



and Other Interventional Techniques

Short- and midterm outcomes of laparoscopic surgery compared for 131 patients with rectal and rectosigmoid cancer

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Abstract

Background: This study aimed to clarify and compare the short- and midterm surgical outcomes of laparoscopic surgery for rectal and rectosigmoid cancer.

Methods: Between June 1992 and December 2004, 131 selected patients with cancer of the rectum ($n = 60$) and rectosigmoid ($n = 71$) underwent laparoscopic surgery. The indications for laparoscopy included a preoperative diagnosis of T1/T2 tumor in the rectum and T1–T3 tumors in the rectosigmoid.

Results: The mean follow-up period was 42 months. The procedures included anterior resection for 117 patients, abdominoperineal resection for 11 patients, Hartmann's procedure for 1 patient, and restorative proctocolectomy for 1 patient. Conversion to an open procedure occurred for four patients (3.1%). Postoperative complications developed in 29 patients (22.1%), including anastomotic leakage in 14 patients (11.8%). The length of hospital stay for the rectal cases was significantly longer than for the rectosigmoid cases (10 vs 7 days; $p = 0.0049$). The tumor node metastasis (TNM) stages included 0 ($n = 14$), I ($n = 72$), II ($n = 15$), III ($n = 29$), and IV ($n = 1$). Recurrences were experienced by 13 patients, including local recurrence ($n = 7$) and recurrences involving the liver ($n = 2$), lung ($n = 3$), and distant lymph nodes ($n = 1$). The 5-year disease-free and overall survival rates were, respectively 91.7% and 97.9% for stage I, 86.7% and 90.9% for stage II, and 77.1% and 90.0% for stage III.

Conclusions: Laparoscopic surgery is feasible and safe for selected patients with rectal or rectosigmoid cancer. The selected patients in this study experienced favorable short- and midterm outcomes.

Key words: Laparoscopic surgery — Midterm outcome — Rectal cancer — Rectosigmoid cancer

Since the successful introduction of laparoscopic cholecystectomy, laparoscopic surgery has been reported as feasible for the treatment of various gastrointestinal disorders. Laparoscopic surgery has gained acceptance for the treatment of benign diseases, but it remains controversial for the treatment of malignancies because of concerns about the adequacy of lymphadenectomy, the extent of resection, early findings of port-site metastasis, and the lack of long-term results [23]. Some retrospective and prospective comparative studies have reported on the feasibility and favorable outcome of laparoscopic surgery for colorectal cancer including earlier return of bowel motility [6, 9, 15, 25], less postoperative pain [6, 25], and shorter hospital stay [6, 8, 9, 25].

Recently, reports of large randomized controlled trials comparing laparoscopic with conventional open surgery have been published, demonstrating that laparoscopic surgery for colon cancer is equivalent to open surgery in terms of postoperative complications and long-term outcome [4, 11, 16].

However, these studies did not include rectal cancer because of technical difficulties, except for the CLASICC trial, which included rectal cancer and showed impaired short-term outcomes for patients undergoing laparoscopic anterior resection for rectal cancer. The CLASICC trial concluded that the routine use of laparoscopy for rectal cancer is not justified. Some reports have examined the feasibility of laparoscopic surgery for rectal cancer. However, the role of laparoscopy for rectal cancer remains to be defined [1, 2, 17, 20, 22].

This study aimed to clarify and compare the feasibility, safety, and short- and midterm surgical outcomes of laparoscopic surgery for cancer of the rectum and the rectosigmoid in a single specialized institution.

Patients and methods

The indications for laparoscopic surgery used to manage colorectal cancer have expanded gradually in our institution, based on the pre-

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operative diagnosis of the tumor. When the authors introduced laparoscopy in 1992, only T1 tumors in the colon were targeted. In 1993, T1 tumors in the rectosigmoid were included, and in 1996, T2 tumors in the colon and the rectosigmoid were included. It was not until 1997 that T1/T2 tumors in the rectum and T1–T3 tumors in the rectosigmoid were included. Patients with bulky tumors (>7 cm), those with a history of extensive adhesions, those with bowel obstruction, and those who did not consent to laparoscopic surgery were excluded.

Between July 1993 and December 2004, 634 selected patients with colorectal cancer underwent laparoscopic surgery at our institution. Of these, 131 selected patients with cancer of the rectum or rectosigmoid undergoing laparoscopic surgery were included in our prospective database, and these formed the basis of the study.

The location of the tumors was defined according to the distance from the anal verge, as determined by colonoscopy: lower rectum (0–7 cm), middle rectum (7.1–12 cm), and upper rectum and rectosigmoid (12.1–17 cm). The patients underwent colonoscopy, barium enema, chest radiograph, computed tomography of the abdomen and pelvis, and magnetic resonance imaging of the pelvis for preoperative staging of tumor extent. No patients in this study received preoperative radiation or chemoradiation because only patients with T1/T2 tumors in the mid- or lower rectum were included.

Surgical technique

All laparoscopic operations were performed by consultant surgeons (M.W., H.H., H.N., Y.I.) experienced in both laparoscopic and open colorectal surgery. The laparoscopic technique has been described previously [24]. In brief, a five-port technique was used. After the left colon had been mobilized, the inferior mesenteric artery was divided intracorporeally at its origin, and radical lymphadenectomy was performed. The rectum was dissected posteriorly toward the level of the levator muscle. For higher lesions, the mesorectal tissue was excised down to 5 cm below the tumor. For tumors in the middle or lower rectum, total mesorectal excision was carried out.

Before the division of the rectum, rectal washout was conducted using 1,000 ml of a 5% povidone-iodine solution. The rectum was divided using laparoscopic linear staplers introduced from the suprapubic trocar, and the proximal end of the bowel was delivered through a small incision of the suprapubic trocar extended to approximately 5 to 6 cm. The bowel was resected extracorporeally, after which an anvil was placed into the proximal colon and an anastomosis was performed intracorporeally by means of the double-stapling technique. A diverting ileostomy was fashioned at the surgeon's discretion in patients with rectal cancer. Conversions to open procedure were defined as an unplanned incision and a longer or earlier incision than anticipated.

Statistical analysis

Statistical analysis was performed using StatView Version 5 (SAS Institute Inc., Cary, NC, USA). Continuous and categorical variables were analyzed using Student's *t*-test and Fisher's exact test, respectively. A *p* value less than 0.05 was considered to indicate a statistically significant difference. The overall and disease-free survival rates were calculated by the Kaplan-Meier method, and the log rank test was used to analyze statistical significance.

Results

Between 1993 and 2004, a total of 131 selected patients (74 men and 57 women) with cancer of the rectum or rectosigmoid underwent laparoscopic surgery at our institution. The patient demographics are shown in Table 1. Their mean age was 59.5 years (range, 30–82 years), and their mean body mass index was 23.2 kg/m² (range, 16.2–34.3 kg/m²). Of these patients, 60 had tumors in the rectosigmoid and 71 had tumors in the rectum. Stage 0 or I disease was present in 86 patients (65.6%).

Table 1. Patient details

	Rectosigmoid (n = 60)	Rectum (n = 71)	<i>p</i> Value	
Sex (M:F)	35:25	39:32	0.7263	
Age: years (range)	60.8 (39–76)	58.4 (30–82)	0.1691	
Body mass index: kg/m ² (range)	23.2 (16.2–34.3)	23.1 (16.5–30.3)	0.9606	
TNM stage 0	10	4	0.1594	
I	33	39		
II	6	9		
III	10	19		
IV	1	0		
Procedures			0.0003	
AR with double-stapling technique	59	49		
AR with sutured coloanal anastomosis	0	9		
APR	0	11		
RP	1	1		
Hartmann's procedure	0	1		
Diverting ileostomy	0	22		
Follow-up: months (range)	42.9 (1–122)	41.4 (2–105)		0.7495

TNM, tumor node metastasis; AR, anterior resection; APR, abdominoperineal resection; RP, restorative proctocolectomy

Table 2. Operative and postoperative outcome

	Rectosigmoid (n = 60)	Rectum (n = 71)	<i>p</i> Value
Operative time: min (range)	255 (160–456)	320 (183–590)	0.0026
Blood loss: ml (range)	10 (0–650)	25 (10–965)	0.0016
Conversion	1	3	0.6246
Dissected lymph nodes: <i>n</i> (range)	15 (0–38)	12 (1–49)	0.0330
Liquid intake: days (range)	1 (1–6)	1 (1–18)	0.4784
Solid food: days (range)	3 (2–21)	3 (2–24)	0.3986
Length of stay (days)	7 (5–58)	10 (5–74)	0.0049

The procedures included anterior resection using the double-stapling technique for 108 patients, with transanal sutured coloanal anastomosis for 9 patients, abdominoperineal resection for 11 patients, restorative proctocolectomy for 2 patients, and Hartmann's procedure for 1 patient. A diverting ileostomy was fashioned in 22 patients with cancer of the rectum.

