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Operation

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手術手技

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はじめに

大腸癌に対する腹腔鏡下手術は，機器や器具の発達とともに手術手技も確立され，低侵襲手術として認められてきた[1]。当初早期癌に限って行われていたが，しだいに進行癌に適応拡大されている。日本内視鏡外科学会のアンケート調査によれば，2003年の腹腔鏡下大腸癌手術の施行総数はついに進行癌が早期癌を上回るまでになった[2]。必然的にD3郭清が要求される手術が増加しているが，左側結腸と比較して，右側結腸進行癌に対するD3郭清は，難度の高い操作である。これは郭清範囲近傍に副損傷に注意すべき臓器が多いことと血管系のバリエーションが多彩であることによっている。より安全にこれらの操作を行うことは，腹腔鏡下大腸手術に残された大きな課題の一つである。我々は十二指腸と膵の損傷を回避しつつ，後腹膜下筋膜に達し，同時に回結腸血管の同定も容易にする“内側アプローチ変法”と，surgical trunk頭側から中結腸血管周囲のリンパ節郭清を安全に行うための工夫“横行結腸間膜挟み撃ち法”を提唱し，行ってきた。今回，これらの手技を供覧し，その有用性について述べる。

I. 体　位

手術体位は開脚仰臥位とし，両側上肢は軽度屈曲挙上しておく。マジックベッドで体幹を固定し，左側にストッパーを装着する。両側下肢は，深部静脈血栓形成予防のため間欠的下肢加圧装置を装着し，leg levitatorに固定している。手術開始前に必ず体位テストを行いしっかり固定されていることを確認しておく。

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II. トロカール

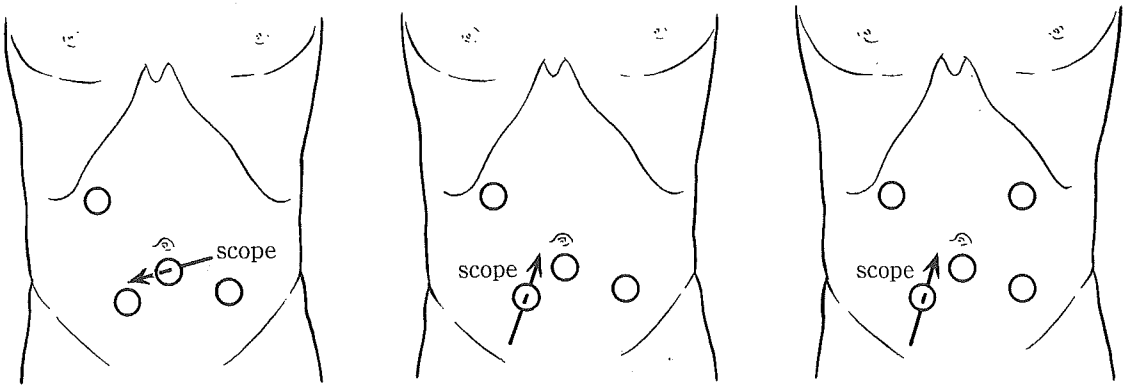
臍下部にopen methodで12 mmトロカールを挿入する。続いて右下腹部に12 mm，右側腹部頭側寄りと左側腹部尾側寄りに5 mmトロカールを挿入する。右側結腸の剝離授動の際には，臍下部よりスコープを挿入し，そのほかのトロカールより操作を行う（図1a）。Surgical trunk前面のリンパ節郭清操作を行う際には，右下腹部よりスコープを挿入する（図1b）。さらに挟み撃ち法でリンパ節郭清操作を行う際には，左側腹部頭側寄りに5 mmトロカールを追加すると操作しやすい（図1c）。

III. 術野展開

大網を横行結腸の頭側に挙上する。次に小腸を左側に排除するが，その際体位を頭低位・左半側臥位にすると視野を確保しやすい。理想とする術野では，十二指腸水平部右側前面が透見できる薄い膜の部分と回結腸動・静脈の膨隆を確認することができる（図2）。一度術野展開ができると，体位を仰臥位に戻しても，術野が損なわれないことが多い。

IV. 内側アプローチ変法

結腸の剝離・授動に際しては大きく分けて外側アプローチ[3]と内側アプローチ[4][5]があり，それぞれに長所・短所がある。後腹膜下筋膜前面に安全に到達できるのであれば，どちらのアプローチ法を選択しても構わないと考えている。我々が内側アプローチを選択している理由は，外側アプローチを行うと主幹血管の処理や血管周囲のリンパ節郭清の際に授動



a）右側結腸の剝離・授動　b）Surgical trunk 前面のリンパ節郭清　c）横行結腸間膜挟み撃ち法

図 1　トロカール

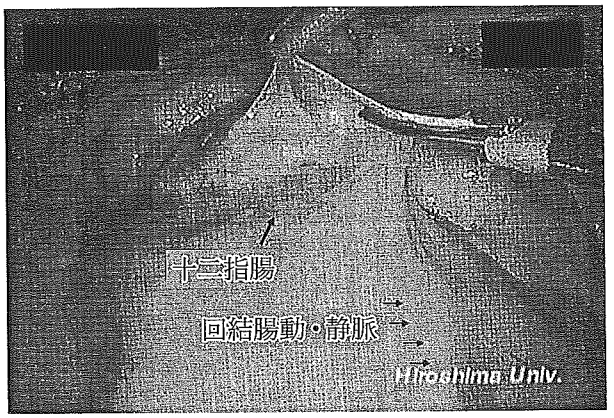


図 2　術野展開
大網を頭側へ，小腸を左側へ排除すると，十二指腸が透見できる薄い膜と回結腸動・静脈の膨隆が同定できる。

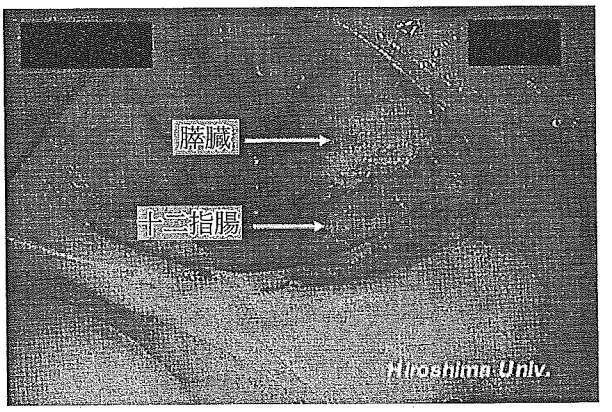


図 3　内側アプローチ変法
十二指腸が透見できる薄い膜から剝離を開始することで，膵臓・十二指腸前面へ安全に到達することができる。

した腸管が垂れ込み，操作の障害になるからである。このように内側アプローチの長所は，主幹血管の処理や血管周囲のリンパ節郭清を良好な術野で先行して行えることである。一方，内側アプローチは後腹膜下筋膜前面に到達するまでの解剖学的特徴を把握し操作に習熟するまで時間を要するという難点がある。また剝離操作が十二指腸・膵臓に向かう状況もあり，それらの損傷には十分注意しなければならない。このような損傷を防ぐ工夫として，内側アプローチにはさらにバリエーション（内側アプローチ変法）がある[6)7)]。

