

Benefits of laparoscopic colorectal surgery in the geriatric patient

G. ANANIA, L. SCAGLIARINI, M. SANTINI, A. MARZETTI, C. GREGORIO,
L. VEDANA, G. RESTA, G. CAVALLESCO

SUMMARY: Benefits of laparoscopic colorectal surgery in the geriatric patient.

G. ANANIA, L. SCAGLIARINI, M. SANTINI, A. MARZETTI,
C. GREGORIO, L. VEDANA, G. RESTA, G. CAVALLESCO

Background. Our aim is the retrospective valuation of results in over 75 year-old patients, with colorectal cancer, treated with laparoscopic and laparotomic surgery, considering how laparoscopic surgery has improved these patients' outcome.

Patients and methods. We took all over 75 year-old patients, affected by colorectal cancer, treated with colectomy. Patients has been divided into two groups: laparotomy group and laparoscopy group. Data concerning patients, i.e., age, sex, BMI, ASA, comorbidities, were collected with data concerning the operation (surgical time, conversion percentage). Postoperative outcomes – i.e., gas evacuation, bowel movements, solid and liquid feeding, need to ICU, complications, re-surgery, hospitalization and type of discharge, mortality – were evaluated.

Results. A total of 145 patients are included: laparotomy 80 and laparoscopy 51. Two groups are homogeneous for age, sex, BMI, ASA, comorbidities. Surgical times are the same. Need to Intensive Care Unit (ICU) is lower in laparoscopy. Gas evacuation and bowel movements are earlier in laparoscopy. Liquid and solid diet is earlier in laparoscopy. Hospitalization was earlier after laparoscopy. Discharge at home is more frequent in laparoscopy. Major and minor complications are lower in laparoscopy. Post-operative mortality is lower in laparoscopy.

Conclusions. Laparoscopy improves over 75 year-old patients' outcomes, after elective surgery for colorectal cancer. Surgery trauma, anaesthesia, nutritional and hemodynamic alterations, are factors that break the old patients' fragile physiologic balance. Less traumatic surgery improves old patients' outcomes.

RIASSUNTO: I benefici della chirurgia laparoscopica del colon retto nei pazienti geriatrici.

G. ANANIA, L. SCAGLIARINI, M. SANTINI, A. MARZETTI,
C. GREGORIO, L. VEDANA, G. RESTA, G. CAVALLESCO

Introduzione. Il nostro obiettivo è una valutazione retrospettiva di pazienti ultra 75-enni sottoposti a chirurgia laparoscopica e laparotomica, considerando il migliore outcome della laparoscopia.

Pazienti e metodi. Abbiamo considerato tutti i pazienti ultra 75-enni, affetti da tumori coloretali, trattati con resezioni coliche. I pazienti sono stati divisi in due gruppi: gruppo laparotomico e gruppo laparoscopico. Abbiamo considerato: dati riguardanti i pazienti (età, sesso, BMI, classe ASA, comorbidità), dati riguardanti l'intervento (tempi operatori e tasso di conversione), dati riguardanti l'outcome postoperatorio (canalizzazione a gas e feci, dieta liquida e solida, necessità di terapia intensiva, complicanze, reinterventi, degenza, tipo di dimissione e mortalità).

Risultati. Abbiamo considerato un totale di 145 pazienti: 80 nel gruppo laparotomico e 51 del laparoscopico. I due gruppi sono omogenei per età, sesso, BMI, classe ASA, comorbidità. I tempi operatori sono i medesimi. La necessità di terapia intensiva è minore nel gruppo laparoscopico. Canalizzazione a gas e feci è più rapida nel laparoscopico, come anche la ripresa dell'alimentazione per liquidi e solidi e la dimissione. Inoltre, minori complicanze e mortalità postoperatorie sono state osservate nel gruppo laparoscopico.