The mean follow-up period was 42 months (range, 1–122 months). There were no significant differences between the rectum and the rectosigmoid in terms of the sex ratio, age, body mass index, tumor node metastasis (TNM) stage, or follow-up period.

Four patients (3.1%) required conversion to an open procedure (3 involving the rectum and 1 involving the rectosigmoid) because of unexpected tumor growth in two patients, uncontrollable bleeding from the presacral plexus in one patient, and other causes in one patient (Table 2). The operative time was longer and the blood loss was greater in the patients with rectal cancer than in those with rectosigmoid cancer (*p* = 0.0026 vs *p* = 0.0016). The number of dissected lymph nodes was significantly greater in the patients with rectosigmoid cancer than in those with rectal cancer (*p* = 0.0330).

Table 3. Postoperative complications

	Rectosigmoid (n = 60) n (%)	Rectum (n = 71) n (%)	p Value
Anastomotic leak	6 (10.0)	8 (13.6) ^a	0.8150
Wound sepsis	2 (3.3)	7 (9.9)	0.1786
Bowel obstruction	0	4 (5.6)	0.1245
Abscess	1 (1.7)	2 (2.8)	0.9999
Others	0	2 (2.8)	0.4997
Total	9 (15.0)	20 (28.2)	0.0705

^a Patients undergoing Hartmann's procedure or abdominoperineal resection were excluded

Table 4. Sites of recurrence

	Rectosigmoid (n = 49) ^a	Rectum (n = 67) ^a	P Value
Liver	1	1	0.9999
Lung	1	2	0.9999
Distant lymph nodes	0	1	0.9999
Local	1	6	0.1242
Total	3	10	0.1404

^a Patients with stage 0 or IV cancer were excluded

Liquid and solid food was started on the median postoperative days 1 and 3 for both the patients with rectal and rectosigmoid cancer. The length of hospital stay for rectal cancer was 10 days, which was significantly longer than for rectosigmoid cancer ($p = 0.0049$).

Postoperative complications were observed in 29 patients (22.1%) (Table 3). The incidence of postoperative complications among the patients with rectal cancer tended to be higher than among those with rectosigmoid cancer. However, this difference did not reach statistical significance. The incidence of anastomotic leakage for rectal and rectosigmoid cancer was, respectively, 13.6% and 10%, but the difference also was not statistically significant.

Of 116 patients undergoing curative surgery, 13 (11.2%) experienced recurrences at a mean follow-up period of 42 months, including local recurrence in 7 patients as well as recurrence involving the liver in 2 patients, the lung in 3 patients, and distant lymph nodes in 1 patient (Table 4). There were no significant differences between the two groups in terms of the recurrence pattern. However, the incidence of local recurrences tended to be higher among the patients with rectal cancer than among those with rectosigmoid cancer. There was no port-site metastasis. The 5-year disease-free and overall survival rates were, respectively, 91.7% and 97.9% for stage I, 86.7% and 90.9% for stage II, and 77.1% and 90.0% for stage III (Figs. 1 and 2).

Discussion

The current study showed that laparoscopic surgery for rectal cancer is safe and feasible, has a low conversion rate, and provides favorable short- and midterm outcomes. Four patients (3.1%) underwent conversion to

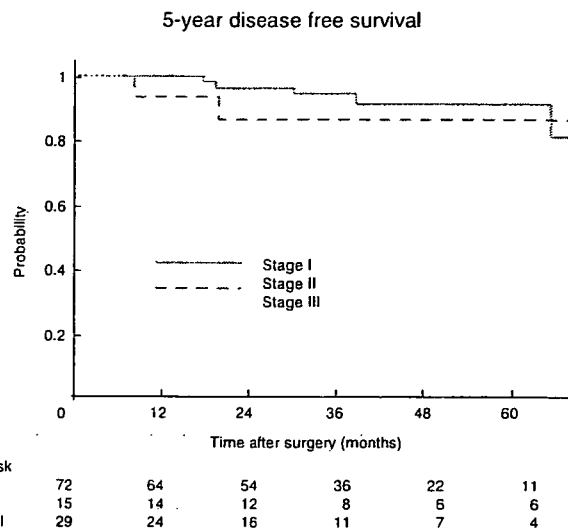


Fig. 1. The 5-year disease-free survival rate.

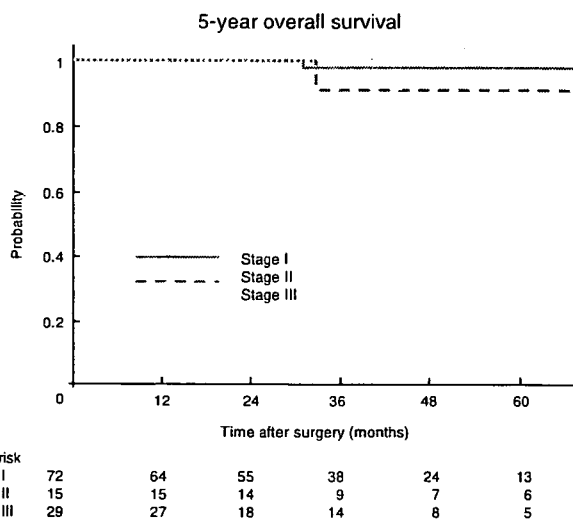


Fig. 2. The 5-year overall survival rate.

open surgery, giving a low conversion rate compared with previously published data (10–30%) [1, 4, 5, 11].

A low conversion rate also was reported by another specialized center [17]. One of the reasons for the low conversion rate may be that the current study included a selected group of patients with rectal cancer (i.e., mainly early rectal cancer), which means that bulky, advanced tumors were not included. A bulky tumor in the narrow male pelvis was one of the reasons for conversion. Another reason may be that very few Japanese patients are overweight. The mean body mass index in the current study was less than 25 kg/m².

“Conversion” itself is not necessarily a negative event, but the appropriate incidence of the conversion is difficult to determine. However, the authors think that good selection of patients is reasonable and justified, considering that the patients with conversion had a higher incidence of postoperative complications than those without conversion in other studies [12].

The number of dissected lymph nodes was significantly greater for the patients with rectosigmoid cancer than for those with rectal cancer in the current study. Although a high tie should have been performed in every case, the level of division of the inferior mesenteric artery in early cancer cases may have been slightly lower than in advanced cases. However, the incidence of early cancers (Tis or T1) was slightly higher among the rectosigmoid than among the rectum cases, and the real reason for this is unknown.

The diverting ileostomy was fashioned at the surgeon's discretion in the current study. Some surgeons routinely fashion a diverting ileostomy for laparoscopic anterior resection in their management of rectal cancer [17]. The presence of a stoma does not prevent the development of anastomotic leakage, but it can prevent a subsequent disaster.

The overall morbidity in the current study was 22%, which compares favorably with the published data of 53% for open procedures [3]. The most common postoperative complication was anastomotic leakage, with an incidence of 11.8%, which is consistent with published reports describing a range of 7% to 17% [5, 17, 18, 22]. Several risk factors are reported to be associated with postoperative complications, especially anastomotic leakage, including male gender, obesity, and the level of the anastomosis [19, 21]. Several reports describe higher anastomotic leak rates after total mesorectal excision than after conventional surgery [3, 13]. Although some authors have reported leak rates lower than 5% after total mesorectal excision [26], others have reported leak rates as high as 10% to 20% [3, 10]. The incidence of anastomotic leakage in laparoscopic rectal surgery seems to be higher than in open surgery. However, some reports show no difference in leak rates between laparoscopic and open procedures [11, 18].

