgery (OS).[4-5]

This study aims to evaluate the short-term outcomes of LCS for CRC in elderly patients, assuming that there are no statistically significant differences compared with younger patients.

METHODS

We retrospectively considered a consecutive unselected series of 159 patients who underwent elective LCS for CRC at our institution between January 2007 and December 2009. Of these patients, 101 (63.5%) were ≤70 years of age (Group A), and 58 (36.5%) were >70 (Group B).

Patients with open procedures, surgery for benign diseases, and emergency operations were excluded from this study. Exclusion criteria for LCS were only the denial of consent by

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the patient and the cases of bowel obstruction not treatable by colonic stent as a bridge to LCS. In patients with a history of extensive adhesions, we decided to continue the operation by laparoscopy or convert it to conventional surgery only after an exploratory laparoscopy.

We considered right colectomies, left colectomies, and rectal resections. Patients in the group "Others" underwent laparoscopic transverse resections and Miles procedures.

Data on demographics of patients, disease features, operative details, and follow-up were extracted from a prospectively collected database, and further clinical information was obtained by the review of clinical papers. Comorbidity was weighted using the Charlson comorbidity index (CCI).

Preoperative care was standardized. All patients followed a low-fiber diet with a high-caloric intake during the 5 days prior to surgery, and no bowel preparation was performed. A nasogastric tube and a urinary catheter were placed after induction of general anesthesia in all cases.

All patients were treated with broad-spectrum intravenous antibiotics (Ceftizoxime + Metronidazole).

All procedures were performed or supervised by the same surgeon (IS). Operative steps and surgical instruments were completely standardized. All were 4-port laparoscopic procedures. Dissection was performed using a Harmonic scalpel, vascular trunks were ligated using Endoclips or stapled by a white-load linear laparoscopic device.

Regarding laparoscopic right colectomies, we performed medial-to-lateral operations both with extracorporeal and intracorporeal ileocolic anastomosis, because, in our learning curve, we have previously performed this procedure with laparoscopic assistance. For the last 3 years a totally laparoscopic technique has been routine. In laparoscopic left colectomies and rectal resections, we performed a conventional medial-to-lateral approach with a Knight-Griffen mechanical end-to-end anastomosis. For rectal cancers, a total mesorectal excision (TME) was always performed. Mid and low rectal anastomoses were made nonfunctional with a loop ileostomy. Drains were not used routinely.

Postoperative care was standardized. All patients were mobilized early, with removal of the urinary catheter. Nasogastric tube was removed after the first flatus, and then the patient began oral intake. Criteria for the discharge included the absence of symptoms, tolerance to a minimum of 3 meals without restrictions and passage of stool.

Clinical follow-up was performed on the 5th and 30th days after hospital discharge.

Continuous variables are expressed as mean ± standard deviation and were analyzed with the Student *t* test, while categorical ones are expressed as percentage value and were analyzed with Fischer's test or chi-square test, when appropriate. $P<.05$ was considered statistically significant. SPSS v. 18.0.0 (SPSS Inc., Chicago, IL, USA) was used for the analysis.

RESULTS

We analyzed right colectomies (29.5%), left colectomies (44.7%), rectal resections (19.5%), and other procedures (6.3%). Demographics and disease-related data are summarized in **Table 1**.

There was no significant difference in sex ratio, body mass, and ASA score between Group A and Group B. Type of surgical procedures was also similar.

Evaluation of specimens is outlined in **Table 2**. There were no significant differences between the 2 groups in the number of lymph nodes harvested and in the histopathologic findings, although Group A had a significantly greater number of patients in stage IV of the disease.

Group B was associated with a statistically higher comorbidity according to CCI (2.2 vs 3.8; $P=.034$). **Table 3** shows data related to operations and short-term outcome.

Median operative time (228±78.1min vs 224.3±97.6min; NS), estimated blood loss (50.0±94.8mL vs 31.2±72.7mL; NS), conversion rate (2.0% vs 1.7%; NS), and timing of first defecation (4.5±1.7 dd vs 4.4±1.3dd; NS) were statistically comparable in both Groups.

