Int Surg 2011;**96:**6–12

Curative Resection of Transverse Colon Cancer via Minilaparotomy

Hideyuki Ishida, Tohru Ishiguro, Keiichiro Ishibashi, Tomonori Ohsawa, Norimichi Okada, Kensuke Kumamoto, Norihiro Haga

Department of Digestive Tract and General Surgery, Saitama Medical Center, Saitama Medical University, Saitama, Japan

Minilaparotomy has been reported to be a minimally invasive alternative to laparoscopically assisted surgery. We retrospectively evaluated the usefulness of minilaparotomy for the resection of transverse colon cancer, which has generally been considered difficult to resect laparoscopically. Patients for whom curative resection was attempted for transverse colon cancer (n = 21) or sigmoid colon cancer (n = 81) via minilaparotomy (skin incision, ≤ 7cm) were analyzed. The 2 groups did not significantly differ in terms of success rate of minilaparotomy (90.5% versus 97.5%), age, sex, pathologic stage, body mass index, operative time (mean, 133.5 minutes versus 122.5 minutes), blood loss (119.7 mL versus 92.4 mL), number of lymph nodes harvested, incidence of postoperative complications (9.5% versus 12.3%), postoperative length of stay, and 5-year disease-free survival rate (86.6% versus 79.6%). Minilaparotomy is feasible, safe, and favorable in terms of early oncologic outcome in patients with transverse colon cancer as well as those with sigmoid colon cancer.

Key words: Transverse colon – Colon cancer – Minilaparotomy – Laparoscopy

Laparoscopically assisted surgery for colon cancer has demonstrated short-term benefits such as less postoperative pain, a shorter hospital stay, and an earlier return to daily life than conventional open surgery. In addition, laparoscopically assisted surgery for colon cancer is now accepted as an alternative to conventional open surgery in terms of long-term oncologic safety.[1–5] However, transverse colon cancer has been excluded from the majority of previous prospective randomized trials[1–4,6,7] because lymph node dissection around the middle colic vessels was generally considered difficult to perform laparoscopically.

Several reports,[8–13] including those of our group,[14–16] have demonstrated favorable results using a minilaparotomy approach without laparoscopic assistance for the resection of colon cancer and have proposed that this approach might be a minimally

Reprint requests: Hideyuki Ishida, MD, PhD, Department of Digestive Tract and General Surgery, Saitama Medical Center, Saitama Medical University, 1981 Kamoda, Kawagoe, Saitama, Japan 350-8550.
Tel.: +81 49 228 3619; Fax: +81 49 222 8865; E-mail: 05hishi@saitama-med.ac.jp

invasive alternative to laparoscopically assisted surgery. On the basis of our favorable results from an initial group of 54 cases,[14] we continued to use this approach as the first choice to resect colon cancer, while laparoscopically assisted surgery for colon cancer has also been widely expanded during this decade.[15,16] Little is known about the feasibility, safety, and early oncologic outcome of the minilaparotomy for the curative resection of transverse colon cancer, which was generally considered difficult to resect laparoscopically. We thus describe our experience of the minilaparotomy approach for the resection of locally advanced transverse colon cancer.

Patients and Methods

Definition of minilaparotomy approach

We defined the minilaparotomy approach as the resection of colon cancer through a skin incision of 7 cm or less in length.[14–16]

Patients

We retrospectively analyzed a database containing details of patients who were initially indicated to undergo curative surgery for colon cancer via minilaparotomy at our department between September 2002 and April 2010. Patients with early colon cancer[17] for which the depth of invasion was limited to the submucosa were excluded since standard lymph node dissection, including removal of the main lymph nodes, is not necessary and was not actually performed in such patients. Patients with synchronous cancer in other organs and those with multiple colon cancers were also excluded. A total of 162 patients with colon cancer who met the criteria of our minilaparotomy approach as described below were selected. Of these, 21 patients had transverse colon cancer (TC group). Eighty-one patients with sigmoid colon cancer served as a control (SC group).