Conclusioni. L'approccio laparoscopico nei pazienti ultra 75-enni migliora l'outcome postoperatorio nella chirurgia coloretale in elezione. Il trauma chirurgico, così come l'anestesia e le alterazioni emodinamiche, alterano il fragile equilibrio dell'anziano. Di conseguenza un approccio meno traumatico migliora l'outcome di questi pazienti.

KEY WORDS: Geriatric - Colorectal - Laparoscopic colectomy.
Anziano - Coloretale - Colectomia laparoscopica.

Introduction

In Italy the decreasing of mortality rate and the increasing of life expectancy in the last decades achieved an average life extension in the population. Compared with other countries, in Italy the aging is major. According to Italian Board of Health and to the Statistic In-

stitute, 9,63% of the population, i.e. 5,739,793 people, is more than 75 years old.

As long as the incidence of neoplastic diseases of gastrointestinal organs grows with the increasing age, the incidence of colorectal cancer grows in old patients too (1). Board of Health's dates, demonstrate the evident increment of colon-rectal cancer in old people, especially in older than 75 years old, the incidence of colorectal cancer in the last 40 years in Italy has been quadrupled.

Surgery is the first and the most important treatment of colorectal cancer, and it is used more and more for old people. The old age is considered a surgical risk factor (2), and it certainly needs some reflections about advantages and disadvantages of surgery. Comorbidity has showed the relationship between more epidemiologic parameters, as complications, hospitalization, and costs (3), and a lot of studies prove that comorbidity impacts on outcome, with a clearer mortality increase in patients with 3 or more diseases than healthy patients (4-6). Moreover, comorbidity has an effect on the disease's management, and on the survival (7, 8).

Morbidity and mortality are higher after abdominal open surgery in old patients, and the most common are pulmonary and cardiovascular complications. Therefore, from the 90's the surgeons turned to laparoscopic approach for colorectal diseases (9), and the outcome realized in a period of ten years, exploded the fear about complications related to pneumoperitoneum (10-13). It's been proved that the outcome in old laparoscopic patients, allow a shorter hospitalization, and a lower cardiopulmonary morbidity than laparotomic patients (14,15). Our aim is the short and medium-term, outcome evaluation, of over 75 year-old patients with colorectal cancer, comparing laparoscopic with laparotomic surgery.

Patients and methods

Our study is retrospective. We took all over 75 year-old patients, affected by colorectal cancer, treated with colectomy between January 2006 and April 2010, in our Department. The evaluation criteria were: diagnosis of colorectal carcinoma at pre surgery biopsy; laparoscopic or laparotomic colectomy; elective surgery. We excluded: emergency surgery; patients with peritoneal metastasis or macroscopic metastasis; benign diseases. Patients has been divided into two groups: the first including laparotomic colectomy, and the second including laparoscopic colectomy.

Data concerning patients were: age; sex; BMI; ASA class; medical and surgical history. We quoted comorbidities which have been grouped together, and classified in connection with organ or apparatus dysfunction. In relation with medical history, we calculated for each patient the Charlson Comorbidity Index. Afterward we picked up other data concerning the operation: cancer site; type of surgery; surgical time; conversion percentage; type of anastomosis; number of lymph nodes removed and Dukes' stage. We noted parameters of post surgery hospitalization: removal of Nasogastric tube (NGT); gas evacuation; bowel movements; solid and liquid feeding. We also con-

sidered the need to hospitalize in ICU, and how many days the patients have been there. We considered minor and major complications in post surgery time; re-surgery; hospitalization and type of discharge (at home or to another ward for acute diseases or to another care facility). Finally we considered mortality and re-hospitalization at 1, 3, 6, 9 and 12 months.

We picked up data using medical records, surgical cards and databases. We used JMP software 7th Version SAS Institute Inc 1989-2007; (Cary, USA) for electronic data processing. Descriptive variables were expressed as mean, standard deviation, median, number of events, patients, and percentage. According to different features of these variables, we used chi-square test, Fisher test and Mann Whitney test (16). We considered $p < 0,05$ statistically significant.

