Usefulness of Reduced Port Surgery for Left Colon Cancer

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Abstract. *Aim: Although laparoscopic surgery has made minimally invasive treatment available for colon cancer, various innovations aimed at developing even more minimally invasive treatment modalities have been reported in recent years. Needlescopic surgery, in which forceps with a small-diameter shaft are used to safely reduce invasiveness without increasing surgeons' stress, has been reported. We introduced the reduced-port surgery (RPS) technique by using needle forceps for the treatment of sigmoidal colon cancer and cancer of the rectosigmoidal region, with the aim of safely reducing invasiveness while maintaining curability. Patients and Methods: The subjects of this study were patients with sigmoidal colon and rectosigmoidal cancer who underwent laparoscopic resection between January 2012 and December 2014. The patients were divided into a conventional multiport surgery (MPS) group and an RPS group for comparison and analysis. Results: No significant difference was observed in the operative time, volume of blood loss, incidence of postoperative complications, especially anastomotic leak, intestinal obstruction, and surgical site infection. The length of postoperative hospital stay was significantly shorter in the RPS group. Conclusion: Without compromising safety and curability, RPS can reduce not only the number, but also the size of incisions, and make even more minimally invasive surgery feasible. Because this procedure is relatively easy to introduce to young surgeons, we consider it to be useful.*

Laparoscopic surgery for colon cancer was first reported by Jacobs *et al.* in 1991 (1). Subsequently, its usefulness for advanced colon cancer has been reported in various

randomized controlled trials, and the procedure is currently widely performed (2, 3).

Although laparoscopic surgery has made minimally invasive treatment available for colon cancer, various innovations aimed at developing even more minimally invasive treatment modalities have been reported in recent years. In particular, single-port surgery is a procedure in which all maneuvers are performed through a single small abdominal incision, and this procedure was first performed for colorectal resection by Bucher *et al.* in 2008 (4). Since then, it has been reported that minimally invasive surgery can be safely performed with this procedure (5). However, this procedure can be stressful for surgeons due to forceps interference and other maneuvers.

Meanwhile, needlescopic surgery, in which forceps with a small-diameter shaft are used to safely reduce invasiveness without increasing surgeons' stress, has also been reported to be beneficial (6).

We introduced the reduced-port surgery (RPS) technique by using needle forceps for the treatment of sigmoidal colon cancer and cancer of the rectosigmoidal region at our Department, with the aim of safely reducing invasiveness while maintaining curability. Here we explain this surgical procedure together with its short-term outcomes.

Patients and Methods

The study included patients with sigmoidal colon and rectosigmoidal cancer who underwent laparoscopic resection between January 2012 and December 2014. The patients were divided into the conventional multiport surgery (MPS) group and the RPS group for comparison and analysis. According to the Japanese Classification of Colorectal Carcinoma (7), patients in whom the main bulk of the tumor was located at the lower margin of the second sacral vertebra or below were included.

MPS was performed with five ports, and a 12 mm port was inserted into the right lower abdomen. In RPS, a lap protector and an EZ access were attached to the small midline incision. A 2-mm port was inserted into the left lower abdomen, a 5 mm port in the right lower abdomen, and a 3 mm port in the right lateral abdomen.

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Table I. *Patients' background data.*

Characteristic	MPS	RPS	<i>p</i> -Value
Gender (male/female), n	28/27	10/16	0.34
Median age (range), years	64 (43-84)	68.5 (49-83)	0.67
Median BMI (range), kg/m ²	21.3 (14.4)-36.0	23.1 (17.3-31.4)	0.10
Median tumor size (range), mm	36 (0-90)	25 (0-60)	0.32
Median preoperative CEA (range), ng/ml	3.2 (0.9-3784.5)	2.3 (0.5-4602)	0.40

MPS: Multiport surgery; RPS: reduced port surgery; BMI: body mass index; CEA: carcinoembryonic antigen.

Table II. *Characteristics of operations performed.*

Characteristic	MPS	RPS	<i>p</i> -Value
Median surgical time (range), min	230 (74-597)	201 (160-347)	0.06
Median blood loss (range), ml	5 (0-269)	5 (0-58)	0.64
Median lymph nodes harvested (range), n	18 (3-97)	21 (9-31)	0.44
Median metastatic lymph nodes (range), n	0 (0-12)	0 (0-15)	0.52
Surgical site infection, yes/no, n	8/45	4/22	1.00
Ileus, yes/no, n	2/47	1/25	1.00
Leakage, yes/no, n	2/53	0/26	1.00
Median postoperative hospital stay (range), days	12 (9-77)	10.5 (6-22)	0.05

MPS: Multiport surgery; RPS: reduced port surgery.

Endo Relief forceps (Hope Denshi Co., Ltd.) were inserted from the 2 mm port, and 3-mm forceps (Karl Storz-Endoskope) were inserted from the 3 mm port (Figure 1). The abdomen after RPS is shown in Figure 2, and each forceps is shown in Figure 3.

