operations. The numbers of TNM stage were as follows: four stage 0, 52 stage I, 103 stage II (IIA, 83; IIB, 20), 95 stage III (IIIA, 6; IIIB, 60; IIIC, 29), and 44 stage IV. The postoperative adjuvant chemotherapy was performed on 75-year-old or less patient of stage III; its frequency was 31.4% of histological curative operations. The regimen of the postoperative adjuvant chemotherapy was taking of oral fluoropyrimidines (tegafur/uracil or 5′-deoxy-5-fluorouridine) for 1 year. The follow-up method is as follows after the operation. The patients of stages 0 and I have gone through the outpatient examination once a year and the tumor marker measurement until 5 years. When abnormality was seen, the computed tomography and/or the colonofiberscopy were performed. The patients of stage II were examined by computed tomography and the tumor marker measurement every 6 months for 2 years and were examined once a year until 5 years afterwards. The patients of stage III were examined by computed tomography and the tumor marker measurement every 4 months for 3 years and were examined once a year until 5 years afterwards. Eighty-six patients (28.9%) died while following up. Deaths due to the colorectal cancer occurred in 63 patients, deaths from other malignancies occurred in 5 patients, and deaths by another sickness occurred in 18 patients. The median follow-up period for surviving patients was 86 (16–141) months.

Cytopathology was determined before the colorectal cancer was excised. The technique of peritoneal lavage cytology was performed with the same method as in the gastric cancer in that the peritoneal lavage cytology was assumed as the prognostic factor [18–21]. The intraperitoneal lavage was performed with 200 ml saline added to 500 U of heparin immediately after the laparotomy. The collected samples were centrifuged at 1,500 rpm for 5 min, and the specimens were stained with Papanicolaou and May Giemsa. A pathology specialist assessed the specimens, and those graded as class IIIb or above of the Papanicolau classification (Table 1), which is used by a lot of pathologists in Japan, were judged to be lavage Cy-positive [lavage Cy (+)] [22]. The cytology results were examined with respect to the following factors based on the *7th edition of the Japanese General Rules for Clinical and Pathological Studies on Cancer of the Colon, Rectum and Anus* [17]: clinical pathological factors, the peritoneal metastasis rate, the peritoneal recurrence rate of the peritoneal metastasis-negative cases, and the overall survival rate.

A diagnosis of postoperative peritoneum metastasis was proven by the positivity of cytology at the peritonitis carcinomatosa or intraabdominal specimen histologically. The histological specimen was excised at reoperation for recurrence, secondary colon cancer, and bowel obstruction.

The data were analyzed using the chi-square test and the Mann–Whitney *U* test. The overall survival rates were calculated by the Kaplan–Meier method and were compared using the log-rank test. A value of $P<0.05$ was considered to be statistically significant for these tests. The multivariate analysis of the pathological factors with respect to the overall survival rate was performed using the Cox's proportional hazards model.

Results

Lavage Cy (+) rate in respect to gender, age, and primary lesion localization

The lavage Cy (+) rate among all of the cases was 6.0% (18/298). The lavage Cy (+) rates for males and females were 3.6% (6/168) and 9.2% (12/130), respectively. The average ages of the lavage Cy (+) and lavage Cy (−) groups were 66.8± 8.1 and 64.5±10.2 years, respectively. These values were not significantly different. The lavage Cy (+) rates according to the localization of the primary lesion were 9.1% (1/11) in the cecum and vermiform appendix, 6.3% (2/32) in the ascending colon, 7.7% (2/26) in the transverse colon, 16.7% (2/12) in the descending colon, 5.2% (5/97) in the sigmoid colon, 6.1% (5/82) in the upper rectum, and 2.6% (1/32) in the lower rectum. There were no statistically significant differences among these values (Table 2).

Lavage Cy (+) rate in cases with peritoneal metastasis at excision

In total, 15 cases (5.0%) had peritoneal metastasis at the time of excision of the primary lesion. The lavage Cy (+) rates in the cases with and without peritoneal metastasis were 46.7% (7/15) and 3.9% (11/283), respectively. This difference was statistically significant at the $P<0.05$ level. According to the 7th edition of the *Japanese General Rules for Clinical and Pathological Studies on Colorectal Cancer*, a small amount

Table 1 Papanicolaou classification

Class1	Absence of atypical or abnormal cells
Class2	Atypical cytology but no evidence of malignancy
Class3	Cytology suggestive of, but not conclusive for malignancy
Class3a	Probably benign atypia
Class3b	Malignancy suspected
Class4	Cytology strongly suggestive of malignancy
Class5	Cytology conclusive for malignancy

Table 2 Patients characteristics and peritoneal lavage cytology

	Cytology (+)	Cytology (−)	*P* value
Number of patients in respective cytology grade	18 (6.0%)	280	
	Class3b: 5 (1.7%)	Class1: 92 (30.9%)	
	Class4: 1 (0.3%)	Class2: 189 (63.4%)	
	Class5: 12 (4.0%)	Class3a: 0 (0%)	
Age (years, mean±SD)	67.3±9.2	64.4±10.3	0.2443
Gender			
Men	6 (3.6%)	162	0.0508
Women	12 (9.2%)	118	
Site of lesion			
Cecum	1 (9.1%)	10	0.7296
Ascending colon	2 (6.3%)	30	
Transverse colon	2 (7.7%)	24	
Descending colon	2 (16.7%)	10	
Sigmoid colon	5 (5.2%)	92	
Upper rectum	5 (6.1%)	77	
Lower rectum	1 (2.6%)	37	
Curability			
R0	4 (1.6%)	247	<0.0001
R1	3 (15.8%)	16	
R2	11 (39.3%)	17	

R0: histological curative operation

R1: Macroscopic curative but histological cancer remnant operation

R2: non-curative operation

of peritoneal metastasis near the primary lesion is classified in P1, a small amount of peritoneal metastasis that exists remotely from the primary lesion is classified in P2, and a large amount of peritoneal metastasis is classified in P3. The lavage Cy (+) rates according to the level of peritoneal metastasis were 0% (0/3) for P1, 42.9% (3/7) for P2, and 80% (4/5) for P3. Hence, the higher the level of peritoneal metastasis, the higher the lavage Cy (+) rate (Table 3).

Lavage Cy (+) rate according to clinical pathological factors in cases without peritoneal metastasis at excision

In total, 283 cases (95.0%) showed no peritoneal metastasis at the time of excision.

Histological type The lavage Cy (+) rate was 3.7% (10/270) in cases with well or moderately differentiated adenocarcinoma and 8.3% (1/12) in cases with poorly differentiated adenocarcinoma and mucinous carcinoma. There were no significant differences in histological type.

Table 3 Peritoneal metastases and peritoneal lavage cytology

	Cytology (+)	Cytology (−)	*P* value
P (−)	11 (3.9%)	272	<0.0001
P (+)	7 (46.7%)	8	
P1	0 (0.0%)	3	<0.0001
P2	3 (42.9%)	4	
P3	4 (80.0%)	1	

P: peritoneal metastasis

P1: small peritoneal metastasis in the vicinity

P2: small peritoneal metastasis in the distance

P1: multiple peritoneal metastases in the distance

Invasion depth The lavage Cy (+) rates were 1.5% (1/65) in cases classified as T2 or shallower, 2.8% (4/142) in T3 cases, 6.5% (4/62) in cases T4 cases, and 14.2% (4/14) in cases classified as T4 with additional organ infiltration. Thus, it appeared that the greater the depth of invasion, the higher the lavage Cy (+) rate. However, this trend was not statistically significant.

