

Laparoscopic colectomy is a reliable option for colon cancer treatment



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Mario Guerrieri, Lorenzo Organetti, Maddalena Baldarelli, Chiara Romiti, Roberto Campagnacci

Clinica di Chirurgia Generale e Metodologia Chirurgica, Ospedali Riuniti-Università Politecnica delle Marche, Ancona, Italy

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AIMS: *To report oncological results in a remarkable single institution series of laparoscopic colectomy for cancer.*

METHODS: *340 not selected patients with adenocarcinoma of colon underwent laparoscopic colonic resection in a five years period (2004-2008). Of the 340 patients, there were 185 male and 155 female. The mean age was 68 years (31-92). Of the 340 procedures, 175 were laparoscopic right colectomy and 165 laparoscopic left colectomy. No tumor touch technique, ligation at vascular origin, adequate lymphadenectomy and minilaparotomy protection against cells implant was the main landmarks of all cases.*

RESULTS: *There was no intraoperative mortality. Twenty patients (5.8%) were converted to open surgery. Two patients (0.58%) died in the postoperative period. Five major complications occurred (1.5%) in the postoperative period. The average hospital stay for patients who underwent right colectomy was 6.7 days (4-27) and 6.9 for patients underwent left hemicolectomy (4-23). The average number of lymph nodes removed was 15.6. In a mean 38 months follow-up (25-78) there were 16 incisional hernias, 12 after right colectomy and 4 after left. Eight patients (4.5%) who underwent laparoscopic right colectomy and ten (6%) of the left colectomy group developed a metastatic disease. The overall mortality rate was 10.8%; 14.3% for patients who underwent resection of the right colon and 7.2% for the left colectomy series.*

CONCLUSIONS: *Laparoscopic colectomy for cancer is feasible, safe and not encumbered by an higher complications rate compared to open colectomy. If the oncological criteria are respected, the results are at least noninferior to the open access.*

KEY WORDS: Colon cancer, Laparoscopic colectomy, Right/left colectomy.

Introduction

Minimally invasive surgery has rapidly gained acceptance in the past two decades, deeply changing a significant part of surgical practice such that at the present time laparoscopy is involved in almost all abdominal proce-

dures. However, its beginning was marked by disputes and skepticism, particularly when laparoscopy was advocated as hypothetical technique over the cancer treatment. In this way, many oncological concerns were raised since the early 1990s, based on the adequacy of the laparoscopic manoeuvres in facing malignancy, the pneumoperitoneum as a possible cause of tumor dissemination with peritoneal, trocar site or minilaparotomy implants, and, at least, the common sense denial by using a so challenging technique in cases in which patients would have been potentially curable by the open way. Moreover, in this particular instance, colonic resections pointed out specific questions concerning the suitability of laparoscopy in achieving a correct oncological resection, with the appropriate number of the lymph node harvested, the vascular ligatures at their origin and the

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Correspondence to: Romiti Chiara, Clinica di Chirurgia Generale e Metodologia Chirurgica, Ospedali Riuniti-Università Politecnica delle Marche. Via Conca 1, 60120, Ancona, Italy (email: c.romiti@email.it).

reliability to achieve a correct stadiation of the disease. Indeed, these doubts were strengthened by a technology lacking in a relevant numbers of tools that today we have, as ultrasonic and radiofrequency based energy instruments. Anyways, in some institutions the use of laparoscopic surgery for colon cancer was pursued while patients expressed interest in this new attractive approach to colon resection, able to offer a better postoperative course and cosmetics. Since its introduction, two decades have passed and significant data concerning recovery end points as duration of surgery, hospital stay, analgesic requirement, short term complications and return to daily activity are available if one would argue over laparoscopic colectomy and the impact it had on the quality of life. Trials as COST, CLASSIC, COLOR and Barcelona have investigated the oncologic outcomes of laparoscopic colectomy as well, by evaluating the overall survival, the disease free survival and the recurrence rate¹⁻³. As a result laparoscopic colectomy is to date an acceptable, safe and effective technique for colon cancer treatment in skilled hands, at least equivalent to the open access under the aspect of oncologic criteria respect and oncological results, and better if we evaluate the short term outcome and quality of life. In this study we report our experience in a significant series of patients who underwent laparoscopic colonic resections for cancer.

