Comparison between Midline and Right Transverse Incision in Right Hemicolectomy for Right-Sided Colon Cancer: A Retrospective Study†

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Background: *The advantage of a transverse incision over a midline incision for open right hemicolectomy remains controversial.*
Objective: *To compare the short-term surgical outcomes of right hemicolectomy through midline incision (RHML) and right hemicolectomy through right transverse incision (RHTR) for right-sided colon cancer.*
Material and Method: *This retrospective study included 74 patients with right-sided colon cancer who underwent elective right hemicolectomies through midline or right transverse incision between February 2004 and June 2006 at the Department of Surgery, Faculty of Medicine Siriraj Hospital. Operative details, postoperative requirement of narcotics, recovery of bowel function, and oncological parameters were analyzed.*
Results: *Fifty-four patients underwent RHML and 20 patients underwent RHTR. Both approaches achieved adequate oncological resection of the tumor. The RHTR group were characterized by shorter operative times (105 vs. 140 minutes; p = 0.001), less blood loss (70 vs. 125 ml; p = 0.004), faster discontinuation of intravenous narcotics (1.2 vs. 1.8 days; p = 0.03), and shorter length of hospital stay (6.0 vs. 7.9 days; p = 0.02). Postoperative complications and time to recovery of bowel function were not significantly different.*
Conclusion: *The authors suggest that RHTR is a safe and effective operation for right-sided colon cancer, which results in a significant reduction in operative time, duration of intravenous narcotics administration, and hospital stay compared with RHML. However, there is no difference in postoperative recovery of bowel function and complication rate.*

Keywords: *Colon cancer, Colectomy, Hemicolectomy, Incision, Transverse*

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A midline incision is the incision of choice in conditions that require rapid intra-abdominal entry, complete exploration of the peritoneal cavity or where the preoperative diagnosis is uncertain, as it can easily be extended[1]. However, the increasing popularity of minimally invasive surgery and enhanced recovery after surgery has improved surgical techniques, including the choice of incision. There is good evidence from randomized controlled trials that a transverse incision for upper abdominal surgery is more beneficial than an upper midline incision due to less postoperative wound pain, better postoperative pulmonary function, and fewer incidences of pulmonary complication[2,3]. A review of the incision made in abdominal surgery by Grantcharov and

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Rosenberg, in 2001, suggested that transverse incision may be more appropriate than vertical incision because it was associated with fewer complications, quicker postoperative recovery, and less incidence of incisional hernia[4].

In cases of right hemicolectomy for right-sided colon cancer, there have been a very small number of clinical studies to determine the advantage of a transverse skin incision on postoperative outcomes compared to a conventional vertical midline incision, and the results remain controversial[5-8].

The aim of the present study was to compare the short-term surgical outcomes of right hemicolectomy through midline incision (RHML) and right hemicolectomy through right transverse incision (RHTR) for right-sided colon cancer in a university hospital.

Material and Method

After approval of the Institutional Ethics Committee, the authors carried out a retrospective analysis of patients with right-sided colonic adenocarcinoma who underwent RHML or RHTR between February 2004 and June 2006, at the Department of Surgery, Faculty of Medicine Siriraj Hospital, Bangkok. Patients with American Society of Anesthesiologist (ASA) class I-III who underwent elective and curative surgery were included. Curative procedures were defined as those in which there was no pre- or intra-operative evidence of distant metastasis and there was no postoperative macroscopic residual tumor. Patients excluded were those who had perioperative epidural analgesia or complicated conditions such as colonic obstruction or perforation. Every patient signed informed consent and received preoperative mechanical bowel preparation one day prior to surgery. All operations were performed by well-experienced colorectal surgeons. Choice of the incision depended on the surgeon's discretion. All patients received general anesthesia. Intravenous prophylactic antibiotics were also administered.

In the RHTR group, an incision was gene rally made along the skin crease on the right side of the abdomen, about 1 cm above the umbilicus; however, the position of the transverse incision could be adjusted according to the patient's height, the location, and fixity of the tumor. In the RHML group, a conventional midline incision was performed. A standard oncological right hemicolectomy with high vessel ligation and wide excision was performed on every patient. Either handsewn or stapled ileocolonic anastomosis was created. The incision was closed layer by layer. No intra-abdominal drain or nasogastric tube was used.