我々が行っている内側アプローチ変法は，十二指腸水平部前面の薄い腹膜を同定し，そこから剝離を開始している。この薄い腹膜の部分は肥満で内臓脂肪が多い患者でもだいたい同定することが可能である。この膜から剝離を開始すると，十二指腸・膵臓前面（後腹膜下筋膜前面）に比較的安全に到達することができると同時に，それらの損傷を防ぐことができる（図3）。さらに後腹膜下筋膜前面と右側結腸間膜の間を十分剝離すると回結腸動・静脈の膨隆が明らかになる。回結腸動・静脈周囲の脂肪織を腹側へ挙上し，その背側を剝離すると先行して剝離し

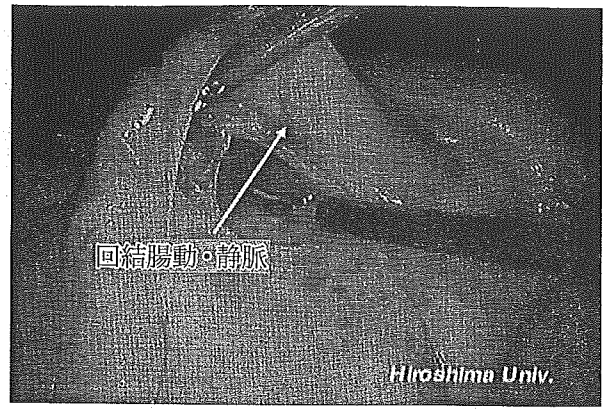


図 4　回結腸動・静脈の同定・剝離
回結腸動・静脈を腹側へ牽引してその背側を剝離すると，先行して剝離した後腹膜下筋膜前面の層とつながる。

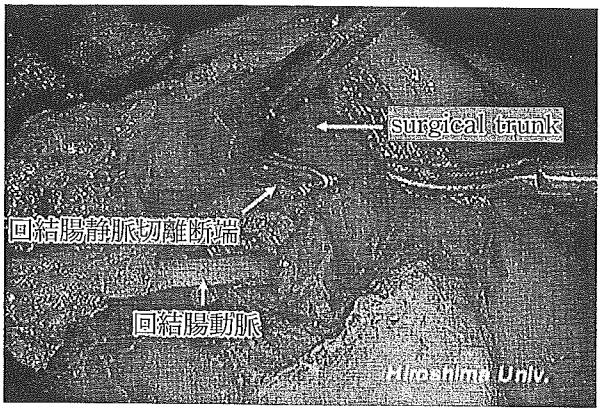


図 5　回結腸動・静脈の処理
我々の内側アプローチ変法により回結腸動・静脈の同定・処理を安全に行うことができる（回結腸静脈切離後，回結腸動脈はこれから処理）。

た後腹膜下筋膜前面の層につなげることができる（図4）。我々は，このような手順と工夫で十二指腸と膵の損傷を回避しながら，後腹膜下筋膜前面に到達し，同時に回結腸動・静脈の同定・処理をも行っている[8)9)]（図5）。

V．横行結腸間膜挟み撃ち法

Surgical trunk 前面，とくに中結腸血管の郭清操作を行う際の工夫として“横行結腸間膜挟み撃ち法”という方法を行っている。Surgical trunk 前面の郭清を尾側から始める時点ではそれまでの術野，つまり横行結腸を頭側へ展開して作った後腹膜下筋膜前面を露出させる層で行う。このまま頭側へ郭清操作を進めていくと次第に術野が狭くなり，横行結腸間膜の背側より覗き込みながら操作するようになりむずかしい手技になってしまう（図6）。そこで，ある程度頭側まで郭清を進めた時点で横行結腸を尾側へ展開し，横行結腸間膜の前面からアプローチしている。まず，胃結腸間膜を切開し網嚢腔へ入り，横行結腸右側を授動していく。

次に膵下縁から横行結腸間膜前葉を剝離し上腸間膜動・静脈を露出し，ここから上腸間膜動・静脈前面のリンパ節郭清を尾側へ進めていく（図7）。そうすると上腸間膜動・静脈を直視下に捉えることができ，胃結腸静脈幹，副右結腸静脈，前上膵十二指腸静脈や中結腸動・静脈の同定・処理を安全に行う

図 6　横行結腸間膜挟み撃ち法(1)
Surgical trunk 前面の郭清操作を頭側へ進めていくと，横行結腸間膜の背側から覗き込むようになり視野が悪くなる。

ことができる（図8，9）。横行結腸間膜を挟んで郭清操作を行うことより“横行結腸間膜挟み撃ち法”と呼んでいる。最後に右側結腸を授動するが，肝彎曲部に腫瘍が存在する場合には回盲部から上行結腸を授動すると同時に，横行結腸から大網を離し肝結腸靱帯を切離することで右側結腸を完全に授動できる。このような工夫で右側結腸進行癌に対する3群リンパ節郭清を安全に行っている（図10）。

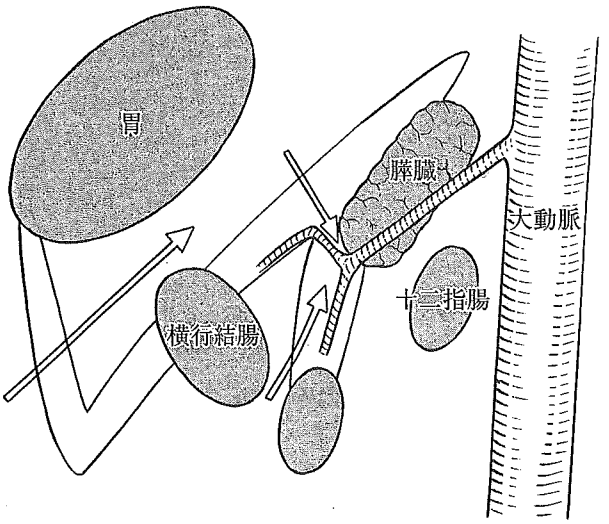


図 7　横行結腸間膜挟み撃ち法(2)
横行結腸を尾側へ展開し網嚢を開放，膵下縁から横行結腸間膜前葉を剝離し上腸間膜動・静脈を同定し尾側へ郭清操作を進めていく。

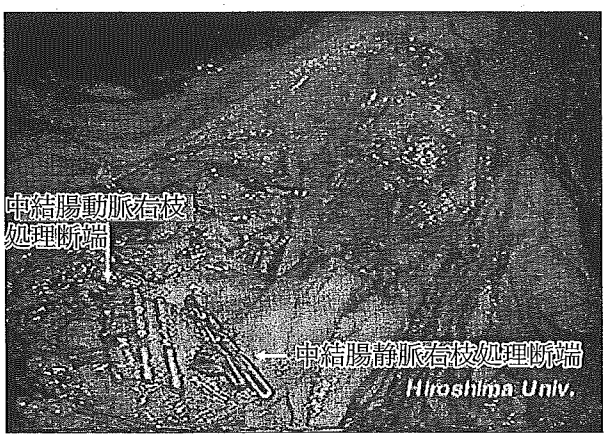


図 9　横行結腸間膜挟み撃ち法(4)
中結腸動・静脈は右枝の根部で処理

VI. 腸管吻合から手術終了へ

腹腔内操作が終わると気腹を終了し，腹部正中に小切開をおき開腹する。腸管を創外に引き出して吻合操作を行うが，腹腔内操作で十分剝離授動を行わなければ吻合に際して緊張がかかり，縫合不全の原因になりかねない。

