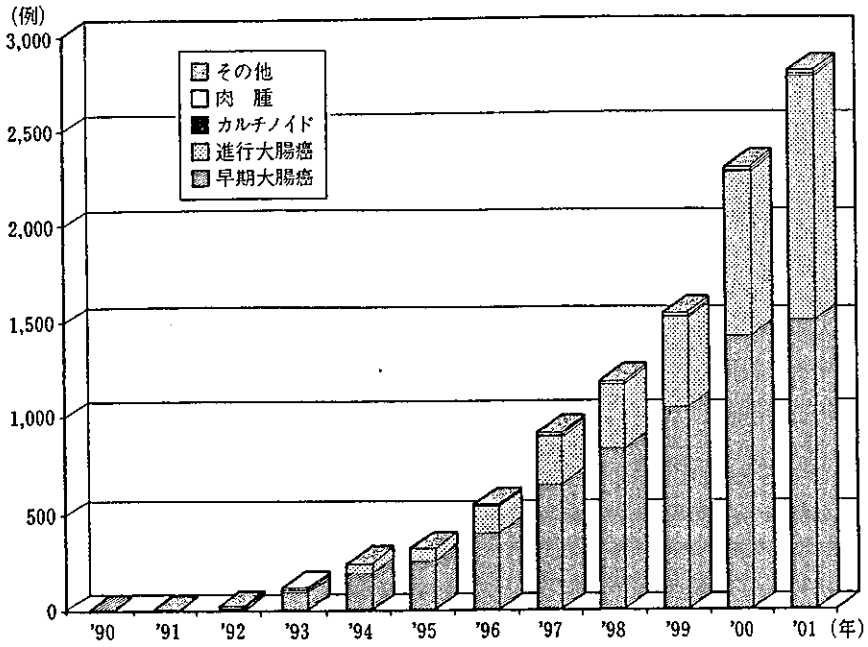

図3 大腸癌に対する腹腔鏡下手術
(日本内視鏡外科学会第6回アンケート調査報告)

外科治療全体に占める割合が急速に増加している(図3)．大腸癌に対する腹腔鏡下手術は，安全な剝離と確実なリンパ節郭清を行うために，さまざまなアプローチ法が開発されてきた[9]．通常の開腹手術と同様に腸管外側から剝離を行い，腸管の授動を十分行った後にリンパ節郭清を行う外側アプローチ法，内側の血管根部をまず処理しリンパ節郭清を行ってから外側の腸管付着部を切離する内側アプローチ法，側腹部から後腹膜を剝離し後腹膜下筋膜の前面と腸間膜の間にスペースを作り血管根部に到達する後腹膜アプローチ法，剝離に先行して後腹膜側に安全なスペースを確保する後腹膜先行アプローチ法など，癌の進行度や施設に応じて選択されている．

2．大腸癌に対する腹腔鏡下手術の評価

大腸癌に対する腹腔鏡下手術は，短期成績では，ランダム化比較試験の結果，開腹手術と比較して，術後の疼痛が少なく腸管蠕動の回復が早く入院期間の短縮や早期社会復帰が可能など低侵襲で整容性に優れている点で国内外で評価されている[10][11]．遠隔成績に関しては，米国(NCI trial)，英国(Classic trial)，オーストラリア，ドイツ，スペイン，ヨーロッパ(COLOR Trial)の研究グループが1990年代後半に大規模な比較試験を開始しているが，その結果を得るにはさらに3～5年を要する．そのなかで，最近，スペインのグループが長期予後に関して，ランダム化比較試験の結果を報告している[12]．対象症例は219例と少ないものの，stage I，II では生存率に差はなく，リンパ節転移を認める stage III において，開腹手術よりむしろ腹腔鏡下手術の方が生存率が有意に高いとの結果であった．

国内での長期成績に関するランダム化比較試験は未だ報告されていないが，昨年，厚生労働省がん研究助成金「がんにおける体腔鏡手術の適応拡大に関する研究」班(北野班)において，国内最大規模の大腸癌に対する腹腔鏡下手術の治療成績が報告された[13]．これによると国内12施設より登録された2,036例の大腸癌症例(結腸癌1,495例，直腸癌541例)において，結腸癌は，観察期間の中央値が32ヵ月(最長125ヵ月)で，5年生存率が，

Dukes A：99.5%，Dukes B：96.8%，Dukes C：79.6%，また直腸癌では，観察期間の中央値が25ヵ月(最長102ヵ月)で，Dukes A：98.7%，Dukes B：86.2%，Dukes C：82.8%という結果であった．これは同ステージおける開腹手術の成績と比較しても劣らず，むしろDukes B結腸癌で腹腔鏡下手術の方が良好な結果が示されている．スペインのグループ[12]やわが国の班研究の結果[13]から腹腔鏡下手術が生存率に良い影響をもたらす可能性が考えられている．この理由として手術侵襲に基づく生体免疫能低下の軽減があげられるが，いまだ明確な結論は得られていない．

今後はわが国における根治性に関する大規模なランダム化比較試験が必要と言えよう．

IV．肝癌に対する腹腔鏡下手術

1．術式の開発と現況

1991年Reich Hらの腹腔鏡下肝切除の最初の報告からしばらくはわが国では肝嚢胞や血管腫，腺腫など良性疾患に対する報告がほとんどであった．しかしここ数年，慢性肝炎や肝硬変など併存疾患を伴う原発性肝癌に対しても腹腔鏡下肝切除を積極的に施行する施設が増加してきた．肝癌に対するマイクロ波およびラジオ波凝固壊死療法ともに近年増加傾向にある．

腹腔鏡下手術の適応基準について，術前肝機能は開腹手術と同様である．最も重要な点は腫瘍の局在部位であり，肝表面や外側区域に局在する腫瘍が対象となる．術式では肝部分切除や肝外側区域切除が適応術式であり，脈管先行処理が必要な系統的肝切除症例は現時点では適応外とされている．

手技上の問題点として，肝実質には低圧系の肝静脈が存在するため，腹腔鏡下肝切除において最も危惧されるのは炭酸ガス塞栓である．したがって，われわれの施設では腹壁吊り上げ法併用の工夫にて肝切除を施行している．

2．肝癌に対する腹腔鏡下手術の評価

腹腔鏡下肝切除の治療成績についてはまだ大規模な臨床研究の報告がなく，積極的にすすめている施設ごとの症例対照研究の報告のみである．当施設において腹腔鏡下肝切除症例20例と同等の開腹切除症例とを比較したところ，腹腔鏡群は開腹群に比べ，出血量が少なく，術後在院日数が短く，合併症発生には差は認めない結果であった．長期成績については，現在までのところ全生存率および無再発生存率において有意な差は認めていない．肝癌においても低侵襲性のメリットが生かされるよう適応症例を選択しながら，凝固壊死療法とともにさらに普及していくものと思われる．