Routine postoperative care was provided. The time elapsing before first bowel movement (passing flatus) was recorded by the nursing staffs. Patients were allowed oral fluids if passing flatus. Resumption of normal diet was decided by agreement between surgeons and patients. Patients were discharged from the hospital when they displayed no fever, had good appetite and satisfactory mobility. All patients were scheduled for postoperative follow-up 30 days later.

The data recorded included patients' demographic and operative details (operative time, blood loss and postoperative complications), recovery details (time to first bowel movement, time to defecation, time to resumption of normal diet, time to discontinuation of intravenous narcotics and length of hospital stay) and oncological details (tumor size, lymph node harvest, tumor staging, resected margin).

All data were prepared and compiled using Statistical Package for the Social Sciences program version 11.0 for Windows (SPSS®, SPSS Inc., Chicago, IL). Kolmogorov-Samirnov test was used to test for the normal pattern of data distribution. Unpaired *t*-test was used to compare data between the two groups when they were in the normal distribution pattern. Mann-Whitney U test was used when this was not the case. Pearson Chi-square test and Fisher's exact test were used when the data were quantitative data. A p-value of less than 0.05 was considered statistically significant.

Results

Ninety-seven patients were enrolled. After the application of exclusion criteria (15 patients receiving epidural analgesia, five patients with liver metastasis, three patients with a history of colonic obstruction), 74 patients with an average age of 63 years (range 27-89) were left for the present study. Fifty-four patients underwent RHML and 20 patients had RHTR.

No thirty-day postoperative mortality was reported. Both groups achieved adequate oncological resection of the tumor. An analysis of the demographic data, operative details and oncological parameters revealed no statistically significant difference between the two groups, except for operative time and estimated blood loss (Table 1). The RHTR group revealed shorter operative times (105 vs. 140 minutes; $p = 0.001$) and less blood loss (70 vs. 125 ml; $p = 0.004$).

Overall postoperative complication rate was not different between the RHTR and RHML groups

(5% vs. 11%; p = 0.43). Superficial surgical site infection was found in one patient (5%) in the RHTR group and four patients (7%) in the RHML group. Two pulmonary complications (1 pneumonia and 1 atelectasis) were also reported in the RHML group. Patients with RHTR had significantly faster time to discontinuation of intravenous narcotics (1.2 vs. 1.8 days; p = 0.03) and shorter length of hospital stay (6.0 vs. 7.9 days; p = 0.02). However, there were no significant differences in time to first bowel movement, time to defecation, and time to resumption of normal diet (Table 2).

Discussion

RHTR appears to be a feasible approach for oncological resection of right-sided colon cancer because surgeons can fully mobilize the right-sided colon and ileocolonic anastomosis can be done through this incision without any tension. Although long-term oncological outcomes of RHTR are still unknown, the authors reported no difference in operative oncological parameters between the two approaches.

Of note, the present study demonstrated that the operative time of RHTR was significantly shorter than that of RHML, which was in accordance with other studies[5,7]. It is plausible that full mobilization of the right-sided colon, including hepatic flexure, can be easily performed through right transverse skin incision. Another possible explanation may be that the RHTR group seemed to have a smaller incision[7,8] resulting in faster wound approximation, whereas, timing of colonic resection and anastomosis through

Table 1. Comparison of demographic data, operative details and oncological parameters between RHML group and RHTR group

	RHML (n = 54)	RHTR (n = 20)	p-value
Age (years)	63 ± 13	65 ± 16	0.51
Female	26 (48)	13 (65)	0.20
Body mass index (kg/m^2)	21.0 ± 2.9	20.7 ± 4.2	0.71
Operative time (minutes)	140 ± 45	105 ± 24	0.001
Estimated blood loss (ml)	125 ± 81	70 ± 52	0.004
Stapled anastomosis	24 (44)	12 (60)	0.23
Tumor size (cm)	6.2 ± 2.3	6.1 ± 2.6	0.78
Nodes harvested	25 ± 17	19 ± 11	0.10
TNM stage			0.85
1	4 (7)	2 (10)	
2	27 (50)	7 (35)	
3	23 (43)	11 (55)	
Positive resection margin	0 (0)	0 (0)	-