Methods

A group of 340 not selected patients with adenocarcinoma of colon underwent laparoscopic colonic resection from January 2004 to December 2008 at the "Clinica di Chirurgia Generale e Metodologia Chirurgica" Università Politecnica delle Marche-Ospedali Riuniti, Ancona. Of the 340 patients, 175 underwent laparoscopic right colectomy and 165 laparoscopic left colectomy. There were 185 males, 70,5 years (31-92) mean aged and 155 females, 65,6 (35-91) mean aged. 180 patients, 105 males and 75 females were older than 70. The study included a preoperative imaging work-up based on pancolonscopy, barium enema in some cases, and thoraco-abdominal CT scan. The same team has performed the procedures. Hemicolectomy action could have been right (for cancer of the caecum, of the ascendant and the hepatic flexure) and left (for cancer of the descending colon and sigmoid). Patients treated for transverse colon tumors have been excluded. All patients underwent a bowel preparation with polyethylene glycol. A combination of two antibiotics, sodium cefuroxime 2g and metronidazole 500mg were administered intravenously at induction of anesthesia and then two more times administered. Patients were placed in a supine position for the right colectomy and gynecological position for left colectomy. All colonic resections were performed after the establishment of the pneumoperitoneum through a small umbilical incision over or under-cord

by the open technique of Hasson. The maximum pneumoperitoneum pressure was 12-14 mmHg. Four trocars and a 45° laparoscope were used. Imaging camera-monitor was based on high definition tele vision (HDTV, 1920x1080 px) standard in a 16:9 format. Technically, criteria were based on those usually applied in open cancer surgery, as ligation at vascular origin, extended lymphadenectomy and respect for the clearance of resection margins. The study protocol involved the assessment of the following parameters: length of the surgical specimen, free margin of resection, number of lymph nodes, pathological stage, local recurrence and wall, distant metastases, survival, overall and according to the stage of the disease. After surgery, patients were followed prospectively with clinical examinations, including blood tests and tumor markers, pancolonscopy, CT scan or MRI. In particular, every 6 months for 3 years each patient has been evaluated by clinical examination, tumor markers, liver ultrasonography and colonoscopy, and every 12 months by chest X-ray, adbomino-pelvic CT scan or MRI.

Results

Of the attempted 340 laparoscopic colonic resections, the conversion rate was 5,8% (20 cases): 10 for right colon and 10 for left colon, due to preoperative stage underestimation, bleeding, splenic flexure take down difficulties, obesity, adhesions for previous surgery and anastomosis tension. Two patients (0,58%) died in the postoperative period. One patient, ASA IV, 88 years old, who underwent right colectomy died in the postoperative course because of myocardial stroke. A second patient, 86 years old, ASA III, who underwent right colectomy had an anastomotic leakage, so that he received a loop ileostomy in the same day. In the following postoperative course, at the day XXVI, a bowel resection for acute ischemia was required, followed by death in the next day. Five major complications occurred (1,5%). Three anastomotic leakages: two in patients who underwent left colectomy and one patients after right colectomy. Those patients were treated by performing a loop derivative ileostomy in four cases, and by a conservative management by means of intravenous antibiotics and ten days fasting in one case. A female patient had a hernia through the minilaparotomy in the sixth postoperative day with a loop small bowel incarceration after left colectomy, while the last case was represented by a postoperative ischemia of the descending colon, at fifth postoperative day, in a patient 70 years of ASA III. Those two patients have been treated by hernia repair and Hartmann procedure respectively. Minor complications were observed in 8 % of total cases and were represented by wound infection, abdominal collection, transitory renal failure, urinary complications, pulmonary minor embolism, pneumonia, respiratory failure and

fever (TC: 38°). The average stay for patients underwent right hemicolectomy was 6.7 days (4-27) and 6.9 for patients underwent left colectomy (4-23). The resumption of bowel activity occurred on average 3.2 days (1-9) for the right colectomy and 3.1 days (2-8) on left. The average length of the surgical specimen was 25.6 cm (16-48): 27.3 cm (16-56) for right colectomy and 22.7 cm (10-48) for left colectomy. The distal free margin for left colectomy was on average 4.1 cm (range 3.2 to 9.3). The average number of lymph nodes removed was 15.6 (3-64): 14.9 (7-39) on right colectomy and 16.3 (range 8-33) concerning left colectomy. The final pathological stage of the right colon resected was: 1 at stage 0, 31 at stage I, 71 at stage II, 67 at stage III and 5 at stage IV. Pertaining left colic resections there were 17 cases at stage 0, 28 at stage I, 57 at stage II, 57 at stage III and 6 at stage IV. Stage zero on both groups occurred in resections performed with intention to radicalize because of unexpected T1 small polyps previously removed endoscopically. In a follow-up period of 38 months (range 25-78 months) there were 16 cases of incisional hernia: 12 after right colectomy and 8 after left. We found no recurrence for patients who underwent right colectomy, while there have been in 8 cases