腸間膜の修復は吻合終了後の再気腹時に腸管や大

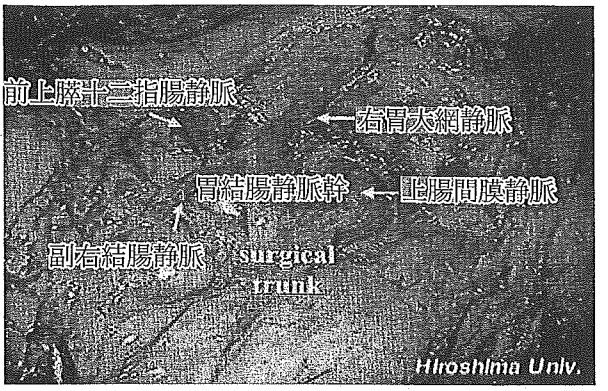


図 8　横行結腸間膜挟み撃ち法(3)
横行結腸間膜前面からアプローチすることで，胃結腸静脈幹，副右結腸静脈，前上膵十二指腸静脈，右胃大網静脈の同定を安全に行うことができる。

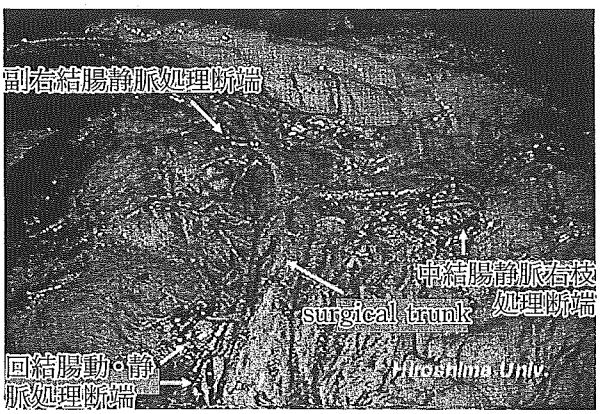


図 10　横行結腸間膜挟み撃ち法(5)
3群リンパ節郭清の終了

網の迷入がないかぎり，原則として行わない。12 mm のトロカールを挿入した部位はヘルニア発症防止のために，筋膜の縫合は必ず行う。閉鎖式ドレーンをインフォメーションドレーンとして必ず留置している。

おわりに

右側結腸進行癌に対する腹腔鏡下手術では surgical trunk 前面のリンパ節郭清がもっとも難度が高く，かつ危険な操作である。この操作を安全・確実に行うための我々の工夫“横行結腸間膜挟み撃ち

法”について述べた。

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SURGICAL ENDOSCOPY
and Other Interventional Techniques

Randomized controlled trial of laparoscopic versus open colectomy for advanced colorectal cancer

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Abstract
Background: After confirming a favorable outcome of laparoscopic surgery for early colorectal cancer, we conducted a randomized controlled trial to compare short-term outcomes of laparoscopic and open colectomy for advanced colorectal cancer.
Methods: Fifty-nine patients with T2 or T3 colorectal cancer were randomized to undergo laparoscopic (n = 29) or open (n = 30) colectomy. Median follow-up was 20 months (range, 6–34 months).
Results: Operative time was longer ($p < 0.0001$) and blood loss ($p = 0.0034$) and postoperative analgesic requirement were less in the laparoscopic group than in the open group. An earlier return of bowel motility and earlier discharge from the hospital ($p = 0.0164$) were observed after laparoscopic surgery. Serum C-reactive protein levels on postoperative days 1 ($p < 0.0001$) and 4 ($p = 0.0039$) were lower in the laparoscopic group than in the open group. Postoperative complications did not differ between the two groups.
Conclusion: Laparoscopic surgery for advanced colorectal cancer is feasible, with favorable short-term outcome.

Key words: Laparoscopic surgery — Colorectal cancer — Short-term outcome — Randomized controlled trial

Since the successful introduction of laparoscopic cholecystectomy, laparoscopic surgery (LS) has been reported to be feasible for the treatment of various gastrointestinal disorders. LS has gained acceptance in the treatment of benign diseases, but it remains controversial for the treatment of malignancies because of concerns about adequacy of lymphadenectomy and the extent of resection, early findings of port-site metastasis, and the lack of long-term results [17]. Some retrospective and prospective comparative studies report on the feasibility and favorable outcome of LS for colorectal cancer, including earlier return of bowel motility, less postoperative pain, and shorter hospital stay [2–5, 8, 11, 14, 18]. Randomized controlled trials comparing laparoscopic and conventional open surgery have been carried out in Western countries, but the long-term oncologic results of these studies are still a few years away. In 1992, we introduced LS for the treatment of early colorectal cancer—that is, Tis tumors that could not be resected endoscopically and T1 lesions. Since the effects of laparoscopy on cancer operations were still unknown, we decided to err on the conservative side, performing LS only in cases in which the risk of lymph node metastasis was minimal. As we confirmed the feasibility of LS in patients with early cancer and established our surgical routine, we gradually expanded our inclusion criteria to T2 tumors in 1996. In 1997, we began to include patients with T3 tumors. After confirming a favorable outcome of LS in patients with early colorectal cancer with a median follow-up of 3 years [7], we felt obliged to perform a randomized controlled trial of laparoscopic versus open surgery for advanced cancer (i.e., T2 and T3 cancers). The aim of the current study was to assess the short-term outcomes of laparoscopic and open surgery for advanced colorectal cancer in terms of time to oral intake, hospital stay, postoperative complications, and immunological parameters in a single tertiary referral center where the surgical routine had been established. The primary end point of this study was overall and disease-free survival, which will be analyzed in a few years after an adequate length of follow-up.

Patients and methods

Inclusion criteria

Ninety-seven consecutive patients with a preoperative diagnosis of T2 or T3 colorectal cancer (N0) who underwent curative surgery at Keio University Hospital between June 1998 and October 2000 were recruited. Patients with Tis and T1 tumors were not included since LS for

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Table 1. Patient demographics

	LS (n = 24)	OS (n = 26)	p
Male:female	14:10	18:8	0.4425
Age (years)	61 (33–75)	61 (37–78)	0.8861
Location			
Cecum	1	8	0.1240
Ascending	7	4	
Descending	1	0	
Sigmoid	13	12	
Rectosigmoid	2	2	
Dukes' stage			
A	2	1	0.8000
B	14	16	
C	8	9	
D	0	0	
Histology			
Well/moderate	24	24	0.5063
Poor/mucinous	0	2	
Number of lymph nodes resected	23 (7–50)	26 (15–56)	0.2485
Previous laparotomy	6	7	0.3660
Follow-up (months)	20 (6–34)	19 (8–32)	0.5431

Values are means (range)
LS, laparoscopic surgery; OS, open surgery

Table 2. Outcome

	LS (n = 24)	OS (n = 26)	p
Operative time (min)	275 (184–410)	188 (127–272)	< 0.0001
Blood loss (ml)	58 (10–350)	137 (32–355)	0.0034
Length of incision (cm)	5.9 (3–12)	17.8 (12–23)	< 0.0001
Flatus (POD)	2.0 (1–5)	3.3 (1–7)	0.0005
Liquid intake (POD)	1.6 (1–6)	3.2 (1–7)	0.0006
Analgesic requirement (POD)	1.7 (0–4)	3.4 (0–17)	0.0022
Postoperative hospital stay (days)	7.1 (4–15)	12.7 (6–57)	0.0164

Values are means (range)
LS, laparoscopic surgery; OS, open surgery; POD, postoperative day

these patients was regarded as a standard procedure at that time. We excluded patients with T3 tumors in the upper and lower rectum because with the current instrumentation it was difficult to perform laparoscopic procedures without grasping and manipulating the tumor; our fear was that this would result in accidental tumor spillage. We also excluded patients with T3 tumors in the transverse colon because it was technically difficult to perform laparoscopic transverse colectomy with radical lymphadenectomy due to variations in the anatomy of the middle colic artery.