Values were given as number (percentage) or mean ± SD
RHML = right hemicolectomy through midline incision
RHTR = right hemicolectomy through right transverse incision

Table 2. Analysis of clinical outcomes between RHML group and RHTR group

	RHML (n = 54)	RHTR (n = 20)	p-value
Postoperative complication	6 (11)	1 (5)	0.43
Time to first bowel movement (hours)	66 ± 28	64 ± 28	0.77
Time to first defecation (days)	4.0 ± 1.2	3.7 ± 1.8	0.40
Time to resumption of normal diet (days)	4.6 ± 1.5	4.3 ± 1.1	0.42
Time to discontinuation of intravenous narcotics (days)	1.8 ± 1.5	1.2 ± 1.0	0.03
Length of hospital stay (days)	7.9 ± 3.2	6.0 ± 2.5	0.02

Values were given as number (percentage) or mean ± SD

a small incision was not prolonged[9]. Perhaps, stapled anastomosis was performed more frequently in RHTR although this difference did not reach statistical significance. It could be an argument that, in general practice, RHTR is performed by highly experienced surgeons whereas RHML is performed in cases of large tumor.

The present findings also indicated that RHTR was associated with shorter duration of intravenous narcotics administration, which was consistent with the findings of less postoperative pain score and fewer amounts of total analgesic administration in other studies[5,6]. The greater distance from costal margin of transverse incision than that of RHML could lead to less pain and reduce narcotic requirement. Potential advantages of decreased narcotics administration include less sedation and diminished side effects of opioids such as nausea and vomiting.

Assessment of postoperative bowel function has proven difficult due to the lack of good objective endpoint. Most surgeons however would agree that the most objective measurement probably is time to passage of flatus or defecation[10], together with the patient's compliance of resuming oral diet. Given that the use of epidural local anesthetics attenuates sympathetic hyperactivity and thus shortens the duration of postoperative ileus[11], the present study excluded patients receiving perioperative epidural analgesia in order to determine the effect of type of incision per se on postoperative bowel function more accurately. In accordance with other reports[5,8], the present study revealed that there was no difference in postoperative bowel function between the two approaches. In contrast, Donati et al[7] found that RHTR was associated with earlier return of bowel function but the reasons for this were unclearly addressed. Recovery of postoperative bowel function is more likely to be multifactorial rather than only the amount of narcotics given. It is well established that many factors including excessive intravenous fluid resuscitation, electrolyte imbalance, systemic opioids, diabetes mellitus, and postoperative infection can compromise the return of bowel function[12].

Overall, postoperative complication did not differ significantly between RHML and RHTR as in previous reports[5,7,8]. One possible explanation is that the present study does not include very high-risk patients who might have the most benefit of RHTR. According to the Cochrane review in 2005, a transverse incision has been recommended for laparotomy in high risk patients, particularly obese patients or those with preexisting pulmonary diseases such as chronic obstructive airway disease[1].

Interestingly, RHTR resulted in a dramatic reduction in length of hospital stay. This finding is supported by other investigators[5,7]. It is plausible that the patients in the RHTR group have experienced less pain and thus they could have earlier ambulation and better perception of their own postoperative recovery. In addition, current evidence from animal model suggests that the magnitude of the incision is associated with a different degree of surgical stress[13]. Notably, the shortening of hospital stay in RHTR can be of great benefit to both patients and health care physicians, as health expenditure is associated with duration of hospital stay, and the surgeons will increase available beds for other surgeries. Many authors have suggested that a transverse incision should be integrated into enhanced recovery programs or fast track protocols for colonic surgery[14,15]. The advantages of RHTR over RHML in the published literature are summarized in Table 3.