One technical factor could be a reason for the higher leakage rates in laparoscopic rectal surgery. With the double-stapling technique, the circular stapler used in laparoscopic procedures is basically the same as that used in open procedures, whereas the linear staplers are different. The authors used laparoscopic linear staplers through a suprapubic port to transect the rectum. Although articulated staplers are currently available, at least two, and sometimes three or four linear staplers are needed, thus resulting in an unduly long staple line. An unduly long staple line could be a reason for the higher leakage rate, although there are no data regarding the number of linear staplers used or the incidence of anastomotic leakage.

A Pfannenstiel incision with the use of the conventional linear stapler for open procedures has been attempted by some surgeons. This is difficult because it provides poor visualization of the deep narrow pelvis, and the conventional stapler has no cutter. Recently, a new curved cutter stapler has become available, and its application to the laparoscopic anterior resection might be a good alternative [14].

The local recurrence rate in the current study was 6%, which compares favorably with the rate reported for the published series of open total mesorectal excision [7]. It is reported that the local recurrence rate after open

total mesorectal excision is 4% for stage II and 8.1% for stage III cancer [12]. Another study has reported that the local recurrence rate was 0% for stage I, 8% for stage II, and 30% for stage III cancer [12].

Two stage I patients experienced local recurrence in the current study. The one patient, who had a T1N0 tumor in the middle rectum, experienced recurrence in the lateral lymph nodes 20 months after the operation. The other patient, who had a T2N0 tumor in the rectosigmoid, experienced recurrence at the anastomotic site 39 months after the operation. These patients underwent surgery in the early study period when articulated laparoscopic linear staplers were not available. Thus the distal surgical margin may have been inadequate.

The results of the current study show that laparoscopic surgery for rectal cancer is feasible for selected patients and promises a favorable outcome. The overall and disease-free 5-year survival rates in the current study were, respectively, 87.6 and 95.1%, which are consistent with previously reported data for laparoscopic surgery [2, 17] and open procedures [7]. A randomized controlled trial showed that the circumferential margin positive rate was greater for patients undergoing laparoscopic anterior resection than for those undergoing open surgery [11]. Although the difference was not statistically significant, it could result in increased local recurrence. Although it will be some years before the long-term results of the CLASICC trial can be reported, further studies are needed to elucidate both the short- and long-term outcomes.

This study had several limitations. It included only selected patients with rectal cancer because the indications for laparoscopic surgery expanded gradually as the authors gained experience. Patients with far advanced rectal cancer were not included, and when surgery was indicated, open procedures were adopted. Therefore, this study was not intended to be a strict comparison between open and laparoscopic procedures. Patients receiving preoperative radiation or chemoradiation were not included, and the feasibility of laparoscopy for these patients also should be evaluated in the future. A randomized controlled trial should be conducted to clarify the benefits of laparoscopic surgery for rectal cancer. However, the authors believe that the findings of the current study are of value in proposing the future studies.

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手術手技

新しい内視鏡下体内結紮法の提案

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手術 手技

新しい内視鏡下体内結紮法の提案

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キーワード：内視鏡下体内結紮法

現 在広く普及している内視鏡下体内結紮法として square knot があるが、さらに迅速簡便に男結びが可能となる新しい結紮法を提案する。本法は既知の slip knot からヒントを得た方法で、対称的な糸のループを形成しておき、その中に糸の一端を通すことで、1回の操作にて迅速簡便に男結びが可能となる結紮法である。当院の5人の外科医の結紮所要時間は、square knot が 41.7 ± 9.41 秒（平均±SD）に対し、新法が 26.2 ± 4.60 秒（同）と有意な所要時間の短縮を認めた。基本である square knot を習得したうえで新しい方法を身に付け、結紮のバリエーションを増やすことは有用であり、また臨床応用上も有用な方法であると考えられる。

はじめに

内視鏡下の糸結びにはさまざまな方法が存在するが、現在広く普及している体内結紮法は Zoltan Szabo が提唱した square knot である¹⁾。本法は確実に男結びができる点、slip knot への conversion が行いやすい点、左右の鉗子の coordination が鍛えられる点で非常に優れている。今回、さらに迅速簡便に男結びができる新しい結紮法を提案する。

手術手技

この新しい結紮法は、既知の slip knot からヒントを得た結紮法である。Slip knot とは直線化された long tail に、もう一方の糸が絡んだ状態であるが²⁾、この絡んだ糸の形態に着目をした。

図 1a の square knot から図 1b の slip knot に conversion して long tail を引き抜くと（図 1c）、2つの対称的なループが残る（図 1d）。筆者らはこのループに着目し、新しい結紮法を考案した。

この一連の流れは可逆的な流れであり、逆順に

たどることも可能である。つまり、あらかじめ先ほどのループを形成しておいて、糸の一端をこのループの中を通して引き抜けば、slip knot、square knot が完成するのである（図 1 の d→c→b→a の順）。

このループを作る手順は簡単で、まず糸の一端で1つのループを作る（図 2a）。次いで、ループの頂点を向こう側に折り返すことで、先ほどの対称的なループが形成される（図 2b）。そしてこのふたつのループを手前側に折りたたみ（図 2c）、鉗子のシャフトに通しておくことで準備は完了する（図 2d）。

実際の新しい結紮法の手順を説明する（図 3）。先ほどのループを予め形成して、このループを補助鉗子のシャフトに通しておく（図 3a）。このままでは針糸が滑って挿入できないため、short tail を把持して針糸を腹腔内に挿入する（図 3b）。腹腔内に挿入後は補助鉗子は short tail を放し、フリーになる（図 3c, d）。フリーとなった補助鉗子も活用しながら針のマウント、運針を行う（図 3d）。図 1 で示したように、「糸の一端を、ルー