In both procedures, 5 mm flexible scopes (Olympus Co., Ltd.) were used. To perform intestinal resection, an automatic suture device was inserted from the 12 mm port in the right lower abdomen in MPS and the 12 mm port in the umbilical incision in RPS.

To compare the differences between MPS and RPS, JMP 12 statistical software (SAS Institute, Cary, North Carolina, USA) was used to perform the chi-square test and Wilcoxon signed-rank test.

Results

As shown in Table I, no significant difference was observed in the background factors. Moreover, concerning the surgical factors, no significant difference was observed in the operative time or volume of blood loss, whereas the number of dissected lymph nodes was comparable between the two groups. As shown in Table II, no significant difference was observed in the incidence of postoperative complications, especially of anastomotic leak, intestinal obstruction, and surgical site infection. The length of postoperative hospital stay was significantly shorter in the RPS group.

Discussion

Laparoscopic surgery has highlighted the great merit of minimally invasive procedures for the surgical treatment of

colorectal cancer (1). In recent years, laparoscopic surgery has also been widely performed for advanced colon cancer in response to the results of large-scale trials (2, 3, 8, 9). Moreover, in Japan, the number of patients undergoing laparoscopic surgery for colorectal cancer is increasing yearly; at the same time, the procedure is also frequently performed for advanced colorectal cancer. Among these cases, attempts to further reduce invasiveness have also been reported (5).

Single-port surgery is performed through a small abdominal incision through which three ports are inserted. It is a minimally invasive surgical procedure, and its short-term outcomes have shown its usefulness (10-12). In addition, a previous report also indicated that the long-term outcomes of this procedure are comparable to those of conventional MPS (13). However, it is also reported that, depending on the form of the pelvic wall, the addition of one port is often necessary (14). Furthermore, there are problems, such as the frequent interference between several pairs of forceps due to a lack of adequate space between them, and the difficulty in obtaining a good view as a result of the noninsertion of forceps handled by assistants. For these reasons, only skilled surgeons can safely perform this procedure while maintaining curability.

Meanwhile, surgery with forceps having a small diameter has also been reported (6, 15). As these tools have gradually been improved in terms of stiffness and operability, extremely useful forceps are available at present. We insert Endo Relief (Hope Denshi Co., Ltd.) from a 2-mm port into the left lower abdomen. Although this model of forceps has a shaft with a 2.4

Figure 1. The left image shows the incisions for port insertion in reduced port surgery (RPS), and the right image shows those used in multiport surgery (MPS). The numbers indicate the size of wounds (mm).

mm diameter, the tip section is the same size as that of the 5 mm forceps. The tip section is attached to Endo Relief after the shaft is inserted through a port. Because Endo Relief is slightly less stiff, it is not appropriate for use by surgeons. We consider that it is appropriate for assistants to use the forceps because this model allows them to hold large tissue. We use the 3 mm forceps manufactured by Karl Storz-Endoskope for insertion from the 3 mm port into the right lateral abdomen. This model of forceps is stiffer and has a slightly smaller tip section than Endo Relief. Delicate maneuvers can be performed with the Karl Storz-Endoskope forceps. However, caution is warranted because, owing to the smaller tip section, tissue is likely to be damaged when held with the forceps and strongly pulled. Thus, there is a risk of damaging the tissue beyond the visual field when assistants use the 3 mm forceps. We consider that it is better for surgeons to use the forceps with their left hand.

Another difference between MPS and RPS is that the length of the port in the right lower abdomen is 5 mm in RPS. To perform intestinal resection with the conventional procedure, an automatic suture device is inserted from the 12 mm port into the right lower abdomen; however, with RPS, the device is inserted from the 12 mm port into the midline incision. We consider that this manner confers an advantage for RPS because the length of the 12 mm port incision in the right lower abdomen, which results in complaints of severe pain, is reduced to 5 mm. Concerning long-term outcomes, it has been reported that even single-incision laparoscopic surgery is comparable to MPS. Our study also shows no difference between the MPS and RPS groups at this point. Because of the small number of cases and the short follow-up period, further careful follow-up is needed.

Conclusion

Without compromising safety and curability, RPS can reduce not only the number but also the size of incisions, and make

Figure 2. The incision sites at 1 month after reduced port surgery. For forceps with a small diameter, the incision is unnoticeable.

Figure 3. A: Gross view of the instruments used in surgery in this study. B: Close up of tips of instruments shown in A. 1: Conventional 5 mm forceps. 2: 3 mm Forceps. 3: Endo Relief with a 2.4 mm-diameter shaft. Endo Relief is composed of a tip section of the same size as that of the 5 mm forceps and a shaft with an extremely small diameter.

even more minimally invasive surgery feasible. Because this procedure is relatively easy to introduce to young surgeons, we consider it to be useful.

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