Indication of minilaparotomy approach

From September 2002 to April 2003, the preoperative indication criteria of our minilaparotomy approach to colon cancer were a body mass index (BMI) of 25.0 kg/m^2 or less and a tumor without invasion to other organ(s), the maximal diameter of which was 7 cm or less, as estimated by barium enema and/or computed tomography (CT). The specified exclusion criteria were suspected severe adhesive formation after major abdominal surgery determined by CT, preoperative ileus, tumors located 10 cm orally or anally from the splenic flexure, and tumors with paraaortic lymph node or distant metastasis. Since April 2005, with advances in surgical techniques, we expanded the limitation of BMI up to 30.0 kg/m^2 for patients with transverse or sigmoid colon cancer.[15,16]

Surgical procedures

The meticulous procedures and relevant instruments utilized in the minilaparotomy approach for colon cancer at any site have been reported previously.[14–16] Throughout the study period, all surgical procedures were performed through a skin incision of 7 cm or shorter in length, which was chosen to facilitate the most straightforward resection, although some modifications were undertaken regarding the retraction of the wound, which did not affect the surgical outcome.[16] The bowel resection with lymph node dissection was performed according to the General Rules for Clinical and Pathological Studies on Cancer of the Colon, Rectum, and Anus in Japan.[17] In the TC group, a transverse colectomy was defined as lymphadenectomy with simultaneous ligation of middle colic vessels at their origins. An extended right hemicolectomy was defined as lymphadenectomy with simultaneous ligation of ileocolic, right colic (if present), and middle colic vessels at their origins. Selection of transverse colectomy or extended right hemicolectomy was decided on the basis of the location of the transverse colon tumor and the branching pattern of vessels of the right side of the colon. In performing transverse colectomy or extended right hemicolectomy, we routinely cut the distal margin of the transverse colon followed by dissection of the corresponding mesentery downwardly, exposing the superior mesenteric vessels at the lower border of the pancreas, enabling lymph node dissection around the middle colic vessels easily and safely (Fig. 1a, 1b). In the TS group, a sigmoidectomy was defined as a lymphadenectomy with simultaneous ligation of inferior mesenteric artery at its origin and inferior mesenteric vein at the same level. All anastomoses were stapled extracorporeally.

Factors evaluated

To evaluate clinicopathologic, surgical, and oncologic outcomes, age, sex, BMI, incidence of prior abdominal surgery, success rate of minilaparotomy, duration of surgery, estimated blood loss during

