

Impact of Conversion on Short and Long-Term Outcome in Laparoscopic Resection of Curable Colorectal Cancer

Ian White, MD, Ron Greenberg, MD, Refael Itah, MD, Roy Inbar, MD,
Shlomo Schneebaum, MD, Shmuel Avital, MD

ABSTRACT

Introduction: Long-term outcome of patients following conversion during laparoscopic surgery for colorectal cancer is not often reported. Recent data suggest a negative impact of conversion on long-term survival. This study aimed to evaluate the impact of conversion on the perioperative outcome and on long-term survival in patients who underwent laparoscopic resection for curable colorectal cancer.

Methods: Evaluation of our prospective in-hospital collected data of patients who underwent laparoscopic surgery for curable colorectal cancer over a 5-year period. Long-term data were collected from our outpatient's clinic data and personal contact when necessary.

Results: During the study period, 175 patients were operated on laparoscopically for curable colon cancer (stage I-III). Mean follow-up was 33 ± 18 months with a minimum follow-up of 12 months. For various reasons, 25 patients (14.4%) had to be converted to open surgery. Short-term outcome revealed a trend towards longer operations, a higher rate of surgical complications, and a longer hospital stay in the converted group. Five-year, Kaplan-Meier, disease-free analysis was worse for converted patients. Overall survival did not differ between the 2 groups. Cox proportional hazards regression analysis revealed that conversion and AJCC stage were independent risk factors for recurrence.

Conclusions: Conversion in laparoscopic surgery for curable colorectal cancer is associated with a worse perioperative outcome and worse disease-free survival.

Key Words: Colorectal cancer, Conversion, Laparoscopy, Survival.

Department of Surgery A, Tel-Aviv Sourasky Medical Center and the Sackler Faculty of Medicine, Tel-Aviv University, Tel-Aviv, Israel (all authors).

Address correspondence to: Dr. Shmuel Avital, Department of Surgery A, Tel-Aviv Sourasky Medical Center, 6 Weitzman Street, Tel-Aviv, Israel. Telephone: 972-3-6947289, Fax: 972-3-6974820, E-mail: avitalshmuel@gmail.com

DOI: 10.4293/108680811X13071180406439

© 2011 by JSLS, *Journal of the Society of Laparoendoscopic Surgeons*. Published by the Society of Laparoendoscopic Surgeons, Inc.

INTRODUCTION

Carcinoma of the colon and rectum is the third most common cancer in North America with an estimated 142 000 new cancer cases and 51 000 cancer-related deaths in United States in 2010.¹

The prognosis of patients with colorectal cancer (CRC) is largely related to the stage at diagnosis. Treatment of potentially curative colorectal cancer patients is based on adequate oncological resection with adjuvant treatment when indicated.² The laparoscopic approach is associated with a faster recovery and shorter hospital stay.⁵ Laparoscopic colorectal surgery for cancer has been proven to be oncologically safe and has become well accepted as a good surgical approach in recent years.^{3,4}

However, some patients have to be converted to open surgery and would not benefit from the laparoscopic approach. Conversion rate in laparoscopic colorectal surgery for cancer varies between 10% to 15% at experienced centers but may increase to 30% in others.⁴ Reasons for conversion may include anatomical aspects, large tumors, adhesions, obesity, and intraoperative complications.⁶

Converted patients may have prolonged operating time, increased morbidity, and slower recovery.^{7,8} Little data are available with respect to the impact of conversion on the long-term outcome in patients with CRC. The objective of this study was to evaluate the impact of conversion on the perioperative outcome and mainly on long-term disease-free and overall survival.

PATIENTS AND METHODS

Data included patients operated on laparoscopically from late 2003 to the beginning of 2009. All operations were performed or directed by 2 laparoscopically trained surgeons with previous training in laparoscopic colorectal surgery.

Early in the study, the operations were performed by both surgeons. Later on, the procedures were performed or directed by either one of these 2 senior surgeons. The volume of laparoscopic colorectal operations during the

study period averaged 70 cases a year with about one-half of them performed for colorectal cancer.

The in-hospital data including all parameters regarding patient demographics, operative data, hospitalization and final pathology were collected prospectively and were inserted into an Excel program file that was specifically created for this purpose.