Results

In this study 145 patients are included, split into two groups: laparotomy and laparoscopy. The first one is composed of 80 patients, while the second one is composed of 51. The total conversion percentage was 8,3% (4 conversions in 15 earliest operations 26,6%, and only 1 in other 45 operations 2,2%). However we made another group composed of converted patients. Basically reasons of conversion are technical, and not for complications raised up during laparoscopic surgery: three of them were for severe adhesion syndrome, one for a biliary cyst-choledocus fistula, and another one was for a stapler malfunction.

There were not differences about age, sex, BMI and ASA class between the two groups. Analyzing our data, each patient was average affected by 3 diseases which caused severe organ dysfunctions. Statistical analysis showed no significant differences between two groups ($p=0,2480$).

High percentage of our patients had a severe Charlson Comorbidity Score, and laparoscopic group had a higher Score than laparotomic one (55% of laparoscopic patients, and 40,6% of laparotomic, had a Score ≥ 3).

Most frequent cancer location was right colon, 62 cases, followed by sigmoid colon 31, transverse colon 14, rectum with 13, left colon 9, and finally rectosigmoid 7.

56 patients of laparotomy group, had a positive abdominal surgery history (70%), while only 24 patients of laparoscopic group had it (43.3%). The difference between two groups is not significant about major abdominal surgery ($p=0,6039$).

Average surgical time was 204 minutes in laparoscopic group, while in laparotomic one was 210 minutes (table 3); however the difference is not significant ($p=0,9178$). By comparison of the first 10 laparoscopic surgery and the others, we noticed a reduction of average surgical times: 216,7 minutes in the first group, 201,9 minutes in the second one ($p=0,0700$). Analyzing average surgical times of the most common surgery, we did not find significant differences. In conversion group, the average is greater (277 minutes).

The most common surgery was right colectomy (46,2% in laparotomic group, vs 48,3% in laparoscopic), followed by anterior resection (18,7% in laparotomic group, vs 16,2% in laparoscopic) and by sigmoidectomy, 21,6% in laparoscopic group. Overall, in laparoscopic surgery, half of the anastomosis, was intracorporeal or transanal, respectively 30% and 20%. However improving the team's surgical experience, the minimally-invasive approach was reflected most.

In laparotomic group, we performed additional surgical procedures in 7 cases during surgery (3 left annessiectomies, 1 isteroannessiectomy, 2 colecistectomies e 1 appendectomy), while in laparoscopic group, we performed 2 colecistectomies during a right colectomy. Regarding Dukes' stage, the most common was B stage (62,1% in laparotomic group, 41,3 in laparoscopic one), followed by C stage (31,1% in laparotomic group, 29,3% in laparoscopic one). Finally was stage A, which was only in 6,7% of laparotomic group, and in 29,3% of laparoscopic one. In laparotomic group were found average 17,4 lymph-nodes (range 4-42) while in laparoscopic group 15,9 (range 2-34). The average was 13,5 in the top 10 surgery, and 16,4 in the others.

In 27,5% of laparotomic patients, needed ICU hospitalization after surgery, average 4,1 days, while only 21,6% of laparoscopic patients needed it, average 3 days. Different need of ICU hospitalisation was significant ($p=0,0466$).

Gas evacuation was earlier in laparoscopic group than laparotomic one ($p<0,0001$): 3,5 days vs 4,4 days. Bowel movements were earlier in laparoscopic group ($p=0,0287$): average 5,2 days vs 6,1 days. In conversion group gas evacuation and bowel movements were respectively after 8,2 and 10 days average. Also NGT was earlier removed in laparoscopic group than in the laparotomic one (1,8days vs 4,6days; $p<0,0001$). Liquid diet was resumed average after 4,0 days in laparoscopic group, vs 6,5 days in laparotomic one. Instead solid diet respectively after 5,2 days vs 8,9 days, (difference was significant: $p<0,0001$). Total hospitalization was significant earlier after laparoscopic colectomy ($p<0,0001$): 9,1 days vs 13,3 days. In converted patients was 16,4 days.