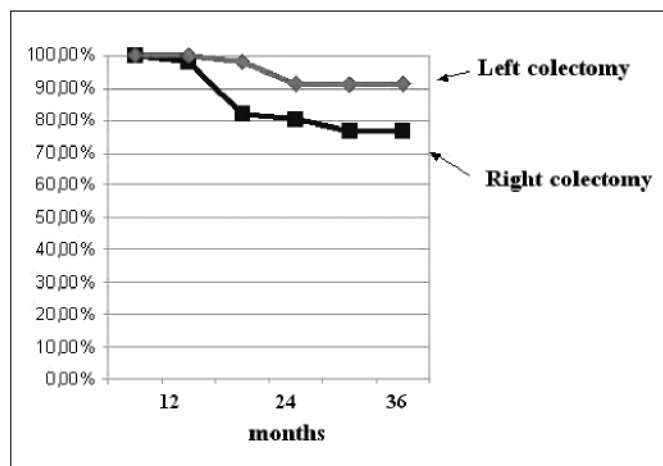


Fig. 3: Survival rate stage III.

after left colectomy, one of whom underwent surgical local reintervention. In 18 patients (5.3%) were observed distant metastases; in 8 patients who underwent right colon resection a metastatic disease was found: 5 were liver metastases, 1 lung, 1 liver and lung involvement and the last with peritoneal carcinomatosis. Of those patients, three cases of liver metastasis have been treated by liver resection; to date, two patients are disease free and one presents liver recurrence. Ten patients after left colon resection had metastatic disease: 7 with liver metastases, 2 with liver and lung metastasis and one with lymph node metastasis. Of liver metastasis group, one patient underwent a new, open liver resection, after having received a synchronous hepatic resection during laparoscopic colectomy. The overall mortality was 44 patients (10.8%), including 6 unrelated to the disease; in detail it was 14.3% over patients who underwent resection of the right colon and 7.2% for those who underwent left colectomy. The survival rate has been separately evaluated by stage; by this way the results are ranging from 78% in laparoscopic right colectomy stage III to 100% for left laparoscopic colectomy stage 0 (Fig.1, 2, 3).

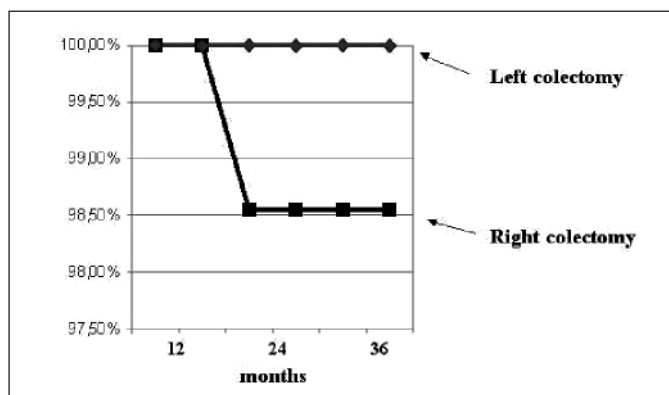


Fig. 1: Survival rate stage I.

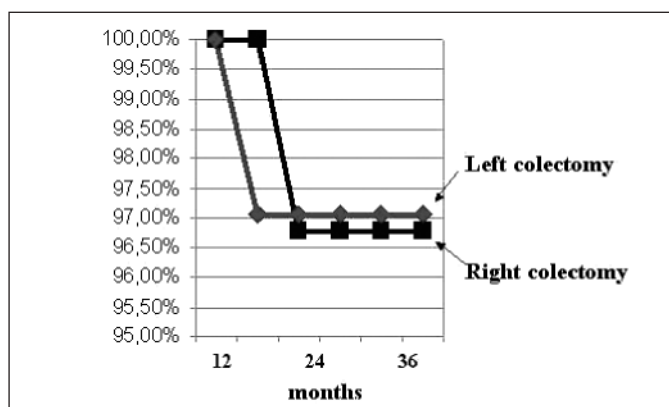


Fig. 2: Survival rate stage II.