Long-term data regarding survival and recurrence was retrieved from our outpatient follow-up charts. When data were not available or were not clear, the patients were personally contacted.

Our routine follow-up protocol for colorectal cancer patients includes physical examination and CEA blood level every 3 months in the first year, every 4 months in the second year, and every 6 months from the third year until 5 years after surgery. Colonoscopy is performed 1 and 3 years after surgery. A CT scan is performed 1 year after surgery.

Principles of the Surgical Technique

Generally, we adopted a standard surgical approach that was retained in most cases. For right colectomies, we use a 3-port technique with a medial to lateral mesocolon dissection, lateral mobilization, colonic exteriorization, colonic transection and extracorporeal anastomosis. Left-sided resections are performed with 4-ports with a medial to lateral dissection, lateral mobilization, intracorporeal distal transection, exteriorization of the proximal colon with proximal transection and intracorporeal anastomosis using an endoluminal stapler.

Statistics

Statistical analysis was performed using the chi-square test, *t* test, the Mann-Whitney nonparametric test, and long-rank test for Kaplan-Mayer survival curves. A Cox regression model was used for multivariate analysis. $P < .05$ was considered significant.

RESULTS

Surgery was performed in 175 patients for curable CRC (stage I-III) with at least 1-year follow-up. This group was further evaluated.

For various reasons, 25 patients (14.4%) had to be converted. Reasons for conversion included large tumors that were difficult to manipulate laparoscopically (44%), low rectal tumors difficult to mobilize (12%), severe adhesions

(12%), tumors that were not found laparoscopically (16%), and other reasons (16%). In only 4 cases (12%) was the conversion purely a reactive one due to an intraoperative complication.

A comparison between the converted and laparoscopic completed groups revealed no significant difference in disease stage, T stage, BMI, and the rate of previous abdominal operations. However, there were more rectal and fewer right colon tumors in the converted group (**Table 1**). The proportion of patients with a lower 2/3 rectal tumor scheduled for TME and patients with upper rectal tumors who underwent wide mesorectal excision was similar in both groups (one-third of rectal cancer patients had their tumor in the lower two-thirds of the rectum in both groups). Only 3 patients (2 from the non-converted and 1 from the converted group) were referred for neoadjuvant radiotherapy due to locally advanced lower two-thirds tumors.

A comparison of the short-term operative outcome revealed a worse perioperative course for the converted group with increased septic complications and longer hospital stay (**Table 2**).

Five-year Kaplan Meier analysis for disease-free survival was worse for converted patients; however, overall survival did not differ between the 2 groups (**Figures 1 and 2**).

Prognosis factors for disease recurrence including conversion, age, sex, tumor location (ie, rectum, left-sided, right-sided, and transverse) and AJCC staging were introduced into a Cox proportional analysis to identify the significant variables. Only conversion ($P=0.05$, $HR=2.3$) and AJCC stage (stage II $P=0.01$ $HR=6.0$, stage III, $P=0.008$ $HR=7.4$) were found to be independent risk factors for recurrence.

DISCUSSION

Surgical approach to colorectal pathologies has changed gradually in the past decade with more surgeons now performing laparoscopic colorectal surgery. Concerns over the adequacy of the laparoscopic approach in colorectal cancer was gradually abandoned leading to an approved statement by several organizations on the safety of the laparoscopic approach in colon cancer patients^{3,4} and further confirmation by long-term multicenter studies.^{9,10}

As in other laparoscopic procedures, the laparoscopic approach for colorectal cancer patients offers short-term benefits with an earlier return of gastrointestinal function,

Table 1.
Patients and Tumor Characteristics of Converted Versus Laparoscopic-completed Group

	Converted Group	Nonconverted	P Value
	(%)	(%)	
Number of Patients	25	150	
Age	74.4 ± 9.9	69.7 ± 12.5	0.076
No. Females	14 (56)	80 (53)	0.76
BMI	26.9 ± 4.0	27.2 ± 4.7	0.8
Previous Abdominal Operations (excluding inguinal hernias and appendectomies)	7 (28)	34 (24.1)	0.75
Operative Time (min)	172 ± 72.3	145.6 ± 55.6	0.034
Tumor Location			
Right colon	8 (32)	73 (49)	0.03
Rectum	9 (36)	21 (14)	
Stage Distribution			
Stage I	7 (28)	49 (33)	
Stage II	7 (28)	55 (37)	0.4
Stage III	11 (44)	46 (30)	
T Stage			
T1	2 (8)	19 (12)	
T2	6 (24)	37 (25)	0.37
T3	15 (60)	91 (61)	
T4	2 (8)	3 (2)	
Poorly Differentiated Tumors	2 (8)	14 (9.3)	NS