A significantly longer length of hospital stay characterized Group B compared with Group A (8.1±2.8dd vs 10.8±6.6dd; $P<.01$).

There was no statistically significant difference in terms of major postoperative complications (3.8% vs 3.4%; NS), reoperations (0.9% vs 1.7%; NS), and 30-day mortality (0% vs 1.7%; NS).

DISCUSSION

Since the first report by Jacobs in 1991,[6] improvements in technology and standardization of techniques have contributed to diffusion of LCS, and a lot of studies have been published about this topic. Nowadays, short-term benefits of LCS compared to OS are well known and include less pain, better pulmonary function, shorter postoperative

Table 1.
Demographics and Disease Related Data (mean ± SD)–(#, %)

	Group A (≤70yo)	Group B (>70yo)	P Value
	n = 101 (%)	n = 58 (%)	
Age	60.4 ±6.6	77.1 ±4.5	
Male/Female	60/ 41 (59.4/40.6)	26/ 32 (44.8/55.2)	.075
BMI[a]	26.2 ±3.9	24.8 ±3.5	.231
ASA Score[b]			
I	20 (19.8)	9 (15.5)	.500
II	77 (76.2)	40 (69.0)	.316
II	4 (4.0)	7 (12.1)	.052
IV	0 (0)	2 (3.4)	.060
Comorbidity CCI[c]	2.2	3.8	.034
Surgical Procedures			
Right colectomy	29 (28.7)	18 (31.0)	.757
Left colectomy	44 (43.6)	27 (46.5)	.715
Rectal resection	21 (20.8)	10 (17.4)	.586
Others[d]	7 (6.9)	3 (5.1)	.660

[a]BMI=Body mass index.
[b]ASA=American Society of Anesthesiology.
[c]CCI=Charlson Comorbidity Index.
[d]Laparoscopic transverse resections and laparoscopic Miles procedure.

Table 2.
Short-term Outcome (mean ± SD)–(#, %)

	Group A (≤70 y)	Group B (>70 y)	P Value
	n = 101	n = 58	
Operative Time (min)	228 ± 78.1	224.3 ± 97.6	0.793
Estimated Blood Loss (mL)	50,0 ± 94.8	31.2 ± 72.7	0.193
Timing of First Stool (d)	4,5 ± 1.7	4.4 ± 1.3	0.699
Hospital stay (d)	8,1 ± 2.8	10.8 ± 6.6	<0.01
Conversions	2 (2.0%)	1 (1.7)	0.909
Anastomotic Leakage	3 (2.9%)	1 (1.7%)	0.629
Other Major Complications	1 (0.9%)	1 (1.7%)	0.689
Reoperations	1 (0%)	1 (1.7%)	0.689
30-Days Mortality	0 (0%)	1 (1.7%)	0.185

ileus and hospital stay.[2-5] In addition, recent randomized clinical trials and a meta-analysis show, with level 1 evidence, that LCS achieves good oncological results compared to OS.[6-10]

This study was designed to determine whether these advantages could also be applied to the elderly, starting from the consideration that the increased life expectancy in western countries will lead us to a growing

Table 3.
Short-term Outcome (mean ± SD)–(#, %).

	Group A (≤70yr)	Group B (>70yr)	P Value
	n = 101 (%)	n = 58 (%)	
Operative time (min)	228 ±78.1	224.3 ±97.6	.793
Estimated blood loss (mL)	50.0 ±94.8	31.2 ±72.7	.193
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Hospital stay (dd)	8.1 ±2.8	10.8 ±6.6	<.01
Conversions	2 (2.0)	1 (1.7)	.909
Anastomotic leakage	3 (2.9)	1 (1.7)	.629
Other major complications	1 (0.9)	1 (1.7)	.689
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30-day mortality	0 (0)	1 (1.7)	.185

number of colorectal resections in patients over 70 years of age.

We have set the cut off age of 70 years as the threshold conventionally chosen by the scientific community to define old age, and it is also the master indicator most widely used.

We believe that patients, such as the elderly, who have more comorbidities could benefit from better postoperative inflammatory response that characterizes LCS. However, data from the current literature are contradictory and unclear about the real risks or benefits of LCS in the elderly.