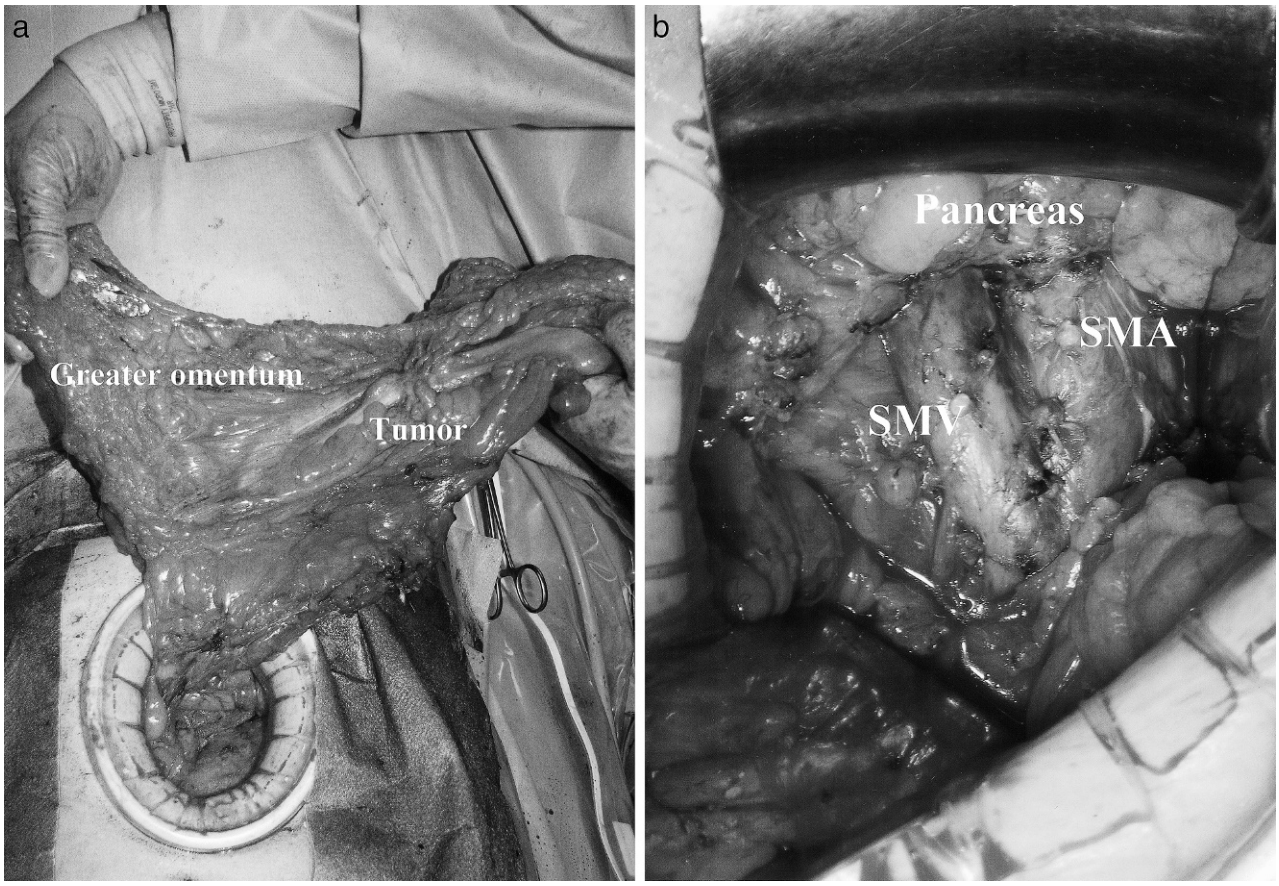

Fig. 1 Photograph showing (a) the transverse colon mobilized through the minilaparotomy wound with its distal margin cut using a linear and (b) the superior mesenteric vessels after lymph node dissection. SMA indicates superior mesenteric artery, and SMV indicates superior mesenteric vein.

surgery, tumor size, pathologic stage,[18] number of harvested lymph nodes, postoperative length of hospital stay, and postoperative complications were compared between the TC group and the SC group. Early oncologic outcome was assessed by comparing disease-free survival periods.

Statistical analysis

A statistical software package (Statview v. 5.0; SAS Institute, Cary, North Carolina) running on a Windows personal computer was used to conduct the analysis. Continuous data were expressed as mean ± standard deviation (SD) and compared using the Student t test. Categorical data were compared by χ^2 or the Fisher exact test. The disease-free survival rate was calculated by the Kaplan-Meier method, and the difference in survival curves was assessed by the log-rank test. All tests were 2-tailed, and $P < 0.05$ was considered significant. Since this study was performed on an intention-to-treat basis, patients with a failed minilaparotomy approach were included in this study.