V．将来展望

1．適応拡大について

内視鏡外科手術の評価において，術中，術後のメリットについては数多く報告されているが，EBMの観点から満足できるものは少ない．また国内外において，胃癌・大腸癌をはじめ進行癌に対する根治性は未だ明確にされていないのが実状である．われわれは2001年度より，厚生労働省がん研究助成金(北野班)にて，大腸癌・肺癌・食道癌など悪性疾患に対する内視鏡外科手術の適応拡大について研究を行ってきた．この研究班で，これまでに国内最大規模の多施設共同の遠隔成績を含めた臨床データを示し，わが国の大腸癌・肺癌・食道癌に対する腹腔鏡下手術の今後の課題，すなわち進行癌に対する遠隔成績の評価の必要性を明らかにした．さらに，この班研究はこの4月より胃癌，前立腺癌における適応拡大をテーマに新たな研究を展開している．またこれらの研究成果を踏まえて，今年度より新たに厚生労働科学研究費補助金(北野班)による新規プロジェクトを発足させ，日本臨床腫瘍研究グループ(JCOG)に参加し，大腸癌に対するランダム化比較試験(RCT)をすすめている．これらのプロジェクト研究より，わが国から世界に発信しうる質の高い研究成果が得られることを確信している．

2．内視鏡外科腫瘍学

手術に伴う生体反応や腹腔内の損傷治癒，さらに炭酸ガスの使用が，癌の増殖・浸潤・転移などの生物学的動向にどのように影響を与えるか，未だ十分に解明されていない．現在，国内外で，担癌動物を用いた基礎実験が行われているが，必ずしも統一した見解が得られていない．われわれも，この新しい分野を「内視鏡外科腫瘍学」[14]と位置付け，炭酸ガス気腹が腹膜播種・肝転移・リンパ節転移・創転移へどのような影響を与えるか転移モデルを用いて検討した．その結果，炭酸ガス気腹は開腹に比べ，腫瘍増殖や腹膜播種，肺転移，創転移，リンパ節転移が抑制されることを見い出し，一方，肝の血管内皮へのダメージのためか肝転移に関しては促進の可能性があることを明らかにした．内視鏡外科の進歩のためには，臨床研究と基礎研究との両サイドからアプローチしていくことが必要と考えられる．

3．患者 QOL の評価

多くの臨床研究により，腹腔鏡下手術の低侵襲性が明らかにされているが，患者 QOL に関してはその客観的評価の困難性より必ずしも明確にはされていない．2002年 JAMA に発表された大腸癌におけるランダム化比較試験の結果からは腹腔鏡下手術のメリットはごくわずかであった[15]．今後，術式に応じた術後機能障害を中心にわが国の生活様式にあった短期および長期の QOL 評価を進めていく必要がある．

4．新しい技術や機器の開発

早期癌の治療はいかに根治性を高めるかということから，いかに患者の QOL を向上させるかということに重きを置く方向となっている．Sentinel node navigation surgery (SNNS) によるリンパ節郭清の必要性を術中に判断し，必要のない予防的リンパ節郭清を省くことにより，侵襲をより小さくすることが可能となるであろう．一方，Hand-assist 法を用いて，広汎なリンパ節郭清を比較的容易に行おうとする工夫がなされ，進行癌への適応拡大も試みられている．Robotic surgery の登場によりさらなる手術侵襲の軽減と適応の拡大が進むと考えられる．高度進行癌において，試験開腹を回避するため，病期決定や腹膜播種などの診断を兼ね備えた腹腔鏡観察が有用であり，診断と治療の両面において腹腔鏡下手術が普及していくものと考えられる．

おわりに

悪性疾患に対する外科治療は，大きく変貌しようとしている．これは「患者にやさしい治療」を実践させうる腹腔鏡下手術の登場と患者主体の治療を求める社会のニーズに帰するところが大きい[16]．今後，各悪性疾患における腹腔鏡下手術の長期成績や患者 QOL，経済性などについてわが国から国家レベルでの質の高い研究成果を明らかにし，ひとりでも多くの患者が安全な腹腔鏡下手術の恩恵に預かるよう願ってやまない．

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SURGICAL ENDOSCOPY
and Other Interventional Techniques

A comparison of the complication rates between laparoscopic colectomy and laparoscopic low anterior resection

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Abstract
Background: This study compared the short-term outcomes, including the complication rate and minimum surgical invasiveness, between patients with colon and rectal carcinomas, who underwent laparoscopic surgery.
Methods: A review evaluated 151 patients who underwent laparoscopic colectomy (Lap-colectomy; $n = 120$) and laparoscopic low anterior resection (Lap-LAR; $n = 31$) between July 2001 and December 2003. The short-term outcomes were compared between the two groups.
Results: The mean operative time and blood loss were significantly greater in the Lap-LAR group. However, the complication rates and postoperative course between the two approaches were similar, and no anastomotic leakage was observed. There was no significant difference in the serum C-reactive protein level and white blood cell count between the two groups in the early postoperative period.
Conclusions: Lap-LAR for rectal carcinoma can be performed safely without increased morbidity or mortality, and its short-term benefits are comparable with those conferred by Lap-colectomy.

Key words: Laparoscopic colectomy — Laparoscopic low anterior resection — Complication — Colorectal cancer — Short-term outcome

More than 10 years have passed since laparoscopic surgery became the approach of choice for colorectal cancer, but its value still remains unestablished. One of the reasons for this is that oncologic safety, which is the most important factor in a cancer surgery, has not been well confirmed for LS as it has for conventional open surgery. Oncologic outcome is not compromised by the laparoscopic approach, at least in the short term [6, 7, 9, 19]. According to some reports, the treatment outcome for laparoscopec surgery is not inferior to that for open surgery in terms of 5-year survival. However, the safety of laparoscopic surgery should be evaluated and confirmed in prospective randomized controlled trials [8, 15].

Unfortunately, laparoscopic surgery as an approach to rectal cancer is a very difficult surgery from a technical standpoint. Consequently, many trials have excluded patients with middle and lower rectal carcinomas. Laparoscopic low anterior resection (Lap-LAR) reportedly involves a high rate of anastomotic leakage (5.7–21%), and some authors have recommended covering ileostomy routinely in Lap-LAR cases, a step that is not required in some open surgery cases [1, 3, 5, 10, 13, 20]. Technical difficulties may be overcome by the surgeon's proficiency, and by the improvement and development of instruments, but because of the high complication rate, it currently is controversial whether Lap-LAR can be regarded as a minimum invasive surgery for rectal cancer.

Since our first laparoscopic colectomy for colorectal carcinoma in 1993, approximately 280 laparoscopic resections for colorectal malignancies have been performed at our institution. In June 2001, we unified our surgical and postoperative management procedures, and began to expand the use of laparoscopic surgery to include middle and lower rectal carcinomas. As a consequence, the complication rate and mean length of hospitalization have been reduced at our institution.

In the current study, short-term outcomes, including the complication rate and minimum surgical invasiveness, were compared selected patients with colon carcinoma and those with rectal carcinoma who underwent laparoscopic surgery at our hospital after June 2001 to evaluate whether Lap-LAR is a surgical technique with benefits similar to those for laparoscopic colectomy (Lap-colectomy).

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Patients and methods

Patients

Between June 2001 and December 2003, we performed 151 continuous laparoscopic resections for selected patients with colorectal carcinoma. Because the safety of laparoscopic surgery patients with cancer remains to be established, candidates for radical surgery were patients who had a preoperative diagnosis of T1 or T2. Additionally, laparoscopic surgery cases also included patients with a preoperative diagnosis of T3 who nevertheless wished to undergo laparoscopic surgery and those with colon or upper rectal carcinoma for which palliative resection was considered necessary. We excluded the following groups of patients from laparoscopic resection: patients with tumors larger than 6 cm, patients with a history of extensive adhesions, patients with severe obesity (body mass index exceeding 32 kg/m2), patients with intestinal obstruction, and patients who did not consent to laparoscopic surgery.