Lymph node metastasis The lavage Cy (+) rate was 1.9% (3/159) in cases classified as N0, 5.3% (4/76) in N1 cases, 7.4% (2/27) in N2 cases, 9.1% (1/11) in the main feeding arterial lymph node metastasis cases, and 14.3% (1/7) in the paraaortic lymph nodes. Thus, it appeared that the greater the level of lymph node metastasis, the higher the Cy (+) rate. However, this trend was not statistically significant.

Lymphovascular invasion The lavage Cy (+) rate was 5.1% (10/196) in cases with lymphatic-positive invasion and 1.2% (1/84) in cases without invasion. Thus, it appeared that the greater the level of lymphatic invasion, the higher the lavage Cy (+) rate. However, this trend was not statistically significant.

The lavage Cy (+) rate was 5.9% (8/135) in cases with vascular invasion and 2.1% (3/145) in cases without invasion. This difference was not statistically significant.

Table 4 Clinicopathological factors and peritoneal lavage cytology in patients excluding peritoneal metastases

	Cytology (+)	Cytology (−)	*P* value
Histology			
Well & Mod	10 (3.7%)	260	0.0543
Por & Muc	1 (8.3%)	11	
Depth			
Tis/T1/T2	1 (1.5%)	64	0.0881
T3	4 (2.8%)	138	
T4	4 (6.5%)	58	
T4 (additional organ infiltration)	2 (16.7%)	12	
Lymph node metastasis			
N0	3 (1.9%)	159	0.2067
N1	4 (5.3%)	72	
N2	2 (7.4%)	25	
Main feeding arterial lymph node	1 (9.1%)	10	
Paraaortic lymph node	1 (14.3%)	6	
Lymphovascular invasion			
ly(−)	1 (1.1%)	86	0.1816
ly(+)	10 (5.1%)	186	
v(−)	3 (2.0%)	145	0.1245
v(+)	8 (5.9%)	127	
Hepatic metastasis			
H (−)	8 (3.0%)	255	0.0347
H (+)	3 (15.0%)	17	

Well well-differentiated adenocarcinoma, *Mod* moderately differentiated adenocarcinoma, *Por* poorly differentiated adenocarcinoma, *Muc* mucinous adenocarcinoma, *ly* lymphatic invasion, *v* vascular invasion

Hepatic metastasis The lavage Cy (+) rate was 15.0% (3/20) in cases with hepatic metastasis and 3.0% (8/263) in cases without. This difference was statistically significant. The lavage Cy (+) rate was high in the multiple hepatic metastases (Table 4).

Peritoneal recurrence rate

The peritoneal recurrence rate was examined in 283 cases that did not have peritoneal metastasis. The peritoneal relapse rate among all of the cases was 2.5% (7/283). Five cases among seven were diagnosed by excising the peritoneum metastasis specimen at reoperation, which were for two bowel obstructions, one hepatic metastasis, one secondary colon cancer, and one local recurrence. Two cases were proven by positivity of cytology at the peritonitis carcinomatosa. The lavage Cy (+) rate was 9.1% (1/11) in the lavage Cy (+) group and 2.2% (6/272) in lavage Cy (−) group. This difference was not statistically significant (Table 5). The peritoneal recurrence rate in the 264 cases that underwent excision, the radical cure, was 2.3% (6/264); there was no peritoneal recurrence in the lavage Cy (−) group (0/7).

Clinical course of lavage Cy (+) cases

The clinical courses of 11 cases that were lavage Cy (+) without peritoneal metastasis at the time of excision were examined. Four of these cases experienced cancer death, and all of the cases had hepatic metastases. The operations were non-curative in three cases, one of whom already had multiple metastases in the peritoneum and liver and died 2 months after the operation (Table 6).

Overall survival rate

The overall survival rate in the 264 cases that underwent excision, the radical cure, was examined. The 5-year overall survival rates in the seven lavage Cy (+) cases and the 257 lavage Cy (−) cases were 83.3% and 71.4%, respectively, and these values were not significantly different (Fig. 1). The independent factors that contributed to the survival rate were the histological type and the depth of invasion. The peritoneal lavage cytology was not selected by the multivariate analysis as prognostic factor (Table 7).

Table 5 Peritoneal recurrence and peritoneal lavage cytology

	Peritoneal recurrence (+)	Peritoneal recurrence (−)	*P* value
Lavage cytology (+)	1 (9.1%)	10	0.2446
Lavage cytology (−)	6 (2.2%)	266	

Table 6 Clinical courses of patients with positive peritoneal lavage cytology

Age	Gender	Curability	Cytology	H	Site	Histology	T	N	Stage	ly	v	Prognosis	P rec.	Cause of death
67	F	R0	4	0	Low. Rec	w	T3	0	2	0	+	55 months, Alive	(−)	
62	F	R0	3b	0	Low. Rec	w	T3	1	3B	+	0	42 months, Alive	(−)	
64	F	R1	5	0	Upp. Rec	w	T3	1	3B	+	0	31 months, Alive	(−)	
55	M	R0	3b	0	S	w	T2	0	1	+	0	24 months, Alive	(−)	
63	M	R1	5	3	Low. Rec& S	w	T4	1	4	+	+	11 months, Alive	(−)	
74	F	R2	3b	0	Low. Rec	m	T4	4	4	+	+	10 months, Alive	(−)	
61	F	R0	5	0	A	m	T4	2	3C	+	+	9 months, Alive	(−)	
68	F	R2	3b	3	S	m	T3	1	4	+	+	26 months, Death	(−)	Hepatic metastasis
86	F	R2	5	0	Upp. Rec	w	T4	2	3C	+	+	12 months, Death	(−)	Hepatic metastasis
70	F	R1	5	0	Upp. Rec	muc	T4	0	3B	+	+	9 months, Death	(−)	Hepatic and lung metastasis
65	M	R2	5	3	D	w	T4	2	4	+	+	2 months, Death	(+)	Hepatic and peritoneal metastasis

Low. Rec lower rectum, *Upp. Rec* upper rectum, *S* sigmoid colon, *A* ascending colon, *D* descending colon, *w* well-differentiated adenocarcinoma, *m* moderately differentiated adenocarcinoma, *muc* mucinous carcinoma, *P rec.* peritoneal recurrence

Discussion

There is currently no effective treatment for peritoneal metastasis of colorectal cancer. It is often diagnosed at a terminal stage and treated by allopathy. However, cases often show unexpected longevity compared with gastric or pancreatic cancer. Operations on intestinal obstructions might present an opportunity for diagnosis. It is therefore of great importance to predict peritoneal recurrence at an early stage and to adopt a strategy that will impede its progress.