All patients underwent preoperative colonoscopy, abdominal ultrasonography, chest radiograph, and computed tomography of the abdomen and pelvis to fully stage the extent of the tumors before surgery. Double contrast barium enema, magnifying colonoscopy, and dye colonoscopy were also performed to confirm the T stage in more detail. After approval from a local ethics committee, all potential candidates with T2 or T3 tumors were asked to participate in the study, and consenting patients were randomized prior to operation to undergo either laparoscopic or conventional open surgery. A total of 38 patients refused. Thus, 59 patients gave informed consent to take part in the study: 29 patients were randomized to undergo laparoscopic surgery and 30 randomized for conventional open surgery.

Surgical technique

All laparoscopic operations were performed using the same bowel preparation and perioperative intravenous antibiotics as those for conventional open surgery. A five-port technique was used. Pneumoperitoneum was established by the open laparotomy technique through a supraumbilical incision used for the camera port. After the appropriate segment of bowel was fully mobilized, the vascular supply was divided intracorporeally at its origin and radical lymphadenectomy performed. The bowel was delivered through a small wound (one of the port sites was extended) and divided extracorporeally. A functional end-to-end anastomosis was fashioned using a linear stapler for all cases except those with tumors in the rectosigmoid. For tumors in the rectosigmoid, the distal rectum was divided intracorporeally using a laparoscopic linear stapler following intracorporeal division of the inferior mesenteric vessels, and the proximal end of the bowel was delivered through a small incision. The bowel was resected extracorporeally, after which an anvil was placed into the proximal colon and an anastomosis performed intracorporeally by means of the double-stapling technique.

Clinical short-term outcomes

Operative time, blood loss, and the length of incision were recorded. Every patient had thoracic epidural analgesia with bupivacaine hydrochloride and morphine hydrochloride for 48 h postoperatively. Additional analgesic requirement was assessed by the total number of days that intramuscular pentazocine was used. Patients were allowed to take liquid when their bowel sounds became audible, and they were progressed to a solid diet as tolerated. Days to the first flatus, liquid intake, and postoperative hospital stay were recorded.

Measurement of plasma interleukin-6, natural killer cell activity, C-reactive protein, and leukocyte count

Peripheral blood samples were obtained from each patient preoperatively and on postoperative days 1 and 7. The plasma levels of inter-

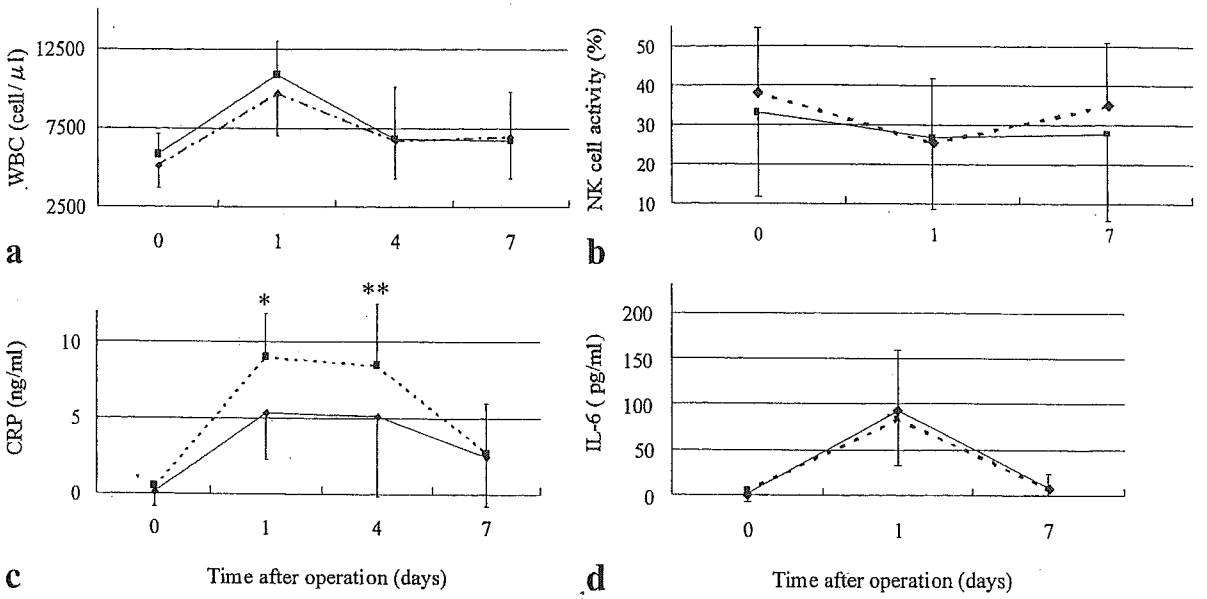

Fig. 1. Changes in (**a**) white blood cell count (WBC), (**b**) natural killer (NK) cell activity, (c) serum C-reactive protein (CRP), and (**d**) plasma interleukin-6 (IL-6) levels in patients following laparoscopic surgery (solid line) and open surgery (dotted line). Values are mean ± standard deviation. $*p < 0.0001$; $**p = 0.0039$.

Table 3. Complications

	LS (n = 24)	OS (n = 26)	p
Wound infection	1	3	
Bowel obstruction	0	2	
Anastomotic leakage	0	0	
Pneumonia	0	0	
Total	1	5 (5 patients)	0.2293

LS, laparoscopic surgery; OS, open surgery

leukin-6 (IL-6) were measured by chemiluminescent enzyme assay using a Lumipulse 2000 kit (Fujirebio, Tokyo). The natural killer (NK) cell activity was measured by ^{51}Cr-releasing assay. C-reactive protein (CRP) in serum and leukocyte count were also measured in each patient using the blood samples obtained preoperatively and on postoperative days 1, 4, and 7.

Statistical analysis

Statistical analysis was performed using StatView Version 5 (SAS Institute, Cary, NC, USA). Continuous and categorical variables were analyzed using Student's t-test and Fischer's exact test, respectively, and the significance level was $p < 0.05$.

Results

Both groups were comparable in terms of age, gender, tumor site, tumor stage, number of lymph nodes dissected, histologic classification, number of previous laparotomies, and median follow-up (Table 1).

Five patients in the laparoscopic group and four patients in the open group were excluded from the analysis due to extensive tumor growth at the time of surgery (T4 tumors in seven patients, liver metastasis in one, and peritoneal dissemination in one). No patients other than the five patients in the laparoscopic group were converted to open surgery. Operative time was longer (LS, 275 min; OS, 188 min; $p < 0.0001$) and blood loss was less (LS, 58 ml; OS, 137 ml; $p = 0.0034$) in the laparoscopic group than in the open group (Table 2). The incision was smaller (LS, 5.9 cm; 17.8 cm; $p < 0.0001$) in the laparoscopic group, and patients in the laparoscopic group required fewer days ($p = 0.0022$) on additional analgesics compared with those in the open group.