All the patients were evaluated before surgery by clinical investigation including barium enema, total colonoscopy, chest x-ray, abdominal ultrasonography, and computed tomography. For the patients with rectal carcinoma, a primary rectal carcinoma was defined according to its distance from the anal verge, as determined by colonoscopy. The tumors were grouped into lower rectum (0–7 cm), middle rectum (7.1–12 cm), and upper rectum (12.1–17 cm). We defined conversion to open surgery as any incision larger than 7 cm, excluding cases in which the incision was enlarged because of a large specimen that could not be removed through a 7-cm incision.

Laparoscopic technique

The techniques of laparoscopic resections have previously been described thoroughly [6, 19, 20]. For right-sided lesions, the right colon was mobilized initially, and the vascular pedicles were divided at their origin, together with the draining lymph nodes intracorporeally. For patients with a preoperative diagnosis of T2–T3 lesions, the laparoscopic no-touch isolation technique was performed [12]. With this technique, after early proximal ligation of the tumor-feeding vessels and resection of the mesentery intracorporeally, mobilization of the right colon was performed. The bowel loop was delivered under a wound protector through a small incision. The division of the marginal vessels and the anastomosis were performed extracorporeally.

For transversecolon lesions, mobilization of hepatic, splenic, or both flexures was performed according to the tumor location. Proximal ligation of the right, left, or both branches of the middle colic vessels at their origins was performed intracorporeally or extracorporeally. The bowel loop was delivered, and anastomosis was performed in the same way.

For the descending colon and the proximal sigmoid colon lesions for which extracorporeal anastomosis was considered possible, the left colon was mobilized initially. After mobilization of the splenic flexure, intracorporeal ligation of the tumor-feeding vessels (left colic artery, sigmoid arteries, inferior mesenteric vessels) at their origins was performed. The bowel loop was delivered through a small incision, and the division of the mesenterium was performed extracorporeally, followed by extracorporeal anastomosis.

For the distal sigmoid colon and rectal lesions, after mobilization of the left colon and splenic flexure, if necessary, intracorporeal high ligation of the inferior mesenteric vessels followed by mobilization of the rectum and mesorectum was performed. For higher lesions, mesorectal tissue down to 5 cm below the tumor was excised routinely. Middle and lower rectal tumors were treated by total mesorectal excision. Rectal transection was performed with endolinear staplers (Endo GIA Universal; Auto Suture, U.S. Surgical Corp., Norwalk, CT, USA). A 4-cm incision then was made over the mid-lower port site, and the bowel was exteriorized under wound protection. The anastomosis was performed by the double stapling technique. For patients with lesions located within 2 cm of the dentate line, laparoscopic intersphincteric rectal resection and handsewn coloanal anastomosis were performed. This surgical technique has been described previously [18].

Study parameters

The parameters analyzed included gender, age, body mass index (BMI), prior abdominal surgery, operative time, operative blood loss, conversion rate, days to resume diet, length of postoperative hospital stay, and both intraoperative and postoperative complications within 30 days of surgery. Pathologic staging was performed according to Dukes' stage. White blood cell (WBC) count and C-reactive protein (CRP) in serum were measured preoperatively and on postoperative day 1 routinely, and on postoperative days 2, 3, and 4, if necessary.

Statistical analysis

Statistical analysis was performed using Student's t test, Fisher's exact test, and the chi-square test as appropriate. A p value less than 0.05 was considered significant.

Results

The patient demographics are summarized in Table 1. No significant differences were observed in baseline characteristics between the two groups, with the exception that mean BMI was significantly greater in the Lap-LAR group ($p = 0.0438$). In the Lap-LAR group, two patients underwent laparoscopic handsewn coloanal anastomosis, and a transverse-coloplasty pouch was constructed for two patients. All the patients with covering ileostomy underwent ileostomy closure. With regard to simultaneously performed surgical techniques, the Lap-colectomy group had two patients who underwent combined surgery: one had a laparoscopic cholecystectomy and the other had resection of a benign submandibular gland tumor. In the Lap-LAR group, two patients underwent concurrent laparoscopic cholecystectomy. Data on these combined surgical techniques all were included in the analyses of the colorectal cancer surgeries.

Operative and postoperative results are shown in Table 2. All the operations were completed laparoscopically in this study. The mean operative time and blood loss were significantly greater in the Lap-LAR group. We did not experience accidental intestinal perforation at or near the tumor site. Liquid and solid foods were started on median postoperative days 1 and 3 in both groups. The median length of postoperative hospitalization was 8 days in both groups. No significant differences were observed in the postoperative course between the two groups. All the patients were discharged to home.

The postoperative complications are listed in Table 3. There were no perioperative mortalities. The morbidity rate was 13.3% (16/120) in the Lap-colectomy group and 16.1% (5/31) in the Lap-LAR group. However, no anastomotic leakage occurred in this study. Reoperation of the laparoscopic division of an adhesive band for a postoperative small bowel obstruction was necessary for one patient in the Lap-colectomy group (0.8%). No significant differences in complication rates were observed between the two groups. No significant differences were found between the two groups in terms of CRP and WBC levels after surgery (Fig. 1). At the end of the study period, only one patient in the Lap-

Table 1. Patient's characteristics

	Lap-colectomy	Lap-LAR	*p* Value
Number of patients	120	31	
Sex ratio (male:female)	71:49	18:13	1.0000
Age(years) *n* (range)	61 (30–88)	59 (37–76)	0.3693
Body mass index (kg/m2) *n* (range)	22.7 (14.9–29.6)	23.8 (17.5–32.4)	0.0438
Prior abdominal surgery *n* (%)	28 (23.3)	14 (45.1)	0.3545
Dukes' stage (*n*)			
A	94	23	0.5248
B	5	0	
C	16	6	
D	5	2	
Follow-up (months) *n* (range)	13 (2–33)	14 (2–33)	0.8472
Location (*n*)			
Cecum	15		
Ascending colon	21		
Transverse colon	16		
Descending colon	12		
Sigmoid colon	56		
Rectosigmoid/upper rectum		6	
Middle rectum		6	
Lower rectum		19	
Laparoscopic colorectal procedures (*n*)			
Ileocecal resection	15		
Right hemicolectomy	27		
Transverse colectomy	5		
Left hemicolectomy	2		
Descending colectomy	10		
Sigmoid colectomy	49		
Partial resection	12		
Anterior resection with DST		29	
Anterior resection with ISR-CAA		2	
Transverse coloplasty pouch		2	
Covering ileostomy		6	

Values are means (range)
Lap, laparoscopic; LAR, low anterior resection; DST, double-stapling technique; ISR-CAA, intersphincteric rectal resection and handsewn coloanal anastomosis

Table 2. Operative and postoperative results

	Lap-colectomy *n* (range)	Lap-LAR *n* (range)	*p* Value
Operative time (min)	200 (115–348)	250 (190–472)	< 0.0001
Blood loss (ml)	32 (5–248)	60 (10–265)	0.0011
Conversion	0	0	
Liquid intake (days)	1 (1–3)	1 (1–3)	0.9562
Solid food (days)	3 (2–5)	3 (2–4)	0.8291
Hospital stay (days)	8 (7–20)	8 (7–17)	0.2520

Values are medians (range)
Lap, laparoscopic; LAR, low anterior resection

Table 3. Morbidities and mortality

	Lap-colectomy (*n*)	Lap-LAR (*n*)	*p* value
Mortality	0	0	
Morbidity			
Wound sepsis	4	2	0.4007
Bowel obstruction	6	1	1.0000
Urinary tract infection	3	0	1.0000
Anastomotic leakage	0	0	1.0000
Abscess	0	1	1.0000
Pneumonia	1	0	1.0000
Pneumothorax	1	0	1.0000
Pulmonay embolism	1	0	1.0000
Enterocolitis	1	0	1.0000
Neurogenic bladder	0	1	0.2053
Total	17(16[a])	5	0.7711

Lap, laparoscopic; LAR, low anterior resection
[a] Number of patients

colectomy group experienced a recurrence (hepatic metastases).