The lavage Cy status is widely used as a predictive factor of peritoneal metastasis in cases of gastric cancer. Many reports have assumed that this is an independent prognostic regulatory factor in multivariate analyses [19, 21]. In many medical facilities, changes to operative procedures and intraperitoneal chemotherapy are made depending on the cytological findings [18–21]. Lavage cytology plays a prominent role in treatment policy decisions for gastric cancer. However, some reports have evaluated the efficacy of peritoneal lavage cytology as a prospective factor of peritoneal metastasis or local recurrence in colorectal cancer cases [8–12]. On the other hand, there were reports that the peritoneal lavage cytology had no detectable impact on survival and peritoneal recurrence [13–16]. The utility of peritoneal lavage cytology has remained controversial until now. The difference in the rate of peritoneal metastasis formation in gastric and colorectal cancers is thought to be due to differences in their biological properties [16, 24]. The rate has been reported as about 20% [9, 10, 12, 13, 15] for colorectal cancer compared with about 40% for T4 gastric cancer [16, 19, 20, 23], while our current study gave a value of 10.5%. It is assumed that cancer cells separate easily from tumors that are exposed on the serosa and also form peritoneal metastases comparatively easily in smaller cancer cell nests in gastric cancer. By contrast, it is thought that peritoneal metastases are not easily formed, even if cancer cells separate to the intraperitoneal cavity, in cancers of the large intestine. The factors regulating peritoneal metastasis seem to involve abnormalities of the characteristics related to hematogenic metastasis. These are associated with all stages in the processes of establishing metastases, including the separation from the original lesion, blood vessel infiltration by the cancer cells, bonding

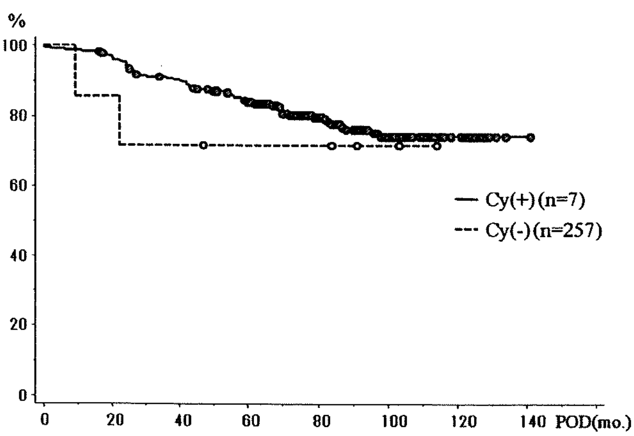

Fig. 1 Cumulative survival rates in patients underwent curative operation

Table 7 Multivariate analysis using the Cox's proportional hazards model between survival and risk of clinicopathological factors

Variable	Hazard ratio	95% Confidential interval	χ^2	*P* value
Peritoneal lavage cytology (+/−)	1.615	0.390–6.678	0.438	0.5082
Histology (por&muc/well&mod)	3.121	1.392–6.997	7.635	0.0057
Depth of invasion (T4/Tis-3)	2.668	1.519–4.688	11.650	0.0006
Lymph node metastasis (+/−)	1.252	0.712–2.202	0.609	0.4350
Lymphatic invasion (+/−)	1.340	0.645–2.786	0.615	0.4328
Vascular invasion (+/−)	1.766	0.960–3.249	3.348	0.0673

of the cancer cells to the endothelium of the target organ, permeation of the blood vessels from the outside, and proliferation within the target organs. Patients with high levels of the sialyl Lewis-X antigen have a high rate of hepatic metastasis [25]. A previous report suggested that a high level of part of the sugar chain was also associated with peritoneal metastasis [26]. We await further clarification of the mechanism of peritoneal metastasis of colorectal cancer by molecular biology techniques in the future.

There can be a problem with the accuracy of the assessment of cytology results. In the current study, the lavage Cy (+) rate in all cases is 6.0%, which differs greatly from the values of 20–25% given in some reports [9, 10]. The data of this study can be trusted because the lavage Cy (+) rate had a high T factor. However, in one T2, three T3, and one lower rectal cancer case, there was a suggestion of false positives. When the details of these cases were examined, the T2 and lower rectal cancer cases were found to have lymphatic invasion. Of the three T3 cases, one had multiple hepatic metastases and one had lymphatic invasion; however, the remaining case had no lymphatic invasion and its histology revealed well-differentiated adenocarcinoma. In the four cases described above, there was a possibility that the cancer cells had originated from the lymph duct or the liver metastasis nest. However, there was a possibility of false positive results in the case with T3 and negative lymphatic invasion. Regarding the other background factors, the more advanced the lymph node metastasis, the higher the lavage Cy (+) rate. This was similar to the finding of a previous report on gastric cancer [27]. It suggested the possibility that the cancer cells are released not only by dropout from the source of origin but also from the metastatic lymph node and the lymph duct as routes of peritoneal metastasis. A previous report showed that lavage Cy (+) rate was according to the histological type by univariate analysis [14]. However, there was no difference between mucinous carcinoma/poorly differentiated adenocarcinoma and well/moderately differentiated adenocarcinoma in this report. This finding was attributed to the fact that the number of cases of mucinous carcinoma/poorly differentiated adenocarcinoma was small and five of the eight cases had lower rectal cancer of mucinous carcinoma. The lavage Cy (+) rate was significantly high for liver metastasis. The lavage Cy positivity was seen in multiple hepatic metastases, but not in single hepatic metastasis. This suggests the possibility that the cancer cell dropout from the hepatic metastasis nest caused the peritoneal metastasis.

A high tendency towards peritoneal recurrence was seen in the lavage Cy (+) cases, although this was not statistically significant. The lavage Cy status was not a useful predictive factor of peritoneal recurrence. This might have been due to a problem with the method used to gather the original specimens. Hase et al. [28] reported that when cytology was performed before and after excision, the peritoneal recurrence rate was 50% for both positivities, whereas it was 16.7% for the positivity before excision alone. One problem with cytology after excision is the possibility of the outflow of cancer cells from the cut lymph duct [29], meaning that the operative procedure might influence the results.

This study is limited in the diagnosis of the peritoneal recurrence. The diagnosis of the peritoneal recurrence was limited to the one that histology proof was done in this study. Four cases of seven in this study presented symptoms of the peritoneal metastases of the ileus and the peritonitis carcinomatosa, etc. The metastasis in the liver and the local recurrence are suggestive of peritoneal recurrence based on the image. However, the peritoneal recurrence was discovered by chance in the case of the secondary cancer. It is suggested that an actual peritoneum metastasis rate is higher because the symptom of the ileus, etc. is not presented in a minute metastasis.

This also suggests the possibility that cytology might be limited by microscopy. Lavage Cy (+) status was not a prognostic factor in curable cases in this study. This suggests that lavage cytology might not be a risk factor for recurrences such as peritoneal, liver, and lung metastases. Previous studies have reported similar findings [16, 30]. Several reports have suggested that immunohistological techniques for the detection of intraperitoneal free cancer cells might be more accurate and useful than cytology. It has also been reported in recent years that a supplementary diagnosis to cytology can be achieved accurately and promptly by the reverse transcription–polymerase chain reaction method [31–34]. Owing to the rapid advances, gene diagnosis looks likely to be ready for practical applications in the near future.