Two large studies[7,8] including 1421 and 1316 patients, respectively, were conducted to identify predictive risk factors for intra- and postoperative complications following LCS procedures. Both studies stated that patient age, over 70 for the Association Française de Chirurgie Study Group,[12] over 75 for Kirchhoff et al,[13] independently increased the risk of postoperative complications. Nevertheless, the largest comparative study of LCS in the elderly by Tan et al[9] concluded that age was not an independent predictor of morbidity and mortality of LCS for CRC.

As can be seen in **Table 4**, some authors compared LCS in older patients with OS, and substantially all of them suggested the great benefit of minimally invasive procedures.[10-22] Only a few comparative studies have compared the outcomes of LCS in the elderly with that in younger patients. However, in the study by Schwandner et al,[11] types of LCS procedures were not comparable between elderly and younger cohorts, while Reissman and colleagues[12] used a cut-off of 60 years old, which is too early in our view. Finally, Yamamoto et al[13] compared 34 patients ≤60 of age to only 17 octogenarians, and the number of laparoscopic rectal resections was quite small.

Only the article from Chautard et al[14] has not shown biases in patient recruitment and selection, observing a large series of LCS procedures with a high percentage of rectal resections (34% of overall) and obtaining similar postoperative outcomes in patients over 70 compared with younger ones.

Here, our 2 series of patients were homogeneous in terms of tumor stage and type of surgery, with a statistically proper percentage of rectal resections. In addition, the homogeneity of our groups was confirmed by the fact that a single surgeon performed, or supervised, or both, all procedures.

Predictably, older patients showed a significantly higher incidence of comorbidity according to CCI. The Charlson Comorbidity Index is a method with 22 variables, such as heart diseases, diabetes, AIDS, or previous cancer, to measure comorbidity. Despite the fact that its use was not originally by surgeons,[15] in our opinion CCI represents a good index to weigh comorbid conditions of patients and to predict postoperative complications. In fact, the surgical risk is directly correlated to the number of comorbidities of a patient. Remember that a CCI >3 is associated with a 1-year mortality, twice that of a score of <3. So the

Table 4.
Summary of Articles Studying the Impact of LCS on Elderly Patients

	Year	Operation[a]	n	Age	Conversion rate (%)	Hospital stay (dd)	Morbidity (%)	Mortality (%)
Reissman[24]	1996	LCS	36	<60	8	5.2	11	0
		LCS	36	>60	11	6.5	14	0
Schwandner[23]	1999	LCS	65	<50	3.1	11.5	4.6	
		LCS	138	50-70	9.4	13.3	10.1	
		LCS	95	>70	7.4	17.2	9.5	
Stewart[15]	1999	LCS	42	>80	11.9	9	16.6	7.1
		OCS	35	>80		17	42.8	11.4
Delgado[16]	2000	LCS	70	<70	11.4	5 ±2	11.4	0
		OCS	59	<70		7 ±3	20.3	0
		LCS	59	>70	16.9	6 ±2	10.01	1.6
		OCS	67	>70		7 ±3	31.3	0
Tuech[17]	2000	LCS	22	>75	9	13.1	18	0
		OCS	24	>75		20.2	50	0
Stocchi[18]	2000	LCS	42	>75	14.3	6.5	14.3	0
		OCS	42	>75		10.2	33.3	0
Law[19]	2002	LCS	65	>70	12.3	7	27.7	1.5
		OCS	89	>70		9	37	5.6
Senagore[20]	2003	LCS	181	<60		3.9 ±5.9	10.5	0
		OCS	122	<60		6.1 ±3.0	13.1	0
		LCS	50	>70		4.2 ±3.0	16	0
		OCS	123	>70		9.3 ±7.6	37.4	1.6
Sklow[22]	2003	LCS	38	<75	16	6.7	29	0
		OCS	38	<75		7.7	37	0
		LCS	39	>75	8	3.9	31	2.6
		OCS	39	>75		4.9	31	0
Yamamoto[25]	2003	LCS	34	<60	0	9	23.5	0
		LCS	17	>80	0	10	11.7	0
Feng[21]	2006	LCS	51	>70	3.9		17.6	0
		OCS	102	>70			37.3	1.9
Chautard J [26]	2008	LCS	103	<70	16	10 ±9	27	0
		LCS	75	>70	21	11 ±8	32	0
Tan KY [14]	2010	LCS	379	<70	8		13	0.3
		LCS	91	>75	7		15	3