Discussion

In the current study, short-term outcomes were compared between patients with colon cancer and patients with rectal cancer who underwent laparoscopic surgery. In the Lap-LAR group, the mean BMI was found to be significantly greater. In addition, there was significantly more blood loss, and the mean operative time was significantly longer. However, the complication rates and postoperative course between the two approaches were similar, and no anastomotic leakage was observed. The observed safety of Lap-LAR may have been attributable to improved instruments and the surgeon's proficiency.

Historically, conventional open LAR has resulted in higher complication rates, and is considered to be an

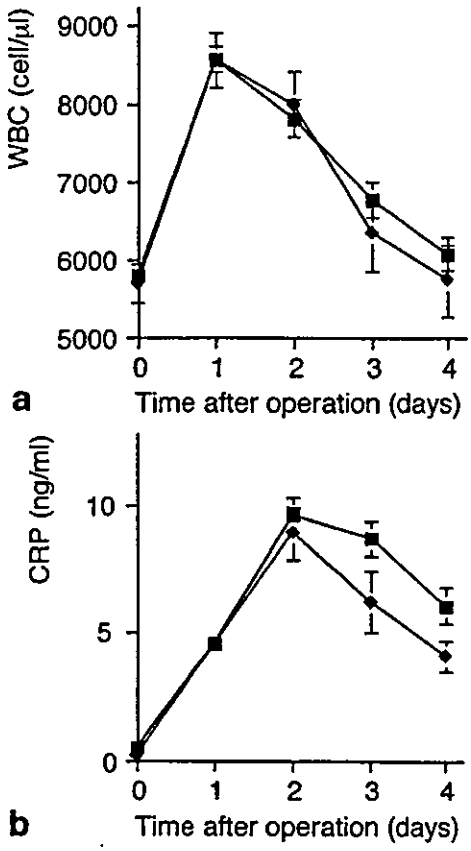

Fig. 1. Changes in white blood cell (WBC) count (a) and serum C-reactive protein (CRP) (b) levels in patients after laparoscopic colectomy (■) and laparoscopic low anterior resection (◇). The difference between the two groups was not significant. Each bar represents the mean ± standard error.

approach of greater invasiveness than open colectomy [2]. In our study, patients were selected appropriately and cautiously. Consequently the conversion rate was 0% in the 151 cases. As a result, in the Lap-LAR group, laparoscopic surgery achieved a minimum invasiveness comparable with that of the Lap-colectomy group. Moreover, when we compared CRP and WBC as objective markers of surgical stress in the early postoperative period, there were no significant differences in either of these markers between the two groups. Instead of expanding the use of laparoscopic surgery without limit, it is necessary to set appropriate criteria for selection, and then to perform laparoscopic surgery while monitoring the safety of the procedure in properly selected patients who can benefit from the advantages of laparoscopic surgery.

This study demonstrated that laparoscopic approaches to rectal carcinoma do not compromise early postoperative recovery such as days to oral feeding and length of hospitalization. Although we did not experience anastomotic leakage, previous studies have reported an anastomotic leakage rate of 5.7% to 21% for patients who underwent Lap-LAR, and some authors have recommended a covering stoma as a routine step in Lap-LAR [1, 3, 5, 10, 13, 20]. For patients who are to have a covering stoma, a surgery for stoma closure also is needed as a matter of course. If a covering stoma, which is not required for open surgery cases, becomes indispensable for Lap-LAR cases, the patient's burden will increase. Currently, with regard to LAR, patients are required to make a choice themselves as to whether they will undergo open or laparoscopic surgery after they have been given sufficient information.

Recently, laparoscopic handsewn coloanal anastomosis has been reported for patients with lesions located in the lower rectum that have more than 2 cm of distal free margin to the dentate line [14, 18]. This technique allows a sufficient distal margin to be obtained under direct vision to preserve the sphincter and avoid abdominal perineal resection. However, further investigation is needed regarding the oncologic and functional safeties of this novel surgical technique.

Despite many successful reports of laparoscopic resection for advanced lower rectal carcinoma in Western countries, advanced lower rectal carcinoma is seldom treated laparoscopically in Japan. Lateral pelvic lymph node dissection combined with total mesorectal excision remains the standard surgical procedure for patients with advanced lower rectal carcinoma in Japan, and lateral lymph node dissection by laparoscopy still is an unexplored frontier.

We believe that the incidence of lateral lymph node involvement for lower rectal cancer (13–16%) is not negligible, and that a 5-year survival rate of 15% to 40 % for patients with lateral lymph node involvement demonstrates that some patients may be cured by extended surgery [4, 11, 16]. In our institution, lateral lymph node dissection by conventional open methods is performed for tumors located in the lower rectum if the preoperative tumor penetration is T3 or T4, despite perirectal lymph node status, or even T2 if perirectal lymph nodes appear to be positive. Therefore, most lesions of the lower rectum treated laparoscopically are T1 or node negative T2 or T3.

In this study, days to the resumption of diet after surgery and length of postoperative hospital stay were compared between the two groups. However, these numeric values are less objective because they are influenced by social factors such as judgment of the physician in charge, clinical pass, manners, and customs. Therefore, it should be noted that these values cannot be indicators of minimum invasiveness. Previous reports on laparoscopic surgery indicate that patients in Japan tend to remain in hospital longer than patients in Western countries [17]. The results of the current study in terms of postoperative stay after laparoscopic surgery for colorectal cancer are among the shortest reported in Japan. However, as compared with data from Western institutions, the mean length of hospital stay was, in fact, 1 to 2 days longer. This may be attributable to the fact the 70% of the medical costs are covered by public health insurance for every patient in Japan. Moreover, many Japanese patients have private health insurance that pays the patient a specified amount of money per day of hospitalization. In some types of insurance contract, the longer the patient stays in hospital, the more the insurance payment is, thereby yielding greater "earnings." Under these circumstances, patients do not need to leave the

hospital in a hurry. Obviously, this situation in Japan is wasting medical funds. It goes without saying that the situation must be improved.

The mean operative time in the current study was a little longer than in previously reported studies. This may be attributable to the fact that at our institution, trainee doctors perform part or all of a surgical procedure under the guidance of staff doctors in many cases. Also, we are unable to make a laparoscopic team. However, it is evident from results of this study that the quality of our operations has not been lowered.