Time to first flatus (LS, 2.0 days; OS, 3.3 days; $p = 0.0005$) and liquid intake (LS, 1.6 days; OS, 3.2 days; $p = 0.0006$) was significantly shorter in the laparoscopic group, as was postoperative hospital stay (LS, 7.1 days; OS, 12.7 days; $p = 0.0164$) (Table 2).

There were no deaths in either group. No difference was found in terms of postoperative complications between the two groups (Table 3).

Serum CRP levels increased following surgery in both groups and decreased on postoperative day 7 (Fig. 1). CRP levels on postoperative days 1 (LS, 5.1 ng/ml; OS, 8.9 ng/ml; $p < 0.001$) and 4 (LS, 4.7 ng/ml; OS, 8.4 ng/ml; $p = 0.0039$) were significantly lower in the laparoscopic group than in the open group (Fig. 1). The plasma IL-6 level and leukocyte count increased in both groups 1 day after surgery and returned to the preoperative level on postoperative days 7 and 4, respectively. No significant differences were found between the groups with respect to IL-6 and WBC. The NK cell activity decreased slightly 1 day after surgery in both the laparoscopic and open groups, without significant difference.

With a median follow-up of 20 months, no port-site metastasis was found in the laparoscopic group.

Discussion

In this randomized study, we compared the short-term outcomes of patients with T2 and T3 colorectal cancers

undergoing LS versus OS. There were no mortalities, and the complication rates between the two approaches were similar. With respect to many parameters, we found advantages to LS. There was significantly less blood loss (58 vs 137 ml) in the laparoscopic group, similar to the findings from a few nonrandomized studies [5, 8, 18]. However, a review of three randomized studies showed no difference in blood loss between the two groups [9, 12, 16]. Blood loss in the current series (in both the LS and OS groups) was much less than that reported by others.

The findings of the current study indicate significantly less analgesic use, faster return of bowel function, and shorter hospital stay after LS. These findings substantiate those of several other studies [2–5, 8, 9, 16, 18]. However, the length of hospital stay was quite susceptible to bias, as can be seen by the fact that even our LS patients were discharged a median of 1 week after operation. It has been customary for Japanese patients to recover in the hospital for 1 or 2 weeks after bowel resection because there is little financial motivation for early discharge of patients, in contrast to many Western countries.

We chose to measure IL-6, NK cell activity, CRP, and WBC as objective markers of surgical stress. Nevertheless, significance was found in the smaller increase in CRP after LS compared with OS, similar to findings from other prospective, randomized studies examining CRP [10, 15]. However, regarding IL-6, WBC, and NK cell activity, no difference was detected in the current study. This finding is in contrast to those of previous small, comparative, nonrandomized studies [6, 13] as well as two randomized studies [10, 15] that showed significantly lower levels of plasma IL-6 after laparoscopic colectomy than after open colectomy. However, one randomized study reported significantly higher IL-6 levels after laparoscopic colectomy than after open colectomy [16]. This, together with the findings from the current study, attests to the limitations of plasma IL-6 level as an accurate marker of surgical stress.

Operations took significantly longer in LS than in OS, which is consistent with results from other studies [1, 9, 12, 16, 18]. Although we have gained laparoscopic experience by operating on hundreds of early colorectal cancer cases (and hence have passed the learning curve), our LS time was a median of 88 min longer than conventional surgery.

Five patients (17.2%) in the LS group required conversion to laparotomy because of intraoperative findings of extensive tumor growth, such as direct invasion to other organs (T4 tumor), liver metastasis, and disseminated peritoneal disease. These were not evident preoperatively despite extensive examinations. The conversion rate was comparable with that of other studies, ranging from 16 to 41% [3, 4, 9, 16]. One can argue that the converted patients should have been included in the analysis of short-term outcome, but we attempted to control for this by excluding patients in the open group with the same advanced disease. Thus only patients with T2 or T3 carcinoma were analyzed.

The findings of our study provide evidence that early outcomes of LS for advanced colorectal cancer are favorable, and that there is justification for further studies to examine the role of LS in advanced colorectal cancer. Even assuming that the long-term outcomes between LS and open laparotomy will be similar, there is still concern regarding which institutions should perform LS for advanced colorectal cancer.

In conclusion, the findings of the current study demonstrated that LS for T2 and T3 colorectal cancer can be performed safely without increased morbidity or mortality, and it conferred benefits in terms of faster recovery of bowel motility, less postoperative analgesic use, and shorter hospital stay compared with OS. It remains to be confirmed whether surgical stress is less in laparoscopy which was not clarified in the present study. Analysis of long-term oncologic outcome will occur in a few years. For now, further studies on the role of LS in advanced colorectal carcinoma are justified, and we believe that in the near future more patients, even with advanced colorectal cancer, will be able to be treated using the minimally invasive approach.

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Original article

Laparoscopic surgery for recurrent Crohn's disease

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Background: The aim of this study was to assess the feasibility of laparoscopic surgery for recurrent Crohn's disease, and the role of repeated laparoscopy in reoperation.
Methods: Between January 1994 and May 2002, 61 laparoscopic operations were attempted in 52 patients with ileal or ileocolonic Crohn's disease. Of these, 16 procedures were performed for recurrence at the anastomotic site (recurrent group). The remaining 45 operations were performed as primary procedures (control group). The median follow-up was 48 (range 3–90) months.
Results: The median time to reoperation was 46 months. The incidence of enteric fistula and the conversion rate did not differ significantly between the two groups. Although the operating time was significantly longer in the recurrent group, there were no differences in the rate of postoperative complications (three in the recurrent group and six in the control group) and hospital stay (both median 8 days).
Conclusion: Laparoscopic surgery for recurrent Crohn's disease is feasible in selected patients without an increase in conversion rate or postoperative complications.

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Introduction

Patients with Crohn's disease often require a number of surgical procedures. The reoperation rate is reported to be approximately 40–50 per cent within 10–15 years after the first operation[1]. Although the role of laparoscopic surgery in the treatment of colorectal cancer remains to be confirmed, the potential advantages of improved cosmesis, earlier return of bowel motility and shorter hospital stay may play an important role in the management of young patients with benign disease[2–6]. There are a number of reports concerning the feasibility and effectiveness of laparoscopic surgery for patients with Crohn's disease[7–9]. However, it is unclear whether laparoscopic surgery is suitable for patients with complex disease such as localized abscess, fistula or recurrent disease[10–12]. It also remains to be clarified whether repeated laparoscopic surgery is feasible in patients with recurrent Crohn's disease.

The aim of this study was to assess the feasibility of laparoscopic surgery for recurrent Crohn's disease and its role in reoperation. In addition, the outcome of surgery for recurrent disease following primary laparoscopic and open operations was compared.

Patients and methods

Between January 1994 and May 2002, 52 patients (43 men and nine women), of median age 30 (range 14–59) years, with ileal or ileocolonic Crohn's disease underwent 61 laparoscopic operations. Of these, 16 procedures were performed for recurrence at the anastomotic site (recurrent group). The remaining 45 were performed as primary procedures (control group). Of the 16 recurrent cases, the primary operation was performed as an open procedure in seven patients (OR group) and laparoscopically in nine (LR group).

All patients underwent an elective procedure after preoperative evaluation consisting of a barium swallow, barium enema and/or colonoscopy. Abdominal computed tomography was performed selectively. Before operation, all patients received intensive conservative therapy consisting of medication, total parenteral nutrition or an elemental diet for more than 2 weeks. During the same period, 19 patients underwent an open procedure; they were considered unsuitable for laparoscopic surgery because they had undergone multiple (more than two) previous operations, had complex fistula or multiple lesions, or required emergency treatment.