Analyzing mode of discharge, we noticed ordinary mode for 48 patients (60,0%) of laparotomic group, and for 53 patients of laparoscopic (88,3%). Different mode of discharge between two groups was statistically significant ($p<0,0001$). 27,4% of laparotomic patients was transferred to another care facility, while only 8,4% of laparoscopic patients was. Some patients were transferred to another ward because of medical complications arisen after surgery, or because of pre surgery diseases. Two patients (2,5%) after laparotomic surgery, and only one (1,7%) after laparoscopy surgery, died before discharge, all of them in ICU, for septic shock or pulmonary failure.

Major complications arisen in 11,6% of laparoscopic patients, vs 16,2% of laparotomic ones ($p=0,0349$). These complications in laparoscopic group were episodic, while in laparotomic group were more severe: pulmonary failure (8,7%) and kidney failure (6,2%).

Minor complications arisen in 33,3% of laparoscopic patients, vs 63,7% ($p<0,0001$). They were predominantly: vomit (11,6% in laparoscopic patients vs 12,5%) and anaemia (18,3% in laparoscopic patients vs 23,7%). In laparoscopic group other complications were episodic. Other significant complications in laparotomic group were delirium (10%), fever (11,2%) and pain (6,2%).

In laparotomic group, two patients needed resurgery: one for laparotomy dehiscence, and another one for anastomosis dehiscence 13 days after sigmoidectomy. In laparoscopic group needed a resurgery two patients with intestinal obstruction (one 8 days after right emicolectomy with adhesion syndrome and endoperitoneal infection, and the other 10 days after the operation because of an ileal loop into a trocar hole), and one patient with intestinal perforation (5 days after a right colectomy because of ischemia in traverse colon). In conversion group we found two anastomosis dehiscences, one of them 9 days after left colectomy, and another one 8 days after "flexura coli" sinistra resection.

Post surgery mortality, 30 days by operation, was 1,7% in laparoscopic group vs 3,7% in laparotomic one. Mortality after 3, 6, 9 and 12 months was respectively 3,4%, 5,5%, 8,2% e 8,5%, for laparoscopic group, vs 3,8%, 5,1%, 6,7% e 7,1%. Percentages of patients who had almost 1 new hospitalization by 1, 3, 6, 9, 12 months is showed.

Discussion

There are different opinions about role's age as a negative prognostic factor in surgical patients with colorectal cancer, comorbidities are very common in old patients, and they increase surgical risk. Therefore, minimally-invasive surgery in old patients, with a lot of comorbidities is very interesting, because reduction of surgical trauma can lead to reduction of postoperative complications, and to a faster recovery even than younger patients. Different studies showed that laparoscopy is safety and associated with specific benefits, as reduction of postoperative pain, shorter convalescence, shorter hospitalization than traditional open surgery. Also, recent randomized clinical trials, showed that laparoscopy is oncologically correct and safe, as open surgery. The analysis of the results show that laparoscopy in treatment of colorectal cancer, has a positive effect in the short and medium term outcome in geriatric patients. This evidence is strengthened by the fact that our study is based on two

homogeneous groups. From the beginning of our laparoscopic experience of colorectal cancer, we had positive results, that encouraged greater use of this technique, and ten months after the first laparoscopic colectomy, the number of patients treated with this technique became the same as patients treated with open surgery. The overall conversion percentage was 8,3%. In the literature are reported conversion percentage from 6,4% to 14% in over 75 year old patients (17). Though conversion was because of technical reasons and not because of surgical complications, we found an interesting influence of the learning curve on the conversion rate, in fact four conversions were in first fifteen surgeries (26,6%), and only one conversion in second fifteen surgeries (2,2%). Also, in these patients we found a worse outcome than other two groups, even if surgical techniques were the same as traditional laparotomic colectomy. After the first surgery, considering the surgical team experience and the learning curve, the approach was totally miniminvasive, through implementation of intracorporeal and transanal anastomosis. In fact, after the first 20 surgeries, this type of anastomosis was respectively 46,2% and 20,5% of all anastomosis. Surgical time was not different between two groups (laparoscopy 204 minutes, vs 210 minutes, $p=0.9178$). We found no significant differences in surgical time between the first 10 laparoscopic surgery and subsequent.