In conclusion, the current study demonstrates that Lap-LAR can be performed safely without increased morbidity or mortality, and that it offers benefits in terms of faster recovery of bowel motility and shorter hospital stay comparable with patients who undergo Lap-colectomy. With improvements in technology and surgeons' experience, we believe that the use of this procedure will expand. Analysis of long-term oncologic outcomes for patients with colon and upper rectal carcinoma will take place in a few years time. It remains unclear, however, whether laparoscopic resection for middle and lower rectal carcinoma is equivalent to conventional open surgery in terms of oncologic outcome, and this can determined only by evaluation of multiple randomized studies.

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SURGERY TODAY

Laparoscopic Colectomy Versus Open Colectomy for Colorectal Carcinoma: A Retrospective Analysis of Patients Followed Up for at Least 4 Years

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Abstract

Purpose. To compare the long-term outcome of laparoscopic-assisted colectomy (LAC) with that of open colectomy (OC) for carcinoma in patients followed up for a minimum of 4 years.

Methods. We reviewed the medical records of 118 patients who underwent LAC between January 1993 and September 1999, and compared the results with those of 163 selected patients who underwent OC during the same period.

Results. Curative surgery was performed in 114 of the LAC patients. Because recurrence did not develop in any of the patients with stage I cancer, we analyzed the patterns of recurrence only in those with stage II or III disease; 58 patients were analyzed in the laparoscopic group and 130 in the open colectomy group. In the LAC group, 7 (12.1%) patients had recurrence after a median follow-up of 58 months and in the OC group, 19 (14.6%) patients had recurrence after a median follow-up of 56.5 months. The 5-year disease-free rate was similar in the LAC (87.8%) and OC (85.5%) groups ($P = 0.75$ by the log-rank test).

Conclusions. Laparoscopic-assisted colectomy is effective and safe for the treatment of colorectal carcinomas under the criteria used in this study. However, further validation of these results is recommended.

Key words Colorectal cancer · Laparoscopic colectomy · Recurrence

Introduction

Laparoscopic surgery is commonly performed for various disorders of the digestive organs. Its benefits include a lower incidence of postoperative ileus, shorter hospitalization, less postoperative pain, and a smaller incision.[1–3] The practice of laparoscopic cholecystectomy for gallstone disease is well established, based on the simplicity of the procedure and the benign nature of the disease. In contrast, laparoscopic operations for cancer of the digestive organs remain controversial. In recent years, many reports on successful laparoscopic colectomy have been published and it is gradually becoming the procedure of choice for the treatment of colorectal carcinoma.[4–10] However, the curability of laparoscopic colectomy for colorectal carcinoma remains controversial because of uncertainties about the adequacy of resection, the possibility of cancer cell spread to the port site, and the lack of data on long-term results. The aim of this study was to compare the clinical outcome of patients who underwent laparoscopic-assisted colectomy (LAC) for colorectal carcinoma with that of patients who underwent conventional open colectomy (OC) after a minimum follow-up period of 4 years.

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Patients and Methods

Study Design

Between January 1993 and September 1999, 118 patients underwent laparoscopic colorectal surgery for colorectal carcinoma at our hospital. All patients diagnosed with colorectal carcinoma were considered candidates for laparoscopic-assisted colectomy (LAC). Criteria determining ineligibility for LAC were: lower rectal carcinomas deemed surgically resectable, lesions of the transverse colon or ascending colon near the hepatic flexure or descending colon which tumors suspected of invading the muscularis or deeper layers, tumors requiring low anterior resection or abdominoperitoneal resection of the rectum, tumors larger than

8cm on barium enema or computed tomography (CT), tumors infiltrating adjacent organs on CT, previous major abdominal surgery near the field of the colorectal operation, and patients presenting with intestinal obstruction or perforation, other gastrointestinal tumors, or obesity (body mass index >30kg/m^2). All patients underwent preoperative colonoscopy and biopsy of the tumor, as well as barium enema to confirm the site of the lesion. CT was done to gauge the size of the lesion and look for evidence of local infiltration or distant metastases. If we considered that the tumor would be difficult to identify during the subsequent laparoscopic procedure, the site was marked preoperatively by a colonoscopic injection of sterilized China ink into the submucosa near the tumor.

All consecutive patients who underwent an elective procedure were enrolled prospectively in a registry database which recorded the following variables: the patient's age, gender, and purpose of procedure (curative vs palliative); conversion to open surgery; tumor pathology data (stage, differentiation, radial margins, lymph nodes harvested, and the number of lymph nodes with metastasis); duration of surgery; intraoperative blood loss; operative and postoperative complications; surgical reintervention; and hospitalization. Follow-up data included the incidence of local, distant, or trocar site recurrence, and cancer-related death. Data on patients requiring conversion to OC were analyzed, together with those on patients who underwent laparoscopically completed surgery, by an intention-to-treat analysis.

The same surgeon performed all laparoscopic procedures using a standardized technique, which we described previously.[11] Surgical standards for colon cancer included radical resection of the tumor-bearing segment with central ligation of its vessels according to the lymphatic dissection. For patients with sigmoid and rectal cancers invading the muscularis propria or deeper layers, high ligation of the inferior mesenteric artery with clips was routinely performed. For patients with right-sided colon cancers invading the muscularis propria or deeper layers, the ileocolic vessels and right colic vessels were clipped at their origin.

During the same period (January 1994 to September 1999), 324 patients underwent conventional curative OC for colorectal carcinoma. To assess the long-term outcome of LAC, a control group of 163 patients was selected as follows. Because abdominoperitoneal resection and low anterior resection were not performed as laparoscopic procedures, no patient who underwent either of these procedures was included in the control group. We also excluded patients with pathological findings of a tumor larger than 8cm or a tumor infiltrating the adjacent organs, those with more than ten lymph nodes positive for metastasis (because the maximum number of lymph nodes with metastasis identified by laparoscopic surgery was ten), and patients older than 84 years (because none of the patients who underwent LAC was older than 84 years).

Pathological classifications were based on the Japanese Classification of Colorectal Carcinoma by the Japanese Society for Cancer of the Colon and Rectum.[12] The number of lymph nodes with metastasis was divided into two groups according to the TNM classification, in which N1 indicates one to three nodes involved, and N2 indicates four or more nodes involved.

Assessment of Endpoints

All patients were followed up by a structured program of four outpatient visits for the first year and two thereafter. Investigations at each visit included regular physical examination, liver function tests, and carcinoembryonic antigen assay. Ultrasonography or CT of the abdomen was done at 3- to 6-month intervals, chest X-ray was done biannually, and colonoscopy was done annually.

Statistical Analysis

Results were evaluated with the chi-squared test, Student's *t*-test, and Mann-Whitney *U*-test to compare categorical, parametric, and nonparametric data, respectively. Disease-free intervals were calculated by the Kaplan-Meier method, and differences between groups were compared with the log-rank test. A P value of less than 0.05 was considered significant.