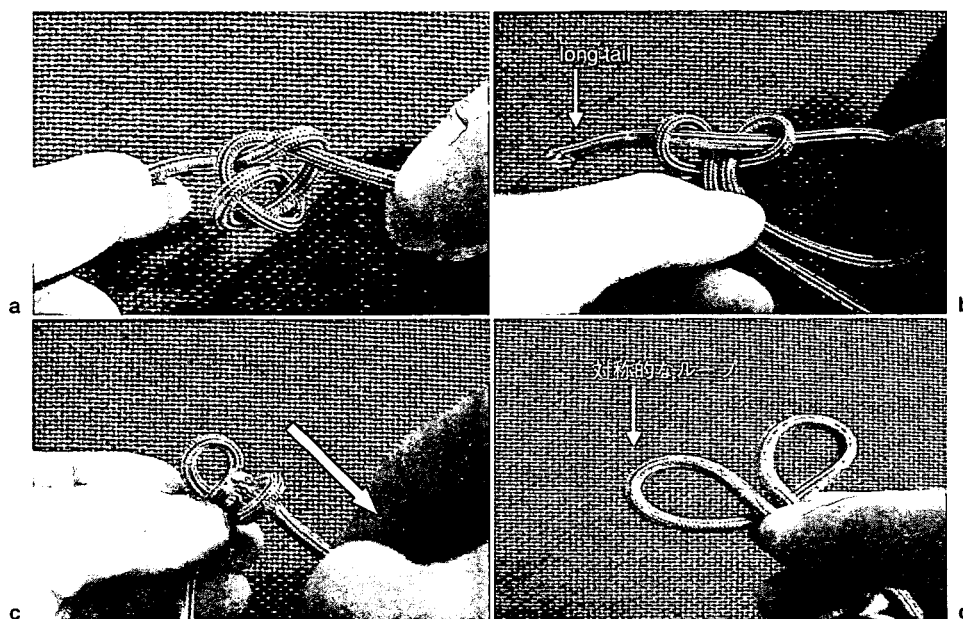


図1 新しい結紮法

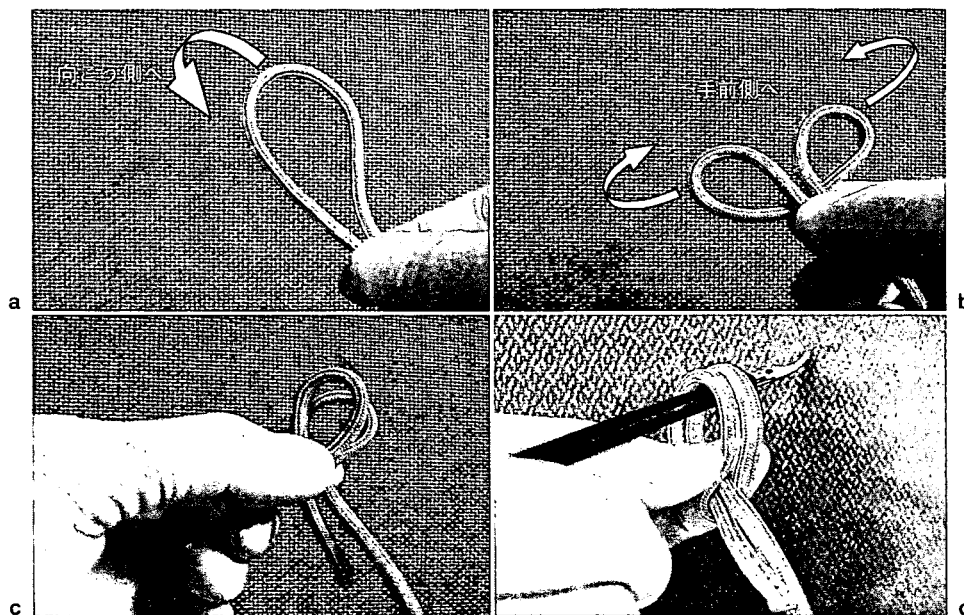


図2 ループを作る手順

プの中を通して引き抜く」ことで結紮が完成するわけであり、まず補助鉗子にて運針後の針糸の holding point (以下、H point) を把持する (図 3e)。この把持した針糸を、ループの中を通して引き抜く (図 3f)。次いで持針器は short tail を把持し (図 3g)、そのまま左右に鉗子を引いて結

紮を完了する (図 3h)。以上のように新法は、1 回の操作にて迅速簡便に男結びができる結紮法である。

実際の臨床応用例を示す。症例は腹腔鏡下胆嚢摘出術における胆嚢管結紮の場面である (図 4)。補助鉗子にループを通して糸を腹腔内に挿入し

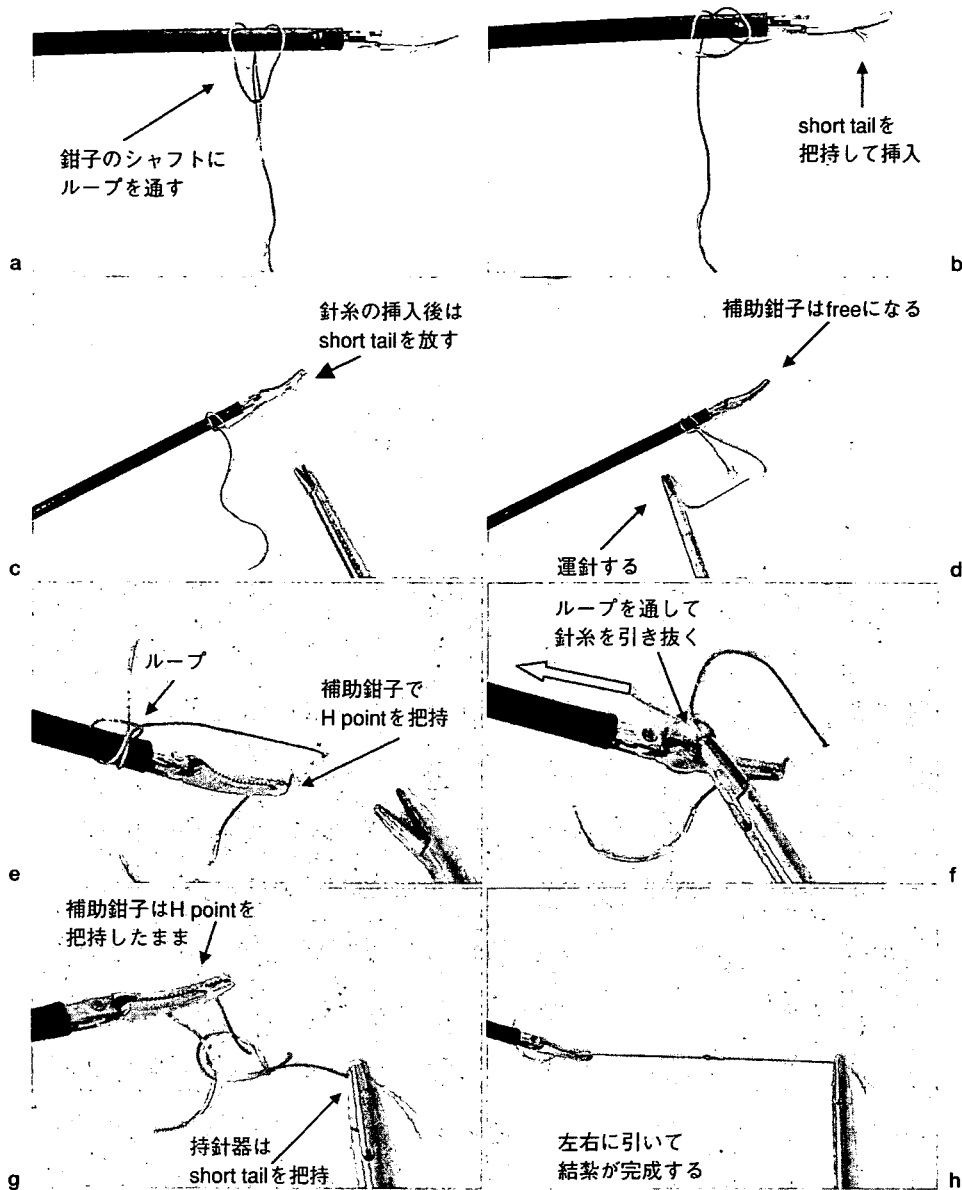


図3 新しい結紮法の手順

(図4a), 胆嚢管の背側に糸を通して糸の一端を補助鉗子で把持する(図4b)。ループの中を通して補助鉗子を引き抜き(図4c), 鉗子を左右に引いて結紮が完了する(図4d)。

考察

当院の5人の外科医(うち4人は結紮縫合手技講習会受講者)が, ドライラボにてそれぞれの方

法での結紮に要する時間を計測した。試行は5人の各術者が, square knotを3回, 新法を3回ずつ連続して行い, 所要時間を計測した。結果は, square knotが 41.7 ± 9.41 秒(平均 \pm SD)に対して, 新法が 26.2 ± 4.60 秒(同)であり, t検定において有意に新法のほうが速いことが判明した($p < 0.01$, 図5)。このように, 講習会を受講した経験のある術者であっても, 明らかに迅速簡便