About oncological radicality, we don't find significant differences about number of lymph nodes removed in the surgical specimen: laparotomy 17,4 lymph nodes, vs 15,9. However there is a slight influence on the number of lymph nodes removed in laparoscopic group (13,5 in the first 10 surgery and 16,4 in subsequent).

According to inclusion and exclusion criteria, we obtained two homogeneous groups without significant differences about age, sex, BMI, and ASA. Even the abdominal surgical history was not significant between two groups. The study of comorbidities, performed with the Charlson index and with the study of clinical history, confirmed that old age is inexorably related to comorbidities. The average number of comorbidities per patient was 3, both for laparoscopic and laparotomic group. Only 10 patients had no comorbidities in their history. It has been shown that comorbidities have influence on the outcome of patients with colorectal cancer (18,19), and it has found a significant mortality increase according Charlson's score, with a survival rate at 1 year of 75% for patients with score 0, while 58% for patients with score ≥ 3 , and 83% for rectal cancer, against 50%. In our study we observed an average Charlson score of 2,8% for laparoscopic group, vs 2,3%, but the very important thing is that about half of patients, 55% of laparoscopic group and 40,6% of laparotomic, had a score ≥ 3 . Therefore, a high percentage of our patients had a severe score, since it is showed that outcome becomes severe when it is

≥ 3 . The difference between two groups about comorbidity was not significant, both for Charlson index ($p=0,4338$) and number of comorbidities per patients ($p=0,480$).

According to hospital stay, we have shown that L.O.S. is related to recovery of intestinal function, and nutrition. Hospital stay is significantly shorter in laparoscopic group, and significantly longer for converted patients. We have shown that length of stay was shorter in laparoscopic group with an average of 9,1 (range 5-35) days, vs 13,3 days (range 6-43).

This also agrees with that observed: 88% of laparoscopic patients went home after hospitalization, vs 60%, with a significant difference ($p<0,0001$).

Gas evacuation and bowel movements are index of intestinal recovery, in order to start an oral nutrition individually, which is a prerequisite to hospital discharge. Our results found average times significantly shorter in laparoscopic group than about 1 day for gas evacuation and bowel movements: gas evacuation after 3,5 days vs 4,4 days and bowel movements after 5,2 days vs 6,1 days. This allowed a more rapid recovery nutrition with liquid and solid diet: respectively 4 and 5,2 days for laparoscopic group, vs 6,5 and 8,9 days.

Another date confirms a less surgical trauma in laparoscopic surgery in old patients: the less need for ICU admission after surgery, for percentage of patients hospitalized in this ward (21,6% against 27,5%), and for average hospital stay (3 days against 4,1 days $p=0,0466$). It's also important to emphasize that about half laparoscopic patients were admitted to ICU only one day, and 2/3 of these patients were admitted to ICU less than 2 days. On the other hand 50 % of laparotomic patients was admitted to ICU more than 2 days.

Laparoscopic surgery is associated to a significant reduce of post-surgery complications, both major and minor (21,22). Minor complications, as anaemia with transfusion, fever, pain and delirium, and other rarest, were more frequent in laparotomic group than laparoscopic one, with a percentage of 63,7% vs 33,3%. Delirium was a significant complication, more frequent in laparotomic patients (10% against 1,6% of laparoscopic patients) and it is very important first of all in post surgery, because of problems of patient management.