It is difficult for small metastases to be distinguished in computed tomography and magnetic resonance images. It has been reported that sensitivity and accuracy have been improved in recent years by new diagnostic techniques such as the application of 8-fluoro-deoxy-glucose positron emission tomography [35–37]. It will be necessary to monitor the advances in the accuracy of imaging diagnostics in the future. Moreover, there will be a need to reexamine these methods, particularly with respect to small peritoneal metastases and prospects of recurrence, in light of the expected improvements in diagnostic imaging. In conclusion, intraperitoneal lavage cytology before the resection of colorectal cancer was not a useful predictor of peritoneal recurrence.

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A Y-shaped vinyl hood that creates pneumoperitoneum in laparoscopic rectal cancer surgery (Y-hood method.): a new technique for laparoscopic low anterior resection

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Abstract
Background Many studies have focused on laparoscopic techniques for the treatment of colon cancer, but such work is more limited for the treatment of rectal cancer, largely because of concerns for safety issues. This report presents an effective method of anal lavage and excision in laparoscopic low anterior resection.
Methods The authors developed clamp forceps for intestinal lavage and a Y-shaped vinyl hood that can be operated under pneumoperitoneum for airproof surgery. These devices enabled secure clamping and cleansing of the area and use of automatic suture instruments for open laparotomy through a minilaparotomy wound. The authors called this technique the Y-Hood method and compared its short-term results from May 2005 to October 2008 ($n = 28$) with those for double-stapling technique surgical cases between September 2000 and October 2008 in which automatic suture instruments were used more than once ($n = 107$). A multivariate analysis of risk factors for anastomotic leakage also was performed.
Results No difference in background factors such as patient sex, age, and tumor node metastasis (TNM) staging were detected. Anastomotic leakage was found in 12 cases that used multiple stapling for rectal transection (11.2%) and 2 cases that used the Y-Hood (7.1%). The cost for rectectomy was 92,505 yen for multiple stapling and 53,107 yen for the Y-Hood ($p < 0.0001$). As risk factors for anastomotic leakage, multivariate analysis identified the number of times stapling for rectal transection was performed and the height of the anastomotic region.
Conclusion The Y-Hood method enables operations to be performed within the interior of the pelvis without reducing the number of ports because the instruments can be accessed using minilaparotomy. Because the use of stapling for rectal transection is minimized, this method is effective in avoiding anastomotic leakage and also cost efficient. The Y-Hood method allows for thorough intestinal lavage and safe laparoscopic low anterior resection.

Keywords Intestinal lavage · Laparoscopic low anterior resection · Rectal cancer

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Laparoscopic surgery, a treatment for colon cancer prevalent worldwide since the early 1990s [1], has become increasingly important in recent years as studies have shown that its outcomes are equivalent to those of open abdominal surgery [2–5]. However, it is less commonly used in the treatment of rectal cancer, particularly cancer of the lower rectum. This is mainly because such surgery requires a high level of technical skill, whereas the technology for the development of medical devices that ensure a safe operation has yet to be established.

Although many studies have focused on methods for intraluminal lavage and excision on the anal side of the rectum after desquamation of the lesion, none has been completely satisfactory [6–9]. Insufficient rectal lavage can increase the risk for relapse in the anastomosis [10, 11]. Moreover, if an excision is required in the lower region of the rectum, use of automatic suture instruments can result in multiple stapling for rectal transection, considered to be one of the risk factors for anastomotic leakage [12].

In this study, we developed a method of laparoscopic surgery that allows rectal lavage and excision to be performed in a manner that closely mimics open abdominal surgery. Excision and reconstruction are performed using the single stapling for rectal transection technique, and the use of surgical instruments is kept to a minimum. Our method appears superior to existing double-stapling techniques using a multiple linear stapler.

Patients and methods

Between 1997 and October 2008, 185 patients underwent laparoscopic low anterior resection of rectal cancer. For 14 of these 185 patients, rectectomy, lavage, and reconstruction were performed through a 10- to 12-cm minilaparotomy wound under direct vision using instruments for regular open abdominal surgery. In 171 cases, a full laparoscopic operation was carried out. For 143 patients, automatic suture instruments were used: to perform single stapling for rectal transection in 36 cases and multiple stapling for rectal transection in 107 cases. The Y-Hood method (Y-Hood), introduced in May 2005, was applied in 28 cases for which multiple use of automatic suture instruments would have been required because of the need to perform rectectomy in the lower region.

We compared the short-term results and the cost required for rectectomy between the 107 cases managed by multiple stapling for rectal transection with automatic suture instruments and the 28 Y-Hood cases. We also conducted a multivariate analysis of risk factors for anastomotic leakage.

The cost of multiple stapling for rectal transection was calculated by adding the list price of the automatic suture instrument to the figure obtained by multiplying the unit price of the stapler by the number of times it was used. The cost of the Y-Hood was calculated by adding the list price of the automatic suture instrument and the cost of creating the Y-shaped hood (Table 1).

Table 1 The cost of each device (fixed price)

Device		Fixed price (Japanese yen)
EndoGIA	Main body	22,000
	Staple	
	60 mm	33,000
	45 mm	30,000
	30 mm	28,000
Echelon	Main body	21,000
	Staple	29,000
Curvedcutter		48,000
TL-30		29,000
Y-hood		6,000

Surgical technique

With the exception of rectal lavage and excision, multiple stapling for the rectal transection surgical procedure is identical to that for the Y-Hood, including treatment of the blood vessels, removal of lymph nodes, desquamation of the retroperitoneum and the rectum, and reconstruction. Rectal lavage was performed using the Endo-Bowel clamp (0L540P) after the rectum had been stitched together. A linear-stapler was used in rectectomy (Endo GIA Universal, Echelon). Its length and height were chosen by the surgeon, considering factors such as the thickness and width of the desquamated rectum. The Contour Curvedcutter Stapler 4.8 or the TL-30 was used as an automatic suture instrument.

The procedure was performed in four steps:

1. *Port-site and small laparotomy* (Fig. 1). Five ports are required for Y-Hood surgery: one for the laparoscope

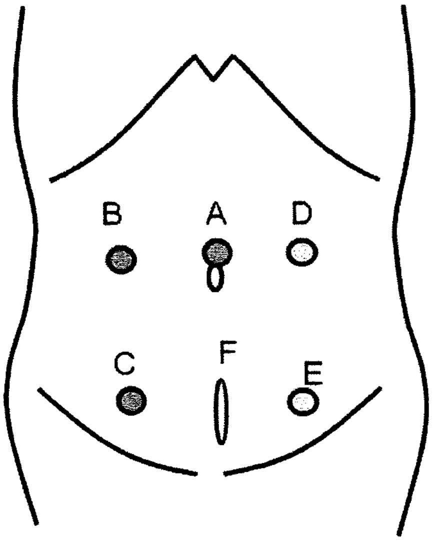

Fig. 1 Laparoscopic ports and a small laparotomy. **A** Laparoscope port. **B, C** Operator. **D, E** Assistant. **F** Small laparotomy. The wound is 5–6 cm long

Fig. 2 Y-shaped hood. **A** Size of each part before use. **B** Forceps operated under the pneumoperitoneum of the abdominal cavity

on the umbilical region and four, respectively, for the surgeon and the assistant on the border of the rectus abdominis of the right and left side of the upper and lower abdomen. When the lesion is located relatively high in the rectum, it is possible to operate with four ports by assigning one for the assistant. In this study, to prevent interference of the instrument operated through the minilaparotomy wound, the port for the laparoscope was set on the upper part of the naval. Approaching from the inside, the central lymph nodes were removed, the retroperitoneum and rectum desquamated, and the outer membrane of the rectum desquamated and exposed along the line of separation on the anal side. A 5- to 6-cm minilaparotomy incision was made in the median of the lower abdomen.