Table 2.
Immediate Operative Outcome of Converted Versus Laparoscopic-completed Group

	Converted Group	Nonconverted	P Value
	(%)	(%)	
Number of Patients	25	150	
Mortality	1 (4)	0 (0)	0.14
Major Surgical Complications	5 (20)	9 (6)	0.035
Wound Infection	5	14	0.16
Operative Time	172.9 ± 72.3	145 ± 55.7	0.09
Hospital Stay	14.4 ± 10.0	8.3 ± 7.1	0.0064

less postoperative pain, faster recovery, better cosmetic results, and shorter hospital stay.^{5,11} However, patients who undergo conversion to open surgery obviously would not benefit from these potential advantages. Despite improved experience and the constant development

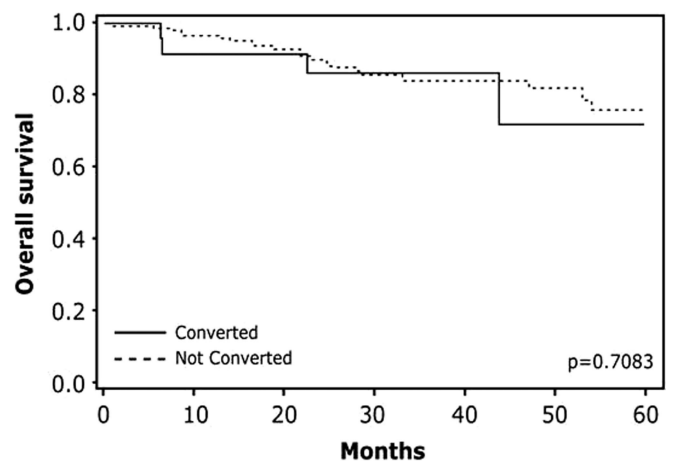


Figure 1. Kaplan-Meier analysis for overall survival, converted versus laparoscopic-completed group.

of laparoscopic technology, experienced centers still quote conversion rates of 10% to 15%.^{6,7} These figures reflect the limitation of laparoscopy in certain circumstances related to patient or disease factors.

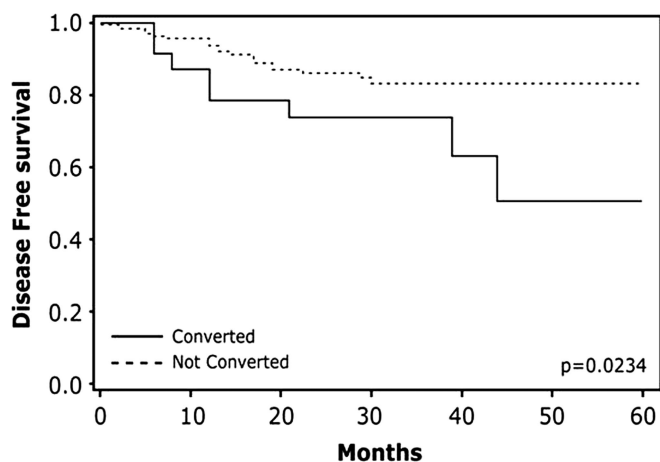


Figure 2. Kaplan-Meier analysis for disease free survival, converted versus laparoscopic-completed group

Factors associated with conversion in general are severe obesity, substantial adhesions, inflammatory conditions, and specifically cancer patients with large tumors and low rectal tumors.¹²

In our series, more than half of the patients were converted due to the difficulty of handling large tumors or low rectal tumors. Substantial data show that converted patients may experience a worse perioperative outcome compared with those who have a completed laparoscopy. Several studies^{7,8,12} have demonstrated that conversion in laparoscopic colorectal resection is associated with prolonged operative times, increased morbidity reflected in more anastomotic leaks and wound infections, increased need for blood transfusion, a slower recovery, and a longer hospital stay. Our results mimic these findings with a longer and more complicated postoperative course in the converted group.