Table 3. Summary of the advantages of RHTR over RHML in the literature

Author	Year	n	OR time	Length of incision	Pain or narcotics used	Recovery of bowel function	CPT	LOS
Stipa[5]	2000	44	+	n/a	+	o	o	+
Lindgren[6]	2001	40	n/a	n/a	+	n/a	+	n/a
Donati[7]	2002	123	+	+	o	+	o	+
Brown[8]	2004	28	o	+	o	o	o	o
Present study	2009	74	+	n/a	+	o	o	+

Results were given as; (+) for significant advantage of RHTR over RHML, (o) for no significant difference between RHTR and RHML, and (n/a) for no data available. Abbreviations: OR time, operative time; CPT, postoperative complication; LOS, length of hospital stay

It is also worthy to mention about the limitation of the present study. First, it is a non-randomized study, in which selected bias could occur. Second, it has a relatively small number of patients in the RHTR group. Therefore, large prospective randomized controlled trials, especially with long-term follow up, are required to verify the clinical advantage of RHTR before a definite conclusion can be drawn.

In conclusion, the authors suggest that RHTR is a safe and effective operation for right-sided colon cancer, which results in a significant reduction in operative time, duration of intravenous narcotics administration, and hospital stay compared with RHML. However, there is no difference in postoperative recovery of bowel function and complication rate.

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การศึกษาแบบย้อนหลังเพื่อเปรียบเทียบผลการผ่าตัด ระหว่างแผลผ่าตัดหน้าท้องแนวตั้งกับแนวขวางในผู้ป่วยมะเร็งลำไส้ใหญ่ด้านขวา

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วัตถุประสงค์: *เพื่อเปรียบเทียบผลการผ่าตัด ระหว่างผู้ป่วยที่มีแผลผ่าตัดหน้าท้องแนวตั้งกับผู้ป่วยที่มีแผลผ่าตัดหน้าท้องแนวขวางในการผ่าตัดผู้ป่วยมะเร็งลำไส้ใหญ่ด้านขวา*

วัสดุและวิธีการ: *การศึกษาย้อนหลังในผู้ป่วยมะเร็งลำไส้ใหญ่ด้านขวาจำนวน 74 ราย ระหว่างปี พ.ศ.2547 ถึง พ.ศ.2549 คณะผู้นิพนธ์ได้ทำการศึกษาวิธีการผ่าตัด, ลักษณะของมะเร็ง และผลระยะสั้น หลังการผ่าตัด (จำนวนยาแก้ปวด, การทำงานของระบบทางเดินอาหารหลังการผ่าตัด, และภาวะแทรกซ้อน)*

ผลการศึกษา: *มีผู้ป่วยจำนวน 54 รายที่ได้รับการผ่าตัดแผลแนวตั้งและ 20 รายได้รับการผ่าตัดแผลแนวขวาง ผู้ป่วยกลุ่มแผลแนวขวางใช้เวลาการผ่าตัดสั้นกว่า (105 กับ 140 นาที; p = 0.001) และเสียเลือดขณะผ่าตัดน้อยกว่า (70 กับ 125 มิลลิลิตร; p = 0.004) เมื่อเปรียบเทียบกับผู้ป่วยกลุ่มแผลแนวตั้ง รวมทั้งระยะเวลาการใช้ยาแก้ปวดชนิดฉีดเข้าหลอดเลือดดำสั้นกว่า และระยะการรักษาในโรงพยาบาลสั้นกว่า (6.0 กับ 7.9 วัน; p = 0.02) แต่ไม่มีความแตกต่างของผลแทรกซ้อน และการทำงานของระบบทางเดินอาหารภายหลังการผ่าตัดในผู้ป่วยทั้งสองกลุ่ม*

สรุป: *การผ่าตัดมะเร็งลำไส้ใหญ่ด้านขวาโดยใช้แผลผ่าตัดแนวขวางเป็นวิธีที่ปลอดภัย สามารถลดระยะเวลาการผ่าตัด ระยะเวลาการใช้ยาแก้ปวดชนิดฉีด และระยะการรักษาในโรงพยาบาลเมื่อเปรียบเทียบกับการผ่าตัดแผลแนวตั้ง*