2. *Y-shaped hood installation* (Fig. 2). A wound retractor (size S) with a protection drape was placed at the edge of the wound. To maintain this under airtight conditions, we developed a Y-shaped hood to be placed around it, creating a pneumoperitoneum. The hood, made of vinyl, is 76 cm long. Each of the upper parts of the "Y" is 60 cm long and 27 cm wide, enabling simultaneous insertion and use of two instruments without collision. In this study, the base of the hood was taped around the external ring of the wound retractor. The ring was flipped upward three to four times, and the wound was retracted to form a seal. The upper parts of the hood were fixed with a rubber band, and the hood then expanded like a balloon, creating an airproof space above the abdomen wall. The pneumoperitoneum pressure was set at 10–12 mmHg to secure sufficient space for the operation.
3. *Rectal lavage and excision* (Figs. 3 and 4). A rectum clamp forceps was inserted through one of the Y-shaped hood's upper parts, which then was resealed with a rubber band around the forearm of the surgeon to recreate a pneumoperitoneum. We developed rectum clamp forceps to close the anal side of the rectal lesion. This forceps is 36 cm long with a 6-cm long clamp and 22 cm between the clamp and the hinge. Because it is relatively long, it can be secured readily during a minilaparotomy and under pneumoperitoneum. It has a J-shaped tip and an improved grip from a groove that runs vertically through the clamp, which reduces the risk of the clamp coming off during the operation. In this study, after closure of the lesion, the interior of the rectum was cleansed from the anus using 2,000 ml of saline with iodine. After lavage, the forceps was moved to one of the Y-shaped hood's upper parts, and the automatic suture instrument was inserted into the other, where it was used to suture and excise the clamped rectum. If a TL-30 was used as the automatic suture instrument, the rectum was excised with scissors along the TL-30 after suturing.

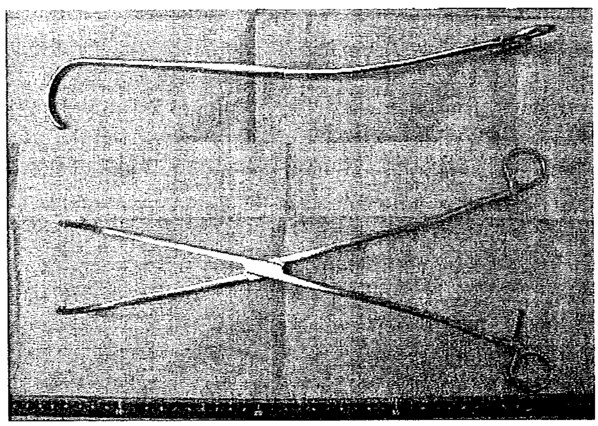

Fig. 3 Rectal clamp forceps

4. *Specimen removal and reconstruction.* The automatic suture instrument and wound retractor were removed from the hood, and the pneumoperitoneum was released. The clamped lesion was extracted with forceps from the minilaparotomy wound, and its entry side was cut off outside the patient's body. An anvil was

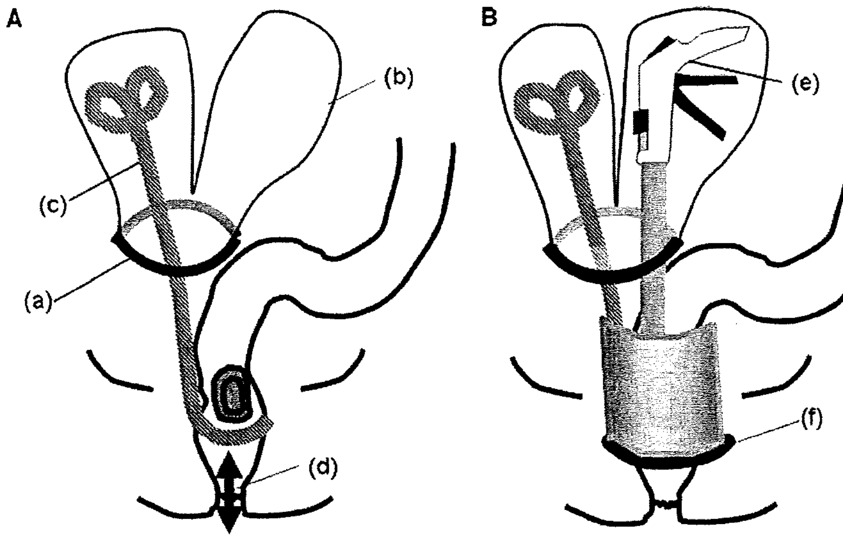

Fig. 4 Rectal irrigation and separation. **A** Rectal irrigation with clamping by forceps in the Y-shaped hood under the pneumoperitoneum. **B** Rectal transaction with the Contour Curvedcutter

placed on the circular stapler, and the minilaparotomy wound was sealed. A pneumoperitoneum was recreated, and the double-stapling technique was used to reconstruct the inside of the abdominal cavity.

Statistical analysis

Comparisons were analyzed using the x-quadruple test and Student's t-test. All p values less than 0.05 were considered significant. The multivariate analysis was conducted using logistic regression analysis. The data were analyzed using Dr. SPSS2 for Windows, version 11.0.1 (SPSS Inc., Chicago, IL, USA).

Results

The main part of the lesion was identified in the upper rectum of 86 patients (80.4%) and the lower rectum of 21 patients (19.6%) among the 107 patients who underwent multiple stapling for rectal transection. This contrasts with the Y-Hood cases, in which significantly fewer lesions were identified in the upper rectum (17 cases, 60.7%) than in the lower rectum (11 cases, 39.3%) ($p = 0.0442$). There were no significant differences in background factors such as sex, age, and TNM stage, between the patients in the two groups (Table 2). Multiple stapling for rectal transection was performed twice in 70 cases (65.4%), three times in 34 cases (31.8%), and four times in 3 cases (2.8%). The EndoGIA97 was used in 97 cases (90.7%) and the Echelon in 10 cases (9.3%). With the Y-Hood method, the Contour Curvedcutter (Johnson & Johnson, USA) was used in 27 cases (96.4%) and Proximate linear stapler TL-30 (TL-30; Johnson-Johnson) in 1 case (3.6%).

Short-term results (Table 3)

The average distance between the dentate line and the anastomosis also did not differ significantly between the two groups: 5.1 cm for the multiple stapling in rectal transection group compared with 4.3 cm in the Y-Hood group. For the sake of comparison, it was 7.1 ± 3.2 cm in single laparoscopic linear staple cases. There was little difference in the number of cases that switched to open abdominal surgery between the two groups (2 cases with multiple stapling for rectal transection in rectal transection [1.9%] and 1 case with Y-Hood [3.6%]).

We observed a significant difference in the average length of time required for surgery (269 min with multiple stapling for rectal transection in rectal transection compared with 226 min using Y-Hood; $p = 0.0017$). However, this analysis included multiple stapling for rectal transection cases managed in the early stages of laparoscopic surgery development. Elimination of these cases and analysis of the 57 cases managed after introduction of the Y-Hood in May 2006 reduced the average time to 243 min, but the difference was not significant.