Results

In the TC group, transverse colectomy was performed in 17 patients and extended right hemicolectomy in 4 patients. Of these, 2 patients needed extension of the minilaparotomy wound to up to 15 cm or 20 cm because of severe adhesions between the right colon and the parietal peritoneum in one patient, who had a history of prior appendectomy, and because of severe adhesions between the small bowel and transverse colon in the other patient, who had undergone surgery for a ruptured abdominal aortic aneurysm. In the SC group, sigmoidectomy was accomplished in all 81 patients, 2 of whom needed extension of the minilaparotomy wound to up to 9 cm or 15 cm because of abundant

Table 1 Clinical characteristics of patients

	Transverse colon cancer (n = 21)	Sigmoid colon cancer (n = 81)	*P* value
Age (years)	71.1 ± 9.8	67.2 ± 11.3	0.15
Sex (male/female)	10/11	53/28	0.21
Body mass index (kg/m^2)	22.2 ± 2.7	21.9 ± 2.8	0.69
Prior abdominal surgery	10 (47.6%)	22 (27.2%)	0.11
Operative time (minutes)	133.5 ± 37.4	122.5 ± 29.5	0.15
Blood loss (mL)	119.7 ± 89.6	92.4 ± 103.6	0.27
Postoperative hospital stay (days)	11.7 ± 4.3	12.0 ± 4.6	0.79
Extension of minilaparotomy incision	2 (9.5%)	2 (2.5%)	0.19

intraperitoneal fat in 1 patient and direct tumorous invasion to the urinary bladder in the other patient. The success rate of the minilaparotomy approach did not significantly differ between the TC group and the SC group (90.5% versus 97.5%, $P = 0.19$). The 2 groups did not significantly differ in terms of age ($P = 0.15$), sex ($P = 0.21$), BMI ($P = 0.69$), incidence of prior abdominal surgery ($P = 0.11$), duration of surgery ($P = 0.15$), blood loss ($P = 0.27$), and postoperative length of hospital stay ($P = 0.79$) (Table 1). The 2 groups also did not differ regarding the maximal diameter of tumor ($P = 0.94$), pathologic stage ($P = 0.56$), and number of harvested lymph nodes ($P = 0.55$) (Table 2). Two patients (9.5%) in the TC group and 10 patients (12.3%) in the SC group developed postoperative complications, all of which improved when treated conservatively (Table 3). The incidence of postoperative complications did not differ between the 2 groups ($P > 0.99$). There were no patients lost to follow-up. After the median follow-up period of 31 months (range, 3–96 months), there were 2 hematogenous recurrences in the TC group and 10 recurrences in the SC group (hematogenous, 5; hematogenous + peritoneal, 1; hematogeneous + lymph nodal, 1; peritoneal, 2; and lymph nodal; 1). The cumulative 5-year disease-free survival was 86.6% in the TC group and 79.6% in the SC group. The disease-free survivial curves did not differ between the 2 groups ($P = 0.58$) (Fig. 2).

Table 2 Pathologic data of patients

	Transverse colon cancer (n = 21)	Sigmoid colon cancer (n = 81)	*P* value
Maximal tumor diameter (mm)	33.0 ± 15.5	33.4 ± 15.7	0.94
pTNM stage			
I	8	22	
II	8	32	
III	5	27	0.56
No. of harvested lymph nodes	14.3 ± 9.4	12.8 ± 7.7	0.44

pTNM, pathologic tumor-node-metastasis.

Discussion

The underlying concept of curative colectomy via minilaparotomy is to utilize the smallest incision necessary to extract the specimen from the beginning of the surgical procedure so that bowel resection, lymph node dissection, and anastomosis can be performed under direct sight without any laparoscopic assistance. The term ''minilaparotomy'' has not strictly been defined among investigators. We[14–16] and Nakagoe *et al*[10,11] considered 7 cm to be the maximal incision length, whereas Fleshman *et al*[9] reported the median incision of minilaparotomy as 12 cm (range, 7–18 cm), and Fürstenburg *et al*[8] reported 10 cm as the maximal length. Of importance is that curative colectomy can be performed through a smaller incision than is generally believed. An incision ranging from 3 to 10 cm is needed to extract the specimen in laparoscopically assisted surgery for colorectal cancer.[10] Offodile *et al*[19] defined conversion as a skin incision greater than 7 cm in laparoscopically assisted right colectomy for neoplasia.