Results

The 118 patients comprised 66 men and 52 women with an average age of 61.7 years (range 31–83), and an average body mass index of 22.5 (range 15.2–30). There was no mortality during the first 30 days after laparoscopic surgery. The rate of conversion from laparoscopic to open surgery was 8.5% (10/118) and the reasons for conversion were bleeding (n = 4), adhesions (n = 1), tumor fixation (n = 3), and injury of the bowel wall (n = 2). Postoperative complications developed in 27 (22.9%) of the 118 patients, wound infection being the most common, occurring in 14 (12.3%). The other complications were small bowel obstruction (n = 6), bleeding (n = 1), and anastomotic leakage (n = 3). In the final assessment of long-term outcome, four patients were excluded because they underwent palliative surgery of colorectal cancer or of coexisting cancer in another organ. The other 114 patients underwent curative surgery. According to TNM staging, 56 patients had Stage I cancer, 33 had Stage II cancer, and 25 had Stage

Table 1. Demographics and tumor characteristics of the two groups of patients

	LAC	OC
Patients		
No.	58	130
Mean age (years)	60.9 (31–83)	64.7 (32–83)
Male/female	29/29	76/54
Tumor size (mm)	43.9 (10–80)	45.8 (15–80)
Differentiation		
Well	40	83
Moderate	14	39
Poor	2	0
Mucinous	1	8
Signet	1	0
Depth of invasion		
sm	2	2
mp	2	4
ss	35	79
se	18	45
si	1[a]	0
TNM stage		
Stage II	33	80
Stage III	25	50

Well, well-differentiated adenocarcinoma; moderate, moderately differentiated adenocarcinoma; poor, poorly differentiated adenocarcinoma; mucinous, mucinous carcinoma; signet, signet cell carcinoma; sm, submucosal invasion; mp, muscularis propria invasion; ss, subserosal invasion; se, serosal invasion; si, other organ invasion; LAC, laparoscopic-associated colectomy; OC, open colectomy
[a] Bladder invasion

III cancer. After a median follow-up period of 58 months and a mean follow-up period of 60.3 months, 93.9% of the patients were free of recurrence. There was no port site recurrence. Peritoneal recurrence developed in two patients operated on for Stage III cancer, and distant metastases developed in five patients: two operated on for Stage II cancer and three operated on for Stage III cancer. The 5-year disease-free survival rates were 100% for Stage I, 94.1% (standard error 4.0%) for Stage II, and 78.6% (standard error 8.5%) for Stage III.

To elucidate the pattern and incidence of recurrence after laparoscopic surgery, we compared the data of patients who underwent LAC with those who underwent OC. Because these was no recurrence in patients operated on for Stage I cancer in either group, we selected Stages II and III for comparative analysis. In the OC group, 33 patients operated on for Stage I cancer were excluded from further analysis, leaving 58 patients in the LAC group and 130 in the OC group. The demographic data of the patients and the tumor characteristics for the two groups are shown in Table 1. The mean age was significantly higher in the OC group (P = 0.032). The mean tumor size in greatest dimension was 43.9mm in the LAC group and 45.8mm in the OC group. The distribution of patients according to TNM stage was similar. The adequacy of lymph node dissection was evaluated by the number of lymph nodes harvested. The median number of nodes identified in a specimen was 16.5 in the LAC group versus 14.0 in the OC group, and the mean number of positive nodes was 2.3 in the LAC group versus 2.2 in the OC group (Table 2). Recurrence developed in only three of ten patients found to have more than four lymph nodes with metastasis (N2 by the TNM classification), all of whom underwent OC.

Table 2. Number of harvested lymph nodes with metastasis in each group

	LAC	OC
Lymph nodes harvested		
Range	3–44	2–65
Median	16.5	14.0
With metastasis		
1–3	24	41
≥4	1	9
Mean	2.3	2.2

LAC, laparoscopic-associated colectomy; OC, open colectomy

Recurrence was found in 7 (12.1%) of the patients in the LAC group after a median follow-up period of 56 months and in 19 (14.6%) of the patients in the OC group after a median follow-up period of 56.5 months. In the LAC group, 2 (3.4%) patients had peritoneal carcinomatosis and 5 (8.6%) had distant metastases. In the OC group, 1 (0.8%) patient had abdominal wall recurrence, 3 (2.3%) had peritoneal carcinomatosis, and 15 (11.5%) had distant metastases. Peritoneal carcinomatosis and abdominal wall recurrence developed in patients with tumor invasion extending beyond the visceral peritoneum in both the LAC and OC groups. The rate of distant metastasis was similar in the two groups (P = 0.62 by Fisher's exact test). The disease-free rates at 5 years were 87.8% (standard error 4.3%) for the LAC group and 85.5% (standard error 3.2%) for the OC group. There was no significant difference between the two groups when the Kaplan-Meier curves were compared using the log-rank test (P = 0.75; Fig. 1).

Discussion

One of the major concerns of laparoscopic surgery for colorectal malignancy is the risk of recurrence, the assessment of which requires prospective randomized studies. Several randomized studies of LAC versus conventional OC for colorectal cancers are in progress; namely, the NCI trial in USA, the CLASICC trial in Great Britain, and the COLOR trial[13,14] in Europe, with a total of 1200 patients recruited in each. Results from

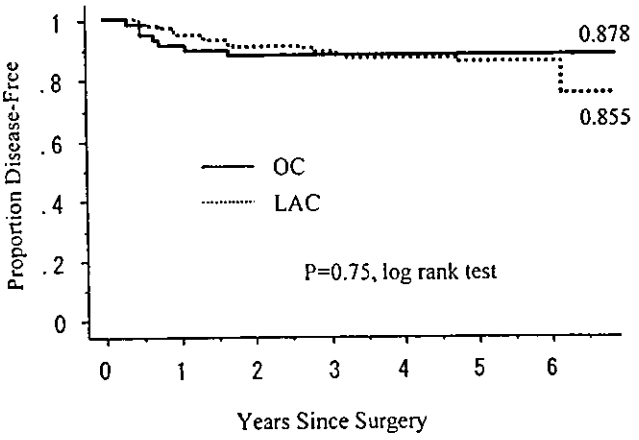

Fig. 1. Kaplan-Meier curves for disease-free survival. *LAC*, laparoscopic-associated colectomy; *OC*, open colectomy

these studies will determine the effectiveness of laparoscopic surgery for colorectal cancer. Many studies comparing laparoscopic with open colorectal surgery for malignancy have demonstrated that the laparoscopic approach provides equal oncological clearance in terms of the number of lymph nodes harvested and the resection margin.[2,4,6,15,16] Furthermore, no differences in early survival rates have been found.[2,6,15,17–21] We began using LAC in the treatment of colorectal carcinoma in 1993 and have followed all our patients prospectively. The first case of recurrence, in the form of peritoneal carcinomatosis, was detected in 1997, 5 years after we began performing LAC, and within 1 year of this patient's operation. This case induced us to compare the rates and types of tumor recurrence in laparoscopic surgery and open surgery.

To assess the suitability of laparoscopic resection, lymph node harvest was compared, but there was no difference between the two groups in the number of lymph nodes harvested in our series. The median number of nodes examined was more than 12, according to the International Union Against Cancer (UICC) requirement that a minimum of 12 nodes must be examined for a diagnosis of stage I or II cancer.

Port site recurrences resulting from a poor surgical technique have been reported.[18,22] To prevent this, we initially planned to exclude tumors extending beyond the visceral peritoneum, based on the belief that they represent a high risk for peritoneal dissemination. However, because it was impossible to accurately assess if cancer invasion beyond the visceral peritoneum had occurred, we performed LAC for some tumors subsequently found to have histological invasion of the visceral peritoneum. To data, no case of port site recurrence has been detected.