As for surgery complications, we observed 2 anastomosis dehiscence in laparotomic group, 1 in laparoscopic group and 2 in conversion group. We also observed two intestinal occlusions surgically treated in laparoscopic group. The percentage of intestinal occlusion after laparoscopic surgery is higher than surgery colon data in the literature. Other authors show a frequency of intestinal occlusion in colorectal laparoscopic surgery from 1,1% to 2,8% (23-25).

Concerning to resurgery, we found: 2,5% of laparotomic group (two patients: one for anastomosis dehiscence, and another one for laparotomy dehiscence), 5%

of laparoscopic group (three patients: one for anastomosis dehiscence, and two for intestinal occlusion) and two out of five patients in conversion group (both for anastomosis dehiscence). The difference between the two groups is not meaningful (0,8500).

Observing patients within 12 months after surgery, we found a high percentage of patients who was hospitalized at least one more time: after 12 months, 31,9% of laparotomic patients, vs 27,1%.

We observed a mortality after surgery (within 30 days) of 3.7% in laparotomic group, vs 1.7%. Three deaths in laparotomic group are related to pulmonary septic complications, with a septic shock, and respiratory failure. The death in laparoscopic group was in a patient with a resurgery for anastomotic dehiscences, with respiratory failure and septic shock after bilateral pneumonia.