[a]LCS = Laparoscopic Colorectal Surgery; OCS = Open Colorectal Surgery.

indexes of our 2 groups express properly the risk of postoperative complications, emerging statistically higher in the elderly. But we have not recorded significant differences in terms of ASA score, which is typically a pattern of preoperative evaluation.

Although we registered different comorbidity scores, there were no significant differences in term of operative time, blood loss, and conversion rate between our 2 study groups, and this underlines the fact that we have not encountered major technical difficulties in laparoscopic

procedures in older patients. There was also a sort of scepticism about LCS in elderly patients, due to the potential adverse hemodynamic effects both by the prolonged pneumoperitoneum and the extreme positions of patients during the laparoscopic operations, but we did not encounter any anesthesiological problems related to circulation during the procedures.

Laparoscopic surgery is associated with less surgical trauma and therefore with a lower systemic response to surgical stress.[16] This aspect provides advantages to patients at high risk, such as the elderly, improving postoperative outcomes and providing good results, comparable to outcomes in younger patients.

In our experience, the low rate of anastomotic leakage and other postoperative complications, reoperations, and 30-day mortality suggests that LCS should be the preferred choice for elderly persons undergoing colorectal surgery. Only the length of hospital stay was significantly higher in our over 70 group, although the postoperative management of patients has been completely standardized according to the procedure. This is explained both by increased caution in the discharge of the elderly and, sometimes, our intention to meet the needs of these patients and their families.

CONCLUSION

LCS appears feasible and safe in elderly patients with increased comorbidity. In our experience, aging did not bring about a significant worsening of intra- and postoperative outcomes after laparoscopic colorectal procedures.

References:

1. Colorectal Cancer Collaborative Group. Surgery for colorectal cancer in elderly patients: a systematic review. *Lancet*. 2000; 356(9234):968–974.

2. Lacy AM, Garcia-Valdecasas JC, et al. Laparoscopic-assisted colectomy versus open colectomy for treatment of non-metastatic colon cancer: a randomized trial. *Lancet*. 2002;359(9325): 2224–2229.

3. Weeks JC, Nelson H, Gelber S, Sargent D, Schroeder G. Clinical outcomes of Surgical Therapy (COST) Study Group. Short-term quality-of-life outcomes following laparoscopic-assisted colectomy vs. open colectomy for colon cancer: a randomized trial. *JAMA*. 2002;287(3):321–328.

4. Veldkamp R, Kuhry E, Hop WC, et al. Colon cancer laparoscopic or open resection laparoscopic surgery versus open surgey for colon cancer: short-term results of a randomized trial. *Lancet Oncol*. 2005;6(7):477–484.

5. Schwenk W, Haase O, Neudecker J, Muller JM. Short-term benefits for laparoscopic colorectal resection. *Cochrane Database Syst Rev*. 2005;20(3):CD003125.

6. Braga M, Frasson M, Vignali A, Zuliani W, Civelli V, Di Carlo V. Laparoscopic versus open colectomy in cancer patients: long-term complications, quality of life, and survival. *Dis Colon Rectum*. 2005;48:2217–2223.

7. Liang JT, Huang KC, Lai HS, Lee PH, Jeng YM. Oncologic results of laparoscopic versus conventional open surgery for stage II or III left-sided colon cancers: a randomized controlled trial. *Ann Surg*. 2007;14(1):109–117.

8. Jayne DG, Guillou PJ, Thorpe H, et al. Randomized trial of laparoscopic-assisted resection of colorectal carcinoma: 3-year results of the UK MRC CLASICC trial group. *J Clin Oncol*. 2007; 25(21):3061–3068.