Peritoneal dissemination only occurred in patients operated on for tumors invading beyond the visceral peritoneum. However, as the incidence of peritoneal dissemination was similar between the two groups, we suggest that laparoscopic surgery does not influence the development of this dissemination. In our series, there were no significant differences in the recurrence rates between the LAC and OC groups. Lujan et al.[23] reported similar 5-year survival rates after laparoscopic and conventional surgery for cancer, although their comparison was done using historical control groups. Lacy et al.[24] reported that LAC is more effective than OC for the treatment of colon cancer, in terms of morbidity, hospital stay, tumor recurrence, and cancer-related survival, but they also observed a much higher rate of locoregional relapse than after OC. In contrast, none of our patients have shown any evidence of locoregional relapse.

Our study is not a randomized clinical trial and therefore there may be a degree of selection bias. Although the limitations of the present study do not permit any conclusion with confidence, 118 patients were treated by curative laparoscopic colon resection for colorectal cancer between 1993 and 1999 and no undesirable results were seen after at least 4 years of follow-up. Under our criteria and with the above restriction in mind, the results of this study indicate that laparoscopic surgery is appropriate and safe for the treatment of colorectal carcinomas.

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特集

癌治療における最近のトピックス

6. 大腸癌—進行癌に対する腹腔鏡下手術—

東京医科歯科大学腫瘍外科

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キーワード：大腸癌，腹腔鏡下手術，鏡視下手術

I. 内容要旨

1991年に初めて報告された大腸の鏡視下手術は，近年では多くの施設で行われるようになっている．十数年間で技術的にも進歩し，熟練した医師は安全にD3郭清を行うことができるようになっている．しかし，技術を習得するには長い時間が必要ということもあり，全国的な普及には至っていない．また，技術的な面だけでなく，癌の治療として受け入れられるために重要な遠隔成績がないことも普及に歯止めをかけている一因であると考えられる．現在進行中あるいは予定されている国内外のRandomized Control Study（RCT）の結果が注目される．RCTにおいて鏡視下手術の遠隔成績が開腹手術に劣らないことが示されれば，さらに鏡視下手術が普及することが期待される．

II. はじめに

大腸の鏡視下手術はJacobらにより1991年に報告された[1]．本邦では1993年に渡辺らにより報告され[2]，当初は良性疾患や早期大腸癌に対して行われていたが，鏡視下手術の技術的な進歩，手術機器の開発，改良により徐々に手術適応が拡大し，1996年には，進行大腸癌に対する鏡視下手術が小西らにより報告された[3]．一方，1996年に早期大腸癌に対する鏡視下手術が保険適応として認められ，2002年には進行大腸癌に対しても認められたため，大腸癌に対して鏡視下手術を行う社会的環境も整いつつある．それに伴い，近年では多くの施設において早期大腸癌だけでなく進行大腸癌に対しても行われるようになってきている．

III. 鏡視下手術の基本理念

鏡視下手術は手術手技の1つであり，新たな治療方法ではない．現段階における鏡視下手術の基本理念は，腫瘍学および解剖学の原理に基づいて確立された開腹手術の手技を，開腹手術とは異なる手術機器を用いて再現することである．

IV. 鏡視下手術の利点

鏡視下手術の利点として，開腹手術に比べて傷が小さいこと，術後腸管運動の再開が早いこと，出血量が少ないことが挙げられる．具体的には，整容性が優れており，術後疼痛が少なく，術後のイレウスが少なく，早期に食事がとることができ，入院期間が短いといった利点がある[4)~6)]．COST multicenter randomized trialの短期Quality of Life（QOL）の結果でも，鎮痛剤の使用回数，入院期間は有意に短かったとしている[7]．しかし，最近では，開腹手術でも鏡視下手術の結果をふまえて食事開始時期が早くなる傾向にあり，退院時期も早くなっている．このように考えると，鏡視下手術の利点は，傷が小さいことから派生する整容性，術後疼痛の軽減，癒着が少ないということになる．手術患者は，短期的には手術の傷や痛み，長期的には再発に対する不安を誰もがかかえている．近年，患者はQOLも重視するようになっており，鏡視下手術の技術的な安全性，予後に対する安全性が確立されれば，少しでも傷が小さいほうがよい，少しでも痛みが少ないほう

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がよいと考える患者側の満足度を高め，鏡視下手術を希望する患者数が増加することが予想される．

V. 手術適応

鏡視下手術でどこまでやるか．開腹手術では姑息的切除から縮小手術，拡大郭清まですべての手術が行われているが，鏡視下手術では大腸癌の治療としての位置づけに統一した見解が得られていないため，その施設の技術的な熟練度により独自に手術適応を定めているのが現状である．鏡視下手術を全く行っていない施設から，早期癌に対してのみ行っている施設，拡大郭清まで行っている施設と，さまざまな施設が存在する．いずれにしても，鏡視下手術を行う医師は，きちんとした知識および技術を身につけた上で，患者に対して鏡視下手術の現状について正確な Informed Consent (IC) を行い，同意を得てから手術を行わなくてはならない．鏡視下手術を行っている施設でも，術前診断にて他臓器浸潤，大きな腫瘍，閉塞を伴う腫瘍は適応外としている施設が多い．盲腸癌や上行結腸癌の小腸浸潤など surgical margin が分かりやすく鏡視下手術でも en bloc に合併切除できる場合もあるが，一般的には他臓器浸潤がある場合は en bloc かつ surgical margin を確保して切除することが困難なことが理由である．腫瘤径が大きな腫瘍は，視野の妨げになることや腫瘍を腹腔内から取り出す際の皮膚切開が大きくなるため整容面のメリットがないこと，閉塞を伴う症例では口側腸管の拡張があり視野の妨げになることが理由である．また，鏡視下手術を試みた場合でも強度の癒着，腸管の拡張，高度の肥満などの要因により視野がとれないときには思わぬ出血や他臓器の損傷を起こす可能性が高い．これらの損傷を起こすと鏡視下操作では修復できないこともあるので術中判断で開腹手術に変更とすべきである．鏡視下手術で開始したが開腹手術へ変更をした率は，全体として 0～28% と報告されている．しかし，コントロールがつかない出血や他臓器の損傷は，近年の各報告例は 0～2 例であり，術者の技術が熟練したことや超音波凝固切開装置をはじめとする手術機器の開発改良などにより，鏡視下手術の技術的な安全性は確実に高まっている．また，術後合併症でも，創感染が 0.5-7%，縫合不全が 0-4.5% と報告されており，手術に関連する合併症の発生率に鏡視下手術と開腹手術とでは差がない[8][9]．

VI. 鏡視下手術の問題点

1. 技術の習得

技術の習得という点に関しては，開腹手術に比べると鏡視下手術では長い時間が必要である．文献的にも，経験症例数が増えれば手術時間が短縮し合併症率が低下するが，そのためには 50 症例の経験が必要，あるいは 30 例ごとに開腹へ変更する率が少なくなるとされている[10][11]．本邦では，腹腔鏡大腸切除研究会などが定期的に実技講習会や講演会を開催しているが，これに参加するだけでは術者としてひとり立ちするには不十分であることは言うまでもない．鏡視下手術を積極的に行っている施設に実際に通って，手技的なことはもちろんのこと，手術室内の環境，周辺機器，鉗子類についての知識も身につける必要がある．このような鏡視下手術を始める際のハードルの高さや人手の問題から，鏡視下手術を行う施設と行わない施設に分かれてしまい，鏡視下手術を行っている施設においても，鏡視下手術に熟練した限られた医師がチームを組んで手術を行っているのが現状である．熟練した医師が行う場合，技術的にはすべての部位において上方向 D3 郭清を安全に行うことができるようになっている．