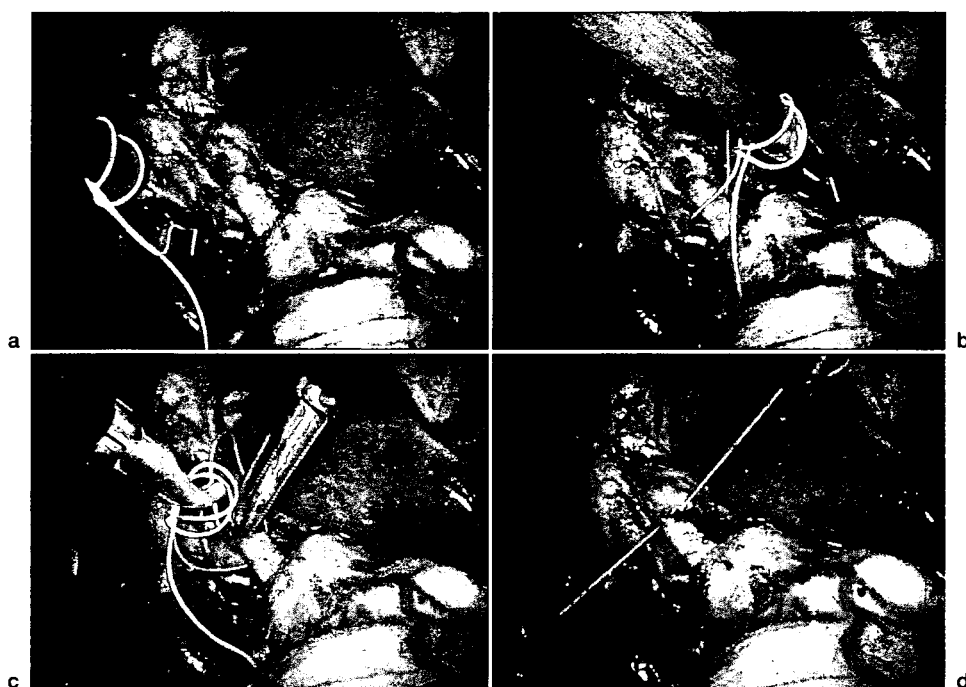


図4 胆嚢管結紮の場面

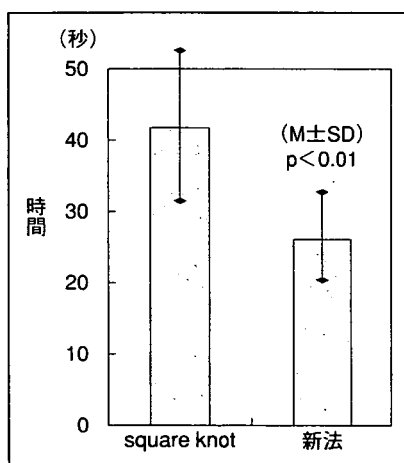


図5 結紮に要する時間

に男結びが施行できる有効な結紮法であると考え
る。

また図4にも示したように、速く・簡単にできるこの結紮法は、臨床応用においても役に立つ結紮法である。単結紮のみならず、連続縫合の始点結紮にても施行可能であり、臨床の様々な場面における応用が期待できる方法であると考え。

この新しい結紮法を施行するにあたり、何点か

コツがあるので考察する。まず使用する糸に関してはどのような種類であっても使用可能ではあるが、絹糸はslipさせにくく、ナイロン糸ははねやすくループの保持が困難になりやすいため、実際にわれわれはバイクリルなどの合成編み糸を使用している。糸の長さはループの分があるため通常よりやや長めの糸が必要で、単結紮では12~15cmが適当である。図3の結紮の過程において、「ループの中を補助鉗子で把持した針糸を引き抜く」操作をスムーズに行うためには、持針器でループを把持して補助鉗子からループを引きずり下ろすような操作をすること(図3f)、補助鉗子の関節部にループが引っ掛かりにくいような鉗子を用いることなどが重要であると考え。

おわりに

内視鏡下に迅速簡便に男結びを行う新しい結紮法を考案した。結紮法の基本は学会推奨のsquare knotであるが、それを習得したうえで新しい方法を身に付け、結紮法のバリエーションを増やすことは有用なことであると考え。また、この新法は、square knotをマスターした術者に

においても有意差をもって迅速に結紮することが可能であり、臨床の場面においても有用な結紮法であると考えらる。

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(みかみ かずひさ: 城北病院外科: ☎920-0848 石川県金沢市京町 20-3)

The new method for intracorporeal knot tying

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The square knot, which is advocated by Zoltan Szabo, is a popular method for intracorporeal knot tying in endoscopic surgery. We propose a new knot tying method. We invented this method from the slip knot. The tail of the thread is passed through a symmetrical loop, and an opposite half knot is made rapidly and easily in one action. The mean knot tying time of five surgeons in our hospital was 41.7 sec. (square knot) and 26.2 sec. (new method). We were able to shorten the knot tying time by using this method. In addition to mastering the basic square knot, it is valuable to learn new method. Moreover, this method is useful in clinical application.

特集

腹腔鏡下大腸癌手術の現状と問題点

腹腔鏡下大腸癌手術の現状と短期成績

齊藤修治*1 山口茂樹*2 石井正之*1 絹笠祐介*1
 赤本伸太郎*1 奥本龍夫*1 富岡寛行*1 間浩之*1
 川崎誠一*1 小島隆司*1

Short-term Outcome after Laparoscopic Colorectal Surgery: Saito S*1, Yamaguchi S*2, Ishii M*1, Kinugasa Y*1, Akamoto S*1, Okumoto T*1, Tomioka H*1, Hazama H*1, Kawasaki S*1 and Kojima T*1 (*1Division of Colon and Rectal Surgery, Shizuoka Cancer Center Hospital, *2Division of Colorectal Surgery, Saitama Medical University, International Medical Center)

We reviewed a short-term outcome after laparoscopic colorectal surgery for colorectal cancer, with approximately similar approach and using same surgical instruments, in one institution. We reviewed 390 cases that operated from September 2002 to December 2006. We compared short term results according to an operator (each four staff doctor and other 8 residents). As a result, there was not almost difference by operator with experience, about short-term results: operation time, blood loss count, conversion rate, intra-operative accident, early post operative morbidity rate and post-operative stay. Uniformity of procedure of operation is able to perform a stable operation and to help education of a new operator.

Key words: Laparoscopic colorectal surgery, Colorectal cancer, Short-term outcome

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はじめに

本邦で1990年代はじめに腹腔鏡下大腸切除術が開始されて15年以上が経過したが、この間にさまざまな手術アプローチが試行され、新たな手術器械も開発されている。

2002年9月に開院した静岡がんセンターでは、ほぼ同様のアプローチ・手術器械を使用し、独立して執刀可能な4人の術者が腹腔鏡下大腸癌手術を行ってきた¹⁻³⁾。腹腔鏡下大腸癌手術の中・短期成績から、現在行っている手術法の妥当性を検証し、定型化された腹腔鏡下大腸癌手術での術者別の短期成績を比較し、術者間の差を検討

した。

1. 当科での腹腔鏡下大腸癌手術の適応

適応の原則は、結腸癌・RS癌症例ではc Stage IIまでとしている。開腹手術 vs. 腹腔鏡手術のRandomized Controlled Study (RCT)であるJCOG-0404⁴⁾に参加同意例ではc Stage IIIの約半数が腹腔鏡手術に割り付けられた。Ra直腸癌症例ではc Stage Iまで、Rb直腸癌症例ではcSM以浅のc Stage Iまでの症例としている。

2. 対象と方法

2002年9月の開院から2006年12月までの4年4カ月間に原発巣を切除した大腸癌症例は1,072例あり、このうち腹腔鏡下手術を行った

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表1 患者背景

Gender	Male	238	Age	26-88 (65.0±10.0)	
	Female	152	Stage	0	18
Location Colon		293 (75%)		I	169
	C	23		II	112
	A	66		IIIa	73
	T	44		IIIb	15
	D	19		IV	3
	Rectum		97 (25%)	Curability	A
	RS	55		B	2
	Ra	22		C	1
	Rb	20	Operator	A	149
Operation procedure	Colectomy	212		B	63
	AR (DST)	170		C	74
	TAA (ISRを含む)	8		D	42
				the other 8	62 cases

Colectomy : 小開腹創から直視下に吻合した結腸切除術

AR : Anterior resection, DST で吻合した高位および低位前方切除術

DST : Double Stapling Technique

TAA : Transanal anastomosis

ISR : Intersphincteric resection

Location, Stage, Curability : 大腸癌取扱い規約 第7版による

390例を対象とした。

患者背景では結腸癌症例が75%を占め、RS癌が14%、RaおよびRb直腸癌が11%と結腸癌が多くを占めていた。手術術式では小開腹創外で直視下に結腸・結腸吻合した結腸切除術が54%、Double Stapling Technique (DST) による前方切除を行ったS状結腸・直腸癌症例が44%、Intersphincteric resection (ISR) など経肛門吻合が2%であった。大腸癌取扱い規約によるStage別では0/Iで約半数の48%で、Stage II : 29%、Stage IIIa : 19%であったが、Stage IIIbは4%のみであった。術者は主な術者4名で全症例の5/6の手術を行っており、レジデントなどその他8名が残りの手術を行っていた(表1)。

評価項目は、術中因子として手術時間、出血量、開腹移行の有無、術中偶発症を検討した。術後短期成績として、術後1カ月以内の早期合併症、術後在院期間を、術後中期成績として、無再発生存率、再発を検討した。術中因子・術後短期成績に関しては術者別の成績も検討した。

表2 手術時間

術式別	術者別	手術時間
全例	Colectomy	189±51分
	AR(DST)	243±54分 (P<0.0001)
	術者A	197分
	術者B	176分
	術者C	186分
	術者D	195分
	その他	189分
		(* : p=0.021 他 N.S)