The average amount of bleeding in the multiple stapling for the rectal transection group was 79 g compared with 41 g in the Y-Hood group, a small difference. For the 57 cases managed after May 2006, the average amount of blood lost was 52 g, which nearly equaled that of the Y-Hood group. The average length of the excision stump on the anal side was similar between the two groups: 40 mm for the multiple stapling in the rectal transection group and 36 mm in the Y-Hood group.

No significant difference was detected in terms of the frequency or type of complication that occurred in the perioperative period. Anastomotic leakage was identified in

Table 2 Characteristics of patient and stapling device for rectal transection in each group

		Multiple stapling for rectal transection group (n = 107)		Y-Hood group (n = 28)	p Value
Age (years)		64.0 ± 10.1		64.8 ± 8.6	0.7209
Gender: n (%)					
Male		64 (59.8)		16 (57.1)	0.8312
Female		43 (40.2)		12 (42.9)	
BMI (kg/m^2)		22.9 ± 3.2		22.3 ± 3.3	0.4848
PNI		53.4 ± 4.0			0.6328
Tumor location: n (%)					
Rectosigmoid		46 (43.0)		10 (35.7)	0.0643
Upper rectum		41 (38.3)		7 (25.0)	
Lower rectum		20 (18.7)		11 (39.3)	
Tumor size (mm)		29.0 ± 17.2		28.5 ± 13.5	0.8891
pTNM stage: n (%)					
0		10 (9.3)		1 (3.6)	0.4729
1		54 (50.5)		15 (53.6)	
2		13 (12.1)		1 (3.6)	
3		28 (26.2)		10 (35.7)	
4		2 (1.9)		1 (3.6)	
Stapling device & stapling times for rectal suturing and transection: n (%)	EndoGIA	97 (90.7)	Curvedcutter	27 (96.4)	
	2 times	64	TL-30	1 (3.6)	
	3 times	30	Single	28	
	4 times	3			
	Echelon	10 (9.3)			
	2 times	6			
	3 times	4			

BMI Body mass index, *PNI* Prognostic nutritional index, *pTNM* pathologic tumor node metastasis

Table 3 Short-term results in each group

	Multiple stapling for rectal transection group (n = 107)	Y-Hood group (n = 28)	p Value
Operative findings			
Distance between dentate line and anastomosis (cm)	5.1 ± 2.7	4.3 ± 2.7	0.8891
Conversion to open surgery: n (%)	2 (1.9)	1 (3.6)	0.5050
Operation time: min (%)	269 ± 68	226 ± 33	0.0017
Operation time after May 2006: min (%)	243 ± 63	226 ± 33	0.1879
Blood loss (g)	79 ± 113	41 ± 55	0.6328
Blood loss after May 2006 (g)	52 ± 109	41 ± 55	0.0880
Distance between anal edge and tumor (cm)	40 ± 31	36 ± 24	0.4807
Postoperative complication: n (%)			
Total	25 (23.4)	6 (21.4)	0.8283
Anastomotic leakage	12 (11.2)	2 (7.1)	0.7338
Stapling times for rectal transection: n (%)			
2 times	5/70 (7.1)		
3 times	5/34 (14.7)		
4 times	2/3 (66.7)		
Surgical site infection: n (%)	13 (12.1)	4 (14.3)	0.7616
Postoperative stay (days)	13.9 ± 10.6	12.2 ± 7.6	0.4354

Table 4 Multivariate analysis of anastomotic leakage

	Odds ratio	95% Confidence interval	p Value
Distance between dentate line and anastomosis (cm)	1.3828	1.0470–1.8263	0.0224
Stapling times for rectal transection (times)	0.2917	0.0903–0.9427	0.0395
Operation time (min)	0.9944	0.9825–1.0064	0.3609
Blood loss (g)	0.0023	0.9935–1.0112	0.6058
Gender (male/female)	1.8974	0.4912–7.3294	0.3530
Cut of inferior mesenteric artery (yes/no)	4.0047	0.7912–20.2700	0.0936
Multiple stapling DST vs. Y-Hood	3.3419	0.2796–39.9413	0.3405

DST double-stapling technique

12 cases of multiple stapling for rectal transection (11.2%) and in 2 cases managed by the Y-Hood (7.1%). Of the 12 cases, multiple stapling for rectal transection was performed twice in 5 cases (7.1%), three times in 5 cases (14.7%), and four times in 2 cases (66.7%). For the sake of comparison, in single laparoscopic linear stapling, the rate was 2.8% (1 case) for anastomotic leakage cases and 22.2% for complication cases.

The height of anastomosis from the dentate line was 0 and 2 cm in the cases of anastomotic leakage that occurred with the Y-Hood, which required excision in the extreme lower front region. The average hospital stay required after surgery was 13.9 days in the group that underwent multiple stapling for rectal transection and 12.2 days in the Y-Hood group, a difference that is not significant.

Risk factor for anastomotic leakage (Table 4)

Multivariate analysis indicated that risk factors for anastomotic leakage were the number of times stapling for rectal transection was performed and the height of the anastomosis.

Medical equipment cost at the rectal separation (Table 5):

The medical cost for the instruments used in the rectal separation was 92,505 yen for multiple stapling in rectal transection and 53,107 yen for the Y-Hood, a significant difference ($p < 0.0001$).

Table 5 Medical equipment cost at the rectal separation

Multiple stapling for rectal transection group (n = 107) (Japanese yen)	Y-Hood group (n = 28) (Japanese yen)	p Value
92,505 ± 15,764	53,107 ± 3,725	<0.0001

Discussion

Laparoscopic surgery for the treatment of colon cancer has been the greatest major innovation in the field of lower gastrointestinal surgery in recent years. Reports on long-term studies and large-scale randomized clinical trials (RCTs) have nearly all demonstrated that laparoscopic surgery is equivalent to open abdominal surgery in terms of overall and disease-free survival rates [2–5].

The retrospective multicenter study of 1,495 colon cancer cases by Kitano et al. [13] showed that in the short term, 4.8% patients would require transition to open abdominal surgery, 1.4% would experience complications during surgery, and 12.6% would experience postoperative complications. Long-term results from the same study showed that the 5-year overall survival rate was 95% for stage 1 patients, 86% for stage 2 patients, and 74% for stage 3 patients. These rates are largely equivalent to findings for open abdominal surgery recorded in the National Colon and Rectal Cancer Registry at the Japan Colon and Rectal Cancer Research Institute.

The Japan Clinical Oncology Group currently is undertaking a major RCT of laparoscopic and open abdominal surgery that integrates studies of progressing stages 2 and 3 colon and rectal cancer and postoperative adjuvant chemotherapy. The findings of this research are scheduled to be presented in the near future and will be of particular interest [14].

Short- and midterm results for cases of laparoscopic surgical rectal cancer treatment show that 21–6% experience complications, 6–17% show anastomotic leakage, and 3–12% switch to open abdominal surgery for reasons of safety [15–18]. This is comparable with the findings of retrospective studies examining 1,057 cases of laparoscopic surgery for colon and rectal cancer (19.8, 9.0, and 7.3%, respectively) [19].