The surgical techniques have been described previously[12]. In brief, pneumoperitoneum was initiated by open laparotomy through a supraumbilical trocar. A 12-mm trocar was inserted in the upper midline, and 5-mm trocars in the lower midline and the right lateral abdomen. If there was a scar from a previous laparotomy, the laparoscope was introduced from the left abdomen. After careful exploration and dissection of abdominal adhesions, the ileocolonic region was identified. Any fistulas other than ileo-ileal were taken down intracorporeally using a laparoscopic stapling device. After mobilization of the ileocolonic region, the bowel was delivered through the upper midline port incision extended to approximately 5 cm. The mesentery was divided extracorporeally, the diseased segment was resected and a functional end-to-end anastomosis was performed.

The median follow-up was 48 (range 3–90) months. Data were collected from a prospectively maintained database and from medical records. Differences between the groups were analysed using the Mann–Whitney *U* test or the Fisher exact test as appropriate. $P < 0{\cdot}050$ was considered statistically significant.

Table 1 Patient demographics

	Primary ($n = 45$)	Recurrent ($n = 16$)	P
Age (years)*	30 (14–59)	32 (23–51)	0·441†
Body mass index (kg/m²)*	19·8 (15·6–29·7)	19·7 (14·7–21·1)	0·367†
Enteric fistula	24	6	0·384‡
Colonic involvement	18	4	0·715‡
Duodenal involvement	0	1	0·262‡

*Values are median (range). Fisher's exact test; †Mann–Whitney *U* test.

Table 2 Demographic and outcome of patients who underwent repeated operation

	LR ($n = 9$)	OR ($n = 7$)	P
Age (years)*	33 (23–41)	32 (25–51)	0·918†
Body mass index (kg/m²)*	19·0 (15·2–20·5)	19·8 (14·7–21·1)	0·662†
Enteric fistula	3	3	1·000‡
Colonic involvement	2	2	1·000‡
Duodenal involvement	1	0	1·000‡
Operating time (min)*	200 (136–280)	260 (150–470)	0·042†
Blood loss (ml)*	30 (10–220)	145 (30–400)	0·175†

*Values are median (range). LR, primary procedure was laparoscopic; OR, primary procedure was open. Fisher's exact test; †Mann–Whitney *U* test.

Table 3 Outcome of laparoscopic operation

	Primary ($n = 45$)	Recurrent ($n = 16$)	P
Conversion to open surgery	3	2	0·599‡
Operating time (min)*	180 (114–400)	210 (136–470)	0·012†
Blood loss (ml)*	50 (10–680)	80 (10–400)	0·290†
Hospital stay (days)*	8 (6–21)	8 (6–14)	0·927†

*Values are median (range). Fisher's exact test; †Mann–Whitney *U* test.

Table 4 Postoperative complications

	Primary ($n = 45$)	Recurrent ($n = 16$)
Wound sepsis	4	3
Bowel obstruction	1	0
Abscess	1	0

There was no significant difference between groups ($P = 0{\cdot}686$). Fisher's exact test.

Results

There were no significant differences between the recurrent and control (primary) groups, or between the OR and LR subgroups, in terms of age, body mass index, and the extent and presentation of the disease (*Tables 1* and *2*). The median time to reoperation was 46 (range 8–90) months. The incidence of enteric fistula did not differ between the two groups. The outcomes are summarized in *Table 3*. The rate of conversion to open surgery was 8·2 per cent overall (five of 61), and was similar in the two groups. The operating time was significantly longer in the recurrent group, but blood loss did not differ between the two groups. The median time to a light diet was 4 days in both groups. Postoperative complications occurred after nine procedures (14·8 per cent). There were no differences between the groups in either postoperative complications or hospital stay (*Tables 3* and *4*).

The operating time was significantly longer in the OR group than in the LR group (*Table 2*). The operative blood loss was less in the LR group, but this difference was not significant. There were no other differences between the two subgroups.

Discussion

The present study showed that laparoscopic surgery for recurrent Crohn's disease was feasible and safe, regardless of whether the primary procedure was laparoscopic or open, which supports the findings of a previous small study[10]. Another study confirmed that there were

no significant differences in the incidence of previous abdominal surgery or the number of previous abdominal procedures between patients who had a laparoscopic procedure and those whose operation was converted[13].

The present study also demonstrated that repeated laparoscopic surgery was possible using the same small incision. It is difficult to quantify the degree of adhesions after surgery; however, adhesions to the abdominal wall were minimal if the primary procedure was performed laparoscopically. This is supported by the fact that the operating time was shorter and blood loss was less in patients who underwent the primary procedure laparoscopically in the present study. The laparoscopic approach also has the advantage of better cosmesis than open surgery in patients with Crohn's disease[14]. The majority of patients appear to prefer laparoscopic to open surgery, even if this entails additional cost and carries the possibility of conversion to open operation[14].

The conversion rate in the present study was 8·2 per cent, comparable to published rates of between zero and 40·9 per cent[2,13]. Conversion to open operation was necessary because of dense adhesions surrounding a fistula in four patients and dense adhesions resulting from bowel perforation in one patient. Interestingly, the two patients whose operation was converted in the recurrent group had fistulas, and in both the primary procedure was laparoscopic, suggesting that recurrent disease *per se* is not a contraindication. Schmidt *et al.*[13] identified internal fistula, smoking, steroid administration, extracaecal colonic disease and preoperative malnutrition as factors associated with conversion.

In the present study, all patients received intensive medical therapy including total parenteral nutrition or an elemental diet for more than 2 weeks. This policy might result in a longer hospital stay and may not be possible in Western countries. However, preoperative bowel rest potentially makes the laparoscopy easier by improving and minimizing adhesions, fistulas or inflammatory masses. Its role should be confirmed in a randomized controlled trial.

The authors opted for an upper midline skin incision rather than a muscle split incision in the right lower quadrant for laparoscopic ileocolonic resection. The midline incision is useful in cases of unanticipated conversion; the right lower quadrant region is spared for a future stoma site. The ileocolonic region can be mobilized upwards more easily than downwards unless the small bowel is immobile in the pelvis. For recurrent disease, the anastomotic site or the neoterminal ileum can be exteriorized through the same incision after mobilizing the hepatic flexure and the transverse colon.

Laparoscopic surgery for recurrent Crohn's disease was feasible in selected patients without increasing either the conversion rate or the incidence of postoperative complications. The study also showed that repeated laparoscopic operations are possible using the same small incision as that of the primary operation. Based on these findings, laparoscopic surgery may be considered the primary procedure of choice in selected patients with Crohn's disease, taken that any reoperation may be performed laparoscopically. The role of laparoscopic surgery in recurrent Crohn's disease may expand in the future, and should be confirmed by comparison with open operation in a randomized controlled trial.