3. 結果

1) 術中因子

手術時間：直視下に吻合した結腸切除術と比較し、DSTによる前方切除は有意に手術時間が長かった。それぞれの手術を術者別に検討すると、結腸切除で術者A/B間に有意差を認められたが、それ以外では術者間に有意差は認めなかった(表2)。

出血量：直視下に吻合した結腸切除術では43

±54 g, DSTによる前方切除では62±125 gと差はなかった。術者別に検討すると、平均出血量は42~63 gであり、各術者間で差を認めなかった。輸血投与症例はなかった。

開腹移行：18例(4.6%)に経験した。移行理由としては、癒着6例、他臓器浸潤3例、腸管虚血2例、肥満2例があった。その他1例ずつのものとして高CO₂血症、自動吻合器使用困難、出血、虫垂穿孔、組織脆弱があった。術者別に検討すると、開腹移行率は2.4~6.3%と各術者間で有意差を認めなかった。

術中偶発症：7例(1.8%)に合併していた。内容は腸管虚血2例、虫垂穿孔2例、出血2例、異物遺残1例であった。これも術者間に差を認めなかった。

2) 術後短期成績

術後早期合併症(1カ月以内)：縫合不全は直視下に吻合した結腸切除術では1例(0.5%)に、DSTでは11例(6.5%)の合計12例に合併した。そのうち7例に再手術を要した。腸閉塞は16例(4.1%)に合併したが、6例は経口摂取開始遅延のみで軽快、9例は経鼻減圧チューブを留置にて軽快したが1例に再手術を要した。創感染は24例(6.2%)に合併していた(表3)。

Common Terminology Criteria for Adverse Events v3.0 (CTCAE v3.0)に基づくGrade 3以上のものは合計27例(6.9%)あり。Grade 3以上のものに限り術者間の発生頻度を比較したところ、発生率は4.1~9.4%と各術者間で差を認めなかった。

術後在院期間：直視下に吻合した結腸切除術(平均8.1日)と、DSTによる前方切除(平均10.5日)とでは差を認めた。それぞれの手術を術者別に検討すると、術者間では差を認めなかった(表4)。

3) 術後中期成績

無再発生存率：3年無再発生存率はstage 0 100%, stage I 97%, stage II 93%, stage IIIa 76%, IIIb 56% (図1)。

再発：平均経過観察期間は30カ月であり、再発症例は19例。初回再発部位は、肺7例、肝6例、腹膜4例、局所2例、遠隔リンパ節2例、

表3 術後早期合併症

術後早期合併症		62例 (15.9%)
縫合不全	再手術	7
	保存治療	5
腸閉塞	再手術	1
	経鼻チューブ挿入	9
	経口摂取開始遅延	6
創感染		24
腹壁癒着ヘルニア	再手術	2
吻合部口側腸管穿孔	再手術	1
後出血	保存的に軽快	3
限局性腹膜炎		1
抜管後呼吸停止		1
肺炎		1
腎盂腎炎		1
胆嚢炎		1
ドレーン孔からの大網脱出		1

早期合併症：術後1カ月以内に発症したもの

表4 術後在院日数

術式別・術者別 術後在院日数	Colectomy AR (DST)	
全例	8.1日	10.5日 (p=0.0008)
術者A	8.1日	11.0日 (p=0.025)
術者B	8.0日	12.2日 (p=0.049)
術者C	7.8日	9.5日 (N.S.)
術者D	7.3日	8.1日 (N.S.)
その他	8.9日	10.8日 (N.S.)
	(N.S.)	(N.S.)

卵巣1例であった(重複あり)。

4. 考察

術者間の検討で唯一有意差があった手術時間の検討では、直視下に吻合した結腸切除では術者により約20分の差があり、最長の術者Aは経験症例数も最多であることより、これは経験症例数の差ではなく、術者Aに開院初期症例や難易度が高い症例が多かったためと考える。その他の術中因子・術後短期成績では術者間に差を認めなかった。独立して執刀しないレジデントなどその他の8名の術者の手術時間・出血量・術中偶発症発生率・術後早期合併症発生率は、術者A/B/C/Dの

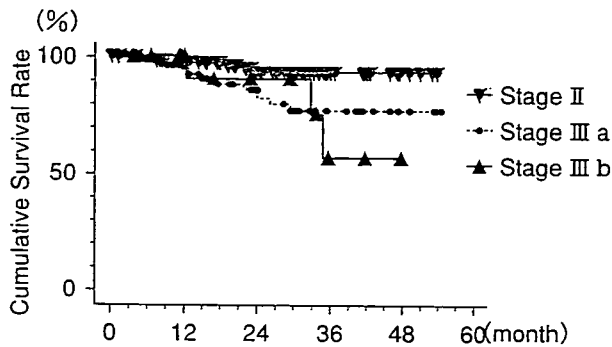


図1 無再発生存率

3年無再発生存率：Stage II 93%，Stage III a 76%，Stage III b 56%。

平均に近い数値であり、ほぼ同様のアプローチ・手術器械を使用による手術の定型化は、経験の少ない術者に執刀させるのに有効だった。開腹手術と異なり限られた方向からの視野、限られた方向からの鉗子操作で安全に手術操作を進めるために手技の定型化は必須な過程である。

累積3年無再発生存率は累積5年生存率にはほぼ相当することから Stage I：97%・II：93%は現在まで非常に良好な成績である。Stage IIIは全国登録の5年生存率にはほぼ類似した結果だった。今回の Stage III b は15例中3例が再発し、3年以上経過している症例は3例だけのため、3年無再発生存率は56%と低い数値となっていた。Stage IIIの長期成績評価には、JCOG-0404によるRCTの結果など症例の蓄積が待たれる。

腹腔鏡下大腸癌手術の術後再発で注目される腹膜再発は4例あり、深達度はpSS/pSE 2例ずつで、組織型は tub1/tub2 が2例ずつであった。再発時期は術後8, 13, 26, 33カ月であり、術後8, 13カ月で再発した2例は port site 再発も合併し

ていた⁵⁾。腫瘍の port site への implantation によると思われる port site のみの再発はなかった。

局所再発の2例はともに Rb 直腸癌であり、1例は stage I であったことより、Rb 直腸癌の適応に関しては慎重にあるべきと考える。

まとめ

ほぼ同様のアプローチ・手術器械の使用により、腹腔鏡下大腸癌手術の短期成績に関しては、経験のある術者による差はほとんどなかった。手術の定型化により安定した腹腔鏡下大腸癌手術が可能となり、新たな術者の育成にも役立つと考える。

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Laparoscopic Mesorectal Excision with Preservation of the Pelvic Autonomic Nerves for Rectal Cancer

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ABSTRACT

Background/Aims: Laparoscopic mesorectal excision with preservation of the autonomic pelvic nerves for rectal cancer including selected advanced lower rectal cancer is now challenging. The aims of the study were to assess the surgical results and short-term outcomes of this procedure prospectively.

Methodology: Seventy-four of 281 rectal cancer patients, since the introduction of laparoscopic colorectal surgery in our hospital, have undergone laparoscopic rectal surgery. The location of the tumor distributed in upper rectum; 33, middle; 22, and lower 19. The mesorectal excision with preservation of the autonomic pelvic nerves was performed for all the patients. The laparoscopic mesorectal excision was performed under 8 to 10 cmH₂O CO₂ pneumoperitoneum and lymph node dissection was performed along the feeding artery depend on individuals. Ipsilateral lateral lymph node dissection was added for

5 cases of advanced lower rectal cancer.

Results: Open conversion occurred in 4 cases, 2 of those were due to locally advanced tumors and 2 technical difficulties in transaction of the distal rectum. There were 15 postoperative complications, 7 anastomotic leakage (10.6%), 3 transient urinary retention (4.1%), 4 wound infection (5.3%), and 1 small bowel obstruction (1.4%). No mortality was recorded in this series. Time of operation was 203±54 min in mesorectal excision cases and 270±42 min mesorectal excision with lateral lymph node dissection cases. Blood loss was 92±90g and 276±66g respectively. The hospital length-of-stay was 11.7 days in average.

Conclusions: Laparoscopic mesorectal excision with preservation of autonomic pelvic nerves for rectal cancer patients including selected advanced lower rectal cancer is favorable.