The nonrandomized nature and the relatively low percentage of patients with transverse colon cancer compared with sigmoid colon cancer are potential drawbacks in this study. Ideally, patients who have undergone resection of transverse colon cancer via

Table 3 Postoperative complications

	Transverse colon cancer (n = 21)	Sigmoid colon cancer (n = 81)	*P* value
Ileus	2	4	
Enteritis		2	
Wound infection		2	
Atelectasis/pneumonia		2	
Total	2 (9.5%)	10 (12.3%)	> 0.99

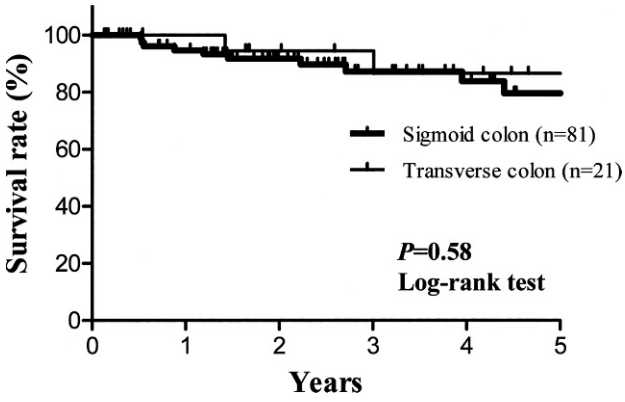

Fig. 2 The cumulative disease-free survival curves in patients with transverse colon cancer (TC group, n = 21) and those with sigmoid colon cancer (SC group, n = 81).

minilaparotomy should be compared with a similar group of patients who have undergone conventional open or laparoscopically assisted surgery in the same period. However, such comparison was not possible since we offered the minilaparotomy approach to all patients who were candidates for the procedure. We thus considered cases of sigmoid colon cancer most suitable for the control group for evaluating the degree of difficulty in performing curative resection of transverse colon cancer, since sigmoid colon (cancer) has the following characteristics: (1) it is the most frequently occurring among all colon cancers; (2) similar to the transverse colon, the sigmoid colon is not fixed to the retroperitoneum; and (3) lymph node dissection around the inferior mesenteric artery required for curative sigmoidectomy seems easier to perform, even via minilaparotomy, than dissection around the middle colic vessels, which is required for the resection of transverse colon cancer. The reasons for excluding cancers near the splenic flexure from the indication of minilaparotomy are twofold. First, mobilization of the splenic flexure is very difficult to perform via minilaparotomy. Nakagoe *et al*[11] reported that the minilaparotomy approach failed in 12 out of 84 cases of colon cancer and that 5 of the failed cases involved cancer in the splenic flexure. Takegami *et al*[12] proposed the use of a laparoscope for performing minilaparotomy for cancer in the splenic flexure. We now perform curative colectomy via minilaparotomy for cancer 10 cm orally or anally from the splenic flexure utilizing laparoscopic instruments. Second, it is more important to access the left colic artery than the middle colic vessels in performing lymph node dissection for cancer near the splenic flexure. Therefore, the point of interest is different from the scope of this article, which focuses on dissection around the middle colic vessels.