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クローン病に対する腹腔鏡下手術

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クローン病に対する腹腔鏡下手術

Laparoscopic surgery for Crohn's disease

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クローン病に対する腹腔鏡下手術の現状とその適応について述べる．現在，教室では待機手術となる症例に対しては全例，腹腔鏡下手術を施行している．これまでにクローン病患者87例に対し，のべ111回手術を施行した．うち腹腔鏡下手術は84例であった．開腹術への移行は9例(11%)に認めた．回盲部の狭窄型，回腸回腸瘻の症例は，初回手術，再手術ともに腹腔鏡下手術の最もよい適応である．回腸回腸瘻以外の瘻孔・膿瘍を有する症例にも腹腔鏡下手術は安全に施行可能であるが，開腹手術への移行率は比較的高い．

はじめに

腹腔鏡下手術が消化器外科領域に導入されてから，10年以上が経過した．なかでも大腸はその解剖学的特長から，剝離・授動を行えば小さな創から病変部を露出することができ，胆嚢摘出術に次いで最も腹腔鏡下手術に適した臓器であるといえる．

悪性疾患に対する腹腔鏡下手術では，ポート部再発，長期予後に対する懸念から欧米では，開腹手術とのrandomised controlled trialが施行されている[1,2]．一方，良性疾患では，合併症を含めた安全性，コストといった問題が解決されれば，quality of life(QOL)の向上，優れた整容性が期待できる．とくにクローン病は若年者に多く，術後の再手術率も高いことから，polysurgeryによる癒着，短腸症候群，瘢痕ヘルニアなどがしばしば問題となる．そこで腹腔鏡下手術が，クローン病に対する新しい外科治療の選択肢のひとつとして認知されれば，患者は本法の利点であるQOLの向上，優れた整容性を享受できる．

本稿ではクローン病に対する腹腔鏡下手術の現状とその適応について述べる．

I. 全国集計

日本内視鏡外科学会が行ったアンケート調査によると，本邦では1991年から小腸・大腸疾患に対し腹腔鏡下手術が施行され，2001年12月末までの総手術件数は12,948例で，良性疾患が2,822例，悪性疾患が10,126例であった[3]．年度別の症例数の推移を示す(図1)．良性疾患に対する腹腔鏡下手術で最も多いのは良性腫瘍で，次いで憩室

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Key words：クローン病／腹腔鏡下手術／開腹移行／低侵襲手術

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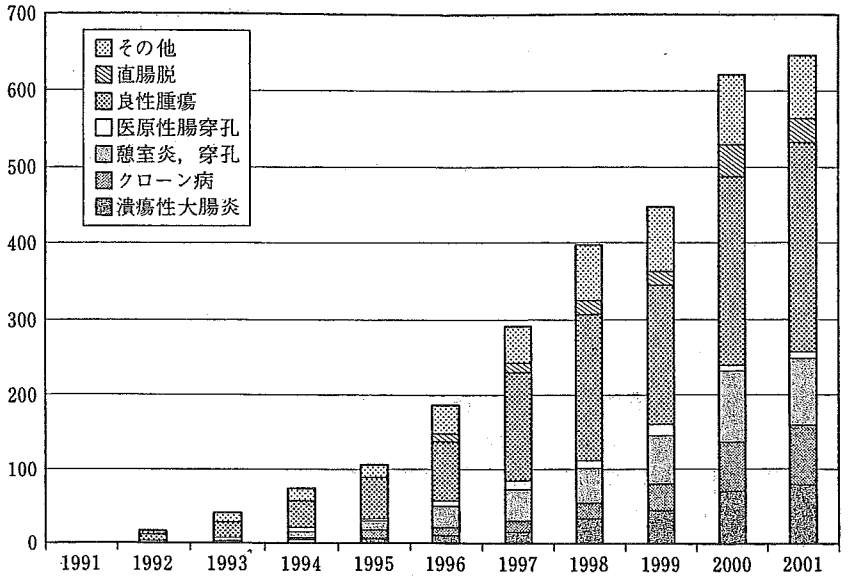

図1 良性腸疾患に対する腹腔鏡下手術症例数の年次推移

炎・穿孔であり，次に潰瘍性大腸炎とクローン病がほぼ同数であった．とくに炎症性腸疾患に対する腹腔鏡下手術件数は，この2年間にほぼ倍増しているのが注目される．

II. 適　　応

クローン病の外科的治療の適応は，内科的治療によって改善しない合併症を伴う疾患である．絶対的手術適応は穿孔，中毒性巨大結腸症，大量出血などであるが，その頻度は低い．一方，相対的適応すなわち待機手術となるのは狭窄が最も多く，そのほかには瘻孔や膿瘍形成が多い．従来，クローン病は癒着が高度で手術に難渋すると考えられていたが，十分な内科的治療により炎症が寛解すると，癒着剝離もあまり困難ではないことが知られるようになった．

クローン病に対する腹腔鏡下手術の適応は，施設により一定していないのが現状である．現在，われわれは待機手術となる症例には全例，原則として腹腔鏡を挿入する方針としている．開腹術を最初から選択する条件として，高度な癒着，汎発性腹膜炎の既往，複雑な瘻孔，多臓器にまたがる病変，緊急手術などである(表1)．

表1 クローン病に対する腹腔鏡下手術の非適応

強度な癒着
汎発性腹膜炎の既往
複雑な瘻孔
多臓器にまたがる病変
緊急手術

III. 方　　法

1. 術前処置

術前に，できる限り内科的治療により炎症を抑えておくことが重要である．術前1～2週間は禁食とし，IVHによる高カロリー輸液により腸管の安静を図るようにしている．とくに瘻孔を有する症例では，瘻孔部の炎症を抑えておくことにより，腹腔内での瘻孔の切離を可能にするためにも重要である．術前のステロイドは，禁食・IVHの導入とともに，できる限り漸減しておく方が望ましい．狭窄が高度で，腸閉塞を呈している場合，術前にイレウスチューブを挿入し，拡張腸管の減圧を図っておくことは，腹腔鏡下手術の際，腹腔内のフリースペースを確保するためにも重要である．大腸前処置として，マグコロール，緩下剤の