KEY WORDS:

Laparoscopic surgery; Preservation of autonomic nerves; Mesorectal excision; Rectal cancer; Lateral Lymph-node dissection

INTRODUCTION

Recent advances in laparoscopic surgery have led to its use for various colorectal diseases and laparoscopic surgery is now routinely used to treat malignant disease. Initially, several reports of port site metastases were published. These were thought to represent exfoliation of cancer cells during the production of pneumoperitoneum and by handling of the tissues due to inexperience with the procedure (1-4). Similar findings have been documented experimentally (5). However, the number of reports of port site metastases has decreased. By minimizing or avoiding tumor manipulation, the use of laparoscopic surgery has now been extended to advanced cancers.

Acceptance of laparoscopic surgery for rectal cancer has met resistance, even though conventional rectal surgery is associated with a high rate of the local recurrence unless complete total mesorectal excision is performed (6). We have found that a magnified view of the deep pelvis via the laparoscopy allows total

mesorectal excision with less blood loss than open procedure. Some of the latest papers, even not randomized controlled trials, have supported the laparoscopic total mesorectal excision in terms of short-term outcomes (7,8). Even for the patients with lower rectal cancer, the laparoscopic view seems to give more benefits than conventional open surgery although some controversies exist concerning the lateral lymph node dissection (9-12).

This paper focused on the mesorectal excision for rectal cancer patients with preserving autonomic nerves under laparoscopic view including some selected advanced lower rectal cancer patients with lateral lymph node dissection. The operative variables and the short-term outcomes after this surgery were assessed.

METHODOLOGY

Three hundred and twenty-eight nonrandomized consecutive patients with a colorectal neoplasm have

undergone laparoscopic colorectal surgery in our hospital since the introduction of this procedure in 1998. During this period, of 281 rectal cancer patients, 74 (26.3%) were treated by laparoscopic anterior resection. The site of rectal neoplasm was defined according to the International Guidelines for Cancer Registrars (13). The protocol, which was changed about the indication in August 2002, was approved by the ethical committee of our hospital and patients gave informed consent. In the first edition of protocol, indication of laparoscopic surgery for rectal cancer was limited to all cases of upper and middle site and early cancers of lower site, but in the new edition that was extended to selected advanced cancers of lower site. The selected cases were identified as tumor confined to the proper muscle layer, occupying within half of the circumference, and without preoperative lymph node metastasis in the lateral region under thin-slice pelvic contrast-enhanced CT exam or MRI. In the absence of specific contraindications to laparoscopy, patients were selected for laparoscopic surgery based on the following criteria: elective surgery, absence of occlusion. Neither morbid obesity, prior major lower abdominal surgery, nor tumor occupying the pelvic space was considered a contraindication to laparoscopic surgery. Partial mesorectal excision was performed for the patients with upper rectal cancer, and a total excision for those with middle and lower. We attempted to preserve the hypogastric nerve and pelvic nerve plexus in all cases. No lymph node dissection of the lateral region was performed for the upper and middle rectal cancers. Ipsilateral lateral lymph node dissection preserving the autonomic nerves was performed in selected lower rectal cancer cases. The bowel reconstruction was basically performed primarily by the double stapling technique. For the middle and lower rectal cancer patients with a satisfactory length of sigmoid colon, J-pouch formation was performed for reconstruction. No bowel restoration of discontinuity was performed for selected lower rectal cancer patients.

Clinical parameters analyzed included patients' characteristics, operative variables, and short-term outcomes. Operative variables included type of operation, blood loss, time of operation, and conversion rate. Conversion to laparotomy was defined as unplanned incision. Short-term outcomes included days needed to regain bowel function, hospital length-of-stay, postoperative morbidity, and 30-days mortality.

Operative Technique

Laparoscopic anterior resection was performed using 5 ports with 8 to 10 cmH₂O of CO₂ pneumoperitoneum. The medial aspect of the rectosigmoid mesocolon was incised to mobilize the retroperitoneal space, preserving both hypogastric nerves. As lymphadenectomy in the mesenteric arterial direction was individualized on a case-by-case basis, the pelvis was approached following the division of the main artery. The rectosigmoid colon was pulled cranially after continuing the dissection laterally, providing excel-

lent exposure of the pelvic space (**Figure 1a**). The reflection of the peritoneum was incised on the anterior wall of the rectum, resecting Denonvillier's fascia to expose the seminal vesicle in men or the vaginal wall in women, and the rectum was mobilized distally so that levator ani was exposed circumferentially (**Figure 1b**).

For the selected lower rectal cancer cases, ipsilateral lateral lymph node dissection on the predominant side of the tumor was added. The lateral lymph node dissection was developed, exposing the internal and external iliac arteries. The internal iliac artery was dissected peripherally, ensuring the superior gluteal artery, obturator artery, inferior vesical artery, and middle rectal artery (**Figure 2a**). Lateral dissection was continued to resect all adipose tissue, including lymph nodes, exposing the obturator nerve to the obturator foramen (**Figure 2b**).

RESULTS

Demographics (Table 1)

74 patients divided into 49 males and 25 females according to gender and of whom median age was 66 ranging from 42 to 94, were recruited. The location of the tumor distributed as 33 upper rectum (44.6%),



FIGURE 1a The rectosigmoid colon is pulled cranially by using a monofilament ligature.



FIGURE 1b The rectum is entirely mobilized and the levator ani is exposed; total mesorectal excision.



FIGURE 2a The lateral lymph node around the left internal iliac artery is entirely dissected exposing the root of left middle rectal artery.



FIGURE 2b The lateral lymph node around the left internal iliac artery and left external iliac artery is entirely dissected exposing the left obturator nerve.

22 middle rectum (29.7%), and 19 lower rectum (25.7%). Preoperative stage was distributed in 35 stage I, 9 stage II, 21 stage III, and 6 stage IV. Determination of the Stage IV was 1 bone metastasis and 5 liver metastases, and a palliative resection was performed for the only distant metastasis patient. The other 5 liver metastases patients underwent curative primary resection and curative therapy for the liver recently. The curative surgery was performed for another 68 patients.

Operative Variables

The laparoscopic anterior resection with partial mesorectal excision was performed in 26 upper rectal cancer patients, and laparoscopic total mesorectal excision was performed in 44 upper, middle and lower rectal cancer patients. Four (5.4%) had conversion to laparotomy: locally advanced tumors in 2 cases and 2 technical difficulties due to obesity and too low for division with enough wedge from the tumor in each. There were no protective diverting stoma formations in our series. The type of reconstruction divided in end-to-end anastomosis in DST for 52 cases and J-pouch formation in DST for 14 cases. No restoration

TABLE 1 Demographics

Gender (male/female)	49/25
Age (mean: range)	66: 42-92
Location	
Upper	33
Middle	22
Lower	19
Stage	
I	35
II	9
III	21
IV	6

of digestive discontinuity was performed in 8 cases. Four patients underwent abdominoperineal rectal amputation and 4 patients Hartman's operation.

The lymphadenectomy along the mesorectum to root of the inferior mesenteric artery was performed in all cases as the appropriate levels depended on the tumor advancing in each case. The high ligation of the inferior mesenteric artery was performed in 40 cases and ligation of the superior rectal artery preserving the left colic artery was performed in 34 cases. Ipsilateral lateral lymphadenectomy on the predominant side of the tumor, preserving the hypogastric nerves and pelvic plexus, was performed in 5 cases (Table 2).

Time of operation was 203 ± 54 min in partial or total mesorectal excision cases and 270 ± 42 min in total mesorectal excision with lateral lymph node dissection cases regardless to reconstruction. Blood loss was 92 ± 90 g and 276 ± 66 g respectively (Table 3).

Postoperative Outcomes

The overall postoperative morbidity rate was 21.1%. The incidence of various morbidities is shown in Table 4; 7 leakage (10.6%), 3 transient urinary retention (4.1%), 4 wound infection (5.3%), and 1 small bowel obstruction (1.4%). Of 7 leakages, only one case required emergency re-operation of making diverting ileostomy with peritoneal lavage and drainage in laparoscopy and the other 6 patients conservatively recovered with drain spontaneously placed during operation. All the 3 with urinary dysfunction had the drain removed within 2 weeks with medical therapy. The patient with small bowel obstruction required placing an ileus tube for a week for decompression but not re-operation. There was no mortality regarding to the operation in our series.