We did not find any significant differences in surgical factors including success rate of minilaparotomy, duration of surgery, blood loss, and the incidence of postoperative complications between the TC group and SC group. The feasibility and safety are considered identical between transverse colectomy (or extended right hemicolectomy) and sigmoidectomy when performed via minilaparotomy. Our results contrasted with those reported by some laparoscopic experts.[20–22] Laparoscopically assisted resection of transverse colon cancer was reported to take significantly longer in terms of operative time than laparoscopically assisted resection of cancer at other sites[20,21] or conventional open surgery[22] for transverse colon cancer; although reports[23,24] from Korea show that no significant difference was found in such comparisons. In addition, 2 study groups[20,21] suggested that laparoscopically assisted resection of transverse colon cancer may have an insignificant higher rate of postoperative complications, which should not be ignored and may be a reflection of the greater complexity associated with the resection of transverse colon, compared with other less challenging segmental colectomies. When our minilaparotomy series is compared with recently reported series of laparoscopically assisted resection in terms of operative time, blood loss, and postoperative complications, the mean operative time (133.5 minutes) is markedly shorter in our minilaparotomy series than those (203.6–260 minutes)[20–24] of reported laparoscopically assisted series, and the blood loss and the incidence of postoperative complications seem to be compatible to or smaller than those of laparoscopically assisted series. On the basis of our results, we feel that lymph node dissection around the middle colic vessels via the minilaparotomy approach is not difficult compared with conventional open surgery, although there is a knack to exposing the superior mesenteric vessels via minilaparotomy, as described in our surgical procedures.

To the best of our knowledge, except for the report by Schlachta *et al*,[20] there have been no reports regarding the oncologic outcome of patients with transverse colon cancer laparoscopically treated. In our minilaparotomy series, the disease-free survival rate was almost identical between patients with transverse colon cancer and those with sigmoid colon cancer. We need additional cases and longer follow-up to draw firm conclusions on the oncologic outcome of the minilaparotomy approach to trans-

verse colon cancer, since this study includes a population with a relatively short-term follow-up and the number of cases of transverse colon cancer is very small.

The laparoscopically assisted approach to oncologic resection of the transverse colon is challenging and requires advanced skills. The safety of laparoscopic lymph node dissection around the middle colic vessels has not been established in general clinical practice, although some laparoscopic experts[24–26] have proposed useful techniques to identify middle colic vessels or to perform lymph node dissection around the middle colic vessels laparoscopically. Innovation of laparoscopic instruments and improved skills of laparoscopic surgeons will expand the indication of laparoscopically assisted resection of transverse colon cancer in the future. Nonetheless, because of the lack of data from prospective randomized trials and low occurrence (about 10%)[27–30] of transverse colon cancer among all colorectal cancers, it will take some time to confirm the significance of laparoscopically assisted resection of transverse colon cancer in terms of the feasibility, safety, and oncologic outcomes.

This was not a comparative study between the minilaparotomy approach and the laparoscopically assisted approach in the treatment of transverse colon cancer. However, the minilaparotomy approach to colon cancer has been reported to have a minimally invasive nature identical to that of the laparoscopically assisted approach.[10] In addition, compared with conventional open surgery, the minilaparotomy approach to colon cancer has been shown to be less invasive in terms of postoperative recovery and various laboratory parameters.[31–33] Furthermore, the minilaparotomy approach to transverse colon cancer does not require special skills or a high cost as in the laparoscopic approach. We do not propose any restriction to the expansion of the laparoscopically assisted approach; however, the minilaparotomy approach should continue to be used as an alternative to the laparoscopically assisted approach for the resection of transverse colon cancer even in the future, depending on surgeons' preference and patients' choice. The minilaparotomy and laparoscopically assisted approaches may warrant further comparative investigations, in terms of feasibility, safety, cost, and oncologic outcome.