9. Kuhry E, Schwenk W, Gaupset R, Romild U, Bonjer HJ. Long-term results of laparoscopic colorectal cancer resection. *Cochrane Database Syst Rev*. 2008;Issue 2:CD003432.

10. Transatlantic Laparoscopically Assisted vs Open Colectomy Trials Study Group. Laparoscopically assisted vs open colectomy for colon cancer. A meta-analysis. *Arch Surg*. 2007;142:298–303.

11. Jacobs M, Verdeja JC, Goldstein HS. Minimally invasive colon resection (laparoscopic colectomy). *Surg Laparosc Endosc*. 1991;1(3):144–150.

12. Alves A, Panis Y, Mathieu P, Mantion G, Kwiatkowski F, Slim K. Association Française de Chirurgie. Postoperative mortality and morbidity in French patients undergoing colorectal surgery: results of a prospective multicenter study. *Arch Surg*. 2005; 140(3):278–283.

13. Kirchhoff P, Dincler S, Buchmann P. A multivariate analysis of potential risk factors for intra- and postoperative complications in 1316 elective laparoscopic colorectal procedures. *Ann Surg*. 2008;248(2):259–265.

14. Tan KY, Konishi F, Kawamura YJ, Maeda T, Sasaki J, Tsujinaka S, Horie H. Laparoscopic colorectal surgery in elderly patients: a case-control study of 15 years of experience. *Am J Surg*. 2011 Apr;(4):531–536. Epub 2010 Jun 3.

15. Stewart BT, Stitz RW, Lumley JW. Laparoscopically assisted colorectal surgery in the elderly. *Br J Surg*. 1999;86:938–941.

16. Delgado S, Lacy AM, García Valdecasas JC, et al. Could age be an indication for laparoscopic colectomy in colorectal cancer? *Surg Endosc*. 2000;14:22–26.

17. Tuech JJ, Pessaux P, Rouge C, Regenet N, Bergamaschi R, Arnaud JP. Laparoscopic vs open colectomy for sigmoid diverticulitis: a prospective comparative study in the elderly. *Surg Endosc*. 2000;14:1031–1033.

18. Stocchi L, Nelson H, Young-Fadok TM, Larson DR, Ilstrup DM. Safety and advantages of laparoscopic vs open colectomy in the elderly. Matched-control study. *Dis Colon Rectum*. 2000;43: 326–332.

19. Law WL, Chu KW, Tung PHM. Laparoscopic colorectal resection: a safe option for elderly patients. *J Am Coll Surg*. 2002; 195:768–773.

20. Senagore AJ, Madbouly KM, Fazio VW, Duepree HJ, Brady KM, Delaney CP. Advantages of laparoscopic colectomy in older patients. *Arch Surg*. 2003;138:252–256.

21. Feng B, Zheng MH, Mao ZH, et al. Clinical advantages of laparoscopic colorectal cancer surgery in the elderly. *Aging Clin Exp Res*. 2006;18:191–195.

22. Sklow B, Read T, Birnbaum E, Fry R, Fleshman J. Age and type of procedure influence the choice of patients for laparoscopic colectomy. *Surg Endosc*. 2003;17:923–929.

23. Schwandner O, Schiedeck THK, Bruch HP. Advanced age – indication or contraindication for laparoscopic colorectal surgery? *Dis Colon Rectum*. 1999;42:356–362.

24. Reissman P, Agachan F, Wexner SD. Outcome of laparoscopic colorectal surgery in older patients. *Am Surg*. 1996;62: 1060–1063.

25. Yamamoto S, Watanabe M, Hasegawa H, Baba H, Kitajima M. Short-term surgical outcomes of laparoscopic colonic surgery in octogenarians. A matched case-control study. *Surg Laparosc Endosc Percutan Tech*. 2003;13:95–100.

26. 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;206:255–260.

27. Charlson ME, Pompei P, Ales KL, MacKenzie CR. A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. *J Chron Dis*. 1987;40(5): 373–383.

28. Buunen M, Gholghesaei M, Veldkamp R, Meijer W, Bonjer HJ, Bouvy D. Stress response to laparoscopic surgery. A review. *Surg Endosc*. 2004;18:1022–1028.