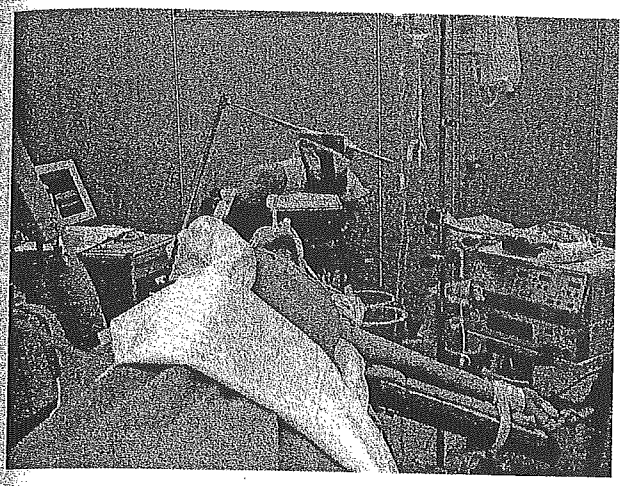

図2 回盲部切除術における体位

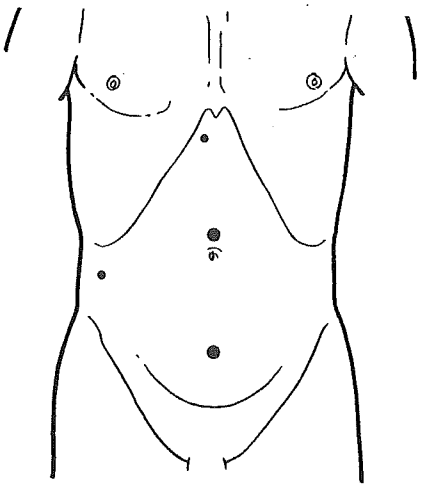

図3 初回手術例におけるポート挿入部位

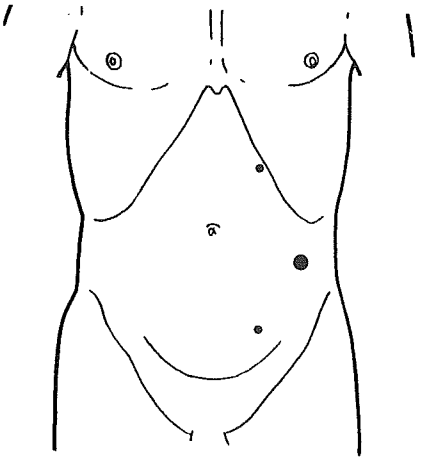

図4 再発例におけるポート挿入部位

投与を行う．ポリエチレングリコール(ニフレック)の投与は，腸管が張り，術野の妨げとなるので避けるべきである．

2．手 術 法

クローン病は多彩な病態を示し，また病変部位も多岐にわたることもあるため，術式もさまざまであるが，最も一般的な回盲部切除術について述べる．基本的に，回腸回腸瘻以外の瘻孔は腹腔鏡下に，自動縫合器により切離するか，困難な場合は直視下に処理を行う．回腸回腸瘻は，創外で処理する．

まず，患者をマジックベッドと側部支持器を用いて，左半側臥位に固定する[4)-6)](図2)．これにより約70度傾けることができるようになり，視野の妨げとなる小腸を視野外に圧排できるようになる．あるいはレビテーターと一体となった腹腔鏡下手術用ベッドを用いると体位をとるのが楽である．右上肢は挙上してアーチに固定し，頭部はスポンジとテープで固定する．初回手術例では，臍上部に縦に約1.5 cm の皮切をおき，open laparotomy 法によって腹腔鏡用トロッカーを刺入し気腹する．次に腹腔内を観察し，癒着の程度，病変の広がり，瘻孔の有無などから操作用トロッカーの位置を決定する．通常，操作用トロッカーは右中腹部，正中下腹部，正中上腹部に刺入する(図3)．あるいは右中腹部のトロッカーを省略し，右上腹部，正中(左)下腹部の2箇所に刺入する．病変は臍上部のトロッカーを延長して引き出す．臍上部と下腹部正中以外のトロッカーは5 mm を用い，皮切は横にしている．

クローン病では，将来回腸人工肛門を造設する可能性もあるので，ストーマ造設に最適な右腸骨窩付近は損傷しないようにし，また今後の再手術も考慮して，病変部を引き出す部位は正中にしている．手術既往がある症例では，正中あるいは右傍正中の術創を避け左中腹部から腹腔鏡を導入する(図4)．正中創直下に癒着がある場合には，5 mm のトロッカーを2本適当な場所に挿入し，癒着剝離を行う．

手術台を左に回転させ，小腸を視野外に圧排し，

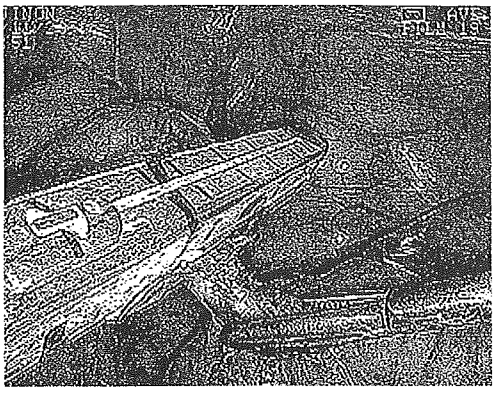

図5 自動縫合器による回腸S状結腸瘻の切離

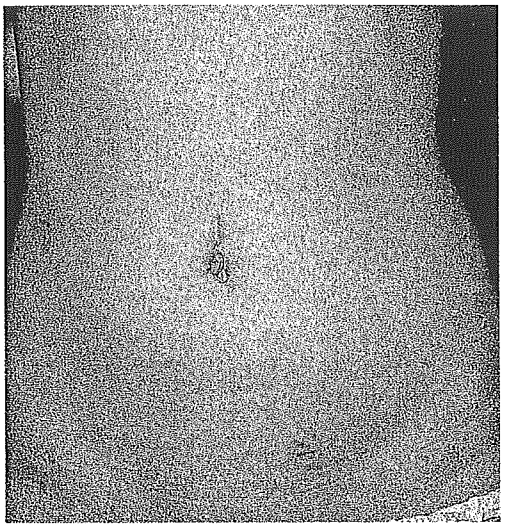

図6 術後創

Toldt の fusion fascia を明らかにする．後腹膜下筋膜を露出し，その前面の層を保持しながら上行結腸を剝離・授動する．とくにクローン病では術前に禁食としていても回盲部の炎症が高度なため，剝離層の同定が困難な場合がある．しかしこのような時でも，まず健常部である腎筋膜前葉を切開し，そこから下方にたどっていけば正しい剝離層を同定することができ，尿管や精巣(卵巣)動静脈を損傷することがない．炎症性腫瘤を形成している場合であっても，まず健常な部分で正確な面を同定できれば，上行結腸を授動することができる．授動を十分に行うためには，回盲部の小腸間膜から後腹膜への移行部を大動脈分岐部に向けて，確実に切開することが重要である．このとき，腹腔鏡を正中下腹部のトロッカーから挿入すると，操作が楽である．上行結腸が短縮し，右結腸切除が必要となるような症例では，腎筋膜前葉から肝結腸間膜を切開し，これにつながる前膵十二指腸筋膜を保つ層で剝離を進める．剝離の際は十二指腸を右側に，横行結腸間膜を左側にみるようにすすめるとよい．また十二指腸の壁は把持せず，薄い前膵十二指腸筋膜を把持して電気メスでこれを切開し，電気メスのへらで十二指腸と横行結腸間膜を左右に払うように剝離する．授動が十分であるかどうかの目安は，盲腸が肝右葉に余裕をもって届くことであり．十分に剝離・授動されていれば，回盲部は臍上部正中の創から容易に露出できる．

回腸回腸瘻以外の瘻孔を有するものは，腹腔内で自動縫合器を用いて切離する(図5)．瘻孔周囲を注意深く剝離し，自動縫合器が入るスペースがあることを確認する．自動縫合器が入らない場合，瘻孔を切離後，手縫いで縫合閉鎖する．一方，回腸回腸瘻は体外に露出し，直視下に切除する．

剝離・授動が完了したならば，臍上部正中の皮切を延長し，病変部腸管を創外に露出する．小腸を全長にわたり他に病変がないか直視下に検索し，切除範囲・術式を決定する．初回手術で回腸末端に病変を有する症例では，回盲部切除を第一選択としている．回盲部切除は型のごとく行うが，腸間膜は肥厚していることが多いので，血管とともに2/0 Vicryl による transfixing suture で集束結紮する．吻合法は自動縫合器による functional end to end anastomosis を好んで行っている[7]．この方法では，手早く吻合が行えるのと，手縫い端端吻合に比べ吻合径が広くとれるので，再発による狭窄をきたしにくいと考えられる．主病変から離れた部位に複数狭窄を認めるものは，できるだけ小腸を温存すべく，狭窄形成術(stricture-plasty)を行う．

吻合が完了したならば，腸管を愛護的に腹腔内に還納し，閉腹する．再度気腹し，止血を確認後，トロッカーを抜去し，手術を終える(図6)．