References

- Boyle P, Langman JS. ABC of colorectal cancer: epidemiology. *BMJ* 2000;321(7264):805–808.
- Polanczyk CA, Marcantonio E, Goldman E, Rohde LE, Orav J, Mangione CM, Lee TH. Impact of age on perioperative complications and length of stay in patients undergoing noncardiac surgery. *Ann Intern Med* 2001; Apr 17;134(8):637–43.
- Eapen L, Villeneuve PJ, Levy IG, Morrison HI. Comorbid survival among elderly male participants of the Canada health survey: relevance to prostate cancer screening and treatment. *Chronic Dis Can.* 1998;19(3):84–90.
- Tiret L, Desmonts JM, Hatton F, Vourc'h G. Complication associated with anaesthesia-A prospective survey in France. *Can Anaesth Soc J.* 1986 May;33(3 Pt 1):336–44.
- Escarce JJ, Shea JA, Chen W, Qian Z, Schwartz JS. Outcomes of open cholecystectomy in the elderly: a longitudinal analysis of 21,000 cases in the prelaparoscopic era. *Surgery* 1995 Feb;117(2):156–64.
- Lemmens VE, Janssen-Heijnen ML, Verheij CD, Houterman S, Repelaer van Driel O J, Coebergh JW. Co-morbidity leads to altered treatment and worse survival of elderly patients with colorectal cancer. *Br J Surg* 2005 May;92(5):615–23.
- Yancik R, Wesley MN, Ries LA, Havlik RJ, Long S, Edwards BK, Yates JW. Comorbidity and Age as Predictors of Risk for Early Mortality of Male and Female Colon Carcinoma Patients. *Cancer* 1998 Jun 1;82(11):2123–34.
- Gross CP, Guo Z, McAvay GJ, PhD, Allore HG, Young M, Tinetti ME. Multimorbidity and Survival in Older Persons with colorectal Cancer. *J Am Geriatr Soc* 2006 Dec;54(12):1898–904.
- Ing RD, Jacobs M, Plasencia G.; Laparoscopic colectomy for colon cancer. In: KA Zucker ed. *Surgical Laparoscopy* 2nd ed. Philadelphia, Pa: Lippincott Williams & Wilkins; 2001:255–274
- Horvath KD, Whelan RL, Lier B, Viscomi S, Barry L, Buck K, Bessler M. The effects of elevated intraabdominal pressure, hypercarbia, and positioning on the hemodynamic responses to laparoscopic colectomy in pigs. *Surg Endosc* 1998 Feb;12(2):107–14
- Vogt D, Goldstein LJ, Hirvela ER. Complications of CO2 pneumoperitoneum. In: Tsoi EKM, Organ CH, ed. *Abdominal Access in Open and Laparoscopic Surgery*. New York, NY: Alan R Liss Inc; 1996:75–98.
- Ballesta Lopez C, Cid JA, Poves I, Bettonica C, Villegas L, Memon MA. Laparoscopic surgery in the elderly patient. *Surg Endosc* 2003 Feb;17(2):333–7. Epub 2002 Oct 8.
- Brunt LM, Quasebarth MA, Dunnegan DL, Soper NJ. Outcomes analysis of laparoscopic cholecystectomy in the extremely elderly. *Surg Endosc* 2001 Jul;15(7):700–5. Epub 2001 May 2.
- Peters WR, Fleshman JW. Minimally invasive colectomy in elderly patients. *Surg Laparosc Endosc* 1995 Dec;5(6):477–9.
- Stewart BT, Stitz RW, Lumley JW. Laparoscopically assisted colorectal surgery in the elderly. *Br J Surg* 1999 Jul;86(7):938–41.
- Sheskin DJ. *Handbook of Parametric and Nonparametric Statistical Procedures* (Second edition). Chapman & Hall/CRC. 2000. Boca Raton. USA
- Vignali A, Di Palo S, Tamburini A, Radaelli G, Orsenigo E, Staudacher C. Laparoscopic vs. open colectomies in octogenarians: a case-matched control study. *Dis Colon Rectum* 2005 Nov;48(11):2070–5
- Delgado S, Lacy AM, García Valdecasas JC, Balagué C, Pera M, Salvador L, Momblan D, Visa J. Could age be an indication for laparoscopic colectomy in colorectal cancer? *Surg Endosc.* 2000 Jan;14(1):22–6.
- Schwandner O, Schiedeck TH, Bruch HP. Advanced age--indication or contraindication for laparoscopic colorectal surgery? *Dis Colon Rectum.* 1999 Mar;42(3):356–62.
- Iversen LH, Nørgaard M, Jacobsen J, Laurberg S, Sørensen HT. The impact of comorbidity on survival of Danish colorectal cancer patients from 1995 to 2006--a population-based cohort study. *Dis Colon Rectum* 2009 Jan;52(1):71–8.
- Cutini G., Sartelli M. (2008) La laparoscopia nel trattamento delle patologie del colon retto. Criteri di radicalità nella chirurgia del colon-retto 4: 54–60. Dalla elioscopia alla chirurgia laparoscopica del colon-retto 3: 40, 41
- Takeshi Naitoh, Takashi Tsuchiya, Hiroshi Honda, Masaya

Benefits of laparoscopic colorectal surgery in the geriatric patient

- Oikawa, Yuko Saito, Yasuhiro Hasegawa. Clinical outcome of the laparoscopic surgery for stage II and III colorectal cancer. *Surg Endosc* 2008 Apr;22(4):950-4.
23. Ng SS, Leung KL, Lee JF, Yiu RY, Li JC, Teoh AY, Leung WW. Laparoscopic-assisted versus open abdominoperineal resection for low rectal cancer: A prospective randomized trial. *Ann Surg Oncol* . 2008 Sep;15(9):2418-25.
24. Chan AC, Poon JT, Fan JK, Lo SH, Law WL. Impact of conversion on the long term outcome in laparoscopic resection of colorectal cancer. *Surg Endosc* 2008 Dec;22(12):2625-30.
25. Veldkamp R, Kuhry E, Hop WC, Jeekel J, Kazemier G, Bonjer HJ, Haglind E, Pahlman L, Cuesta MA, Msika S, Morino M, Lacy AM; COLon cancer Laparoscopic or Open Resection Study Group (COLOR).. Laparoscopic surgery versus open surgery for colon cancer: short term outcomes of a randomized trial. *Lancet Oncol* 2005 Jul;6(7):477-84.
-