References

1. Lacy AM, García-Valdecansas JC, Delgado S, Castells A, Taurá P, Piqué JM *et al.* Laparoscopy-assisted colectomy versus open colectomy for treatment of non-metastatic colon cancer: a randomized trial. *Lancet* 2002;**359**(9325):2224–2229
2. Leung KL, Kwok SP, Lam SC, Lee JF, Yiu RY, Ng SS *et al.* Laparoscopic resection of rectosigmoid carcinoma: prospective randomized trial. *Lancet* 2004;**363**(9416):1187–1192
3. Fleshman J, Sargent DJ, Green E. Clinical Outcomes of Surgical Therapy Study Group. Laparoscopic colectomy for cancer is not inferior to open surgery based on 5-year data from the COST Study Group trial. *Ann Surg* 2007;**246**(4):655–662
4. Jayne DG, Guillou PJ, Thorpe H, Quirke P, Copeland J, Smith AM *et al.* Randomized trial of laparoscopic assisted resection of colorectal carcinoma: 3-year results of the UK MRC CLASICC Trial Group. *J Clin Oncol* 2007;**25**(21):3061–3068
5. Reza MM, Blasco JA, Andradas E, Cantero R, Mayol J. Systematic review of laparoscopic versus open surgery for colorectal cancer. *Br J Surg* 2006;**93**(8):921–928
6. Hewett PJ, Alladyce RA, Bagshaw RF, Frampton CM, Frizelle FA, Rieger NA *et al.* Short-term outcomes of the Australasian randomized clinical study comparing laparoscopic and conventional open surgical treatments for colon cancer: the ALCC trial. *Ann Surg* 2008;**248**(5):728–738
7. Kitano S, Inomata M, Sato A, Yoshimura K, Moriya Y (Japan Clinical Oncology Study Group). Randomized controlled trial to evaluate laparoscopic surgery for colorectal cancer: Japan Clinical Oncology Study JCOG 0404. *Jpn J Clin Oncol* 2005;**35**(8):475–477
8. Fürstenberg S, Goldman S, Machado M, Järhult J. Minilaparotomy approach to tumors of the right colon. *Dis Colon Rectum* 1998;**41**(8):997–999
9. Fleshman JW, Fry RD, Birnbaum EH, Kodner IJ. Laparoscopic-assisted and minilaparotomy approaches to colorectal diseases are similar in early outcome. *Dis Colon Rectum* 1996;**39**(1):15–22
10. Nakagoe T, Sawai T, Tsuji T, Jibiki M, Nanashima A, Yamaguchi H *et al.* Retrospective comparison of minilaparotomy (''moving window method'') and laparoscopic-assisted approaches for colon cancer resection. *Acta Med Nagasaki* 2001;**46**(1):25–32
11. Nakagoe T, Sawai T, Tsuji T, Ayabe H. Use of minilaparotomy in the treatment of colonic cancer. *Br J Surg* 2001;**88**(6):831–836
12. Takegami K, Kawaguchi Y, Nakayama H, Kubota S, Nagawa H. Minilaparotomy approach to colon cancer. *Surg Today* 2003;**33**(6):414–420
13. Hsu TC. Feasibility of colectomy with miniincision. *Am J Surg* 2005;**190**(1):48–50
14. Ishida H, Nakada H, Yokoyama M, Hayashi Y, Ohsawa T, Inokuma S *et al.* Minilaparotomy approach for colonic cancer: initial experience of 54 cases. *Surg Endosc* 2005;**19**(3):316–320
15. Ishida H, Ishiguro T, Ishibashi K, Ohsawa T, Kuwabara K, Okada N *et al.* Impact of prior abdominal surgery on the curative resection of colon cancer via a minilaparotomy approach. *Surg Today* (in press)