Patients in the converted group had significantly more major surgical complications (20% versus 6%), a trend towards more wound infections (although not statistically significant, 20% vs. 9.4%, $P=0.12$), and a substantially longer hospital stay that averaged more than 14 days and was 6 days longer than the laparoscopically completed group. The reason for the increased complication rate and slower recovery in our series and in others lies probably in the fact that conversion is in many cases an indicator of a more complex and surgically challenging case regardless of the surgical approach (laparoscopic or open). Other reasons may be related to the prolonged operative times and the increased reported blood loss, both of which may cause an increase in body stress response and dampen the

host immune response leading to increased susceptibility to developing postoperative complications.¹³

An interesting study by Belizon et al⁸ demonstrated that prompt conversion in <30 minutes may reduce the overall morbidity associated with conversion. In addition, a recent study comparing short-term outcome of converted cases to primarily open colorectal resection demonstrated that conversion did not result in poorer short-term outcomes than the open colorectal resections.¹⁴ One of the limitations of our study is that the timing of conversion was not recorded, and we could not evaluate the impact of this factor on patient outcomes.

The second aim of this study was to evaluate the long-term oncological outcome of cancer patients. The main limitations of our study in this aspect are the limited number of patients and follow-up time. However, it is important to note that we included in this study only patients who had at least 1-year of follow-up and that more than half of our patients had at least a 3-year follow-up. Additionally, this study reflects the experience of a dedicated laparoscopic colorectal team. Few studies have looked into this issue.^{13,15-18} These studies report similar trends towards worse long-term outcome in converted patients; however, their results were different regarding overall and disease-free survival.

Chan et al¹³ demonstrated no statistically significant difference in overall survival between laparoscopically completed and converted patients. However, they did show a worse 5-year disease-free survival with a significant increase in local recurrence in the converted group.

Comparable results were reported by Ptok et al.¹⁵ They, likewise, demonstrated no difference in 5-year overall survival, but, interestingly, they reported a worse disease-free survival only in stage II converted patients. Contrary to these reports, other studies have demonstrated a worse overall survival^{16,17} but no change in disease-free survival.¹⁸

Moloo et al¹⁶ demonstrated a worse overall 2-year survival rate and a trend towards lower 5-year survival for converted patients compared to laparoscopic-completed ones. However, they did not report on disease-free survival. The converted and nonconverted groups had similar stage distribution, and the difference in survival could not be attributed to cancer stage. Subgroup analysis from the CLASSIC trial¹⁸ revealed that conversion to an open operation was associated with a significantly worse overall but not disease-free survival. This was mostly marked in the early follow-up period.

Another study¹⁷ focusing only on right colon cancer showed that conversion increased the perioperative morbidity, but, moreover, it had a negative impact on overall survival.

In our series, the converted patients had a worse disease-free survival with no impact on overall survival. Because our follow-up is somewhat limited, it may be assumed that a difference in overall survival might be evident later in the follow-up.

It is important to note that converted patients are not a homogenous group, and the characteristics of converted patients undergoing laparoscopy for CRC may vary between different surgeons and centers. Other factors that may impact the characteristics of a group of converted patients is the learning curve of the specific surgeon or center and obviously the different indications for conversion.

In our series, there was no difference in stage distribution between converted and nonconverted patients; however, the converted group had had more low rectal tumors that may be associated with an increased recurrence rate. Rotoli et al¹⁹ in a recently published article reported a higher local recurrence rate for converted patients in a series of 173 laparoscopic rectal resections.

Furthermore, also in the Chan et al¹³ study, it appears that the difference in disease-free survival between converted and nonconverted patients lies mainly in the difference in rectal cancer patients. Nearly all local recurrences in their series were in patients with rectal cancer with a 9.8% local recurrence in the converted group versus 2.8% in the nonconverted group. Nevertheless, in our study conversion was found to be an independent factor for recurrence in a multivariate analysis.

CONCLUSION

We have demonstrated a decrease in disease-free survival in converted versus laparoscopic-completed colorectal cancer patients operated on to cure their condition. These results are comparable to results of other recent published reports. However, the exact explanation for this difference is not very clear.