All patients were out of bed on the first postoperative day of surgery. Flatus was passed after 1.8 days on average. The indwelling urinary catheter was removed after the first or second postoperative day, excluding three patients who developed urinary retention due to neurogenic bladder due to surgical procedure. The hospital length-of-stay was 11.7 days on average in cases without postoperative complications and 19.9 days on average in all cases including complications (Table 5).

TABLE 2 Variables of Operation (n=76)

Open conversion	4
Operation method	
Anterior resection with end-to-end reconstruction	55
Anterior resection with J-pouch reconstruction	14
Abdominoperineal resection	4
Hartman's operation	4
Lymph node dissection	
Ligation of IMA	40
Ligation of SRA	34
Palliative	2
With lateral lymph node dissection	5

TABLE 3 Operation Results

	Operation time	Blood Loss
Mesorectal excision	203±54 min	92±90g
Mesorectal excision with lateral lymph node dissection	270±42 min	276±66g

TABLE 4 Complications (n=76)

Anastomotic leakage	7 (10.6%)
Urinary retention	3 (4.1%)
Wound infection	4 (5.3%)
Small bowel obstruction	1 (1.4%)

TABLE 5 Short-term Outcomes

Amburation	1 POD
Bowel movement	1.8±0.9 POD
Discharge	11.7±3.2 POD

DISCUSSION

Only sporadic reports have specifically addressed the laparoscopic surgery for rectal cancer despite the increase in recent attention to laparoscopic colorectal surgery. Regarding laparoscopic colon surgery, several randomized prospective studies referring to long-term outcomes have been published. Most of those report on the equivalence of cancer related survival between laparoscopic surgery and open surgery. These trends of advocating the validity of laparoscopic colon surgery have influenced the rectal field, and some prospective studies regarding laparoscopic total mesorectal excision for rectal cancer have been reported (7,8).

Surgical techniques for lower rectal cancers are determined by more individual factors than other types of colon cancer. For example, in a narrow pelvis it can be extremely difficult to resect. Even under the best conditions, preserving pelvic function while extirpating disease can be challenging. Preservation of controlled defecation is not discussed here. Micturition and sexual function are preserved by preserving the autonomic pelvic nerves, including both the hypogastric nerves and both pelvic plexuses. The chief aim of cancer surgery is to cure the patient, even at the expense of some functional impairment. However, a high percentage of patients who undergo surgery for lower rectal cancer suffer local recurrence and have poorer survival than patients with other

types of colorectal cancer. The development of total mesorectal excision by Heald *et al.* (14) in 1982 has markedly reduced the local recurrence rate after rectal cancer surgery (6,15-18). In this procedure, the mesorectum is dissected sharply in the "Holy plane" rather than using conventional blunt dissection (19). The local recurrence rate has decreased from 25 to 30 percent to 7 to 10 percent.

We designed this study for proving feasibility and excellence of short-term outcomes of not only laparoscopic total mesorectal excision for lower rectal cancer but partial mesorectal excision for upper rectal cancer and additionally of laparoscopic lateral lymph node dissection, but not for comparing to open rectal surgery. Recruiting patients within indication for laparoscopic procedure prospectively, 2 patients with pelvic space-occupying tumor and massive invasion to the posterior pre-sacral fascia were obliged to convert to open, in whom preoperative CT scan could not detect the findings. One patient was converted to open because of technical failure of rectal division laparoscopically in the early phase of this series. Those 3 cases of conversion, however, represent a relatively appropriate rate when comparing to other reports, although upper rectum cases were included in our series.

Concerning complications, there were relatively high rates of leakage compared to reports of open rectal surgery. This fact was discussed in some reports regarding to laparoscopic rectal surgery (7,8). We speculate the reason of high rate of leakage in laparoscopic rectal surgery as a difference of device and method for transecting the distal rectum from open surgery. Some efforts decreasing the leakage in laparoscopic procedure are required. We introduced a novel laparoscopic technique of transaction of the distal rectum using a conventional dividing device for open surgery under pneumoperitoneum since 2002 (20). Although no evidence was showed in this article, this technique is thought to be similar to the open technique. We report the rate of anastomotic leak as 10.6%, which compares favorably with the rate of leak in other reports of open series (13,14).

The incidence of urinary retention was 4.1% in our series. As there were few reports of laparoscopic total mesorectal excision referring to urinary function, this rate compares favorably with 9% by Morino *et al.* (7) and 2% by Quah *et al.* (21). Those reports all subjected total mesorectal excision whereas our series included cases with lateral lymph node dissection despite the fact that we did not assess the sexual function. Moreover, we determined urinary retention as a slight delay in removing the urinary catheter even if they were able to improve in a fortnight conservatively. Those who were obliged to place a urinary catheter forever reported in the past report are not noticed in our series. In any case, the mortality and morbidity in our series are 0% and 21%, which compare favorably with mortality ranging from 3% to 7% (13,14) and a morbidity of 36% to 53% (7,14).

Although some reports of laparoscopic total

mesorectal excision including long-term outcomes have already been published, no reports describing laparoscopic lateral lymph node dissection have been published so far. The aim of this report is displaying results of the laparoscopic mesorectal excision preserving the autonomic pelvic nerves additionally describing the laparoscopic lateral node dissection. Not until this year did we feel that advanced tumors below the peritoneal reflection could be resected safely and completely laparoscopically. Even concerning the laparoscopic total mesorectal excision, the feasibility and benefits have been discussed (22,23). However in 2002, a technique which provides a way to obtain pelvic exposure without touching the tumor was developed (24). In the technical paper, the upper rectum is manipulated using a monofilament ligature behind the mesorectum and traction on the ligature translates into traction on the rectum.

Concerning the lateral node dissection, its propriety has been debated. Although total mesorectal excision has decreased the rate of local recurrence dramatically, all local recurrence does not arise in the mesorectum, and actually about 10% to 25% of the advanced lower rectal cancers are associated with metastasis to lymph nodes along the iliac artery, including occult metastases, in the Japanese experience (11). In fact the lateral efferent lymphatic drainage system of primary rectal cancer was recognized as early as the 1930s (25,26). Ueno *et al.* (10) investigated the determinants of survival in rectal cancer patients with lateral lymph node metastasis and discussed the possibility of lateral dissection. However, most Western surgeons have not found that survival improves with lateral lymph node dissection and do not perform it (12). Japanese surgeons have developed methods for preserving the pelvic autonomic nerves related to sexual and urinary function in conventional open surgery for advanced rectal cancer (27,28). In this article, we demonstrated the feasibility of laparoscopic lateral lymph node dissection with preservation of the autonomic nerves. Although the number of the patients was small, there were no metastases in this series. We do not recommend this

procedure for more advanced and bulky lower rectal tumors that have apparently invaded the adventitia (T3), because in such cases, the tumor would hinder the view of the pelvic bottom which is not related to indication of lateral lymph node dissection.

Lastly, we ought to refer to operation and short-term outcomes. The mean operative time and blood loss of the laparoscopic mesorectal excision regardless of digestive reconstruction is 203 minutes and 92g respectively in our series, which appeared to be permitted in general, although few reports refer to the operation time and blood loss of open rectal surgery. The mean operative time and blood loss of the 5 cases of the mesorectal excision with lateral lymph node dissection in this series were relatively long and great. In all those cases, however, the total mesorectal excision was basically performed and the precise lateral lymph node dissection was added, which requiring another 70 minutes of time and 180g of blood loss. Concerning the postoperative course, all patients could walk on the first operative day and mean days of bowel movement assessed as flatus was 1.8 days. Those were similar to past reports. Although the postoperative hospital stay tends to be longer in Japan than other countries, our results appeared to be favorable even comparing within Japan. This may be due to differences of the medical insurance system and social background.

We concluded that the laparoscopic mesorectal excision with preservation of the autonomic pelvic nerves for rectal cancer in all sites is likely to be performed favorably. We hope that this article is regarded as a cohort study of laparoscopic rectal surgery including some lower rectal cancer cases by means of pelvic autonomic nerve preservation procedure. Although not only the relatively good operative results and short-term outcomes, but feasibility of laparoscopic lateral lymph nodes dissection were showed, large-scale randomized studies comparing laparoscopic and open surgery for rectal cancer, if possible including the lower site with lateral lymph node dissection, will be necessary to evaluate the benefits and long-term clinical outcomes.

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