2. 遠隔成績

癌の治療である以上，腫瘍学的に開腹手術に劣らないという evidence があって初めて QOL にすぐれた鏡視下手術を行うことに意味をもってくるが，歴史が浅いということもあり，長期的な予後を示す evidence がないのが現状である．いくら技術的に安全確実に手術が行われるようになっても，その手技に対する腫瘍学的な安全性がなくては癌の治療としては成立しない．腫瘍学的な安全性を示唆する文献としては，摘出リンパ節個数や切離断端の距離に関して鏡視下手術と開腹手術を比較検討して差がないとする報告があり，鏡視下手術が癌の手術として十分受け入れられる可能性を示している[5)~7)9)12)]．鏡視下手術に特異的な再発形式として報告された port site metastasis (PSM) は，術中の腫瘍細胞散布，患者の免疫力低下が原因とされている．しかし，手術創に再発する率は開腹手術 (1～3%)，鏡視下手術 (0～1.3%) で差がないという報告や，最近の論文では PSM の報告がほとんどないことから，鏡視下手術に特異的なものではなく，当初報告された PSM は手技の未熟さに加え，手術対象が高度進行癌であったことが原因と考えられるようになっている[13)14)]．また，ヒト免疫に関与する因子についての Randomized Con-

trol Study (RCT) の結果では，術前と術後の T cell, B cell, CD4/CD8, IgG, IgM, IgA, C3, C4 を調べ，開腹手術と鏡視下手術では免疫への影響には差がないことが報告されている[15]．鏡視下手術が行われた大腸癌の予後に関する論文は，術後の follow up 期間が短く，開腹術との比較を historical control, nonrandomized study で行っているのが現状であるが，これらの報告では，いずれも再発率，無再発生存率は鏡視下手術と開腹手術では差がないとされている[16][17]．2002 年の Lancet の論文は，cancer related survival を first endpoint とした RCT で，横行結腸を除く結腸癌 219 症例を対象として，follow up 期間の中央値 43 カ月 (27～85) で開腹手術と鏡視下手術を比較検討した．結果は，overall survival には有意差がなかったが，cancer related survival は開腹手術に比べて鏡視下手術が有意に良好であった．TMN stage 別にみると，stage I, II では差がなかったが，stage III で free of recurrence, overall survival, cancer related survival のいずれにおいても開腹手術に比べて鏡視下手術が有意に良好であったとしている[18]．しかし，stage III の開腹手術の生存率が 50% と低すぎることから，さらなる検証が必要であると考えられる．日本における開腹手術の stage III における成績は 69.2% で，この論文における鏡視下手術の成績とほぼ同等である[19]．対象とした開腹手術の quality が良くないために有意差が出た可能性がある．1990 年後半から COLOR trial (N＝1,500), NCCTG-934653 (N＝900), MRC-CLASICC (N＝1,200), COST multicenter randomized trial (N＝650) など disease free survival を first end point とした大規模な prospective randomized trial が進行中であり，腫瘍学的予後からみて鏡視下手術が癌の治療として適切であるかどうか，その結果が注目される．本邦においても，厚生省労働科学研究費補助金による「進行大腸がんに対する腹腔鏡下手術と開腹手術の根治性に関するランダム化比較研究」が Japan Clinical Oncology Group (JCOG) においてまもなく開始される予定となっている．

VII. おわりに

鏡視下手術の技術的な安全性は確実に高まっており，短期 QOL に対する有用性も示されているが，遠隔成績から見た腫瘍学的な安全性については明確にされていないのが現状である．数年後には RCT による遠隔成績が次々に発表され，大腸癌の治療としての位置づけが示されることになる．もし，遠隔成績においても開腹手術に劣らないことが示されれば，evidence として患者に提示して IC を行うことができるようになり，鏡視下手術を希望する患者数もさらに増加することが期待される．

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LAPAROSCOPIC SURGERY FOR ADVANCED COLORECTAL CANCER

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Laparoscopic colectomy for benign diseases and early cancers has been widely accepted since the first report on it was published in 1991. The indications for laparoscopic colectomy have been expanded with advances in the operative technique and instrumentation. Although laparoscopic surgery for advanced colorectal cancer is technically feasible, the long-term outcome should be confirmed in prospective, randomized, controlled trials of laparoscopic surgery in the treatment of advanced colorectal cancer.

特集　内視鏡外科手術を安全に行うために

腹腔鏡下大腸手術を安全に行うために

國場　幸均　　渡邊　昌彦　　中村　隆俊　　佐藤　武郎
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医学書院

特集 内視鏡外科手術を安全に行うために

腹腔鏡下大腸手術を安全に行うために*

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* Safe laparoscopic colectomy

キーワード：大腸疾患，腹腔鏡下大腸手術，偶発症

要旨：腹腔鏡下大腸手術を合併症なく安全に行うためには腹腔内においての鉗子操作をはじめ様々な工夫を要する．本法では開腹手術に比較し視野が狭小で腹腔の全体像が把握しにくく，適切な視野展開が困難な場合が多い．腹腔内の限られた空間で鉗子操作を合理的に進めるためには鉗子を挿入する以前に体位固定の準備を含め種々の工夫が必要となる．また術中出血を極力抑えることが最も重要であり，そのためには安全な剝離層を露出し，手技を継続するための膜構造と血管走行をはじめとする解剖を熟知することが常に要求される．ただし術中偶発症によっては躊躇せず開腹に移行する判断力が求められることを忘れてはならない．

はじめに

腹腔鏡下大腸手術は早期癌へ初めて施行されてから12年が経過した[1]．その間，筆者らも種々の手技の工夫を行ってきた[2~5]．腹腔鏡下手術は開腹手術とは異なり限られた閉鎖腔の中で鉗子操作が行われる．特に大腸手術では比較的広範囲での鉗子操作が求められる．本稿では，いかに合併症を起こさず，安全に腹腔鏡下大腸手術を行うための工夫について紹介する．

患者の体位

鉗子操作を安全に行うには大網や小腸を排除し，良好な術野を確保しなければならない．とくに施設内に腹腔鏡手技に習熟した者が常に助手として参加できない場合は術野の展開には難渋する．そこで小腸を術野から排除するために十分な体位変換を行って重力を利用することが大変有効である．体位変換を十分に行うためにはそれに適した手術台を開発することが最良であるが，通常の手術台を用いる場合はマジックベッドにより体躯と肩部を固定し，さらにその周囲を多関節固定具でしっかりと固定する．両側の上肢は万能手台を利用し，頭側へ肘関節を屈曲した良肢位で挙上させると上肢が突出しないため体幹の両側に自由なスペースを確保でき，術者とスコピストが互いに干渉し合うことが少なくなる．ただし肩関節と肘関節には決して無理のかからないよう注意する．左側結腸・直腸症例ではイエローフィンを用い砕石位が自由に調整できるようにする．また上肢が挙上されていると術中の輸液管理も容易である．さらに，シーツを頭側の両脇へ立てたポールに吊るすとシーツ架台（L字棒）が不要であり，体幹前面でのスコープや鉗子類の可動制限のない自由な空間が得られる[6]（図1）．

術者・助手・モニターの位置

右側結腸病変では術者は患者の左側，左側結腸・直腸病変であれば患者の右側に位置する．モニターは術者と病変部の同一線上に並ぶように配