Reasons for the difference in long-term outcome may be attributed to the increased complication rate that may impact the immune system perioperatively and lead to a higher chance for recurrence. Additionally, it may be related to some characteristics of converted patients such as a higher rate of complex rectal cancers. We believe that an early and correctly judged conversion is important to

avoid a short- and long-term inferior outcome. Late conversions, specifically in low and difficult rectal cases, may lead to inadequate surgery that may put the patient at risk for postoperative complications and long-term outcome. Further larger studies with standardization of late versus early conversion and stratification for tumor stage and location are needed to draw final conclusions.

References:

1. Jemal A, Siegel R, Xu J, Ward E. Cancer statistics, 2010. *CA Cancer J Clin*. 2010;60(5):277–300, Sep–Oct.
2. Samantas E, Dervenis C, Rigatos SK. Adjuvant chemotherapy for colon cancer: evidence on improvement in survival. *Dig Dis*. 2007;25(1):67–75.
3. The American Society of Colon and Rectal Surgeons. Approved statement: Laparoscopic Colectomy for Curable Cancer. *Surg Endosc*. 2004;18(8):A1.
4. Veldkamp R, Gholghesaei M, Bonjer HJ, et al.; European Association of Endoscopic Surgery (EAES). Laparoscopic resection of colon cancer: consensus of the European Association of Endoscopic Surgery (EAES). *Surg Endosc*. 2004;18(8):1163–1185, Aug.
5. Guillou PJ, Quirke P, Thorpe H, et al; MRC CLASICC trial group. Short-term endpoints of conventional versus laparoscopic-assisted surgery in patients with colorectal cancer (MRC CLASICC trial): multicentre, randomised controlled trial. *Lancet*. 2005 May 14–0;365(9472):1718–1726.
6. Tekkis PP, Senagore AJ, Delaney CP. Conversion rates in laparoscopic colorectal surgery: a predictive model with 1253 patients. *Surg Endosc*. 2005;19(1):47–54.
7. Marusch F, Gastinger I, Schneider C, et al. Importance of conversion for results obtained with laparoscopic colorectal surgery. *Dis Colon Rectum*. 2001;44(2):207–214, discussion 214–216.
8. Belizon A, Sardinha CT, Sher ME. Converted laparoscopic colectomy: what are the consequences? *Surg Endosc*. 2006;20(6): 947–951.
9. Fleshman J, Sargent DJ, Green E, et al.; for The Clinical Outcomes of Surgical Therapy Study Group. 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(4):655–662, Oct.
10. Jayne DG, Guillou PJ, Thorpe H, et al.; UK MRC CLASICC Trial Group. 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, Jul 20.
11. Hewett PJ, Allardyce RA, Bagshaw PF, et al. Short-term outcomes of the Australasian randomized clinical study compar-

ing laparoscopic and conventional open surgical treatments for colon cancer: the ALCCaS trial. *Ann Surg*. 2008;248(5):728–738.

12. Gervaz P, Pikarsky A, Utech M, et al. Converted laparoscopic colorectal surgery. *Surg Endosc*. 2001;15(8):827–832.

13. 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;22(12):2625–2630.

14. Gonzalez R, Smith CD, Mason E, Duncan T, Wilson R, Miller J, Ramshaw BJ. Consequences of conversion in laparoscopic colorectal surgery. *Dis Colon Rectum*. 2006;49(2):197–204.

15. Ptok H, Kube R, Schmidt U, Köckerling F, Gastinger I, Lippert H; Colon/Rectum Carcinoma (Primary Tumor) Study Group. Conversion from laparoscopic to open colonic cancer resection – associated factors and their influence on long-term oncological outcome. *Eur J Surg Oncol*. 2009 Dec;35(12):1273–1279.

16. Moloo H, Mamazza J, Poulin EC, et al. Laparoscopic resections for colorectal cancer: does conversion survival? *Surg Endosc*. 2004;18(5):732–735.

17. Li JC, Lee JF, Ng SS, et al. Conversion in laparoscopic-assisted colectomy for right colon cancer: risk factors and clinical outcomes. *Int J Colorectal Dis*. 2010;25(8):983–988.

18. Jayne DG, Thorpe HC, Copeland J, Quirke P, Brown JM, Guillou PJ. 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(11):1638–1645.

19. Rottoli M, Bona S, Rosati R, et al. Laparoscopic rectal resection for cancer: effects of conversion on short-term outcome and survival. *Ann Surg Oncol*. 2009;16(5):1279–1286.