16. Ishida H, Ishiguro T, Ohsawa T, Okada N, Yokoyama M, Kumomoto K *et al.* Curative colectomy via a minilaparotomy approach without utilizing specific instruments. *Tech Coloproctol* 2010;**14**(2):153–159
17. Japanese Society for Cancer of the Colon and Rectum. *Japanese Classification of Colorectal Carcinoma*. [English, 2nd ed]. Tokyo, Japan: Kanehara & Co Ltd, 2009
18. International Union Against Cancer. In: Sobin LH, Gospodarowicz M, Wittelkind C, eds. *TNM Classification of Malignant Tumors*. 7th ed. New York, NY: Wiley-Blackwell, 2009:100–105
19. Offodile AC, Lee SW, Yoo J, Whelan RL, Moradi D, Baxter R *et al.* Does prior abdominal surgery influence conversion rate and outcomes of laparoscopic right colectomy in patients with neoplasia? *Dis Colon Rectum* 2008;**51**(11):1669–1674
20. Schlachta CM, Mamazza J, Poulin EC. Are transverse colon cancers suitable for laparoscopic resection? *Surg Endosc* 2007; **21**(3):396–399
21. Zmora O, Bar-Dayan A, Khaikin M, Lebeydev A, Shabtai M, Ayalon A *et al.* Laparoscopic colectomy for transverse colon carcinoma. *Tech Coloproctol* 2010;**14**(1):25–30
22. Akiyoshi T, Kuroyanagi H, Fujimoto Y, Konishi T, Ueno M, Oya M *et al.* Short-term outcomes of laparoscopic colectomy for transverse colon cancer. *J Gastrointestinal Surg* 2010;**14**(5):818–823
23. Lee YS, Lee IK, Kang WK, Cho HM, Park JK, Oh ST *et al.* Surgical and pathological outcomes of laparoscopic surgery for transverse colon cancer. *Int J Colorectal Dis* 2008;**23**(7):669–673
24. Kim HJ, Lee IK, Lee YS, Kang WK, Park JK, Oh ST *et al.* A comparative study on the short-term clinicopathological outcomes of laparoscopic surgery versus conventional open surgery for transverse colon cancer. *Surg Endosc* 2009;**23**(8): 1812–1817
25. Fujita J, Uyama I, Sugioka A, Komori Y, Mtsui H, Hasumi A. Laparoscopic right hemicolectomy with radical lymph node dissection using the no-touch isolation technique for advanced colon cancer. *Surg Today* 2001;**31**(1):93–96
26. Báca I, Perko Z, Bokan I, Mimica Ž, Petričević A, Družijanić N *et al.* Technique and survival after laparoscopically assisted right hemicolectomy. *Surg Endosc* 2005;**19**(5):650–655
27. Ichihara T, Tanaka M, Fukumoto S, Kuroda Y. Lymphadenectomy along the middle colic artery in laparoscopic resection of transverse colon. *Hepatogastroenterology* 2004;**51**(56): 454–456
28. Wray CM, Ziogas A, Hinojosa MW, Le H, Stamos MJ, Zell JA. Tumor subsite location within the colon is prognostic for survival after colon cancer diagnosis. *Dis Colon Rectum* 2009;**52**(8):1359–1366
29. Sjo OH, Lunde OC, Nygaard K, Sandvik L, Nesbakken A. Tumor location is a prognostic factor for survival in colonic cancer patients. *Colorectal Dis* 2008;**10**(1):33–40
30. Hayne D, Brown RS, McCormack M, Quinn MJ, Payne HA, Babb P. Current trends in colorectal cancer: site, incidence, mortality and survival in England and Wales. *Clin Oncol (R Coll Radiol)* 2001;**13**(6):448–452
31. Nakagoe T, Tsuji T, Sawai T, Sugawara K, Inokuchi N, Kamihira S *et al.* Minilaparotomy may be independently associated with reduction in inflammatory responses after resection for colorectal cancer. *Eur Surg Res* 2003;**35**(6):477–485
32. Ishibashi K, Okada N, Nagamine T, Kuwabara K, Ohsawa T, Yokoyama M *et al.* Systemic and peritoneal cytokine response in curative surgery for T2/T3 colon cancer: Comparison of minilaparotomy and conventional laparotomy [in Japanese with English abstract]. *Nihon Gekakei Rengou Gakkai Zassi (J JPn Coll Surg)* 2006;**31**(5):801–806
33. Ishikawa M, Nishioka M, Hanaki N, Miyauchi T, Kashiwagi Y, Miki H. Colorectal resection by a minilaparotomy approach vs. conventional operation for colon cancer. Results of a prospective randomized trial. *Hepatogastroenterology* 2007; **54**(79):1970–1975