Discussion

In this study we aimed to evaluate the long-term results of laparoscopic colon resection for malignancy in a consecutive series of unselected patients, having based the surgical technique on the well known principles of cancer surgery, with ligation at the vascular origin, extended lymphadenectomy and respect for the clearance of the margins of the section. Since the early 1990's, when laparoscopy was at the beginning concerning the colon cancer treatment, many years, experiences, technical refinements and technological progresses have passed and the related learning curves have been completed. To date, there is a lot of manuscripts demonstrating laparoscop-

TABLE I - Anagraphic

	Right colectomy	Left colectomy
Male	88	97
Female	87	68
Total	340	
Mean age	70,5 (31-92)	65,6 (35-91)
Older than 70	105	75
Total	180	

TABLE II - Complication

	Right colectomy	Left colectomy
		Major (1,2%)
Anastomotic leakage	1	1
Po hernia	0	1
Colon ischemia	0	1
		Minor (7,8%)
Abdominal collection	2	0
Transient hepatic failure	1	0
Pulmonary embolism	0	1
Pneumonia	0	1
Urinary retention	6	7

TABLE III - Cancer stages

	Right colectomy	Left colectomy
Stage 0	1	17
Stage 1	31	28
Stage 2A	50	31
Stage 2B	21	26
Stage 3A	19	20
Stage 3B	32	26
Stage 3C	16	11
Srage 4	5	6
	175	165

ic colon surgery for malignancy feasible and safe, with a percentage of conversions to open acceptable (5-18%), low morbidity (5-20%), and low perioperative mortality (0-5%). Moreover, despite this remains a still debated issue, several authors have reported experiences in which laparoscopy seems to be adequate in the advanced colon cancer stages⁴⁻⁷. In our series, the total percentage of conversion was 5.8%, similar to that reported in the literature, the length of the pieces removed was similar to open surgery, the free margins of resection and the number of lymph nodes removed were adequate. The drop out of follow-up was negligible. Amid the results worthy of note is the absence of implants over the parietal sites for the introduction of trocars and extraction

of the surgical specimens, in the past matter of strong debate. While in the early experience there have been few cases, in this series no spread of disease at the sites of introduction of the trocars or wall recurrence after laparoscopic resection for colorectal cancer have encountered, suggesting a relationship with the learning curve completion rather than with the laparoscopic technique tout court. Wexner⁹ by examining cases of trocar site/minilaparotomy implants reported on literature since 1993 found an incidence of 0.64%, while Tomita¹⁰ reports its first, 25% on 2635 cases¹⁰. These data are comparable with those reported by Hughes and Reilly after open surgery (0.8 and 0.6% respectively)^{11,12}. In fact, at the present time this seems to be an out of date problem. Regarding the incidence of local recurrences and distant metastases in our series we have not found significant differences with the percentages reported in the literature for traditional surgery. The increased mortality we found in the group of patients who underwent right colectomy, higher than left colectomy mortality rate, is probably related to the late diagnosis usually reached for the carcinoma of the right colon. In confirmation of this in the right colon we had an higher percentage of advanced stages. Concerning the advanced stages issue, in 2002 Lacy reported a better recurrence-free survival rate for colon cancer stage III in patients laparoscopically treated, whereas this trend did not appear comparing laparoscopic with open colectomy for stage I and stage II⁵. Laparoscopy is known to be less stressful and cause less immune system impairment than open surgery, so that it could be argued it is less reducing the patient resistance against local or distance recurrences. Moreover, a correct laparoscopic technique use might imply a minor tumor manipulation than open way, so that it could avoid exfoliation of the malignant cells, that in fact is probably a major "condicio sine qua non" for tumor cell implant. The above mentioned facts could exclude a specific laparoscopic risk for intraperitoneal tumour cell seeding and implantation, as well as suggest a role of laparoscopy on the better survival rate trend in the later stages. Yin et al¹⁴ comparing patients who underwent laparoscopic vs laparotomic colectomy by the analysis of clinical data, operative times, complication rates and long term results conclude that laparoscopy is freer of complications than the open approach at an early outcome including hospital stay, resumption of daily activity or cosmetics, and provides the adequate oncological criteria respect with comparable percentages of local recurrence and disease-free survival. According to Siani et al¹⁵ laparoscopy can be considered a valid option for surgical right colon cancer removal. In a five years experience, comparing two groups of patients treated with laparoscopic and open approach having similar age, sex, comorbidity, and stage of disease, right colon cancer non-metastatic non-invasive, the authors found the laparoscopic way better in terms of reduced intraoperative blood loss, although with