The long-term results of the current study show that the 5-year overall survival rates were 100% for stage 0, 96.4% for stage 1, 84.7% for stage 2, and 75.6% for stage 3 patients. In Japan, a multicenter prospective study on cancer of the lower rectum is in progress, and many are awaiting its findings with anticipation [20].

However, a large-scale RCT has excluded lower rectal cancer from the object, largely because of concerns over safety issues. In particular, instruments have not been developed that enable rectal resection to be performed and the lesion on the anal side to be cleansed. Such procedures require maneuvering in the narrow interior of the pelvis. The clamp required for rectal lavage can be insufficient, which may lead to a relapse in the anastomosis. It also is difficult to control the automatic suture instrument used for excision, which may result in multiple stapling for rectal transection.

Furuhata et al. [6] used the Endo-Bowel clamp (0L540P) for rectal lavage with good results. Because the direction of the block is adjustable with this technique, the axis of the intestinal tract can be clamped vertically inside the abdominal cavity, sufficiently blocking the periphery. In addition, ports for surgery do not need to be reduced because the rectum can be left clamped inside the abdominal cavity. However, clinical studies found that although clamping near the turnover flap of the abdominal wall was straightforward, as in surgery for sigmoid colorectal cancer, clamping inside the narrow pelvic cavity of a male patient with lower rectal cancer was more difficult.

To overcome these problems, alternative instruments have been developed. These include rectal clamp forceps from Yamamoto et al. [7], with sufficient length and grip as well as multidirectional clamps, and the Rectum Catcher from Matsumoto et al. [8] that enables a secure rectal clamp and is effective for desquamation of tumor cells in the rectum and thorough cleansing. However, these methods require the use of one 12-mm port. Moreover, because rectectomy entails the use of automatic suture instruments, the stapler must be used multiple times for cancers in the lower region. Yamamoto et al. [7] showed that multiple stapling for rectal transection was required in 61.9% of upper rectum cancer cases and 100% of middle to lower rectum cancer cases. In particular, for 80% of these latter cases, stapling for rectal transection was required more than twice.

Hamada et al. [9] have developed the laparoscopic double-stapling technique (LDST). This technique maintains airtight conditions by placing a surgical glove on the minilaparotomy wound in the lower abdominal region and cleansing the rectum by clamping it with Doyen forceps. Rectectomy is performed by inserting a linear automatic suture instrument through one of the glove fingers and excising the rectum from the front to the back of the body. This offers the advantage of secure clamping and reduces the number of ports because clamp forceps and automatic suture instruments are inserted through the minilaparotomy wound. However, it does not avoid multiple stapling for rectal transection and requires an average of 1.6 staples per case.

The current study and previous work by Ito et al. [12] found that the number of staplings for rectal transection and the total mesorectal excision (TME) were risk factors for an anastomotic leakage during laparoscopic low anterior resection. Although it is unclear why multiple stapling for rectal transection increases the risk, possible reasons include incomplete staple formation at the stapler intersection and inadequate blood flow at the intersection caused by zigzag stapling for rectal transection. In our study, anastomotic leakage developed in 7.1% of the cases with stapling for rectal transection performed twice. This was nearly identical to the rate for the Y-Hood method, in which 7.4% of cases showed anastomotic leakage. As stapling for rectal transection increased to three times, anastomotic leakage was found in 14.7% of cases, and for patients stapled four times, the leakage rate was 66.7%. Manipulation of the stapler was a difficult in cases requiring four staplers because the pelvis lumen is very narrow. The EndoGIA 60 mm in length could not be used for a narrow pelvis lumen. These findings suggest that multiple stapling for rectal transection should be avoided and limited to twice at most.

Previous work on triple stapling developed a technique that performs rectal lavage after suturing and sealing of the lesion on the anal side with titanium staples (TA; Covidien. CT, USA) [21]. This technique, usually called the double TA method in Japan, is recognized as a very beneficial method. Excision then is performed with automatic suture instruments for laparoscopic surgery by using the anal side as the intended excision line. This technique offers an effective method for complete lavage and excision. However, I think that the faults of this method include exposure of the bowel lumen even for a short time after a cut with scissors subsequent to stapling and unnecessary cost partially due to stapling in the resected specimen.

In very lower rectal cancer, a technique is performed that involves transrectal extraction of the specimen with an inversion of the rectum. This technique also is profitable for a very low case of rectum cancer. However, it is thought that the procedure is limited to a small tumor without the possibility of rupture by reversal.

The Contour Curvedcutter stapler allows stapling for rectal closure and excision to be performed simultaneously. It encloses the intestinal tube inside the stapler with a retaining pin so the rectum can be securely sutured and excised using the technique of single stapling for rectal transection. Similarly, the TA and TL-30 instruments enable rectal suturing by single stapling for rectal transection. Their smaller tips are good for maneuvering, but only the Contour Curvedcutter allows simultaneous suturing and excision. However, these devices are designed for open abdominal rather than laparoscopic surgery. Ishii et al. [22] used the Contour Curvedcutter in laparoscopic rectectomy by inserting it through a surgical glove finger and maintaining airtight conditions using bone wax. However, this did not prevent interference of the instrument and forceps, and the relatively cumbersome and complicated technique caused problematic maneuvering.

Our Y-Hood method uses long forceps and a Y-shaped vinyl hood. It allows for rectal clamping, lavage, suturing, and excision through the minilaparotomy wound using single stapling for the rectal transection technique. We optimized the forceps' length to 36 cm and the distance between the clamp and the hinge to 22 cm. These dimensions enable the forceps to be maneuvered with a single hand through the minilaparotomy wound under pneumoperitoneum while sufficient grip also is maintained. Similarly, the Y-shaped hood dimensions were optimized to enable maneuvering of the Contour Curvedcutter's handles. The hood was initially I-shaped, but we modified its shape to a "Y" to prevent interference of the instruments with each other. Because none of the instruments pass through a port, the existing ports can be used for other operations such as expansion of the operative field. In some cases, it is possible to designate one port for the assistant and to perform surgery with four ports.

Use of the Contour Curvedcutter reduces the overall cost because stapling for rectal transection is performed only once. A beneficial point of this method is that the apparatus at a minimum can perform rectal lavage and rectal transection by single stapling. The basic procedures for the Y-Hood, such as rectal clamping and the use of suturing instruments, are the same as those for regular open abdominal surgery and yield equivalent results.

One shortcoming of our method is that the large head of the Contour Curvedcutter is difficult to insert when the patient has a narrow pelvis. However, this also is an issue with open abdominal surgery. If a slightly smaller device could be manufactured, it might become possible to choose the instrument of the most appropriate size for each patient.

An additional problem that we encountered was air leakage from the location of the wound retractor. This occurred because we constructed the Y-shaped hood manually, although this has been improved somewhat by securing the device with tape. We believe that the Y-Hood method could become even more effective if we could enlist the service of a relevant manufacturer to develop our product further.

This study analyzed the anastomotic leakage rate according to the circular staple size: 0% (0/8) for 25 mm, 17.9% (5/28) for 28 mm, 3.2% (1/31) for 29 mm, 9.4% (6/64) for 31 mm, and 50% (2/4) for 33 mm. There is a significant difference ($p = 0.0250$). The reason for this is uncertain, and because the circular staplers used the product of two different companies, they seem difficult to analyze simply by the size alone. There was no significant difference between companies A (11.7%) and B (7.3%). It seems that a case-matched control study with some conditions arranged is necessary to determine the relation between the circular stapler and the anastomotic leakage.

In conclusion, the Y-Hood method, which enables secure rectal lavage and separation by single stapling for rectal transection, offers an effective and cost-efficient procedure for laparoscopic rectectomy in the lower front region. We believe this method is valuable for cases in which stapling for rectal transection using the automatic suture instrument is performed more than twice.

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標準的内視鏡外科手術

永井書店

マスターしておきたい標準的内視鏡外科手術

標準的腹腔鏡下結腸右半切除術

Laparoscopic right hemicolectomy

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腹腔鏡下結腸右半切除術では，まず基本となるのは回結腸動静脈幹の同定と把持，後腹膜下筋膜の同定と剝離である．この際に十二指腸前面まで剝離しておくことが偶発症を避けるポイントである．次に回結腸動脈，静脈の処理とリンパ節郭清であるが，ここでのランドマークは上腸間膜静脈である．続いてsurgical trunkの郭清と，中結腸動脈，静脈の処理であるが，ここは血管の変異も多く，また血管損傷などの術中偶発症のおきやすい部位でもあり，注意を要する．

Key Words 腹腔鏡下結腸右半切除術／surgical trunk／内側アプローチ

はじめに

腹腔鏡下大腸切除術が導入されてから，15年以上が経過した．この間に，欧米では本法と開腹手術との無作為化比較試験の結果が明らかとなり，結腸癌に対する本法はある一定の地位を獲得した感がある．本邦でも，多施設無作為化比較試験が進行中であり，まもなくその症例集積も終了する見込みである．その中期・長期予後が明らかになるには，まだ数年かかると思われるが，結果の公表を待つまでもなく，進行結腸癌に対する腹腔鏡下手術は，本邦でも今まで以上に広く行われるようになるであろう．

腹腔鏡下回盲部切除術およびS状結腸切除術は，最も多く行われている術式であるが，腹腔鏡下結腸右半切除術は回盲部切除術に比べ，血管処理が煩雑となるため，難易度が高くなる．

本稿では，教室で施行している腹腔鏡下結腸右半切除術について概説する．

適　応

腹腔鏡下結腸右半切除術あるいは回盲部切除術は，stage 0もしくはIの盲腸・上行結腸癌，肝彎曲部の横行結腸癌に対して，今日では標準手術となっており，推奨される．また，stage II/IIIの進行癌に対しても，近年では積極的に行われるようになってきている．しかし，6～7cmを越えるような大きな腫瘍や，リンパ節転移が高度な症例は，あまりよい適応とはいえない．このような症例では，症例に応じて，癌の広がりの範囲に応じた手術が必要で，腹腔鏡下手術の経験が少ないと癌組織に触れたり，切り込んだりする危険もあ

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る．

術前準備

漿膜側から病変部位がわからないような小さな病変，すなわち，EMR後の追加腸切除や，術前深達度SM-MPのような病変に対しては，術前に大腸内視鏡下にマーキングを施行しておく．われわれは，腫瘍遠位側2カ所に，まず生理食塩水を粘膜下に注入し膨隆をつくり，墨汁を0.1～0.2 ml注入している．決して腸管外に突き抜けないように，あらかじめ生理食塩水を確実に粘膜下に注入するのがこつである．

手術2日前に入院し，入院後は禁食としている．腸管前処置には，ニフレックを用いると，腸管が水分ではってしまう可能性があるので，マグコロールとラキソベロンを用いている．

手術室での準備

麻酔導入時に，未熟な麻酔科医が胃内に過剰の空気を送気するのを防ぐ目的で，麻酔導入前に胃管を胃内に留置し，開放しておく．麻酔が導入されたら，両足に下肢静脈血栓予防のため，間欠的陽圧加圧装置を装着する．レビテーターが内蔵され，通常の手術台よりも左右へ大きく(約70度)傾けることができる腹腔鏡下大腸切除用の手術台(瑞穂社製)が市販されており，これを用いると体位をとるのが楽である．体位は股間に人が入れるように開脚とし，やや左半側臥位としている(図1)．普通の手術台を用いる場合は，マジックベッドと側部支持器で体躯の両側を固定する．頭部は額にレストンパッドをあて，そこをテープで手術台に固定する．

加刀前にあらかじめ手術台を左右，頭高位，低位にし，体躯のずれがないことを確認する．モニターは患者の左右に1台ずつ配置する．電気メス，吸引管，超音波切開凝固装置は患者頭側左側，腹腔鏡と気腹チューブは頭側右側にまとめておく．術者は患者の左側あるいは足側に立ち，scopistは足側あるいは左側，助手は右側に立つ．腹腔鏡はオリンパス社製の5 mm flexible scopeを用いている．

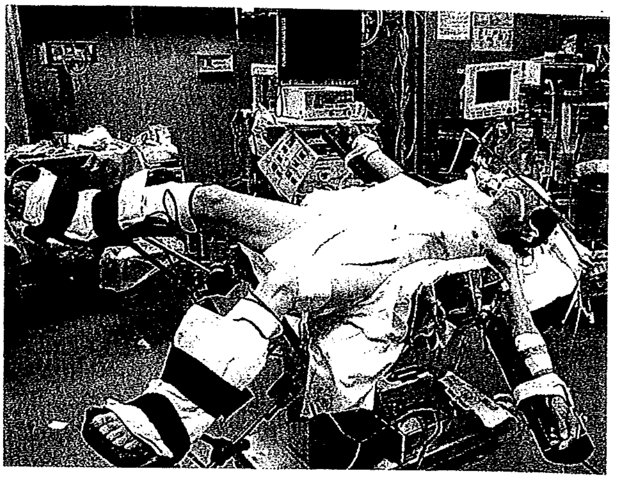

図1　体　　位

皮切とトロッカーの位置

時代により，多少のバリエーションはあるが，まず上腹部正中に約4～5 cmの切開をおき，開腹した後，Lap disc mini(八光製)を装着し，12 mmトロッカーを挿入し気腹する．続いて，5 mmトロッカーを臍下部，下腹部正中，右側腹

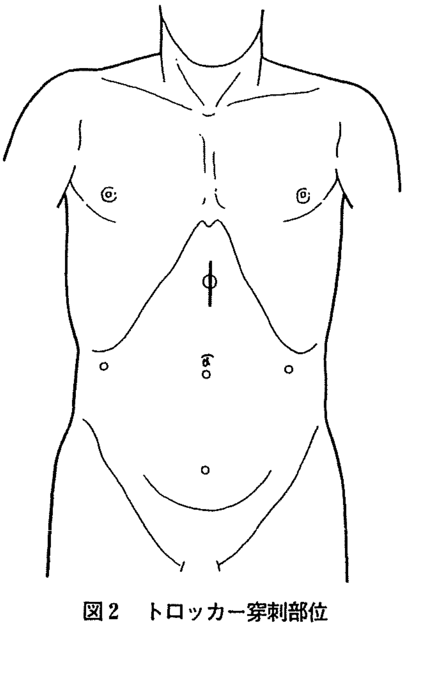

図2　トロッカー穿刺部位