operating time slightly longer than the open approach. The two approaches also had the same morbidity, mortality and complication rate at 30 days after surgery as well as the same ability to conduct an appropriate regional lymphadenectomy. Tan et al¹⁶ reported an experience of right colectomy with two different approaches underscoring the advantages of laparoscopy in terms of aesthetics (laparoscopic incision length of 5.7 cm against 11.2 cm laparotomy), and pointing out they had not significant differences between open and laparoscopic surgery, as regard the recovery function bowel, the number of lymph nodes harvested, the length of margin proximal and distal, the use of narcotics for anesthesia, the length of hospital stay and postoperative morbidity and mortality. Also Coratti et al¹⁷ report laparoscopy able to allow the patient to return to a normal diet, as well as daily activities, faster than the open approach. Hester Yui Shan Cheung et al¹⁸ focus they observations on the lower risk when the laparoscopic approach is used to the preparation of ostomy; moreover they include patients with stenosing tumors of the large intestine to benefit of this minimally invasive technique. Many others are the works that highlight the features and benefits of laparoscopy¹⁹⁻²¹. Luz Moreira et al.²² argue that laparoscopy is a viable option for the treatment of colorectal cancer in patients with ASA III and IV, as it ensures less blood loss, a quicker return to normal bowel function, decreased hospital stay and lower and wound infections in terms of complications and mortality 30 days after surgery. Laparoscopy is comparable to open approach and not increases the risk of local recurrence and distant metastases. Our series have results similar to this lot of studies, but we would emphasize a concept among other things: the adequacy of the oncological results, based on the oncological criteria respect, that per se could validate the minimally invasive approach. In fact laparoscopy do it.

Conclusions

Laparoscopic colectomy for cancer may be considered as a safe and effective technique if performed by surgeons skilled in this field and after an adequate learning curve. To date, if correctly applied, the minimally invasive approach allows results at least comparable to the open approach concerning the medium-long term oncological follow-up, while the short outcome is undoubtedly better if one use the laparoscopic way. Our series of more than three hundred cases is in agreement with this literature trend.

Riassunto

Lo scopo di questo studio è stato quello di valutare prospettivamente i risultati oncologici a lungo termine del-

le resezioni del colon per via laparoscopica in una serie consecutiva di 340 pazienti non selezionati affetti da adenocarcinoma del colon, dal gennaio del 2004 al dicembre del 2008, presso la Clinica di Chirurgia Generale e Metodologia Chirurgica dell'Università Politecnica delle Marche. Dei 340 pazienti affetti da carcinoma del colon giunti alla nostra osservazione, 175 sono stati sottoposti a emicolectomia destra, 165 a emicolectomia sinistra, osservando i criteri oncologici della chirurgia tradizionale con legatura vascolare all'origine, estesa linfadenectomia e rispetto della clearance dei margini di resezione. Il protocollo dello studio prevedeva la valutazione dei seguenti parametri: lunghezza del pezzo operatorio; margine libero di resezione (emicolectomia sinistra); numero dei linfonodi; stadio patologico; recidive locali e di parete; metastasi a distanza e sopravvivenza (globale e secondo lo stadio della malattia). Dopo l'intervento i pazienti sono stati seguiti prospettivamente con un esame clinico, esami ematichimici incluso i markers neoplastici, Rx torace, pancoloscopia, ecografia, TAC e/o una RM, scintigrafia ossea. I risultati del nostro studio hanno evidenziato che complessivamente l'incidenza di conversioni è stata del 5,8%, 10 nei colon destri e 10 nei colon sinistri, per tensione dell'anastomosi, obesità, emorragia, difficoltà di mobilizzazione della flessura splenica e sindrome aderenziale. Due pazienti (0,58%) sono deceduti nel periodo postoperatorio. Cinque sono state le complicanze maggiori (1,5%) nel periodo postoperatorio. La degenza media per i pazienti sottoposti a colectomia destra è stata di 6,7 giorni (4-27) e 6,9 per i pazienti sottoposti a emicolectomia sinistra (4-23). Il numero medio di linfonodi asportati è stato 15,6. In una media di 38 mesi di follow-up (25-78), si sono verificati 16 laparoceli, 12 dopo colectomia destra e 4 dopo la sinistra. Otto pazienti (4,5%) sottoposti a colectomia laparoscopica destra e dieci (6%) del gruppo di colectomia sinistra ha sviluppato una malattia metastatica. Il tasso di mortalità complessiva è stata pari al 10,8%, 14,3% per i pazienti sottoposti a resezione del colon destro e 7,2% per la serie colectomia sinistra. La colectomia laparoscopica per il cancro è fattibile, sicura e non gravata da un tasso di complicanze più elevato rispetto alla colectomia open.

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